

Middle East

**Data Collection Survey on
Utilization of Digital Technologies
for Development in North Africa
(Egypt, Morocco, Tunisia)**

Final Report

May 2022

Japan International Cooperation Agency (JICA)

**Koei Research & Consulting Inc.
Nippon Koei Ltd.**

7R
JR
22-014

Table of Contents

Chapter 1	Overview of Survey	1-1
1.1.	Background.....	1-1
1.2.	Objectives and Target Countries.....	1-1
1.3.	Team Members	1-1
1.4.	Target Sectors	1-1
1.5.	Workflow.....	1-2
1.6.	Survey Schedule	1-2
Chapter 2	Overview of Digital Technologies	2-1
2.1.	Egypt.....	2-1
2.1.1.	Policies/Strategies and Legal Environment for Digital Technologies.....	2-1
2.1.2.	Overview of the Digital Infrastructure.....	2-2
2.1.3.	Projects Using Digital Technology to Solve Development Issues	2-3
2.1.4.	Development Partners in the Area of ICT and Digital Technologies	2-6
2.1.5.	Status of Policy Support for Private Companies with Digital Technology	2-8
2.2.	Morocco.....	2-9
2.2.1.	Policies/Strategies and Legal Environment for Digital Technologies.....	2-9
2.2.2.	Overview of Digital Infrastructure.....	2-10
2.2.3.	Projects Using Digital Technology to Solve Development Issues	2-11
2.2.4.	Development Partners in the Area of ICT and Digital Technologies	2-13
2.2.5.	Overview of Policies to Support Private Companies with Digital Technologies	2-14
2.3.	Tunisia	2-15
2.3.1.	Policies/Strategies and Legal Environment for Digital Technologies.....	2-15
2.3.2.	Overview of Digital Infrastructure.....	2-17
2.3.3.	Projects Using Digital Technology to Solve Development Issues	2-19
2.3.4.	Development Partners in the Area of ICT and Digital Technologies	2-21
2.3.5.	Status of Policy Support for Private Companies with Digital Technology	2-23
Chapter 3	Evaluation of Validity of Target Sectors	3-1
3.1.	Validity Evaluation Method and Target Sectors	3-1
3.1.1.	Validity Evaluation Criteria.....	3-1
3.1.2.	Candidates of Target Sectors to be Considered in Target Countries	3-1
3.2.	Egypt.....	3-2
3.2.1.	Results of Validity Review by Target Sector.....	3-2
3.2.2.	Results of Validity Evaluation by Target Sector.....	3-7
3.3.	Morocco.....	3-8
3.3.1.	Results of Validity Review by Target Sector.....	3-8
3.3.2.	Results of Validity Evaluation by Target Sector.....	3-11
3.4.	Tunisia	3-12
3.4.1.	Results of Validity Review by Target Sector.....	3-12
3.4.2.	Results of Validity Evaluation by Target Sector.....	3-16
3.5.	Selection Result of Target Sectors	3-17
3.5.1.	Egypt.....	3-17
3.5.2.	Morocco	3-18
3.5.3.	Tunisia.....	3-18
Chapter 4	Current Status and Issues in the Surveyed Sectors	4-1
4.1.	Egypt.....	4-1
4.1.1.	Overview.....	4-1
4.1.2.	Agriculture and Fishery.....	4-2
4.1.3.	Transport	4-6
4.1.4.	Education	4-10
4.1.5.	Health.....	4-16
4.2.	Morocco.....	4-19
4.2.1.	Overview.....	4-19

4.2.2. Agriculture and Fishery.....	4-21
4.2.3. Education	4-24
4.3. Tunisia	4-30
4.3.1. Overview.....	4-30
4.3.2. Agriculture and Fishery.....	4-32
4.3.3. Industrial Development.....	4-35
4.3.4. Transport.....	4-39
Chapter 5 Cases of the Utilization of Digital Technology by Sector.....	5-1
5.1. Agriculture and Fisheries Sector	5-1
5.1.1. Agriculture Sector	5-1
5.1.2. Fisheries Sector	5-4
5.2. Industrial Development Sector	5-12
5.2.1. Application of Digital Technology to Industrial Development.....	5-12
5.2.2. Steps to Introduce Digital Technologies to Manufacturing Site.....	5-13
5.2.3. Cases of the Utilization of Digital Technology to Contribute to Industrial Development	5-14
5.3. Transport Sector.....	5-21
5.3.1. Traffic Big Data Utilization Technology.....	5-22
5.3.2. Traffic Control and Management	5-24
5.3.3. Highway Management	5-25
5.3.4. Management of Public Transport Operation	5-27
5.3.5. Others.....	5-28
5.4. Education Sector.....	5-28
5.4.1. Education Sector (General)	5-28
5.4.2. Vocational/Skill Training	5-36
5.5. Health Sector	5-39
5.5.1. Utilization of Digital Technology in the Health Sector.....	5-39
5.5.2. Cases of the Utilization of Digital Technology in the Health Sector	5-39
Chapter 6 Development Issues and Applicable Digital Solutions Identified through Local Workshops...	6-1
6.1. How to Extract Development Issues and Digital Technologies Applicable to Resolution	6-1
6.2. Egypt.....	6-2
6.2.1. Agriculture and Fisheries Sector.....	6-2
6.2.2. Transport Sector	6-5
6.2.3. Education Sector	6-7
6.2.4. Health Sector.....	6-9
6.3. Morocco.....	6-13
6.3.1. Agriculture and Fisheries Sector.....	6-13
6.3.2. Education Sector	6-15
6.4. Tunisia	6-18
6.4.1. Agriculture and Fisheries Sector.....	6-18
6.4.2. Industrial Development Sector.....	6-20
6.4.3. Transport Sector	6-22
Chapter 7 Specification of Applicable Digital Solutions to Development Issues through Workshop in Japan	7-1
7.1. How to Extract Applicable Digital Technologies	7-1
7.2. Agriculture and Fisheries sector	7-1
7.2.1. Agriculture Sector	7-1
7.2.2. Fisheries Sector	7-4
7.3. Industrial Development Sector	7-8
7.4. Transport Sector.....	7-12
7.5. Education Sector.....	7-15
7.6. Health Sector	7-17
Chapter 8 Evaluation and Narrowing of Digital Solutions Applicable to Development Issues	8-1
8.1. Setting Evaluation Criteria	8-1

8.2.	Agriculture and Fisheries Sector	8-1
8.2.1.	Review Results.....	8-1
8.2.2.	Narrowed Applicable Digital Solutions	8-6
8.3.	Industrial Development Sector	8-8
8.3.1.	Review Results.....	8-8
8.3.2.	Narrowed Applicable Digital Solutions	8-9
8.4.	Transport Sector.....	8-10
8.4.1.	Review Results.....	8-10
8.4.2.	Narrowed Applicable Digital Solutions	8-14
8.5.	Education Sector.....	8-15
8.5.1.	Review Results.....	8-15
8.5.2.	Narrowed Applicable Digital Solutions	8-19
8.6.	Health Sector	8-20
8.6.1.	Review Results.....	8-20
8.6.2.	Narrowed Applicable Digital Solutions	8-23
Chapter 9	Evaluation of Effectiveness and Validity of Digital Technologies for Resolution of Development Issues through Local Workshops	9-1
9.1.	How to Evaluate Effectiveness and Validity of Digital Technologies for Resolution of Development Issues	9-1
9.2.	Egypt.....	9-2
9.2.1.	Agriculture and Fisheries Sector.....	9-2
9.2.2.	Transport Sector.....	9-4
9.2.3.	Education Sector	9-6
9.2.4.	Health Sector.....	9-9
9.3.	Morocco.....	9-12
9.3.1.	Fisheries Sector.....	9-12
9.3.2.	Education sector.....	9-14
9.4.	Tunisia	9-16
9.4.1.	Agriculture and Fisheries Sector.....	9-16
9.4.2.	Transport Sector.....	9-18
9.4.3.	Industrial Development Sector.....	9-21
Chapter 10	Proposal of Candidate Projects	10-1
10.1.	Criterion of Selection of Draft Project Plans and Draft Project Concepts.....	10-1
10.2.	Egypt.....	10-1
10.2.1.	Digital Technology Innovation (Reinforcement of the Digital Innovation Ecosystem, ICT Policy Implementation System and Innovation Promotion System).....	10-1
10.2.2.	Agriculture and Fishery.....	10-8
10.2.3.	Transport.....	10-14
10.2.4.	Education	10-23
10.2.5.	Health.....	10-30
10.3.	Morocco.....	10-40
10.3.1.	Digital technology innovation (reinforcement of the digital innovation ecosystem, ICT policy implementation system, and innovation promotion system).....	10-40
10.3.2.	Fishery.....	10-49
10.3.3.	Education	10-54
10.4.	Tunisia	10-61
10.4.1.	Digital Technology Innovation (Reinforcement of the Digital Innovation Ecosystem, ICT Policy Implementation System and Innovation Promotion System).....	10-61
10.4.2.	Agriculture and Fishery.....	10-70
10.4.3.	Industrial Development.....	10-76
10.4.4.	Transport.....	10-85

List of Candidate Projects

Candidate Project 1 Draft Project Concept for Digital Technology Innovation in Egypt: Strengthening the Government's Implementation Capacity to Promote Digital Innovation	10-3
Candidate Project 2 Draft Project Concept for Digital Technology Innovation in Egypt: Digital Innovation Ecosystem Strengthening Project	10-5
Candidate Project-3 Draft Project Plan for Fisheries sector of Egypt: Inland Water Aquaculture Improvement and Propagation Project.....	10-9
Candidate Project-4 Draft Project Plan for the Agricultural sector of Egypt: Arrangement of an Information Provision System to Improve the Income Generation of Small-scale Farmers	10-11
Candidate Project-5 Draft Project Concept for the Agricultural Sector of Egypt: Information Collection and Confirmation Survey for the Utilization of Digital Technologies for Efficient Water Resource Management	10-13
Candidate Project-6 Draft Project Plan for the Transport Sector of Egypt: Information Collection Survey for the Utilization of Traffic Data and Digital Technologies to Solve Transport Issues.....	10-16
Candidate Project-7 Draft Project Concept for the Transport Sector of Egypt: Project for the Establishment of Smart Traffic Management System in the Cairo Metropolitan Area	10-18
Candidate Project-8 Draft Project Concept for the Transport Sector of Egypt: Project for Capacity Development of Traffic Management in the Cairo Metropolitan Area.....	10-19
Candidate Project-9 Draft Project Concept for the Transport Sector of Egypt: Project for Capacity Development of Toll Road Management Utilizing Digital Technology.....	10-21
Candidate Project-10 Draft Project Concept for the Transport Sector of Egypt: Project for Capacity Development of Traffic Safety in Cairo Using Digital Technology	10-22
Candidate Project-11 Draft Project Concept for the Education Sector of Egypt: Project to Strengthen Teachers' ICT Skills for Blended Learning Practices in Primary Education	10-25
Candidate Project-12 Draft Project Concept for the Education Sector of Egypt: Project to Improve the Quality of Technical Education and Vocational Training by Using Digital Technology to Meet the Needs of Industry.....	10-28
Candidate Project-13 Draft Project Concept for the Health Sector of Egypt: Data Collection Survey for the Support for the Universal Health Insurance System.....	10-32
Candidate Project-14 Draft Project Concept for the Health Sector of Egypt: Support for the Establishment of the Health Management Information System (HMIS).....	10-35
Candidate Project-15 Draft Project Concept for the Health Sector of Egypt: Establishment of the Nationwide Network of Pathologic Examination.....	10-36
Candidate Project-16 Draft Project Concept for the Health Sector of Egypt: Expansion of Remote Diagnosis for Primary Healthcare	10-38
Candidate Project-17 Draft Project Concept for Digital Technology Innovation in Morocco: Strengthening the Government's Policy Implementation Capacity Using Digital Technologies	10-42
Candidate Project-18 Draft Project Concept for Digital Technology Innovation in Morocco: Strengthening the Government's Implementation and Governance Capacity to Promote Digital Innovation	10-44
Candidate Project-19 Draft Project Concept for Digital Technology Innovation in Morocco: Digital Innovation Ecosystem Strengthening Project	10-46
Candidate Project-20 Draft Project Plan for Fisheries sector of Morocco: Marine Aquaculture Improvement for Small Scale Fishermen Project	10-50
Candidate Project-21 Draft Project Concept for Fisheries Sector of Morocco: Strengthening Fisheries Association to Realize a Sustainable Fisheries sector	10-52
Candidate Project-22 Draft Project Plan for the Education Sector of Morocco: Project to Strengthen Teachers' ICT Skills for Blended Learning Practices in Primary Education	10-56
Candidate Project-23 Draft Project Concept for the Education Sector of Morocco: Project to Improve the Quality of Vocational Training by using Digital Technology to Meet the Needs of Industry.....	10-59
Candidate Project-24 Draft Project Concept for Digital Technology Innovation in Tunisia: Strengthening Government Implementation Capacity through Using Digital Technology	10-63
Candidate Project-25 Draft Project Concept for Digital Technology Innovation in Tunisia: Strengthening Governance Capacity to Promote Digital Innovation.....	10-65

Candidate Project-26 Draft Project Concept for Digital Technology Innovation in Tunisia: Strengthening the Digital Innovation Ecosystem.....	10-67
Candidate Project-27 Draft Project Plan for the Agriculture and Fisheries sector of Tunisia: Project for Curriculum Development Support for Training Schools for Agricultural and Fishery Workers .	10-71
Candidate Project-28 Draft Project Concept for the Agriculture and Fisheries sector of Tunisia: Project for Strengthening the Organization of Fishery Cooperatives for the Realization of Sustainable Local Fishery	10-73
Candidate Project-29 Draft Project Concept for the Agriculture and Fisheries sector of Tunisia: Project for Support for Strengthening the Assessment System for Fishery Resources	10-75
Candidate Project-30 Draft Project Concept for Industrial Development Sector in Tunisia: IoT-Based Factory Improvement Program	10-78
Candidate Project 31 Draft Project Concept for Industrial Sectors in Tunisia: R&D Support by Strengthening Function of the R&D Support Center	10-81
Candidate Project 32 Draft Project Concept for Industrial Development Sector in Tunisia: Two-step Loan for Supporting Digitization Investments	10-83
Candidate Project-33 Draft Project Plan for the Transport Sector of Tunisia: Support for Formulating a Framework for Transportation Data Platform and Data Use	10-87
Candidate Project-34 Draft Project Concept for the Transport Sector of Tunisia: Project for Capacity Development of Toll Road Management Utilizing Digital Technology	10-89
Candidate Project-35 Draft Project Concept for the Transport Sector of Tunisia: Support for the Establishment of Smart Traffic Management System in the Tunis Metropolitan Area	10-90
Candidate Project-36 Draft Project Concept for the Transport Sector of Tunisia: Project for the Capacity Building of Traffic Management in the Tunis Metropolitan Area	10-91
Candidate Project-37 Draft Project Concept for the Transport Sector of Tunisia: Project for Capacity Development of Traffic Safety in Tunis Using Digital Technology	10-93

List of Figures

Figure 1-1 Workflow of the Project	1-2
Figure 1-2 Changes of Implementation Schedule	1-3
Figure 1-3 Revised Survey Schedule	1-4
Figure 2-1 Percentage of Households with Internet Access at Home in Egypt 2018~2019 (Urban and Rural)	2-3
Figure 2-2 Percentage of Internet use in Egypt by Gender (%)	2-3
Figure 2-3 Percentage of Households with Internet Access at home in Morocco (%) 2018-2019 (urban and rural)	2-11
Figure 2-4 Percentage of Internet Use in Morocco by Gender (%) 2018-2019	2-11
Figure 2-5 Percentage of Households with Internet Access at home in Tunisia (%), 2018-2019 (urban and rural)	2-19
Figure 2-6 Percentage of Internet Use in Tunisia by Gender (%), 2018-2019	2-19
Figure 4-1 GDP Growth (annual,%) (Egypt)	4-1
Figure 4-2 Percentage of Main Industries in GDP (Egypt)	4-1
Figure 4-3 Production Value of Agriculture and Fisheries	4-3
Figure 4-4 Water use in 2015/16 by purpose	4-3
Figure 4-5 Type of Water Resource in 2015/16	4-3
Figure 4-6 Fish Production by Place	4-4
Figure 4-7 Cairo Metro	4-6
Figure 4-8 New Capital Construction Site	4-6
Figure 4-9 City Bus Control Center	4-6
Figure 4-10 Trunk Roads in North Area of Egypt: Target Roads of ITS Project Phase-1	4-7
Figure 4-11 Congestion in Cairo	4-8
Figure 4-12 Broken Traffic Lights	4-8
Figure 4-13 Traffic Accident on the Highway	4-8
Figure 4-14 ETC Planned Toll Gate	4-9
Figure 4-15 Illegal Parking in the City	4-9
Figure 4-16 Traffic Data Utilization based on RFID	4-9
Figure 4-17 Transition of Enrollment Rate in Primary and Secondary Education	4-11
Figure 4-18 Literacy Rate by Gender from 15 to 24 years old	4-13
Figure 4-19 Literacy Rate by Gender over 65	4-13
Figure 4-20 Tutoring Services of Orcas	4-14
Figure 4-21 Real GDP Growth Rate (Morocco)	4-20
Figure 4-22 Percentage of Main Industries in GDP (Morocco)	4-20
Figure 4-23 Actual GDP Growth Rate and Changes in Agricultural Production Growth Rate	4-21
Figure 4-24 Percentage of Production Type of Cultivated Acreage, Amount of Production, Employees and Export Value	4-21
Figure 4-25 Fishery Production Volume & Value	4-22
Figure 4-26 Production Volume (Left) and Value (Right) by Fishery Type	4-22
Figure 4-27 Fishery in Morocco	4-23
Figure 4-28 Number of Out-of-School Children and Adolescents	4-25
Figure 4-29 Literacy Rate among the Population aged 15 years and older	4-25
Figure 4-30 Illiterate Population by Gender	4-28
Figure 4-31 Kiffeslesmaths Website	4-28
Figure 4-32 Botischool Website	4-29
Figure 4-33 GDP Growth (Tunisia)	4-31
Figure 4-34 Percentage of Main Industries in GDP (Tunisia)	4-31
Figure 4-35 Impact of COVID-19 on GDP	4-33
Figure 4-36 Value Added to Manufacturing by Sector (2020)	4-36
Figure 4-37 Change in Value Added to Manufacturing by Sector (Real basis)	4-36
Figure 4-38 Trends of FDI	4-37
Figure 4-39 Tunisia Companies Utilizing Digital Technology	4-37
Figure 4-40 Highway Network in Tunisia	4-39
Figure 4-41 Highway Toll Plaza	4-39

Figure 4-42 Highway Section in Service	4-39
Figure 4-43 Tunis Suburban Railway	4-40
Figure 4-44 Tunis Metro	4-40
Figure 4-45 Traffic Situation in Tunis.....	4-41
Figure 4-46 Collection, Storage and Analysis of Road Traffic Information	4-43
Figure 5-1 Farming Support System.....	5-2
Figure 5-2 Farm Analysis by Drone and AI	5-2
Figure 5-3 Spraying Pesticides by a Drone.....	5-2
Figure 5-4 Zero Agri Mechanism.....	5-2
Figure 5-5 Tabe Choku Mechanism	5-3
Figure 5-6 Automated Purchase Order Entry	5-3
Figure 5-7 A Cargo Container with a Chilled and Freezer System	5-3
Figure 5-8 Utilization Image of Learning System	5-4
Figure 5-9 Utilization Image of Simple CTD	5-7
Figure 5-10 Underwater Glider.....	5-7
Figure 5-11 Fish Length Measurement Image	5-7
Figure 5-12 Utilization Image of ICT buoy	5-7
Figure 5-13 Utilization Image of Triton's halberd	5-7
Figure 5-14 Mapping Function of ISANA.....	5-8
Figure 5-15 Commissioned Development of Sea Condition Forecasting System “SEAO ME”	5-8
Figure 5-16 Screen on Umishiru.....	5-8
Figure 5-17 Analysis of the Growth of Laver by Drone	5-9
Figure 5-18 Float-sink Type Farming Cage	5-9
Figure 5-19 Smart Feeding System for Aquaculture “UMITRON CELL®”	5-10
Figure 5-20 Utilization Flow of Digital Operation Logbook.....	5-10
Figure 5-21 Making Aquaculture Know-How into a Manual by AI Analysis	5-11
Figure 5-22 Overview of Poaching Monitoring System.....	5-11
Figure 5-23 A Map Showing Fishing Boats.....	5-12
Figure 5-24 Structure of Introducing Digital Technologies to the Manufacturing Sector	5-13
Figure 5-25 The Process of Applying Digital Technology to Manufacturing.....	5-14
Figure 5-26 Process to Develop Prototypes.....	5-15
Figure 5-27 Activities of the Monozukuri Prototype Development Support Center.....	5-15
Figure 5-28 Kaizen by Utilizing a Camera at a Production Site	5-16
Figure 5-29 Software for Work Analysis	5-16
Figure 5-30 Factory Facility Operation Monitoring and Performance Management System.....	5-16
Figure 5-31 Schematic Drawing of IoT Sensor Data Collection Tool	5-16
Figure 5-32 Configuration of ERP.....	5-17
Figure 5-33 ERP example	5-17
Figure 5-34 Example of BI (DEFTeam)	5-17
Figure 5-35 Example of BI (SAP Analytical Cloud)	5-18
Figure 5-36 Example of BI (Datapine)	5-18
Figure 5-37 Example of Supply Chain Management System	5-18
Figure 5-38 Verification of Project Utilizing Information Obtained from IoT Home Appliances.....	5-19
Figure 5-39 Example of Open Platform for Utilizing IoT Home Appliance Data	5-19
Figure 5-40 Example of BPO Service.....	5-20
Figure 5-41 Example of Available BPO.....	5-20
Figure 5-42 Probe Data Utilization (1)	5-22
Figure 5-43 Probe Data Utilization (2)	5-23
Figure 5-44 Mobile Station Data Utilization	5-23
Figure 5-45 Image Analysis and AI Technology Utilization.....	5-24
Figure 5-46 Traffic Signal Control System and Relevant Technologies	5-24
Figure 5-47 RFID Technology Utilization	5-25
Figure 5-48 Highway Traffic Management System.....	5-25
Figure 5-49 Electronic Toll Collection System.....	5-26
Figure 5-50 Overload Detection System and Application of Probe Technology	5-26
Figure 5-51 BRT System.....	5-27

Figure 5-52 Public Transport Priority System for Bus.....	5-27
Figure 5-53 Common Smart Card.....	5-28
Figure 5-54 Combination of Park and Ride Measure and EV	5-28
Figure 5-55 Overview of Digital Technology in the Education Sector.....	5-29
Figure 5-56 System Configuration Diagram and Usage Image of “Wisebook Cloud” of Begal Co., Ltd.	5-30
Figure 5-57 Screen Image of “SuRaLa”	5-31
Figure 5-58 Screen Image of “SoroTouch”	5-31
Figure 5-59 Screen Image of “Khan Academy”	5-32
Figure 5-60 Concept of Educational Big Data / Learning Analytics	5-33
Figure 5-61 Screen Image of “respon”	5-33
Figure 5-62 Screen image of “Forestanet”	5-34
Figure 5-63 Screen image of “SENSEI NOTE”	5-34
Figure 5-64 Screen image of “Digital School Business of Integrated School Business Management System”	5-35
Figure 5-65 Screen Image of “Edmode”	5-36
Figure 5-66 Vocational Training Utilizing “ActiVaR”	5-37
Figure 5-67 Screen Images of “Polytechnic University AR Bar Arrangement Drawing & Steel Frame Drawing App”	5-38
Figure 5-68 Operation Screen of “AR Welding Skill Training System”	5-38
Figure 5-69 Case of Medical Information Collaboration Network.....	5-40
Figure 5-70 Case of District Health Information System	5-41
Figure 5-71 Case of Remote Medical Services.....	5-41
Figure 5-72 Case of Telepathology Network	5-42
Figure 5-73 Case of Cloud Medical Care Support System	5-42
Figure 5-74 Case of Health Insurance System.....	5-43
Figure 5-75 Case of Hospital Management System.....	5-43
Figure 5-76 Case of Utilizing RFID at Hospitals.....	5-44
Figure 5-77 Case of Application for Keeping Health	5-44
Figure 6-1 Scenes of the Workshop with the Local Persons Concerned in Egypt (November 22, 2020).....	6-1
Figure 6-2 Scenes of the Workshop with the Local Persons Concerned in Morocco (November 19, 2020).....	6-1
Figure 6-3 Scenes of the Workshop with the Local Persons Concerned in Tunisia (November 11, 2020).....	6-2
Figure 6-4 Scenes of the Workshop Held in Tunisia (March 4, 2020).....	6-2
Figure 7-1 Scenes of the Workshop in Japan (December 22, 2020)	7-1
Figure 9-1 Scene of the Workshop with the Local Persons Concerned in Egypt (28 th December 2021).....	9-1
Figure 9-2 Scene of the Workshop with the Local Persons Concerned in Morocco (21 st December 2021)	9-1
Figure 9-3 Scene of the Workshop with the Local Persons Concerned in Tunisia (23 rd December 2021)	9-1

List of Tables

Table 1-1 List of JICA Study Team Members.....	1-1
Table 2-1 Public Institutions in Charge of Digital Technologies (Egypt)	2-2
Table 2-2 Support by Other Donor Agencies (Egypt).....	2-6
Table 2-3 Institutions in Charge of Digital Technologies and Regulations (Morocco).....	2-10
Table 2-4 Support by Other Donor Agencies (Morocco).....	2-13
Table 2-5 Institutions in Charge of Digital Technologies and Regulations (Tunisia)	2-17
Table 2-6 Support by Other Donor Agencies (Tunisia)	2-21
Table 3-1 Validity Evaluation Criteria	3-1
Table 3-2 Candidate Sectors to be Evaluated as Target Sectors for Each Target Country	3-1
Table 3-3 Results of Validity Review of Candidate Sectors (Egypt)	3-2
Table 3-4 Summary Table of Validity Evaluation Results by Target Sector (Egypt).....	3-7
Table 3-5 Results of Validity Review of Candidate Sectors (Morocco)	3-8
Table 3-6 Summary Table of Validity Evaluation Results by Target Sector (Morocco)	3-12
Table 3-7 Results of Validity Review of Candidate Sectors (Tunisia).....	3-12
Table 3-8 Summary Table of Validity Evaluation Results by Target Sector (Tunisia).....	3-16
Table 3-9 Evaluation Result of Target Sectors (Egypt).....	3-18
Table 3-10 Evaluation Result of Target Sectors (Morocco).....	3-18
Table 3-11 Evaluation Result of Target Sectors (Tunisia).....	3-19
Table 4-1 Economic Outline (Egypt).....	4-1
Table 4-2 JICA's Supporting Plan and Major Projects (Egypt)	4-2
Table 4-3 Fish Production by Fish Group	4-4
Table 4-4 Examples of Agricultural and fisheries Startups in Egypt	4-5
Table 4-5 Examples of Startups in Transport Sector in Egypt	4-9
Table 4-6 Examples of Startups in Education Sector in Egypt	4-15
Table 4-7 Indexes of Health in Egypt (2018).....	4-16
Table 4-8 Egypt Vision 2030.....	4-17
Table 4-9 Example of Startups in Health Sector in Egypt	4-18
Table 4-10 Economic Outline (Morocco)	4-19
Table 4-11 JICA Support Plan and Major Projects (Morocco)	4-20
Table 4-12 Examples of Startups in Agriculture and Fisheries sectors in Morocco	4-24
Table 4-13 Examples of Startups in Education Sector in Morocco	4-29
Table 4-14 Economic Outline (Tunisia).....	4-30
Table 4-15 JICA's Supporting Plan and Major Projects (Tunisia)	4-31
Table 4-16 Major Agricultural Production.....	4-32
Table 4-17 Volume of Fish Landings by Fishery Type	4-32
Table 4-18 Examples of Startups in Agriculture and Fisheries sector in Tunisia.....	4-34
Table 4-19 Total Length of Developed Roads by Road Type	4-39
Table 4-20 Examples of Startups in Transport Sector in Tunisia.....	4-43
Table 5-1 Cases of the Utilization of Digital Technologies in the Agriculture Sector	5-1
Table 5-2 Cases of the Utilization of Digital Technologies in the Fisheries sector.....	5-4
Table 5-3 Steps to Introduce Digital Technologies to Manufacturing Industry.....	5-13
Table 5-4 Cases of the Utilization of Digital Technology to Transport Sector	5-21
Table 5-5 Utilization Examples of Digital Technologies in the Education Sector	5-29
Table 5-6 Utilization of Digital Technology in the Health Sector.....	5-39
Table 6-1 Assumed Stakeholders (Agriculture and Fishery Sector in Egypt).....	6-4
Table 6-2 Assumed Stakeholders (Transport Sector in Egypt)	6-6
Table 6-3 Assumed Stakeholders (Education Sector in Egypt).....	6-9
Table 6-4 Assumed Stakeholders (Health Sector in Egypt)	6-13
Table 6-5 Assumed Stakeholders (Agriculture and Fishery Sector in Morocco).....	6-15
Table 6-6 Assumed Stakeholders (Education Sector in Morocco).....	6-18
Table 6-7 Assumed Stakeholders (Agriculture and Fishery Sector in Tunisia).....	6-19
Table 6-8 Assumed Stakeholders (Industrial Development Sector in Tunisia).....	6-22
Table 6-9 Assumed Stakeholders (Transport Sector in Tunisia)	6-23

Table 8-1 Evaluation Criteria for the Selection of Candidate Projects	8-1
Table 9-1 Outline of the Workshops	9-1
Table 9-2 Major Comments on the Digital Solutions Proposed for the Agriculture and Fisheries Sector in Egypt	9-2
Table 9-3 Result of Analysis of Digital Solutions in the Agriculture and Fisheries Sector in Egypt.....	9-3
Table 9-4 Major Comments on the Digital Solutions Proposed for the Transport Sector in Egypt	9-4
Table 9-5 Result of Analysis of Digital Solutions in the Transport Sector in Egypt.....	9-5
Table 9-6 Major Comments on the Digital Solutions Proposed for the Education Sector in Egypt	9-6
Table 9-7 Result of Analysis of Digital Solutions in the Education Sector in Egypt.....	9-7
Table 9-8 Major Comments on the Digital Solutions Proposed for the Health Sector in Egypt.....	9-9
Table 9-9 Result of Analysis of Digital Solutions Proposed for the Health Sector in Egypt	9-10
Table 9-10 Major Comments on the Digital Solutions Proposed for the Fisheries Sector in Morocco	9-12
Table 9-11 Result of Analysis of Digital Solutions in the Fisheries Sector in Morocco	9-13
Table 9-12 Major Comments on the Digital Solutions Proposed for the Education Sector in Morocco	9-14
Table 9-13 Result of Analysis of Digital Solutions in the Education Sector in Morocco	9-15
Table 9-14 Major Comments on the Digital Solutions Proposed for the Agriculture and Fisheries Sector in Tunisia	9-16
Table 9-15 Result of Analysis of Digital Solutions in the Agriculture and Fisheries Sector in Tunisia.....	9-17
Table 9-16 Major Comments on the Digital Solutions Proposed for Transport Sector in Tunisia.....	9-18
Table 9-17 Result of Analysis of Digital Solutions in the Transport Sector in Tunisia.....	9-19
Table 9-18 Major Comments on the Digital Solutions Proposed for the Industrial Development Sector in Tunisia	9-21
Table 9-19 Result of Analysis of Digital Solutions Proposed for the Industrial Development Sector in Tunisia... ..	9-22
Table 10-1 Draft Candidate Projects for Digital Technology Innovation in Egypt.....	10-2
Table 10-2 Evaluation of Draft Candidate Projects for Digital Technology Innovation of Egypt.....	10-3
Table 10-3 Draft Candidate projects for Agricultural and Fishery Sectors in Egypt	10-8
Table 10-4 Evaluation of Draft Candidate Projects for Agriculture and Fisheries sector of Egypt	10-9
Table 10-5 Draft Candidate Projects for the Transport Sector in Egypt.....	10-15
Table 10-6 Evaluation of Draft Candidate Projects for Transport Sector of Egypt.....	10-15
Table 10-7 Candidate Projects for the Education Sector in Egypt (Draft).....	10-24
Table 10-8 Evaluation of Candidate Project for the Education Sector in Egypt.....	10-24
Table 10-9 Draft Candidate Projects for the Health Sector in Egypt (Draft)	10-30
Table 10-10 Evaluation of Draft Candidate Projects for Health Sector of Egypt	10-31
Table 10-11 Draft Candidate Projects for Digital Technology Innovation in Morocco	10-41
Table 10-12 Evaluation of Draft Candidate Projects for Digital Innovation Technology of Morocco	10-42
Table 10-13 Draft Candidate Projects for Fisheries Sectors in Morocco.....	10-49
Table 10-14 Evaluation of Candidate Projects for the Fisheries Sector in Morocco.....	10-50
Table 10-15 Draft Candidate Project for the Education Sector in Morocco	10-55
Table 10-16 Evaluation of Candidate Project for the Education Sector in Morocco	10-55
Table 10-17 Draft Candidate Projects for Digital Technology Innovation in Tunisia.....	10-62
Table 10-18 Evaluation of Draft Candidate Projects for Digital Innovation Technology of Tunisia.....	10-63
Table 10-19 Draft Candidate Projects for Agriculture and Fisheries sectors in Tunisia	10-70
Table 10-20 Evaluation of Candidate Projects for the Agriculture and Fisheries sector in Tunisia.....	10-71
Table 10-21 Draft Candidate Projects for Industrial Development Sector in Tunisia.....	10-77
Table 10-22 Evaluation of Draft Candidate Projects for Industrial Development of Tunisia	10-77
Table 10-23 Draft Candidate Projects for the Transport Sector in Tunisia	10-85
Table 10-24 Evaluation of Draft Candidate Projects for Transport Sector of Tunisia	10-86

Abbreviations

ADD	Digital Development Agency
ADSL	Asymmetric Digital Subscriber Line
AFD	Agence Française de Développement
AI	Artificial Intelligence
AIS	Automatic Identification System
ANME	National Energy Management Agency
AR	Augmented Reality
AfDB	African Development Bank
B2B	Business to Business
B2C	Business to Consumer
BPO	Business Process Outsourcing
BRT	Bus Rapid Transit
CAD	Computer-Aided Design
CAE	Computer Aided Engineering
CAM	Computer Aided Manufacturing
CAPMAS	Central Agency for Public Mobilization and Statistics
CIO	Chief Information Officer
CIRAD	Centre de Coopération Internationale en Recherche Agronomique p le Développement
D2C	Direct to Consumer
DFID	United Kingdom Department for International Development
DHIS	District Health Information System
DPF	Development Policy Financing
DX	Digital Transformation
E-JUST	Egypt-Japan University of Science and Technology
EKB	Egyptian Knowledge Bank
ERP	Enterprise Resource Planning
ETC	Electronic Toll Collection
EU	European Union
EV	Electric Vehicle
FAO	Food and Agriculture Organization
FDI	Foreign Direct Investment
FIPA	Foreign Investment Promotion Agency
FOSS	Free and Open Source Software
GAFRD	General Authority for Fish Resources Development
GAHC	General Authority of Health Care
G2C	Government to Citizen

GDP	Gross Domestic Product
GDPR	General Data Protection Regulation
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GMP	Good Manufacturing Practice
GPS	Global Positioning System
GSMA	Global System for Mobile Communications Association
HCP	High Commission for Planning of Morocco
HMIS	Health Management Information System
ICT	Information, Communication, Technology
IDRC	International Development Research Centre
IFAD	International Fund for Agriculture Development
IFC	International Finance Corporation
IMF	International Monetary Fund
IoT	Internet of Things
IPF	Investment Project Financing
IPO	Initial Public Offering
ISP	Internet Service Provider
ITIDA	Information Technology Industry Development Agency
ITS	Intelligent Transport Systems
ITU	International Telecommunication Union
IUU	Illegal, Unreported and Unregulated
JICA	Japan International Cooperation Agency
KPO	Knowledge Process Outsourcing
KfW	Kreditanstalt für Wiederaufbau
LRS	Learning Record Store
MALR	Ministry of Agriculture and Land Reclamation
MCIT	Ministry of Communications and Information Technology
MOHP	Ministry of Health and Population
MOOCs	Massive Open Online Courses
MRP	Material Requirement Planning
MVNO	Mobile Virtual Network Operator
MWRI	Ministry of Water Resources and Irrigation
MaaS	Mobility as a Service
NGO	Non-Governmental Organization
NTRA	National Telecommunications Regulatory Authority
OCR	Optical Character Recognition/Reader
ODA	Official Development Assistance

OECD	Organization for Economic Co-operation and Development
OEM	Original Equipment Manufacturer
POS	Point of Sale
PPP	Public Private Partnership
PTPS	Public Transport Priority System
PoC	Proof of Concept
R&D	Research & Development
SDGs	Sustainable Development Goals
SECO	State Secretariat for Economic Affairs
SME	Small and Medium Enterprise
STEM	Science, Technology, Engineering, and Mathematics
TDM	Traffic Demand Management
TGM	Tunis-Goulette-Marsa
TIMSS	Trends in International Mathematics and Science Study
UHI	Universal Health Insurance
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPA	Unified Medical Procurement Authority
USAID	United States Agency for International Development
VC	Venture Capital
VHF	Very High Frequency
VMS	Vessel Monitoring System
VR	Virtual Reality
WB	World Bank
WHO	World Health Organization
WSIS	World Summit on the Information Society

Chapter 1 Overview of Survey

1.1. Background

In the 21st century, digital technology using the internet and smart phones has stimulated innovations in all industries by solving issues of spatial and time constraints. The internet became widely available in recent years in Egypt, Tunisia, and Morocco and there are many tech-hubs which provide co-working spaces and run platforms to support/invest in entrepreneurs utilizing digital technology. Thus, there is the possibility that digital technology will contribute to the further development in these countries. For example, the World Bank views the utilization of digital technology as an important factor to support the North Africa region and considers how to utilize it in specific projects.

Therefore, there is a possibility that current and future JICA projects in Egypt, Tunisia, and Morocco can contribute to their development by utilizing digital technology (e.g., remote education, increase added value in agriculture, health, science technology research). Also, the utilization of digital technology may increase the involvement of private sector as it is often developed by private sector.

1.2. Objectives and Target Countries

This project targets Egypt, Tunisia, and Morocco for the objectives below.

- Identify the issues in target sectors in the countries
- Discuss the possibility of utilizing digital technology to solve the development issues in the sectors
- Propose new projects utilizing digital technology in consideration with the collaboration with JICA projects

1.3. Team Members

The members of JICA Study Team are listed below.

Table 1-1 List of JICA Study Team Members

Name	Position	Sector in charge
Mishima Kazuo	Team Leader/ Digi Tech Business Planner	Industrial Development and Health
Yamanaka Atsushi	Digital Technology Lead	All sectors
Takahashi (Shimokoshi) Shinobu	Digi Tech Business Planner	Agriculture and Fishery
Totani Hiroya	Digi Tech Business Planner	Transport
Mizuno Rena/ Yosuke Sekiguchi	Digi Tech Business Planner	Education

1.4. Target Sectors

The following three factors were considered in the selection of target sectors:

- 1) The possibility of utilizing the experiences/assets accumulated through past Japanese cooperation
- 2) The possibility of introduction and application of digital technology

3) Whether digital technology can produce increased results

The potential target sectors in each country were selected as discussed below.

Egypt: Agriculture and fishery, transport, health, and education

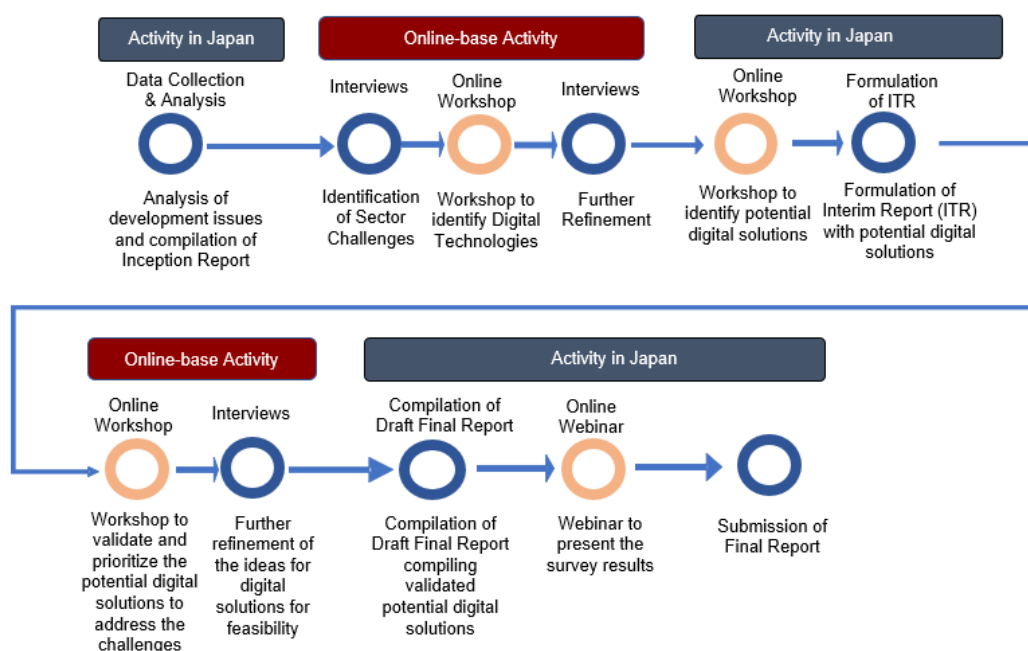
Morocco: Agriculture and fishery and education

Tunisia: Agriculture and fishery, industrial Development and Transport

Using the above sectors as a base, the JICA Study Team examined the validity of the sectors. (See Chapter 3 for more details)

1.5. Workflow

The Project was implemented by following the workflow below. Due to travel restrictions imposed by the global spread of COVID-19, the field work was reassigned to work in Japan (the details are explained in 1.6).



Source: JICA Study Team

Figure 1-1 Workflow of the Project

1.6. Survey Schedule

(1) Modified Survey Schedule

In the initial contract, the implementation period was from January 23, 2020 until October 30, 2020. The JICA Study Team had to discontinue the field work in response to the global spread of COVID-19 which had become serious after March 2020. On May 15, 2020, JICA and the JICA Study Team agreed to extend the deadline of the deliverables' delivery to the end of May 2022 considering the circumstances of COVID-19.

The activity plan before and after the extension of the deadline is shown in the following figure.

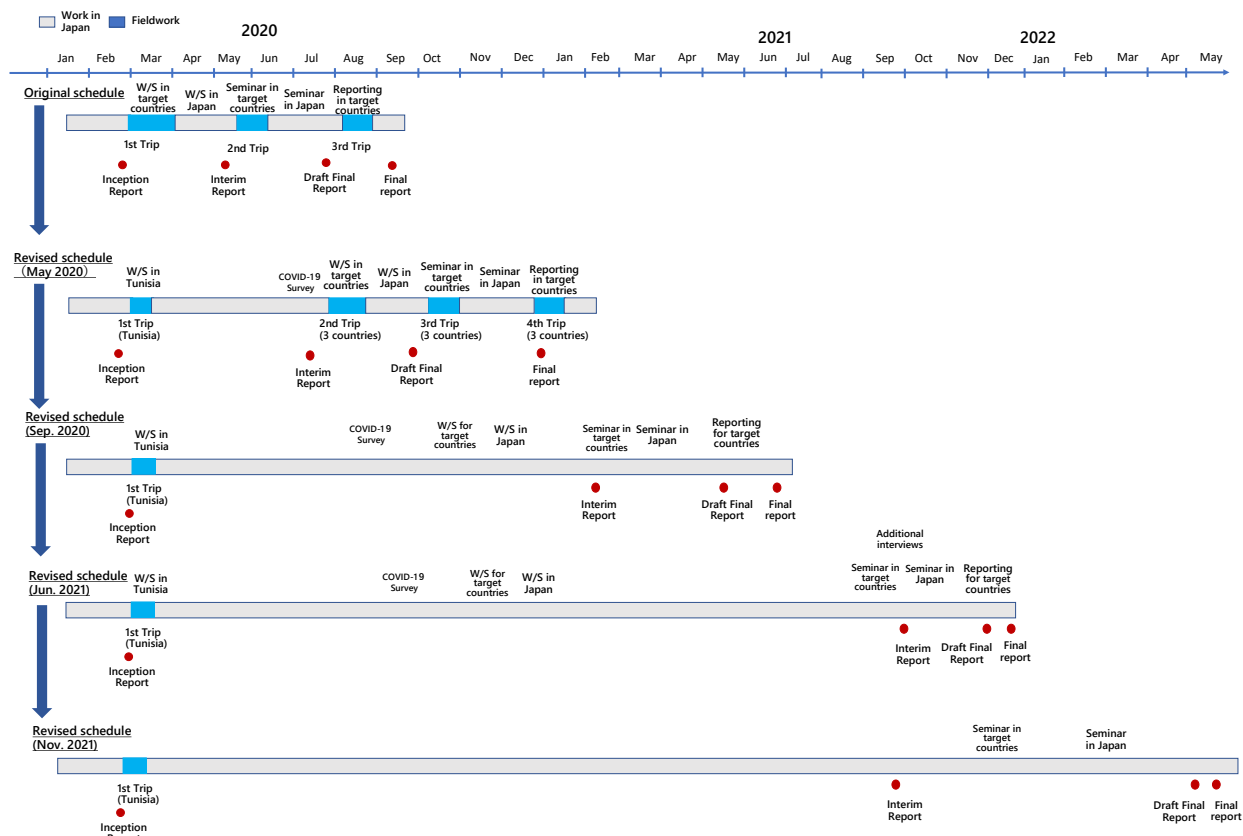


Figure 1-2 Changes of Implementation Schedule

The revised implementation schedule for the survey due to the extension of deadline is shown in the figure below.

Date	Country/holidays	Survey items/method	Report	Submission
December, 2019	End of FY (Morocco, Tunisia) Start of FY (Morocco, Tunisia)	1 Analyze the utilization of digital technology and development issues in the target countries 1-1) Analysis on digital technology Outline of digital infrastructure • Policy and laws related to digital technology • Government support to private sectors including startup companies which utilize digital technology • Trend of international organizations and other donors	1-2 Analysis on potential target sectors	
January, 2020		2 Select the target sectors and develop hypotheses 2-1 Analyze the validity of the sectors 2-2 Narrow down the target sectors 2-3 Select possible counterpart organizations		
February, 2020	Tunisia	3 Consider the possible utilization of digital technology and list up the stakeholders 3-1 Consider the possible utilization of digital technology in the target sectors 3-2 List up the stakeholders in the country including private companies 3-3 List up the stakeholders including private companies in Japan	Discuss on Ic/R	Δ Ic/R
March, 2020		4 Analyze the potential projects which utilize digital technology 4-1 Interview government organizations and private companies 4-2 Conduct a workshop with government organizations and private companies		
April, 2020	End of FY (Japan)			
May, 2020	Start of FY (Japan)	Ramadan (around Apr.23 - May 22)		
June, 2020	End of FY (Egypt)			
July, 2020	Start of FY (Egypt)			

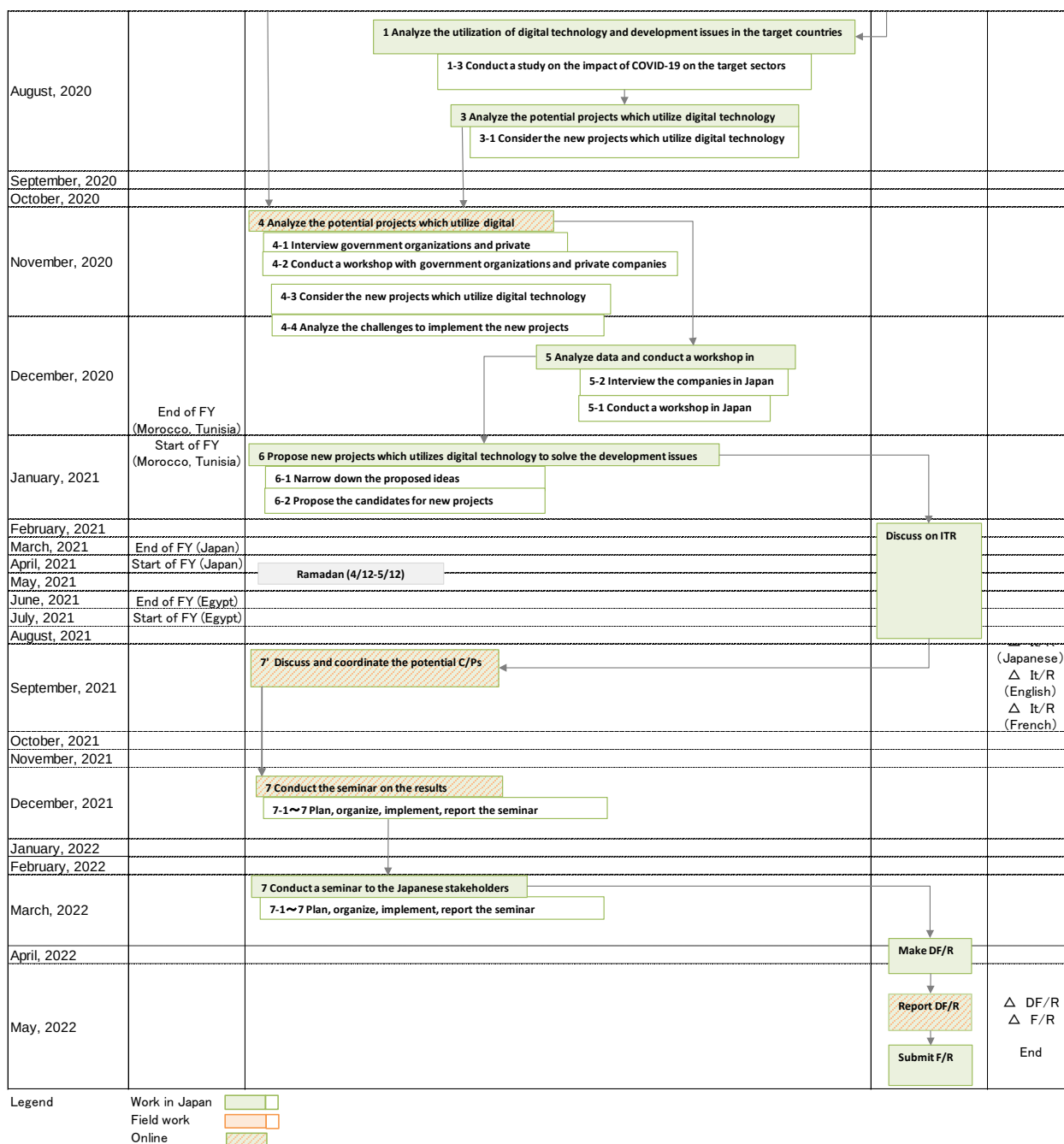


Figure 1-3 Revised Survey Schedule

(2) Completed Activities

The following is a summary of the activities completed.

1) January to March 2020 (Work in Japan)

- The JICA Study Team started the Work in Japan after the conclusion of the contract on January 23, 2020. The Study Team conducted the survey of the current conditions related to the utilization of digital technologies in the target countries, the analysis of the development issues, narrowing down of the sectors

subject to the survey, etc. By compiling the results of these surveys, the Interim Report in Japanese, English, and French was prepared and submitted to JICA.

- The preparation for the first Field Work to the three target countries was conducted by making a list of interviewees, a question list and a visit request letter, acquiring an appointment for the interview survey through a local consultant and preparing a workshop.
- Policy making meetings with JICA offices in the three target countries were held to discuss the execution policy and progress of preparation of the first Field Work based on the result of the narrowing down of the target sectors of the three target countries.

2) March 2020 (Field work)

- The JICA Study Team started the first Field Work on February 29th and entered Tunisia on 1st March. The JICA Study Team started collection of materials and the interview survey and held the first workshop on 4th March.
- On 4th March, the JICA Study Team decided to cancel the Field Work in Egypt and Morocco with the consultation with JICA considering the spreading trend of COVID-19 in Egypt and Morocco.
- On 9th March, the JICA Study Team decided to cancel the second workshop scheduled on 10th March in response to the assembly prohibition instruction of the Ministry of Health of Tunisia.
- The JICA Study Team decided to cancel the planned activity in Tunisia and returned to Japan on 12nd March, considering JICA's policy of postponing overseas trips.

3) March to August 2020 (Work in Japan)

- It was considered that the development needs and digital technology utilization needs of the target sectors had changed as COVID-19 had a big impact on the three target countries. The JICA Study Team discussed with JICA on the implementation policy and methods of the additional survey.
- In August 2020, the JICA Study Team compiled the results of its activities into the Interim Report (preliminary version).

4) September to October 2020 (Work in Japan)

- Based on the above-mentioned consultation, the JICA Study Team conducted an additional survey on how COVID-19 had affected the digital technology sector and target sectors (Agriculture and fishery, industrial development, transport, education, and health) of the target countries and what kinds of new digital technologies would be demanded for the COVID-19 countermeasures and the post-COVID-19 circumstances. The JICA Study Team collected information from websites and local consultants and online interviews with local companies and knowledgeable persons and formulated the survey report.
- Initially, this Project was a short-term survey of less than one year but extended by eight months due to COVID-19. Considering the characteristics of the Project, the JICA Study Team firstly considered ways to finish the survey within the deadline (June 30, 2020). As a result of the consultation with JICA, the JICA Study Team decided to do all of the planned activities (on-site workshops, domestic workshops and interviews, consideration of new project candidates, survey report presentation seminars, and preparation of reports) in Japan because it was still unclear when the COVID-19 problem would end.

5) November 2020 to September 2021 (Work in Japan)

- Based on the above-mentioned policy, an online workshop using Zoom was held firstly with Tunisia on 11th November, then with Morocco on 19th November, and with Egypt on 22nd November, and the JICA Study Team organized a report.
- Based on the results of the workshops held in the three countries, a domestic workshop was held on 22nd December to confirm the appropriateness of the ideas for the use of digital technology for the development issues, to examine the possibility of using Japanese digital technology, and to extract ideas for the development of projects. The results of the domestic workshop were compiled as a domestic workshop report. In addition, the JICA Study Team exchanged opinions with some of the participants of the domestic workshop to supplement the workshop results.
- Based on the results of the workshop in Japan, the JICA Study Team examined potential new projects that utilize digital technology to solve the development issues.
- The results of the activities to date have been compiled into the Interim Report (Japanese, English and French).

6) October 2021 to May 2022 (Work in Japan)

- The second field workshop was held in Morocco on 21 December, Tunisia on 23 December and Egypt on 28 December to hear the opinions of concerned stakeholders in respective countries on the use of digital technologies that could potentially contribute to solving development issues of the target countries under study. The workshops were conducted online using Zoom. The results of the workshops were compiled in a field workshop report.
- A seminar in Japan was held on 2 March to disseminate the findings of the study. The seminar was conducted online using Zoom. The results of the seminar in Japan were compiled in a seminar report.
- The results of the survey were compiled into a Draft Final Report (Japanese, English and French).
- Reflecting JICA's comments on the Draft Final Report, a Final Report (Japanese, English and French) was compiled and submitted to JICA.

Chapter 2 Overview of Digital Technologies

2.1. Egypt

2.1.1. Policies/Strategies and Legal Environment for Digital Technologies

Egypt is one of those countries which effectively formulate and implement information and communication technology (ICT) strategies for an extended period of time.

In September 1999, a national program, "National Programme for the Development of the Communication and Information Technology Sector" began to be implemented. The Egyptian Ministry of Communications and Information Technology (MCIT), the driving force behind the ICT and development program in Egypt, is the agency established to promote the implementation of the program. One of the goals of the program was to create a competitive and export-oriented ICT sector.

The Egyptian Information Society Initiative was launched at the first session of the UN World Summit on the Information Society (WSIS) in 2003. Since then, efforts have been focused on achieving the Tunis Commitment, which was agreed upon at the second WSIS meeting held in Tunis in 2005.

It has formulated and implemented 5 visions and strategies since 2003. Most recent ICT strategy is "Egypt's ICT 2030 Strategy (2016)" which specifies holistic use of ICT for socio-economic development in Egypt. In addition, there are a number of specific ICT strategies which include "e-commerce strategy" (2017), "Cybersecurity strategy" (2018), "Arabic Contents Strategy" (2014), "FOSS (Open source) Strategy" (2014).

The National Telecommunications Regulatory Authority (NTRA), the regulatory authority, is in charge of ICT-related regulations. Although there are some critical views regarding the preferential treatment of the state-owned Telecom Egypt and the regulation of Internet access, the NTRA's telecom management is based on Egypt's policy of fostering private enterprises, with the aim of encouraging the competition necessary to foster private enterprises. As for the protection of personal information, which is essential for the future expansion of ICT-related businesses, Egypt's first Data Protection Law completed its parliamentary review in November 2018 and came into effect on October 16, 2020. The Law's regulation is set to come into force within six months of the law's approval date, and there is a one-year grace period for enforcement from the date of issuance of the Regulation. This means that the Law may not be fully implemented until early 2022. The outline of the Law is similar to the EU's General Data Protection Regulation (GDPR), but there are four main differences.

- 1) Financial institutions under the Central Bank of Egypt are exempted from the law
- 2) No restrictions on the processing of special category personal data (e.g., health, racial, religious data) or criminal convictions data and a different regime governing cross-border data transfer
- 3) No legal basis of processing personal data where this is necessary to enable the data controller to pursue some legitimate interest
- 4) No specific emphasis on the principle of transparency (i.e., requiring that any information addressed to individuals be concise, easily accessible, easy to understand, and presented in clear and plain language)¹.

¹ Egypt: A New Data Privacy Law, PWC-Middle East, <https://www.pwc.com/m1/en/services/tax/me-tax-legal-news/2019/new-egyptian-data-privacy-law-nov-2019.html>

Table 2-1 Public Institutions in Charge of Digital Technologies (Egypt)

Name	Role	URL
Ministry of Communications and Information Technology	Ministry in charge of ICT Policies/Strategies formulation and implementation agency	www.tra.gov.eg
National Telecommunications Regulatory Authority	Regulatory Agency in ICT sector	https://tra.gov.eg
Information Technology Industry Development Agency	Agency in charge of ICT private sector development and investment promotion	www.itida.gov.eg
Egypt ICT Trust fund	UN/MCIT ICT Trust fund of socio-economic development	https://www.ictfund.org.eg/
National Telecom Institute	Higher Research/Education Institution for ICT and Telecom	http://www.nti.sci.eg/nti/
Information Technology Institute	Public Research/Educational Institution in the area of ICT	http://www.iti.gov.eg
Ministry of International Cooperation	Ministry in charge of improved social services and sustainable development	Ministry of International Cooperation - Homepage (moic.gov.eg)
Information Technology Industry Development Agency (ITIDA)	Organization established by the PPP framework between the Ministry of Communications and the private ICT sector in order to develop ICT sector	https://www.itida.gov.eg/English/Pages/default.aspx

Source: JICA Study Team

2.1.2. Overview of the Digital Infrastructure

According to the official statistics issued in November 2021, Egypt boasts cellphone subscription of 101.34 million (98.048% of population as of October 2021), mobile Internet subscription is 61.79 million (19.90% increase of the previous year, as of October 2021), and international Internet connection is 2.56578 Tbps (35.77% increase of the previous year, as of April 2020).² Internet penetration in 2019/2020 is 57.3%.³ Mobile penetration rate among the age group between 18 to 64 years is 91.8% and 96% of it is through smartphones. 91.8% within all Internet access is through mobile devices and social media penetration rate is 47.4% (mobile based social media access rate is 99.1%)⁴.

Telecom liberalization started in 1998 and currently 4 mobile telecommunication providers are operational (Orange, Vodafone, Etisalat, WE (Egypt Telecom)). Internet access (especially broadband access) is still dominated by Egypt Telecom. However, 7 Class A Internet service providers (with their own infrastructures) exist in Egypt.⁵

Egypt used to be the leader of ADSL services but most of current broadband access are mobile-based technologies (67% of mobile internet connection is through 3G & 4G). Quality of broadband access is still uneven in the country. On the other hand, the digital divide remains unresolved, with issues related to quality of

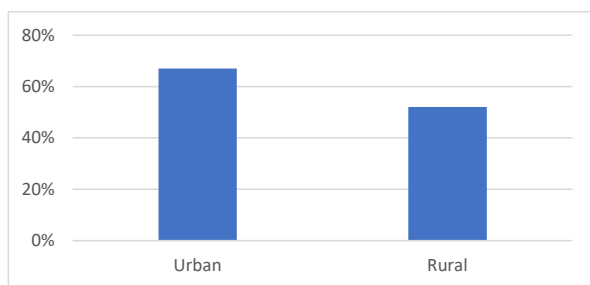
² International internet bandwidth capacity in Egypt from April 2014 to April 2020 , Statista, <https://www.statista.com/statistics/1093854/egypt-international-internet-bandwidth-capacity/>

³ Egypt ICT indicator in Brief, Nov 2021, MCIT, https://mcit.gov.eg/Upcont/Documents/Publications_29122021000_ICT_Indicators_in_Brief_November_2021_29122921.pdf

⁴ Digital Egypt 2021, Hootsuite, 2021, original data excerpted from globalwebindex.com <https://datareportal.com/reports/digital-2021-egypt>

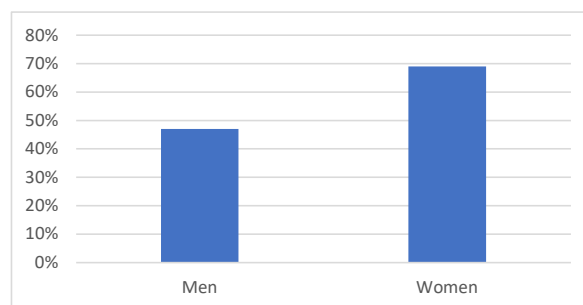
⁵ Egypt's Internet providers are classified into A, B, and C categories. Class A is holistic license which is granted to the major ISPs. The companies which were granted with the class A license provide services to whole Egypt and could sell their bandwidth to other providers. Companies with Class B license could not sell their bandwidth to other companies. ISPs with Class C license need to buy or lease bandwidth from the companies with Class A license and only allowed to provide Internet services to individual customers.

broadband access, regional disparities in infrastructure, and the cost burden on the poor. As shown in the statistics below, there is a significant disparity between rural and urban areas, as well as by gender, in terms of the digital divide in Egypt, and various measures are needed to resolve the issue. The case of the government-led distribution of tablet devices to secondary school students to promote online education⁶ is one notable example of the Egyptian government's initiative to bridge the digital divide.



Source: Arab Barometer Wave V⁷

Figure 2-1 Percentage of Households with Internet Access at Home in Egypt 2018~2019 (Urban and Rural)



Source: Arab Barometer Wave V

Figure 2-2 Percentage of Internet use in Egypt by Gender (%)

2.1.3. Projects Using Digital Technology to Solve Development Issues

Under the Vision 2030: Sustainable Development Strategy (2015), Egypt has defined eight pillars of development (education, innovation, environment, economy, urban development, healthcare, transparent governance institutions, etc.) to promote social and economic development in Egypt.⁸ In order to achieve these goals, the use of ICT is essential, and the ICT 2030 Strategy (2016) also aims to support the achievement of these goals. many startups have emerged in the priority areas and key economic sectors related to the main development pillars of Vision 2030. The Egyptian Ministry of Communications and Information Technology (MCIT), the authority responsible for ICT, keeps statistics on the number of new companies and issued share capital in the ICT sector. According to the statistics, a large number of ICT companies have been established in the year 2019, with 1,703 companies established and 2,092.36 million Egyptian pounds raised in share capital.⁹ The steady growth of the Startups was also reported in the ICT indicators in Brief which was published in April 2020.¹⁰ Although there are concerns about the impact of COVID-19, the number of new ICT companies established between January and March 2020 was 361, indicating that the entrepreneurial situation in Egypt is very active.

⁶

<https://www.youm7.com/story/2020/2/6/%D8%A7%D9%84%D9%85%D8%AF%D8%A7%D8%B1%D8%B3-%D8%A7%D9%84%D8%AB%D8%A7%D9%86%D9%88%D9%8A%D8%A9-%D8%AA%D9%88%D8%A7%D8%B5%D9%84-%D8%AA%D8%B3%D9%84%D9%8A%D9%85-%D8%B7%D9%84%D8%A7%D8%A8-%D8%A7%D9%84%D8%B5%D9%81-%D8%A7%D9%84%D8%A3%D9%88%D9%84-%D8%A3%D8%AC%D9%87%D8%B2%D8%A9-%D8%A7%D9%84%D8%AA%D8%A7%D8%A8%D9%84%D8%AA/4617680>

⁷ The Arab World's Digital Divide, September 25, 2020, Arab Barometer, https://www.arabbarometer.org/wp-content/uploads/ABV_Egypt_Report_Public-Opinion_Arab-Barometer_2019.pdf

⁸ Egypt's Vision 2030, <https://mped.gov.eg/EgyptVision?lang=en>

⁹ ICT Indicators Bulletin, December 2019 | Quarterly Issue, MCIT, Cairo, April 2020

http://www.mcit.gov.eg/Upcont/Documents/Publications_2942020000_ICT_Indicators_Quarterly_Bulletin_Q4_2019.pdf

¹⁰ ICT Indicators in Brief, MCIT, Egypt, April 2020, http://www.mcit.gov.eg/Publication/Publication_Summary/6218

Under the COVID-19 pandemic, the Egyptian government has been encouraging the active use of digital technologies from the early stages, as virtual and online environments using digital technologies are effective in maintaining social distance and social life. As a result, it has been actively collaborating with the private sector (especially in fintech and telecommunications) and supporting freelance workers. Many of these services have been developed by Egyptian startups and SMEs. In addition, the Egyptian government is actively using crowdsourcing to solicit innovative solutions from the public in an open manner.

The following are some examples of startups in key sectors.^{11 12 13}

(1) Agriculture/Fisheries

The number of startups in the agriculture and fisheries sector in Egypt seems to be less than those in other sectors. The most notable examples of “agriculture x ICT” startups and investments in the African region are mainly observed in Sub-Saharan Africa and relatively few in North Africa. In Egypt, the Food and Agriculture Organization (FAO) has been supporting the application of ICT technology in irrigation and other areas. One example of FAO support is a project by the Ministry of Water Resources and Irrigation (MWRI) and the Ministry of Agriculture and Land Reclamation (MALR) to effectively manage water resources based on data collected by sensors in 10 districts. The government aims to use this system to reduce the loss of water resources for irrigation by more than 20% in the future¹⁴.

It was found that the digital technology used in the agricultural sector is mainly supported by public institutions, and there are few examples of Egyptian startups involved. One of the few examples of agro-tech startups is Agrimatic Farms, which produces vegetables without soil. The Agrimatic Farms is one of the seven Egyptian startups that participated in the US-backed Global Entrepreneurship Summit 2019. Another example is FreshSource, which is not directly an agri-tech startup, but a B2B-based distribution startup for agricultural products.

(2) Transport/Mobility

As for new forms of public transport services such as ridesharing, Uber (U.S)) is the largest provider of such services in Egypt. Uber acquired Careem (Dubai), the largest competitor, for \$3.1 billion in January 2020. Halan has also received a Series A round of investment and has plans to expand into the Ethiopian market. Other unique services have also emerged, such as Raye7, a secure mutual ridesharing service that is only available to community members. The service won second place for Best Mobile Startup at the Mobile World Congress organized by the Global System for Mobile Communications Association (GSMA) in 2016. While the lockdown

¹¹ Current Status of Egyptian Startups (sector situation and main players) June 2019, JETRO
<https://www.jetro.go.jp/world/reports/2019/01/c58123432e4c99fc.html>

¹² Egypt Research 2019, Ministry of Internal Affairs and Communications 2019
https://www.soumu.go.jp/main_content/000621018.pdf

¹³ Here is a list of Egypt's most funded startups, 9th September 2019, <https://digestafrica.com/egypts-most-funded-startups>

¹⁴ FAO Egypt launches water management and irrigation project in collaboration with MWRI and MALR, 24 March 2018, Cairo, Egypt, <http://www.fao.org/neareast/news/view/en/c/1111170/>

in the COVID-19 pandemic has had an impact on startups in the transport sector, some companies have responded by changing their routes to transport and delivery services.

Swvl, an Egyptian bus transport network company based in Cairo, is also transforming Egypt's old-style matatu public transport system. To date, it has raised \$80 million in investment and operates in five African countries; as of September 2019, it was the largest investment in the region, not just Egypt.

Slyde, a micro-mobility service, is starting a transport sharing system for electric scooters. In Egypt, there are similar services such as Baddel, an electric bicycle sharing service, but they are struggling to expand their business due to the lack of micro mobility-friendly road infrastructure.

(3) Fintech

Fintech is an area that has received a great deal of attention in Egyptian startups. Fawry, the largest and most well-known electronic payment system, successfully completed its initial public offering (IPO) in 2019, exceeding its target by 30 times. The company offers a variety of services. Also, 7aweshly, which enables individuals to make micro-savings; Tpay, a service that connects telecom companies' online payment systems with individuals and businesses to make payments; and DoPay, a cloud-based payroll system, are expanding the businesses to other countries in North Africa and/or Middle East. Sales of mobile payment services such as Fawry are growing, partly because cash transactions are not recommended under the COVID-19 pandemic. Fintech services are playing a particularly important role in the COVID-19 disaster, and are spreading rapidly in Egypt, along with the surge in e-commerce.

(4) Education

Tatweer International (online based career platform) is an Egyptian EdTech startup which provides affordable career improvement and training opportunities to improve youth employment. It provides high-valued education solutions through partnering with 11 domestic and international partners.

Online tutoring services are becoming popular within EdTech businesses which are known to have difficulty establishing viable business models. Nafham started out with free online contents expanded into tutoring services and is growing steadily. Similar online tutoring service, Orcas, which integrates parenting involvement in their services has received Pre-Series A funding from different VCs.

Other notable startups include Almakinah which aims to create high-skilled next generation talents, Nawah Scientific which provides services to mitigate shortages of scientific laboratories, and Agora which provides a high-quality class environment using augmented reality (AR).

As is known globally, it is difficult to carve out viable EdTech business models in Egypt. However, compared to other countries, Egyptian startups are receiving relatively more funding and investments from VCs and other funding sources. Face-to-face school education was stopped globally as a countermeasure against the COVID-19 pandemic. In Egypt, the government expanded the access of Egyptian Knowledge Bank (EKB)¹⁵ from

¹⁵<https://nam03.safelinks.protection.outlook.com/?url=https%3A%2F%2Fstudy.ekb.eg%2F&data=02%7C01%7Cmtrucano%40worldbank.org%7Cd12671555d524655546808d7d5f30abd%7C31a2fec0266b4c67b56e2796d8f59c36%7C0%7C0%7C637213112152387518&sdata=TSfHwcD2BEuso%2FbwGsDd08%2BxCODJ945FUSZ%2FeOSIWI%3D&reserved=0>

students of kindergartens to those of junior high schools for remote education using digital technologies, concluded a contract for remote education with Edomodo¹⁶, which is not a startup of Egypt, and the demand of this sector is considered to increase more from now on, considering the current situation of the pandemic.

(5) Health

Egypt's startups in the healthcare field are booming. These innovative startups include Vezeeta online doctor reservation, Chefaa, an e-commerce site for medical supplies, Roshetta Mobile app for medicine/drug information/guide, Shezlong which provides an on-line psychotherapy service, ElBalto an online medical diagnostics service, D-Kimia, an affordable medical laboratory testing service, Vditory a service for visually impaired people (using smart glasses and image recognition software to readout texts), Smart Medical Services affordable and customizable group insurance service, Mogassam provider of affordable medical devices created by 3D printing, SuperMama information service for mothers, Nabda Care electrical and sharable medical records service, etc. These and other health care-oriented startups are receiving vigorous incubation opportunities, as well as investments from venture capital investment firms.

(6) Others

Egyptian startups are getting recognitions in the area of Artificial Intelligence (AI) and data analysis as well. An AI startup called AvidBeam has been recognized as one of top 20 Startups in the AI field by an industry leading business magazine, CIOReview. Other notable data-oriented startups include Dignified which provides an Arabic OCR (Optical Character Recognition/Reader) service using deep learning" technology, Crowd Analyzer which provides data analysis services for social media platforms, and Synapse Analytics which provides data driven strategic management support service for businesses.

2.1.4. Development Partners in the Area of ICT and Digital Technologies

World Bank, African Development Bank, UN organizations, and many bilateral development partners have supported Egypt in the area of ICT/Digital infrastructure and policy development. Recently, many of these supports put special emphasis on the economic development (especially employment generation).

Table 2-2 Support by Other Donor Agencies (Egypt)

Donor agency	Project name/activities	Type	Period	Amount
Agence Française de Développement (AFD)	Support to introduce enterprise resource planning (ERP) in energy sector	Technical cooperation	Under consideration	N/A
	Support for strengthening the digital sector *Including support for startups. The French Embassy has been actively supporting startups, and the AFD has started to provide support since the French President's visit to Egypt in	Technical cooperation	2019~	N/A

¹⁶ <https://edomodo.org/>

Donor agency	Project name/activities	Type	Period	Amount
	2019. The French Embassy has been actively supporting startups, but the AFD has started supporting startups since the French President's visit to Egypt in 2019. Co-hosted with the central bank, the event included start-up competitions in the fields of insurance, fintech, and sustainable cities were organized. The support will be expanded in the future.			
	E-government support *In the future, they are planning to apply Etalab in Morocco (an attempt to enable the procurement of innovative services by creating a department within the government where startups can solve government challenges) to Egypt and also, they are considering supporting cyber security.	Technical cooperation	Under consideration	N/A
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) in collaboration with European Union (EU)	Decent Work for Youth Using ICT under Egypt Trust Fund Support	Financial cooperation (Contributions to the Trust Fund)/technical cooperation	2017~2018	N/A
United Nations Conference on Trade and Development (UNCTAD)	Support for creating e-Commerce strategy	Technical cooperation	2017~2018	N/A
United Nations Development Programme (UNDP)	Egypt ICT Trust Fund support ¹⁷ *Under this initiative, a variety of ICT support was provided. One example is the telemedicine pilot project. Based on the success of the project, the number of telemedicine centers is currently 150 in the country and will be expanded to 300. These telemedicine nodes are playing an important role in the COVID-19 pandemic. *Japan has also contributed to this trust fund in the past.	Technical cooperation	2004~	N/A
World Bank (WB)	Catalyzing Entrepreneurship for Job Creation Project for Egypt *Project for job creation. Major components include loans (\$50 million) to youth and women's enterprises and startups.	Investment Project Financing (IPF)	2019~2025	0.2 billion USD

¹⁷ Egypt ICT Trust Fund <https://www.ictfund.org.eg/>

Donor agency	Project name/activities	Type	Period	Amount
Collaboration among International Finance Corporation (IFC), United Kingdom Department for International Development: DFID/UK Aid), State Secretariat for Economic Affairs (SECO), Netherland, and Islamic Development Bank	Education for Employment (e4e) - ICT *As part of IFC's regional program for the Middle East and North Africa, Egypt sought to develop its ICT sector and strengthen linkages between the government and private ICT companies by supporting the development of a National Competence Framework for ICT and the Information Technology Industry Development Agency's (ITIDA) ICT education initiative to develop a private sector workforce with the necessary skills.	Technical cooperation	2014~ *Second phase started from 2016 but not sure when it completes.	N/A
Collaboration between International Telecommunication Union (ITU), with support from Bill & Melinda Gates Foundation, and WB	Financial Inclusion Global Initiative *To support the achievement of the Universal Financial Access 2020 goal, which is to advance financial inclusion for low-income people in Egypt, the Gates Foundation provides financial contributions to the ITU and contribute to the financial inclusion of low-income people in Egypt through the use of digital technology. Jointly supported and implemented with the World Bank.	Grant from Gates Foundation to ITU Technical cooperation from ITU/WB to the government	2017~2020	Through ITU 3,405,932USD Through WB 9,658,976USD

Source: JICA Study Team based on the various documents

2.1.5. Status of Policy Support for Private Companies with Digital Technology

Egypt initiated ICT sector development in 1998. By recognizing ICT as a vehicle to increase employment and create export-oriented industry, Egypt has accelerated its support for the ICT development in the mid-2000 by supporting initiatives such as establishment of smart villages and techno-parks like “Maadi Technology Park”¹⁸. The ICT sector in Egypt escaped from the negative effects of macro-economic disturbances which affected Egypt from 2011. The sector continues to grow steadily and its 2020 contribution to gross domestic product (GDP) is expected to reach 8.4%¹⁹. ICT export segment boasts many businesses processing outsourcing (BPO) and knowledge processing outsourcing (KPO) businesses which reached \$3.3 billion in 2017 and is expected to reach \$4.7 billion in 2020²⁰.

Recent trends in the sector include the establishment of incubation centers and corresponding startup incubation program. With ample high-quality and low-priced ICT human resources, Egyptian startups are making their

¹⁸ Maadi Technicak Park <https://www.itida.gov.eg/English/Pages/MaadiPark.aspx#>

¹⁹ The analysis of IT/ICT sector in Egypt <http://baltmodus.com/the-analysis-of-itict-sector-in-egypt/>

²⁰ Liberalization of private and foreign investment drives ICT growth in Egypt
<https://oxfordbusinessgroup.com/overview/upwardly-mobile-ever-increasing-openness-private-sector-and-foreign-investment-set-ensure-continued>

presence known in such high value-added fields such as fintech and AI. Some of the notable incubation centers are the following^{21,22}.

- Technology Innovation and Entrepreneurship Center
- The Innovation Clusters Initiative
- The GrEEK Campus
- AUC Venture Lab

The Egyptian Government is also placing a greater emphasis on the startups development as it produces employment. Accordingly, it provides tax incentives and infrastructure development for the incubation centers and techno parks. Similar incentive mechanisms are available in Morocco and Tunisia, but Egypt has advantages of having larger domestic market and economy. In addition, private sector investments into startups are more prevalent and financial mechanisms such as VC are more developed than other countries. Furthermore, challenges which Egypt currently faces (e.g., degrading infrastructure, traffic, etc.) are or will be problematic in many other countries. These provide Egyptian startups advantages which make it easier for them to expand their services and products to other countries²³. Government also established the ICT Fund to spearhead ICT for social-economic development initiatives with UNDP which is being funded by various developmental partners including Japan (contribution: \$5.6 million)²⁴, Canada International Development Research Centre (IDRC), Italian Government, Swiss Agency for Development and Cooperation, GIZ, Islamic Bank, World Health Organization (WHO) and FAO.

2.2. Morocco

2.2.1. Policies/Strategies and Legal Environment for Digital Technologies

For the creation of competitive and transparent digitalized socio-economic development, Morocco adopted "Morocco Digital Program 2020" in July 2016 (Successor to the "Plan Maroc Numeric 2013"). This strategy calls for achieving the following KPIs by 2020.

- Attaining top 3 positions in MENA region for e-Government, IT infrastructure, Doing IT criteria.²⁵
- Attaining 50% digitization of government and public service processes
- Reducing digital divide by 50%
- Increasing Internet connectivity of SMEs to 20%
- Attaining off-shore businesses' annual growth rate of 5 - 10%
- Creating No. 1 digital hub in French speaking Africa (No. 2 in entire Africa)

²¹ Current Status of Egyptian Startups (sector situation and main players) June 2019, JETRO
<https://www.jetro.go.jp/world/reports/2019/01/c58123432e4c99fc.html>

²² Egypt Research 2019, Ministry of Internal Affairs and Communications 2019
https://www.soumu.go.jp/main_content/000621018.pdf

²³ "Here Are Reasons Egypt's Startup Ecosystem Is Booming" <https://afrikanheroes.com/2019/08/05/here-are-reasons-egypts-startup-ecosystem-is-booming/>

²⁴ Egypt, Employment generation program through public initiatives
<https://www.jp.undp.org/content/tokyo/ja/home/presscenter/articles/2014/06/20/-html>

²⁵ Based on WEF's Network Maturity Index.

- Creation of more than 15,000 IT human resources
- Making 5 out of 30 top ICT companies in Africa to be Moroccan companies.
- 60,000 job creation through off-shore businesses

Table 2-3 Institutions in Charge of Digital Technologies and Regulations (Morocco)

Name	Position	URL
Ministry of Industry and Trade	ICT Policies/Strategy Formulation and Monitoring institution	https://www.mcinet.gov.ma/en
National Telecommunication Regulatory Agency	Regulatory Agency for IT industries	https://www.anrt.ma/en/
Federation of Information Technologies, Telecommunications, and Off-shoring	ICT/Off-shoring Industrial Association	http://www.apebi.org.ma
Moroccan Investment and Export Development (AMDIE)	Investment and Export Promotion agency	https://www.morocconow.com
Digital Development Agency (ADD)	Implementation agency for digital strategy and promotion of digital technologies	https://www.add.gov.ma/

Source: JICA Study Team

2.2.2. Overview of Digital Infrastructure

Morocco's digital adaptation is quite advanced. According to 2020 statistics, it has a cellphone penetration of 43.47 million (117.1% of its population), Internet penetration of 74.4% (89.6% of it is through mobile access), social media penetration rate of 59.3% (mobile based social media access is 98.9%)²⁶.

Morocco, as with many other developing countries, began exploring ICT for development possibilities in the early 1990s. In 1997, "law n°24-96 on postal and telecommunications services" was passed and telecommunication service was liberalized, and a new independent regulatory agency called "National Telecommunications Regulation Agency (ANRT)" was established. The law also liberalized value-added services in the area of telecommunications and separated the postal service from telecommunications services (Morocco Telecom – 35% of the share was privatized by 2001). In 1999, the second mobile telecom operator received a license.

The EU and Morocco signed the Deep and Comprehensive Free Trade Areas (DCFTA) in March 2000. This has greatly eased Morocco's access to the EU market. DCFTA includes service industries which has allowed Morocco to provide variety of knowledge-based services to the EU which includes ICT services (e.g., Call Centers).

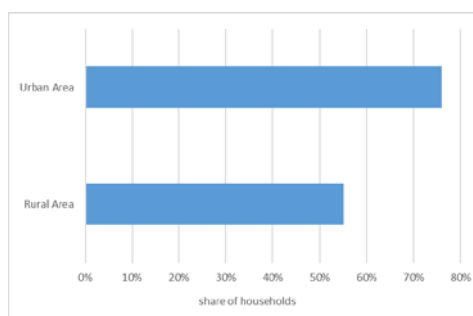
In 2010, Morocco instituted an ICT infrastructure guideline to alleviate digital divide. This has accelerated ICT infrastructure development in Morocco²⁷. As of 2019, 3 telecom providers were in operation (Orange, Maroc Telecom, Inwi). Mobile broadband services are provided through 3G and 4G connections and currently 61% of mobile connections are at broadband speed²⁸.

²⁶ Digital Morocco 2021. Hootsuite, 2021, original data excerpted from GSMA, UN, and others.
<https://datareportal.com/reports/digital-2021-morocco>

²⁷ Local Governance and ICTs in Africa: Case Studies and Guidelines for Implementation and Evaluation Editor(s), Timothy Mwolo Waema and Edith Ofwona Adera, Pambazuka Press, IDRC 2011-08-01

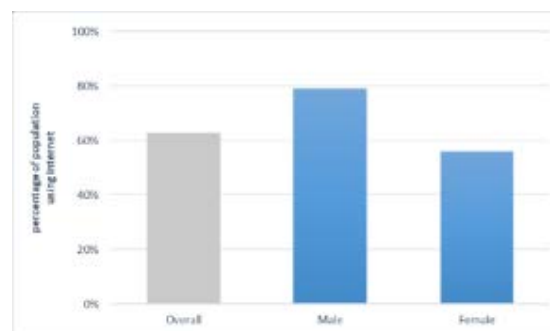
²⁸ Digital 2019 Morocco. Hootsuite. <https://datareportal.com/reports/digital-2019-morocco>

Despite this progress in the development of telecommunications infrastructure in urban areas, there are still many challenges to the digital divide, particularly in rural areas. As indicated in the statistics below, there are significant disparities in the digital divide in Morocco between rural and urban areas and by gender.



Source: Arab Barometer Wave V²⁹

Figure 2-3 Percentage of Households with Internet Access at home in Morocco (%) 2018-2019 (urban and rural)



Source: Arab Barometer Wave V

Figure 2-4 Percentage of Internet Use in Morocco by Gender (%) 2018-2019

The issue of the digital divide has become a prominent problem in the COVID-19 pandemic. The problem of smart device penetration, especially in rural areas, the excessive burden of telecommunication costs on household expenditures, and digital literacy have all emerged.

2.2.3. Projects Using Digital Technology to Solve Development Issues

"Morocco Digital Program 2020" aims to reduce the digital divide by 50%. In order to achieve that goal, it has noted that a wider adaptation of ICT is critical to the following 4 main sectors: agriculture, health, education and financial inclusion. This section introduces some examples of startups in the targeted sectors.

(1) Agriculture/Fishery

The environment for nurturing and developing startups (startup ecosystem) in Morocco has become relatively mature, and there have been cases of incubating not only startups from Morocco but also promising startups from Africa and around the world³⁰. Examples of homegrown startups are Atlan Space, a smart drone poaching monitoring service, and AGRIOT, an Internet of Things (IoT) service in the agriculture sector, originally started by Shortlink, a customer relationship management service startup. As a general trend, the agriculture and fisheries sector does not have as many homegrown startups as other sectors (e-commerce, transport, fintech, etc.).

The special economic zones of Agri-Polis (Meknes and Belkane) and Haliopolis (Agadir) are focusing on processing of agricultural and fishery products, respectively and they may utilize the expertise of startups.

²⁹ The Arab World's Digital Divide, September 25, 2020, Arab Barometer, https://www.arabbarometer.org/wp-content/uploads/ABV_Egypt_Report_Public-Opinion_Arab-Barometer_2019.pdf

³⁰ Impulse Morocco Accelerator Program Announces Top 16 Startups, <https://masschallenge.org/announcement/impulse-morocco-accelerator-program-announces-top-16-startups>

(2) Financial Inclusion

There is a growing momentum for existing financial institutions to actively utilize innovative services brought by startups. Major banks and other institutions in Morocco are planning fintech challenges. It is expected that the widespread availability of simple and easy financial services developed by startups will increase the financial inclusion of more citizens, not to mention the low-income groups with limited access to financial services in Morocco³¹. In the field of online payments and digital finance, the New Banking Law (Fintech Law) (Law 103-12 - Arabic Gazette (#6328), French Gazette (#6340)), adopted in 2014, eases the provision of large financial institutions and products, enacts regulations in line with international standards, and provides incentives to encourage a reform of existing financial institutions. As a result of these reforms, a number of financial institutions have entered the online payment and digital finance sector in Morocco. Some, such as "Ways to Cap," an e-commerce startup for businesspersons to business (B2B), have introduced their own electronic payment systems. These moves toward digitization in the financial services sector have been accelerated by the COVID-19 pandemic, and along with the surge in e-commerce, are expected to transform Moroccan business practices in the long term after the pandemic. Even under the COVID-19 pandemic, investments are seen in startups in the financial services sector, including funding from the Moroccan Digital Fund II for OnePay, a Moroccan fintech operator, in July 2020³². The continued investment in startups in this field shows the high expectations for the growth of the fintech sector.

(3) Education

Some of the education-oriented startups are receiving investments from VCs in Morocco. "9rayti" which provides online based test preparation and employment skills training has received funding from the "Maroc Numeric Fund"³³. In the same manner, "eDukaty," a test preparation platform for Franco-phone countries, received funding from the "Morocco Growth Fund"³⁴. Due to the COVID-19 pandemic, there has been a growth in the number of startups in the education sector, but issues such as regional disparities in service provision have also emerged.

(4) Health

Startups in the health sector are "DabaDoc," a search and reservation system for doctors and medical services; "PocketDoc," a decision support service for medical professionals (a service that allows doctors to search for diagnoses from a database of medical content and search for verified medical treatment methods for the disease); and "MedTrucks," which aims to expand mobile medical services by combining clinics with trucks.

³¹ <https://www.politicalanalysis.co.za/moroccan-banks-calls-on-all-african-start-up-to-apply-for-fintech-challenge/>

³² <https://mnf.ma/portfolio/onepay-2/>

³³ <https://www.wamda.com/2014/12/morocco-education-media-company-raises-280000-an-unusual-story>

³⁴ <https://www.seaf.com/seaf-invests-in-innovative-moroccan-digital-education-company/>

2.2.4. Development Partners in the Area of ICT and Digital Technologies

Many donors support skills development initiatives to increase employment which include ICT related support. Some of the examples include.

Table 2-4 Support by Other Donor Agencies (Morocco)

Donor agency	Project name/activities	Type	Period	Amount
World Bank (WB)	Financing Innovative Startups and Small and Medium Enterprises Project *Private equity funds that invest in innovative startups and SMEs (funds that invest money raised from multiple private investors in unlisted companies with the aim of increasing the value of the company through management support and other involvement in management, and then profit from the IPO or sale), quasi-equity financing (financing through the issuance of new shares), and loans to promote the growth of angel investors in Morocco. The goal is to encourage the development of the Moroccan financial market and to create a system that allows innovative SMEs to obtain more funding.	Investment Project Financing (IPF)	2017~2023 (Repayment term 25 years, Usual Period 5 years)	50 million USD
	Financial Inclusion and Digital Economy - Development Policy Financing *A loan that promotes financial inclusion and the transformation to a digital economy in Morocco. the DPF builds on the government's five-year (2017-2021) program and is implemented to promote the National Financial Inclusion Strategy and the National Strategy to Drive Digital Transformation.	Development Policy Financing (DPF)	2019~2020	0.7 billion USD
	Gov Tech for Public Sector Performance Program * The goals are to improve the effectiveness, transparency, fairness, and accountability of government functions, and to improve the efficiency of evidence-based policy making and public spending.	Investment Project Financing (IPF)	Waiting for approval (it was supposed to be in 2020 but in delay)	0.3 billion USD
International Telecommunication Union (ITU)	Assistance to Arab Techno parks and Incubators Network * Through the support of the Arab ICT Incubators and Techno parks Association members, the goal is to strengthen cooperation and develop business exchanges between Arabian companies and startups, and between incubators and techno parks in the Arabian region.	Regional project / Technical cooperation	2019~	N/A
	Regional E-waste Monitor for the Arab Region * Based on the framework of the ITU-led Global E-Waste Statistics Partnership, a monitoring system for e-waste in the Arab region to be established.	Regional project / Technical cooperation	2019~	N/A
Agence Française de Développement (AFD)	Etalab (coinage from L'Etat Laboratoire) * Support for e-government is being implemented. Deploying problem-solving startups within the government to post innovative and	Technical cooperation	2018~	N/A

Donor agency	Project name/activities	Type	Period	Amount
	responsive solutions to problems within the government.			
	A municipality orients innovation towards the resolution of public urban problem The use of data and digital technologies to solve urban problems in Casablanca is enforced through a startup and open innovation model.	Technical cooperation	2017~2018	N/A
Kingdom of Saudi Arabia	Framework Cooperation Agreement in the areas of Cooperation and partnership on ICTs – Saudi Arabia Communications and Information Technology Commission *Saudi Arabia's program to strengthen partnerships on ICT in the Middle East and North Africa. Morocco is also a target country, and a partnership with ITU is in effect.	Regional project / Technical cooperation	2018~	N/A
Belgian development agency	European pilot project linking Moroccan ICT development and labor shortages in Flanders *Pilot project to train high-level ICT personnel in Morocco, with the goal of both hiring those who are lacking in the Flanders region and creating jobs in Morocco.	Technical cooperation	2018~2019	N/A
United States Agency for International Development (USAID)	Interactive Digital Center& Virtual Reality Innovation Academy (Virtual Reality solutions for education) *Through a public-private partnership between USAID and Morocco, the goal is to develop the capacity of human resources in the areas of AR and Virtual Reality (VR), and to develop solutions specifically for education providers.	Technical cooperation	2019~2024	Total 29 million USD among which 3 million USD is from USAID
International Fund for Agriculture Development (IFAD) / Centre de coopération internationale en recherche agronomique pour le développement (CIRAD)	Food security: innovation for better water resource management in North Africa * Based on the IFAD/CIRAD partnership, the project will work with local stakeholders, especially small-scale family farmers, to conduct proof of concept for innovative technologies (e.g., ICT use, subsurface drip irrigation, new solar pump technology, wastewater reuse, etc.). At the same time, support the reform of water source management organizations.	Technical cooperation	2019~2023	2 million Euro

Source: JICA Study Team

The AFD expressed the possibility of expanding their support to cyber security, private sector investment through the Digital Africa program (managed by PROPARCO, the financing arm of the AFD), and other areas.

2.2.5. Overview of Policies to Support Private Companies with Digital Technologies

Morocco has been politically stable with a long history of strong economic connections to European countries. Morocco is an early adopter of knowledge-based ICT services which includes various outsourcing services.

With strong ties with the EU and multi-lingual human resources (especially with France), digital industries grew especially in the area of call centers. Currently, most of the call center operations for France have been done from Tunisia and Morocco. Recently, ties with Spain are becoming stronger as well.

In order to increase youth employment and create value-added industries, Morocco has been active in fostering ICT industries with a strong focus on outsourcing businesses. The government's industrial development policies are having an effect, as evidenced by the EU Offshore Association's selection of Morocco as the "Offshore Destination of the Year" in 2012.

Morocco is also strong as an incubator of competitive national ICT and digital startups. In this regard, it has fostered its own startups ecosystem (e.g., Creation of \$200million ICT startups venture capital fund, "Maroc Numeric Fund" and establishment of many techno-parks and incubation facilities) in the last 5 years. However, while the ecosystem is getting due attention and is being strengthened, some reports indicate that it still is difficult to get financing from existing financial institutions and also support from the existing private sector networks³⁵. Thus, the World Bank and other development partners are also supporting the initiative and with a highly skilled workforce, the chances of Morocco carving out a larger market is high.

Morocco has invested heavily in establishing many techno parks as focal points for ICT and ICT related industries. The Casablanca Technopunk was the first of these centers and it was established under PPP scheme in 2001 as "Maroc Technopark (MITC)." Currently, "Maroc Technopark (MITC)" operates 3 technopunks (Casablanca, Tangier, Agadir) where many startups and international ICT companies are operating from. In addition to the MITC Techno parks, private entities are operating ICT/Technology parks such as Technopolis in Fez and Oujda, and many other centers such as facilities specializing in offshore services and co-working/incubation spaces.

The government has been actively supporting ICT and education initiatives. ICT and education initiative such as the "GENIE Program," using ICT to enhance primary and secondary school education, has received an award of ICT and Education from UNESCO. Foundations are also active in the education of ICT initiatives (e.g., Foundation Zakoura's education initiative).

Growth of ICT industries in European markets and the Gulf region is causing serious brain-drain from Maghreb countries (especially Tunisia and Morocco). Morocco graduates approximately 8,000 ICT engineers per year from higher learning institutions but approximately 10 - 20% of these graduates are employed outside of Morocco. It is becoming difficult to supply human resources for the expanding domestic ICT and ICT enabled industries³⁶.

2.3. Tunisia

2.3.1. Policies/Strategies and Legal Environment for Digital Technologies

Tunisia, like Egypt and Morocco, is one of the countries that have made ICT a pillar of its national development from the very early stage, and is the country that proposed the holding of the "United Nations World Summit on the Information Society" at the ITU Plenipotentiary Conference held in Minneapolis in 1998 (adopted as

³⁵ "In Morocco, Startups Often Face a Full Stop," US News, By Brionne Frazier Contributor March 18, 2019, at 7:00 a.m., <https://www.usnews.com/news/best-countries/articles/2019-03-18/moroccos-tech-startup-sector-falling-behind-other-countries-in-africa>

³⁶ Heated debate in Morocco over brain drain, 31/03/2019, Arab Week, <https://the arabweekly.com/heated-debate-morocco-over-brain-drain>

Resolution No. 73 of the conference), with the aim of building an information society through the active use of ICT in social and economic activities.

The 10th National Five-Year Development Plan for 2002-2007 also calls for the use of ICT, and an ICT strategy to support its implementation was developed in 2002 with the support of the World Bank and other organizations. This first ICT strategy was built with four main pillars: 1) strengthening the legal and statutory framework; 2) developing infrastructure for the knowledge economy; 3) developing human capacity; and 4) promoting the private sector. This strategy led to the liberalization of telecommunication companies in Tunisia. As a companion to this strategy, a white paper on the use of ICT for governmental reform was prepared in 2003 with the support of the United Nations Development Program.

At the second meeting of WSIS in Tunis in 2005, the Tunis Commitment to Achieve an Information Society was adopted. As the host country of the WSIS, Tunisia has continued to focus on the realization of the Tunis Commitment since 2005, strengthening the ICT sector and developing the country using ICTs.

As of 2020, there are three main ICT-related strategies and programs. The first is Digital Tunisia 2020 which is a comprehensive national strategy for ICT and development and is established to support the achievement of Tunisia's National Development Plan 2016-2020. The Digital Tunisia 2020 has four pillars: i) infrastructure development (bridging the digital divide); ii) e-government (providing transparent, efficient, and equitable citizen services by digitizing public services); iii) e-business (achieving efficiency by digitizing business); and iv) smart Tunisia (making Tunisia a leader in offshore business and a model for other countries in "ICT and Development"). This strategy includes more than 70 projects under the 4 pillars. The second is the "Smart Tunisia Programme (2016-2020)," which aims to foster offshore industries, one of the pillars of Digital Tunisia 2020, and promote investment in these industries. The goal is to create 50,000 jobs by 2020. The Smart Tunisia Secretariat has been established under the Ministry of Communication Technologies (MICT) as the implementing agency and is promoting investment from abroad by offering various incentives. Thirdly, Tunisia's startup strategy called "Tunisia Startup Acts" was established in April 2018 to transform the startup ecosystem in Tunisia, where startups experience lots of difficulties to start a business. It consists of five components: i) defining startups; ii) supporting entrepreneurs; iii) simplifying procedures for starting, expanding, and dissolving startups; iv) expanding access to finance; and v) providing access to foreign markets. More than 100 requests were received from startup promotion organizations, of which 20 have been adopted³⁷.

The year 2020 is the final year of these strategies and programs, and the National Digital Transformation Strategy for 2021-2025, the successor strategy to Digital Tunisia 2020, has begun to be formulated. The successor strategy will consist of seven axes, including infrastructure development, the generalization of Internet services in rural areas, and financial integration by encouraging e-commerce and electronic payments. The strategy will also seek to strengthen Tunisia's position in the field of digitalization and innovation, enhance its status as a destination for investment in the ICT sector, and provide incentives to encourage private sector-led innovation. In order to promote this strategy, the use of startups will be a key, and strengthening the startup development ecosystem will continue to be important. Nearly half of the projects planned in Digital Tunisia 2020 were not implemented, and those projects that were not achieved will be carried over to the next strategy.

³⁷ Tunisian Startup Act, <http://www.insme.org/the-tunisian-startup-act/>

There are many laws and regulations in Tunisia and the following 4 of them play an important role. In 2001, the Telecommunications Act 2001 was enacted to define the establishment of ICT-related institutions, universal access, etc. Based on this Act, the liberalization of communication was achieved in 2002. In 2008, the Telecommunications Act Amendments 2008 was enacted to revise the Basic Law of 2001, mainly by adding provisions to strengthen auditing. In 2013, the Telecommunications Reform Act 2013 was enacted, abolishing Internet censorship, proposing digital signatures, and defining the requirements for e-commerce. Because of the reform, Tunisia is called the only country with internet freedom in Middle East & North Africa region. In 2018, an EU GDPR-compliant bill called the Draft Law on Personal Data protection 2018 was submitted to the Parliament. Although the data protection law has not yet been passed by the Parliament, it is an essential bill for Tunisia, which undertakes many BPOs in Europe, and it is hoped that this bill will strengthen the protection of personal data in Tunisia.

Table 2-5 Institutions in Charge of Digital Technologies and Regulations (Tunisia)

Name	Position	URL
Ministry of Communication, Technologies, and Digital Economy ³⁸	Supervisory and policy institution for ICT sector, which is responsible for planning, coordinating, acquiring of new technologies and improving telecommunication sectors	www.mincom.tn
Ministry of Higher Education and Scientific Research	Supervisory and coordination institution for higher learning and science and technologies researchers	www.mes.tn
Centre de Calcul El Khawarizmi	Research institution in charge of ICT use and promotion	www.cck.rnu.tn
National Authority of Telecommunications (NAT)	Regulatory authority for ICT	www.intt.tn

Source: JICA Study Team

2.3.2. Overview of Digital Infrastructure

Tunisia boasts commendable ICT penetration as compared to the neighboring countries. According to a report of the Instance Nationale des Télécommunications of Tunisia (INTT), the cellphone subscription ratio and mobile data subscription ratio to the population as of November 2021 was 132.3%³⁹ and 83.0%⁴⁰, respectively. The data communication traffic had increased at an annual rate of a little less than 30% since 2015, and then rapidly increased by 40.2% from 2018 to 2019⁴¹. As Tunisia does not censor the internet⁴², social media has been used commonly and the social media penetration rate in 2020 stands at 69% (mobile based social media access was at 97.8%)⁴³.

Telecommunication liberalization started in 2002 but anticipated reduction in the access cost of telecommunication services (especially international connections) was not achieved until mid-2010. In 2014, under the revised telecommunications policy of 2013, the international telecommunications network, which was

³⁸ The name was changed from Ministry of Communication Technologies and Digital Economy to Ministry of Communication Technologies again in 2020.

³⁹ Tableau de Bord Mensuel Téléphonie Mobile, Observatoire de l'INT, République Tunisienne Instance Nationale des Télécommunications, November 2021, http://www.intt.tn/upload/files/TB2_Tel-Mobile%20-11_2021.pdf

⁴⁰ Tableau de Bord Mensuel Data Fixe, Observatoire de l'INT, République Tunisienne Instance Nationale des Télécommunications, November 2021, http://www.intt.tn/upload/files/TB4_Data-Mobile%20-11_2021.pdf

⁴¹ INTT Annual report 2019, <http://www.intt.tn/upload/files/Rapport%20Annuel%202019.pdf>

⁴² According to the regulatory authorities, the government institutions, etc. order the provider to disclose information when Internet or communication is used by terrorists or Islamist extremist organizations.

⁴³ Digital Tunisia 2021, Hootsuite, 2021, original data excerpted from ookla global broadband speed test, <https://datareportal.com/reports/digital-2021-tunisia>

previously an oligopoly of the state-owned Tunisi Telecom, was opened up. This led to the construction of submarine fiber optic cable facilities by private companies, which dramatically enhanced the Internet environment. The revision also allowed for the establishment of Mobile Virtual Network Operator (MVNO) entities to provide cheaper telecommunications services.

As of 2019, three telecommunication providers offer services (Ooredoo, Tunisie Telecom and Orange). In addition, two MVNO services are available. Ooredoo started to construct NB-IOT (low powered wide area network standard to be used for IoTs) which could provide wide opportunities in the IoT in Tunisia. The first 5G license is expected to be granted by 2021.

Due to the scarcity of natural resources, Tunisia set up human resource development as its foundation and has been actively investing in the education field since its independent in 1960. This trend has not changed even under the severe economic conditions. According to the statistics of 2015, the spending of the government on education exceeded 6.6% of GDP, which is much higher than the average value of Organisation for Economic Co-operation and Development (OECD), 4.5%⁴⁴. According to the statistics of the Global Innovation Index announced every year by INSEAD⁴⁵ and World Intellectual Property Organization (WIPO), Tunisia is ranked the 2nd in the number of graduates in science and engineering among all higher education institutions⁴⁶, and the 15th in research in science and engineering in proportion to purchasing power parity GDP.⁴⁷

The higher education institutions consist of 13 public universities and 205 other institutions including research institutions. There are 245 thousand students studying under 23 thousand teachers and researchers. Concerted efforts were made to create competitive offshore industry in the area of ICT. With ample multilingual population, a large number of BPOs were established. As of 2017, more than 350 call centers were operational which employed over 22,000 people⁴⁸.

According to the Foreign Investment Promotion Agency (FIPA), Tunisia produces 12,000 college level IT engineers per year ⁴⁹. Tunisia also ranked 43rd in the world for “availability of scientists and engineers” in the World Economic Forum 2017-2018 Global Competitiveness index and produces high-skilled human resource⁵⁰.

Although Tunisia has an abundance of highly skilled human resources, many SMEs have little motivation to invest in innovation activities or to add-value to their industries using their own highly skilled human resources. There are few SMEs that can effectively utilize highly skilled human resources. In addition, growth of ICT industries in Europe and Gulf region is causing severe “brain-drain” from Tunisia. This trend has increased after “Arab Spring” and more than 10,000 IT engineers have left Tunisia and this is causing social issue⁵¹.

⁴⁴ UNESCO Country Data portal – Tunisia, <http://uis.unesco.org/en/country/tn>

⁴⁵ Business School and Graduate School of Business which have campuses in Fontainebleau, France, Singapore and Abu Dhabi

⁴⁶ Tertiary graduates in science, engineering, manufacturing, and construction (% of total tertiary graduates) | 2016, UNESCO Institute for Statistics, UIS online database (2010–18). <http://data.uis.unesco.org> Global Innovation Index 2019, <https://www.wipo.int/publications/en/details.jsp?id=4434&plang=EN>

⁴⁷ Clarivate Analytics, special tabulations from Thomson Reuters, Web of Science, Science Citation Index (SCI), and Social Sciences Citation Index (SSCI); International Monetary Fund, World Economic Outlook Database, October 2018 (PPP\$ GDP). (<https://apps.webofknowledge.com>; <https://www.imf.org/external/pubs/ft/weo/2018/02/weodata/index.aspx>

⁴⁸ https://webcache.googleusercontent.com/search?q=cache:8A0px_WCKGcJ:https://www.export.gov/article%3Fid%3DTunisia-Telecommunications-Equipment-Services+&cd=1&hl=ja&ct=clnk&gl=us

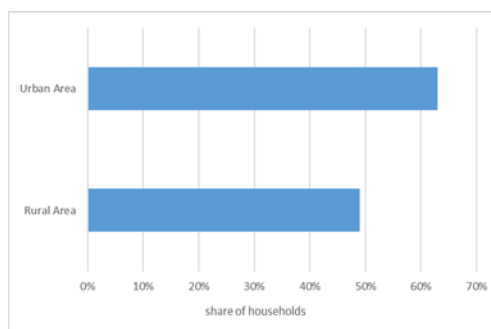
⁴⁹ http://www3.weforum.org/docs/Arab-World-Competitiveness-Report-2018/WEF_GCI_2017_2018_Profile_Tunisia.pdf

⁵⁰ https://www.jica.go.jp/information/seminar/2018/ku57pq00002iqac8-att/investment_and_business_opportunities_in_tunisia.pdf

⁵¹ <https://www.france24.com/en/20190118-focus-tunisia-brain-drain-graduates-doctors-engineers-work-move-abroad>

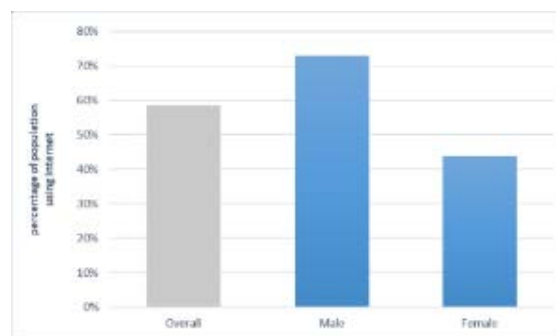
The startup support policy by the government and the enactment of laws related to businesses started by students are expected to contribute to not only job creation but also domestic utilization of highly educated human resources. However, students do not necessarily understand business correctly, so it is necessary to provide support such as mentoring and coaching and cultivate the entrepreneur spirit in universities. In addition, universities have to achieve practical transformation from conventional research institutions to the core of innovation for solving social and economic problems.

Due to the country's small size, it has a more developed digital infrastructure than Morocco and Egypt, but it lags behind both countries when it comes to Internet usage. According to a survey by the Arab Barometer, a nonpartisan research network that provides insights into the social, political, and economic attitudes and values of ordinary citizens in the Arab world, the country ranks 10th out of 11 countries for Internet usage in the Middle East and North Africa, excluding the Gulf countries.⁵² It can be said that there is a significant gap between the state of infrastructure development and actual usage, and that there is a significant digital divide problem. In addition, as seen in the statistics below, there are significant disparities between rural and urban areas, as well as by gender, as in Morocco and Egypt.



Source: Arab Barometer Wave V⁵³

Figure 2-5 Percentage of Households with Internet Access at home in Tunisia (%), 2018-2019 (urban and rural)



Source: Arab Barometer Wave V

Figure 2-6 Percentage of Internet Use in Tunisia by Gender (%), 2018-2019

The issue of the digital divide was particularly acute during the COVID-19 disaster. In particular, the low penetration of smart devices in households and low Internet penetration in rural areas prevented Tunisian students from receiving a satisfactory education during the lockdown. Similarly, the COVID-19 disaster brought to the surface issues such as the excessive burden of telecommunication costs in household expenditures and the lack of digital literacy among citizens.

2.3.3. Projects Using Digital Technology to Solve Development Issues

As a measure to achieve Digital Tunisia 2020, Tunisia is promoting resolution of development issues using digital technologies, startup and job creation by expansion of the ICT industry. Various startups have been founded and the detailed information has been updated in the startup portal⁵⁴ which was formulated at the time of the enactment of the startup act. The following shows some examples of startup using ICT and digital

⁵² The Arab World's Digital Divide, September 25, 2020, Arab Barometer, https://www.arabbarometer.org/wp-content/uploads/ABV_Egypt_Report_Public-Opinion_Arab-Barometer_2019.pdf

⁵³ <https://www.france24.com/en/20190118-focus-tunisia-brain-drain-graduates-doctors-engineers-work-move-abroad>

⁵⁴ <https://www.startupact.tn/startups.html>

technologies in mainly the three subject sectors of social development of this survey: Agriculture and fishery, transport, and industrial development.

(1) Agriculture/Fisheries

"Poulina Group Holding,⁵⁵ is a good example of a company that uses startups to solve its own problems: Poulina invests in the Level 1 Incubation Center, one of the leading incubation centers in Tunisia, and invites startups to submit their agricultural and business challenges and innovative solutions to solve them at low cost and very quickly. Until now, many Tunisian companies have viewed support for startups only as a corporate social responsibility (CSR) activity. However, as major companies such as Poulina have been able to leverage startups and achieve results, other Tunisian companies have begun to explore the power of startups to improve the efficiency of their core business and solve their problems.

On the other hand, the psychological and financial hurdles to the adoption of new technologies for smallholders remain high, and the adaptation of digital technologies still seems to be low. However, Tunisian agriculture is plagued by an aging population, and efficiency improvement through digital and new technologies is inevitable. In this context, companies such as "iFarming", a water management system using AI algorithms, and "Ezeeyra", an agricultural management system, have begun to offer solutions for smallholders. Ezeeyra is also developing a solution for detecting diseases and ripeness of agricultural products using ground-based drones.

In the fishery field, no outstanding startup case was found but there are considered to be great opportunities to use digital technologies for logistics, fishery management, etc. Proposing on-site issues to startups is expected to lead to creation of new services.

(2) Industrial Development

In terms of industrial development, industrial digitization is proceeding mainly in leading companies but the propagation of digital technologies among small and medium companies are delayed. The Ministry of Industry, Energy and Mines aims to promote reforms in the existing industries (automotive industry, apparel industry, food processing industry, etc.) in order to develop industries which can remain competitive even in the future, but how to introduce digital technologies is the issue because many companies still hesitate to introduce new technologies.

As described below, GIZ is constructing the Industry4.0 center in the techno park, etc. in order to adapt Industry4.0 to the local industries in appropriate ways and are planning to provide consulting services for utilization of digital technologies to existing SMEs for free and provide services such as work mapping. In this context, examples of startups include "Sea Group," which provides digital automation services, "Wevioo," which is dedicated to the introduction of digital technologies in the existing industries (plants, etc.), and "Wattnow," which provides monitoring solutions of energy consumption using IoT. Moreover, startups using the AR technology for training of complicated equipment appeared such as "Onboard SARL." However, the introduction of these solutions to SMEs, etc. in Tunisia is yet to proceed due to the above-mentioned reason.

⁵⁵ <https://www.poulinagroupholding.com/en/>

On the other hand, completely new industries such as techno park have come to appear: EnovaRobotics, etc. are manufacturing and selling security monitoring robots, etc. using domestic technologies.

In Tunisia, different from Morocco and Egypt, basically real money is used for payments in daily life because commercial banks and the postal savings system are well developed. Since credit settlement systems such as credit cards are yet to be propagated among citizens and the regulations on domestic transfer, etc. are severe. Although there are signs of change due to the effects of COVID-19, startups are yet to be developed like other countries in the B2C and G2C fintech fields for domestic services such as mobile money and E-commerce fields, which is pointed out as an issue.

On the other hand, there seem to be many startups which use and analyze data for AI, big data analysis, etc. This trend may be derived from the affluence of highly educated human resources in addition to the various obstructive factors mentioned above.

(3) Transport

In the capital city, Tunis, streetcars and public buses called metro as well as trains to nearby train lines are available but the existing public transport systems are not so convenient and the established interest is so great that the motivation for improvements is weak. Under these circumstances, a startup providing a car dispatch service using bikes, "IntiGo," was founded. However, the backlash from the taxi companies, which have vested interests, is significant, so even serious incidents such as destruction of bikes of IntiGo occurred. Since vested interests are great in Tunisia, car dispatch services which have succeeded in Egypt are difficult to be established. On the other hand, the issues of the transport sector are so big that there is great room for utilization of digital technologies to complement the existing transport sector and promote improvements in services.

2.3.4. Development Partners in the Area of ICT and Digital Technologies

The World Bank, African Development Bank, United Nations and other development partners have supported Tunisia in the area of infrastructure and policies/strategies. Many development partners are interested in using digital technologies to solve development issues in recent years. However, in this survey, it was not reported that overall coordination was conducted. A mechanism to make adjustments will be required when development partners increase in the future. Several partners expressed opinions that it is necessary for many partners to cooperate with each other for innovations and construction of eco systems.

Recent support activities include SME and startup support for improvements in governance and economic development (promotion of employment) using digital technologies and industrial reforms using the concept of Industry4.0. The following table shows examples of projects of big development partners in digital-related support. Major projects/initiatives in ICT/digital technologies.

Table 2-6 Support by Other Donor Agencies (Tunisia)

Donor agency	Project name/activities	Type	Period	Amount
World Bank (WB)	Digital Transformation for User-Centric Public Services *Supporting the use of ICT to strengthen public sector governance	Investment Project Financing (IPF)	2019~2025	0.1 billion USD

Donor agency	Project name/activities	Type	Period	Amount
	Tunisia Innovative Startups and SMEs project * Support for solving social issues through ICT by fostering startups and SMEs. This includes: contributions to the Anava Fund (\$45 million), a fund for companies and startups; contributions to the Tech SME Innovation Fund (\$17 million); technical cooperation (\$8 million to support the establishment of ecosystems and enterprise levels for innovative startups and SMEs - \$5 million to strengthen startup ecosystems and \$3 million to support SME investment enablement and new technology adaptation capacity building); and another \$5 million for the Special Project Implementation Unit.	Investment Project Financing (IPF)	2019~2026	75 million USD
African Development Bank (AfDB)	Support Project for the Implementation of the "In order to implement Digital Tunisia 2020" National Strategic Plan and Digital Tunisia 2020, (i) Establishment of major government information systems (e.g., e-finance, e-justice, e-local government), and (ii) Establish interoperability of all platforms that guarantee e-government (e.g., public cloud, government intranet)	Loan + Government contribution 63.4 million Euro	2018~2022	71.56 million Euro
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	Digital Transformation Center Tunisia * A program that uses digital technology to solve social problems and promote economic development, which in turn fosters startups and industrial transformation using digital technology. A Novatech center is under construction in the Technopark in Sousse and Sfax to establish partnerships between Tunisian companies and more than 50 European companies, and to apply and educate SMEs on Industry 4.0 technology.	Technical cooperation	2019-2023	N/A
	Digital4Reform * Administrative reform project using digital technology	Technical cooperation	From 2020	7 million Euro
Kreditanstalt für Wiederaufbau (KfW)	Compact with Africa reform partnership - Better weathering the coronavirus crisis through reforms * Improving the efficiency of the transport, energy, and electronic payment services sectors; reforming the governance of public institutions; improving the performance of public administration and public financial management; and promoting economic and social inclusion.	Promotional Loan 15-year maturity plus 5-year grace period. Interest rate is 0.9% per year.	From 2021	0.15 billion Euro
Agence Française de Développement (AFD)	Un Partenariat pour Soutenir l'innovation et les Start-ups en Tunisie * Support for the formation of Anava, a startup support fund	Technical cooperation	2017	N/A
	Programme de renforcement du e-santé en Tunisie	Loan + government contribution (€5.10 million)	From 2019	2.73 million Euro
	AFD Digital Challenge: The Start-ups Designing Sustainable Cities	Granting subsidies/Te	From 2020	20 thousand

Donor agency	Project name/activities	Type	Period	Amount
	* A contest for startups and others to submit solutions for sustainable cities. Grants and technical support are provided to startups selected in the contest. In 2002, WinCari, a company from Tunisia that uses data to provide real-time information on public bus services and uses the data to manage the services, was selected.	chnical cooperation		Euro per company
United Nations Development Programme: UNDP)	SDG Camp * This is a program that identifies issues related to the Sustainable Development Goals (SDGs) through participatory workshops and uses social innovation methods to solve these issues. Entrepreneurship promotion and the use of digital technology are also part of the program.	Technical cooperation	From 2016	N/A
	Acceleration lab * It supports the resolution of local social issues through innovative methods by soliciting solutions through citizen participation and openness and uses digital technology as an important method for acquiring information and deriving innovative solutions.	Technical cooperation	From 2020	N/A
International Finance Corporation (IFC)	Investment in fintech venture capital * Investment in startup support institutions (incubation centers) and assistance in establishing incubation funds for seed funding In 2016, \$4M capital investment (equity investment) in Flat6 labs, an incubation facility. In 2019, equity investment in Anava Seed Fund \$1 million for seed funding of startups ⁵⁶	Blended Finance	From 2016	5 million USD

Source: JICA Study Team

Tunisia is one of the largest recipients of GIZ's digital technology support, with a budget of 25 million Euros. In addition to digital technology, GIZ also has a program to develop industrial clusters, including new technology-connected clusters, AI clusters, and collectivization of IT companies.

AFD may also expand its support to other areas such as cybersecurity and the application of Etalab, a Moroccan initiative to solve government problems through open innovation, in Tunisia.

2.3.5. Status of Policy Support for Private Companies with Digital Technology

Tunisia has become well-known as a country which has promoted active and sustained use of digital technologies for its development. It has identified ICT as an important developmental area and a pillar for its development in the 1980's and has supported creation of enabling ICT infrastructures and high skilled ICT human resources through academic and vocational institutions. The 11th National Development Plan (2006-2011) called for active use of ICT for Tunisia's development and created numerical targets in the area such as contribution of ICT sector to GDP, employment, and export.

⁵⁶ A seed fund for startups managed by Flat6Lab, different from the government Anava Fund, which is a "Fund of Fund".

In order to increase youth employment and create competitive local value-added industries, Tunisia has embarked on an ambitious support program for innovative start-ups. This program has been also attracting support from various development partners. Tunisia currently boasts a large number of Africa's leading tech-hubs, 11 techno-parks which are bases for industrial accumulation through industry-government-academia collaboration, and venture capital funds such as the Banque Internationale Arabe de Tunisie (BIAT) fund, Caisse des Depots et Consignations Tunisie (CDC TN) fund, Anava Fund, etc., start-ups industry association (Tunisian Startups), and many startups incubation programs and incubation centers.

There are also many incubation facilities run by local private companies; "Level1" is one of them and succeeded in securing of partnerships and working capital by, for example, making startups solving issues of leading companies (e.g., agricultural company syndicates and entertainment industry).

Among the governmental support measures, "Smart Capital," which is a governmental startup investment company, has a big impact. Smart Capital is managing not only the ANAVA fund mentioned above but also funds for new startups as subsidiaries and much anticipated as a public financing facility for startups.

Tunisia is providing many policies and support measures for development of the ICT industry, but these measures do not necessarily lead to effective development of companies. Tunisia had enacted a startup act and associated laws and measures which are innovative even on a global level. Almost all of the public institutions, education institutions, companies, and development partners that the JICA Study Team interviewed pointed out the complexity of the administration process and the difficulty of obtaining appropriate information, which have also made many ambitious young people give up starting business.

The government institutions keenly recognize this problem, and the Ministry of Communication Technology and Digital Transformation (MTCEN) takes the lead in the management of the startup portal as "one-stop shop"⁵⁷ to promote start-up. However, it is pointed out especially from the private sector that the environment surrounding startups is still severe. The problems of the policies and measures of the government are caused by the administrative methods in the French style and the inflexible and inefficient administrative organizations is the bottleneck in the execution of policies. For example, the complexity of the administrative procedures makes it difficult to register companies and get approval for start-up support measures. The current inconsistency between new policies and existing policies also leads to the failure to certify the business category of innovative companies of "ICT x resolution of social issues" (it is difficult to register agriculture x ICT, etc.). The protective policies for the existing industries and the pressures from them (including lobbying) prevents entry of new startups. Due to these problems, it is still difficult to start innovative companies with good ideas. In addition, financial problems such as difficult to handle foreign currencies in domestic accounts in Tunisia and lack of mobile money also leads to the difficulty of starting a business. Furthermore, much anticipated startup financing mechanism ANAVA fund was not operational as of January 2021.⁵⁸

Another factor that makes it difficult for startups to grow in Tunisia is the inability of the government to procure and support the innovative products and services that startups offer. This is because the Tunisian government has difficulty in creating new mechanisms due to its rigid bureaucracy. In a country with a small market size, it is necessary for companies to find opportunities in foreign markets or for the government to use government

⁵⁷ Startup Act Tunisie, <https://www.startupact.tn/>

⁵⁸ ANAVA fund became operational in March 2021.

procurement to encourage the growth of companies. As for the latter, various countries are enacting policies to increase opportunities for startups by calling for "procurement of innovation". However, in the case of Tunisia, there is still no framework for the government to procure solutions provided by startups. And even if startups develop solutions to solve social issues in Tunisia, the government is unable to procure, effectively use, and expand these solutions. Although the Ministry of ICT launched a web portal and catalogued these solutions⁵⁹ as a response to COVID-19 and GIZ offered financial support for them, the government was unable to create a new mechanism to pay the funds to startups and could not support their ideas. As a result, startups with few resources were unable to expand their innovative solutions, and many of them remained as proof of concept (POC) .

Although these challenges remain, as seen in these cases, support to promote structural reform of startup support mechanism is relatively increasing in both the public and private sectors. The World Bank, the African Development Bank, the EU and others are also providing focused support for organizational reform in the government. On the other hand, there are those who point out the lack of capacity of human resources working in government organizations, and therefore, there is a continuing need for capacity building support for civil servants. Although government reform is difficult and some startup support organizations has skeptical opinions, the momentum for change is growing.

From the interviews with startup support organizations, other than resistance from the government structure and existing interests and financial access as mentioned above, weak infrastructure (low penetration of smart devices and digital divide in rural areas) was mentioned as a problem. In particular, there was a comment that the issue of digital divide has become apparent once again amidst the rapid increase in access to infrastructure during the COVID-19 pandemic. Even in light of the current negative situation, the potential for the development of ICT industry and new industries enabled by ICT in Tunisia is high, given the country's deep human resources and emphasis on ICT infrastructure.

⁵⁹ Collecte des Contributions technologiques - Initiatives technologiques pour la gestion de la crise et la lutte contre le COVID19, <https://forms.office.com/Pages/ResponsePage.aspx?id=fRHckg8C-kuZG5TNIK1-SpjAZceNHvFJh6vhS39EEhRUNTU0WIBGNTJLU0JYWk9GWkIISEQyQ0xaOC4u>

Chapter 3 Evaluation of Validity of Target Sectors

3.1. Validity Evaluation Method and Target Sectors

3.1.1. Validity Evaluation Criteria

Based on the 7 criteria shown in the below table, the JICA Study Team evaluated and confirmed the validity of the candidate sectors as target.

Table 3-1 Validity Evaluation Criteria

	Criteria	Description of the criteria	Evaluation indices
1	Possibility of using the experiences accumulated through the past Japanese cooperation	Maintain consistency with government development cooperation policies, etc., and confirm whether there is a track record of Japanese research and support such as the ones conducted by JICA.	Number of past JICA projects (Excluding third country training) (Only projects started after 2010)
2	Priority of the sector in the target country	Considering the priority of each policy and plan and confirm whether the content contributes to achievement of the priority.	Description in National Development Strategy (Vision 2030) of target country
3	Possible outcome by the utilization of digital technology	Based on lessons learnt from similar case studies in other countries, confirm whether any challenge can be resolved by utilizing digital technology.	Trend of digital technology introduction by government and startup status by sector
4	Cooperation of C/Ps and other government organizations	Confirm whether it is possible to secure resources (budget, human resources, technical level, etc.) of counterpart organizations and government organizations.	Relationships through past JICA projects
5	Feasibility of the project	Considering the situations of 2 to 4, confirm whether the project is feasible.	Matching development needs with digital technology
6	Possible collaboration with JICA scheme	Considering, beneficiaries, scale, and schedule, etc., confirm whether it is possible to be implemented under the JICA schemes.	Candidate JICA projects and private sector projects
7	Possible collaboration between local and Japanese companies	Based on lessons learnt from similar case studies in other countries, confirm whether collaboration between local and Japanese companies is possible.	Expansion status of Japanese companies

Source: JICA Study Team

3.1.2. Candidates of Target Sectors to be Considered in Target Countries

In consultation with JICA and based on the above validity evaluation criteria, the validity as target sectors of the following candidate sectors was evaluated and confirmed for each target country.

Table 3-2 Candidate Sectors to be Evaluated as Target Sectors for Each Target Country

Target Country	Sectors to Be Considered
Egypt	Agriculture and fishery, transport, education, health
Morocco	Agriculture and fishery, education
Tunisia	Agriculture and fishery, industrial development, transport

3.2. Egypt

3.2.1. Results of Validity Review by Target Sector

The table below shows the results of validity review by sector in Egypt.

Table 3-3 Results of Validity Review of Candidate Sectors (Egypt)

	Criteria	Evaluation indices	Details of evaluation
Agriculture and Fishery			
1	Possibility of using the experiences accumulated through the past Japanese cooperation	Number of past JICA projects (excluding third country training) (projects started after 2010)	5 projects Technical cooperation - Improving Small-Scale Farmers' Market-Oriented Agriculture Project - Project for Strengthening Water Management Transfer - Project for Rural Development Through Improving Marketing of Agricultural Produce in Upper Egypt - Project for Managing Drainage Water Quality and Reuse for the Nile Delta Irrigation Loans - Project for Construction of the New Dirout Group of Regulators
2	Priority of the sector in the target country	Description in National Development Strategy (Vision 2030) of target country	The sector is related to economic growth, employment and poverty eradication in economic development section of the national policy, which is a major pillar. It is included in the priority issues to be addressed by JICA.
3	Possible outcome by the utilization of digital technology	Trend of digital technology introduction by government and startup status by sector	Challenges which can be addressed by digital technologies - Improvement of various management (water, production, quality, facilities, sales) - Provision of various information (market conditions, farming methods) - Various matching (connections between producers, carriers, processors, consumers) Response status of Egypt The government takes initiative together with development partners to improve agricultural productivity and strengthen value chain using ICT. Although startups in the sector are not many, there are some consumer services cases (categorized as e-commerce).
4	Cooperation of C/Ps and other government organizations	Relationships through past JICA projects	Cooperation can be expected from experiences of existing JICA projects.
5	Feasibility of the project	Matching development needs with digital technology	This is especially a sector where involvement of public institutions is expected, and there is a possibility of creating a project. Since this is a priority sector of the government, and the spillover effect of appropriate and innovative use of digital technology is high. However, in order to enter into the sector as a startup, there may be difficulties to solve challenges.
6	Possible collaboration with JICA scheme	Candidate JICA projects and private sector projects	As government initiatives, in addition to water management, provision of agricultural and fishery products market information and farming information, support for collaboration between agriculture, commerce and industry and research and development of seeds etc., systems such as the one to turn knowledge from experiences based on "experiences" and "intuitions" of farmers and fishermen into explicit knowledge can be considered. As private sector initiatives, various products and services such as the ones for agriculture and fishery efficiency

	Criteria	Evaluation indices	Details of evaluation
			improvement, production management, facility management and POS using various data can be considered.
7	Possible collaboration between local and Japanese companies	Expansion status of Japanese companies	Kobe Bussan Egypt Ltd. has expanded with agricultural product processing. The company also invests in agriculture. As food and beverage companies, Ajinomoto and Japan Tobacco have achieved expansion. Taichi Holdings operates Japanese restaurants.
Transport			
1	Possibility of using the experiences accumulated through the past Japanese cooperation	Number of past JICA projects (excluding third country training) (projects started after 2010)	4 projects Technical cooperation - The Project on Enhancement of Competitive Strategy for Suez Canal - Project for Improvement of Bridge Maintenance Capability Building Loans - Borg El Arab International Airport Extension Project - Greater Cairo Metro Line No.4 Phase 1 Project
2	Priority of the sector in the target country	Description in National Development Strategy (Vision 2030) of target country	Increasing the use of public transport is mentioned in urban development, which is a major pillar. It is included in the priority issues to be addressed by JICA.
3	Possible outcome by the utilization of digital technology	Trend of digital technology introduction by government and startup status by sector	Challenges which can be addressed by digital technologies Possibility to greatly contribute to fragile infrastructure and poor traffic conditions. Improvement of traffic management and traffic demand management, improvement of public services, traffic safety measures, improvement of operation and management of roads and equipment, etc. Response status of Egypt Solutions with many digital technologies are emerging in the mobility sector and situation of Egypt (especially Cairo) is close to that of other countries facing similar problems, and some services are being rolled out to other countries as well. Because this sector has many startups, a lot of investments are being made from VCs and the like.
4	Cooperation of C/Ps and other government organizations	Relationships through past JICA projects	Cooperation can be expected from experiences of existing JICA projects (however, it is necessary to build new relationships with counterparty organizations in fields other than roads and public rail transport systems).
5	Feasibility of the project	Matching development needs with digital technology	Projects utilizing existing ICT can be created in many sectors. It is also possible to create a new project using startups. Services that are attractive and can be expanded to other countries are created in Egypt. Services that use Egypt as a place for proving concept and expand to other countries have been created.
6	Possible collaboration with JICA scheme	Candidate JICA projects and private sector projects	The following support can be considered for conventional JICA projects. - Support for projects after ITS Project Phase 2 (*ITS Project Phase 1: currently ongoing project targeting high-standard roads of approximately 1000km funded by own government) - Traffic signal improvement project(technical cooperation project/loan => grant etc.) - Traffic safety technical cooperation project - Technical support for road asset management utilizing IT technology - Bus operation management system sophistication project (JICA SDGs projects, etc.) - Transport big data analysis demonstration project (SDGs/SME support project, etc.) - Support for building smart city in the new capital area, etc. (Technical cooperation project)

	Criteria	Evaluation indices	Details of evaluation
7	Possible collaboration between local and Japanese companies	Expansion status of Japanese companies	Although the number of Japanese companies is limited, there are some major manufacturers such as Panasonic, OMRON, Kawasaki Heavy Industries, Sony and etc.
Tourism			
1	Possibility of using the experiences accumulated through the past Japanese cooperation	Number of past JICA projects (excluding third country training) (projects started after 2010)	2 projects Technical cooperation - Grand Egyptian Museum Joint Conservation Project (GEM-JC) Loans - The Grand Egyptian Museum Construction Project (Phase 2)
2	Priority of the sector in the target country	Description in National Development Strategy (Vision 2030) of target country	Related to economic growth, employment and poverty eradication in economic development, which is a major pillar. It is in a recovery period from the decline in international tourism due to political instability, and further tourism promotion is required. It is included in the priority issues to be addressed by JICA.
3	Possible outcome by the utilization of digital technology	Trend of digital technology introduction by government and startup status by sector	Challenges which can be addressed by digital technologies As applicable sectors, the following sectors can be considered. - Improving and differentiating tourism promotion and services (individualization) - Improving tourism competitiveness - Improving competitiveness of small and medium-sized travel agents Response status of Egypt The government has implemented tourism promotion by making heavy use of social media, electronic visa issuance system as well as promotion in various media. This is a sector where many multinational travel agencies have participated, and the level of ICT utilization by local small and medium-sized travel agencies is still low. Very few startups specialize in tourism.
4	Cooperation of C/PS and other government organizations	Relationships through past JICA projects	Themes other than the Grand Egyptian Museum, building new relationship with counterpart organizations is necessary.
5	Feasibility of the project	Matching development needs with digital technology	The applicable targets of digital technologies for tourism promotion are wide-ranging, including business environment, transport and resource conservation. There are few remarkable startups, and although it is important to utilize digital technology for SMEs, it is difficult to support it as a project.
6	Possible collaboration with JICA scheme	Candidate JICA projects and private sector projects	In the tourism promotion and tourism service sectors, the mainstream is tourism service portal sites (reservation, sharing service, tourist information, hotel service improvement, among others) hosted by private sector (leading companies and startups). As government initiatives, archiving of tourism resources, creating portal site by putting together tourism information from local governments, developing tourism human resources, improving transport infrastructure and services for tourists, etc. can be considered (technical cooperation project, SDGs/SME support project, etc.).
7	Possible collaboration between local and Japanese companies	Expansion status of Japanese companies	H.I.S Travel Egypt has expanded into Egypt

	Criteria	Evaluation indices	Details of evaluation
Education			
1	Possibility of using the experiences accumulated through the past Japanese cooperation	Number of past JICA projects (excluding third country training) (projects started after 2010)	7 projects <u>Technical cooperation</u> • The Project for Quality Improvement of Early Childhood Development. (June 2017 to October 2021) • Project for Enhancement and Dissemination of Tokkatsu Models (October 2021 to October 2027) • The Project for Procurement of Education and Research Equipment for Egypt-Japan University of Science and Technology (E-JUST) Phase 3 (February 2019 to January 2025) <u>Loans</u> • Egypt-Japan Education Partnership <u>Grants</u> • The Project for Procurement of Education and Research Equipment for Egypt-Japan University of Science and Technology (E-JUST) • The Project for Procurement of Education and Research Equipment for Egypt-Japan University of Science and Technology(Phase 2)
2	Priority of the sector in the target country	Description in National Development Strategy (Vision 2030) of target country	Taken up as a major pillar. High goals are set for pre-university education, technical education, and higher education. It is included in the priority issues to be addressed by JICA. It is included in the priority issues to be addressed by JICA.
3	Possible outcome by the utilization of digital technology	Trend of digital technology introduction by government and startup status by sector	Challenges which can be addressed by digital technologies In the education sector, utilization of ICT is increasing, and contribution to spread of education is expected by means such as remote learning. However, building a sustainable startup business model with significant development prospect is difficult. Response status of Egypt The government recognizes education as a very important sector for achieving Vision 2030 and expectations for ICT for skill development and improvement of educational level and educational content are especially high. There are services similar to online cram schools, but the number of startups is relatively small to medium compared to other sectors.
4	Cooperation of C/PS and other government organizations	Relationships through past JICA projects	Cooperation can be expected from experiences of existing JICA projects.
5	Feasibility of the project	Matching development needs with digital technology	Especially, in the sector where public institutions such as Government Education Department or schools are involved, there is a high possibility of creating a project. The effect of utilizing appropriate and innovative digital technologies by startups is also expected.
6	Possible collaboration with JICA scheme	Candidate JICA projects and private sector projects	The following support can be considered for conventional JICA projects. • Teacher training and literacy education support through content distribution (Technical cooperation project, SDGs/SME support project, etc.). • Increasing communication through the spread of SNS for schools (collaboration with E-just, etc.) • Classwork support utilizing immediate feedback, lesson analysis apps, etc. (SME support project, etc.) • Platform development for distribution of teaching materials, improvement of teaching of teachers, and learning support (individual optimization) for students (technical cooperation project, SME support project, etc.)
7	Possible collaboration	Expansion status of Japanese companies	• Yamaha Co., Ltd. plans to develop a "School Project" to support the creation of an environment where children can

	Criteria	Evaluation indices	Details of evaluation
	between local and Japanese companies		experience playing musical instruments in their school education. The project was selected as a JICA Small and Medium Enterprises and SDGs Business Support Project as part of the 'Study for the Introduction of Japanese-style Instrumental Music Education into Primary Education in Egypt'. - The following studies are also supported by JICA's Small and Medium Enterprises (SMEs) and SDGs Business Support Programme, which includes: Castalia Co., Ltd, "Study on IT-enabled advanced Japanese-style Primary Education [Africa Issue Presentation Type]"; Surala Net Co., Ltd., "Study for Strengthening Children's Academic Achievement in Mathematics Using e-Learning"; and Tokyo Shoseki Co. Ltd., 'Study for Building an Evaluation Business Model for Improving Cognitive (Arithmetic) and Non-Cognitive Skills [Africa Problem Proposal Type]'. - The following companies participated in JICA's "Africa Local Issues Confirmation Study (Study Tour) - Education (Improvement of the Quality of Education)' in 2019 and visited Egypt (main business and products handled in brackets; it is not clear whether they intend to expand into Egypt). Kogawa Kyoiku Kenkyujo (maths drills), Castalia (mobile learning platform), Shinko Shuppansha Keirinkan (learning materials), Tsukuba Educe Corporation (cram school), Tokyo Gakugei University Kodomo Mirai Kenkyujo (research), Tokyo Shoseki (learning materials), PEPerson International (community development); WakuWaku&Life (abacus classes).
Health			
1	Possibility of using the experiences accumulated through the past Japanese cooperation	Number of past JICA projects (excluding third country training) (projects started after 2010)	1 project Grants The Project for Construction of Outpatient Facility at Cairo University Specialized Pediatric Hospital (Project for improving hospital quality)
2	Priority of the sector in the target country	Description in National Development Strategy (Vision 2030) of target country	Taken up as a major pillar. The development of ICT health care system is taken up as a program. It is included in the priority issues to be addressed by JICA.
3	Possible outcome by the utilization of digital technology	Trend of digital technology introduction by government and startup status by sector	Challenges which can be addressed by digital technologies As applicable sectors, following sectors can be considered. - Inclusive medical coverage - Improving the quality and access of health services - Expansion of health services (both rural and urban areas) - Development of health personnel Response status of Egypt Egypt has a small number of doctors per capita, and the brain drain of highly skilled medical personnel is also a problem. The Ministry of Health and Population is implementing several e-health projects. Startups are very active and providing services in a variety of fields, from services for consumers to companies, and to improving a wide range of health services using data. A lot of investments are being made from VCs and the like.
4	Cooperation of C/Ps and other government organizations	Relationships through past JICA projects	Experiences in JICA projects are limited these days than before. The Ministry of Health and Population is implementing a digital technology project and is familiar with the field (however, other donors are taking a big bite).

	Criteria	Evaluation indices	Details of evaluation
5	Feasibility of the project	Matching development needs with digital technology	Improving health indicators is a goal for the SDGs, and the Ministry of Health and Population is trying to introduce digital technologies. Startups cover a wide range of areas, including disease prevention, diagnosis, treatment (including surgical support), hospital operations (data utilization, AI, IOT utilization, etc.), caring, and support for people with disabilities. Building a business model by utilizing digital technology is relatively easy, and there is a high possibility that it will be expanded not only in two countries but also in other countries. By supporting projects in Egypt, it is considered possible to expand to other countries.
6	Possible collaboration with JICA scheme	Candidate JICA projects and private sector projects	As government initiatives, improvement of hospital operations using Kaizen and IoT, healthcare service utilizing health related big data and through patient data monitoring, diagnostic system, remote diagnosis and treatment utilizing AI, etc. (technical cooperation project, SDGs/SME support project, etc.) As private sector initiatives, there can be various health services.
7	Possible collaboration between local and Japanese companies	Expansion status of Japanese companies	FUJIFILM Medical Systems Middle East S.A.E and Egypt Otsuka Pharmaceutical Co. S.A.E have expanded into Egypt

3.2.2. Results of Validity Evaluation by Target Sector

The table below shows the results of validity evaluation based on the review results.

Table 3-4 Summary Table of Validity Evaluation Results by Target Sector (Egypt)

	1	2	3	4	5	6	7
Criteria	Possibility of using the experiences accumulated through the past Japanese cooperation	Priority of the sector in the target country	Possible outcome by the utilization of digital technology	Cooperation of C/Ps and other government organizations	Feasibility of the project	Possible collaboration with JICA scheme	Possible collaboration between local and Japanese companies
Agriculture & Fishery	☆☆☆	☆☆	☆☆☆ Applicability in a wide value chain	☆☆☆	☆☆ There are candidate projects at each stage of supply chain	☆☆ Some candidate projects have a high affinity with JICA scheme	☆☆☆
Transport	☆☆☆	☆☆	☆☆☆ Contribution to solving transport infrastructure challenges in terms of transport management	☆☆☆	☆☆☆ Based on lessons learnt from existing projects, multiple projects can be created	☆☆☆ Has a high affinity with JICA scheme	-
Tourism	☆	☆	☆ Contributes to tourism promotion. Startups are a B2C service for tourists.	☆	☆☆ Applying existing digital technologies is relatively easy	☆ Many of the project themes are of auxiliary nature	☆

	1	2	3	4	5	6	7
Criteria	Possibility of using the experiences accumulated through the past Japanese cooperation	Priority of the sector in the target country	Possible outcome by the utilization of digital technology	Cooperation of C/Ps and other government organizations	Feasibility of the project	Possible collaboration with JICA scheme	Possible collaboration between local and Japanese companies
Education	☆☆☆	☆☆☆	☆☆ Contribution to spread of education and improvement of education methods	☆☆☆	☆☆ Applying existing digital technologies is relatively easy	☆☆ Increasing the effect of JICA scheme with ICT technologies	-
Health	☆	☆☆☆	☆☆☆ Contribution to spread and improvement of health service	☆	☆☆☆ There are many examples of innovative technology introduction	☆☆ It is possible to create a project. Since other donors have participated, demarcation is necessary	☆☆☆
Notes		From the viewpoint of SDGs, the evaluation is as mentioned above. It can be said that all sectors have high priority.		Cooperation through existing JICA projects is evaluated			Just the evaluation of expansion status of Japanese companies

3.3. Morocco

3.3.1. Results of Validity Review by Target Sector

The table below shows the results of validity review by target sector in Morocco.

Table 3-5 Results of Validity Review of Candidate Sectors (Morocco)

	Criteria	Evaluation indices	Details of evaluation
Agriculture and fishery			
1	Possibility of using the experiences accumulated through the past Japanese cooperation	Number of past JICA projects (excluding third country training) (projects started after 2010)	10 projects <u>Technical cooperation</u> - Project for Enhancing the Capacity for Rural Development in the Province of Errachidia - Capacity Development of Fisheries Resource Monitoring for Sustainable Management of Small Pelagic Resources in the Kingdom of Morocco <u>Loans</u> - Oceanographic and fishery research vessel construction project <u>Grants</u> - The Project for Construction of Shellfish Aquaculture Technology Research Center <u>Public-Private Partnerships</u> (Dissemination, demonstration, and a commercialization project) Spread of water-saving agricultural technology in arid lands/demonstration project (Preparatory survey for cooperation) Cactus high value-added project preparatory study

	Criteria	Evaluation indices	Details of evaluation
			• (Collaboration Program with the Private Sector for Disseminating Japanese Technology) ALA (5-Aminolevulinic Acid) Dissemination Project for fertilizers • (Challenge-solving business in developing countries) Argan oil production and distribution business for creating women's employment • (Project feasibility study) project feasibility study for adding value to agricultural and fishery products by introducing advanced refrigeration storage technology • (Dissemination, demonstration, and a commercialization project) Dissemination and demonstration project for adding value to fishery products by introducing advanced refrigeration storage technology
2	Priority of the sector in the target country	Whether there is ⁶⁰ government policy (long-term plan by sector) of target country and description in 2020 Budget Law.	For agriculture, there are plans aimed at moving from traditional protected agriculture to market economy-based agriculture, and for fishery, there are plans to focus on improving "sustainability," "competitiveness" and "performance." •Agriculture: Plan Maroc Vert (Morocco Green Plan) •Fishery: Plan Halieutis (Fisheries Plan) Budget is also allocated by the 2020 Budget Law.
3	Possible outcome by the utilization of digital technology	Trend of digital technology introduction by government and startup status by sector	Challenges which can be addressed by digital technologies • Water resource management • Water resource detection and management •Improvement of various management (water, production, quality, facilities, sales) • Provision of various information (market conditions, farming methods) • Various matching (connections between producers, carriers, processors, consumers, etc.) Response status of Morocco With the support of development partners etc., efforts are made to improve agricultural productivity, strengthen value chain and manage fishery resources using ICT. In the Mediterranean Sea area, there are other cases utilizing digital technologies in fisheries management, and it can be said that there are a lot of opportunities to utilize digital technologies. Moroccan startups are also emerging in areas such as water resource management and agricultural IOT. On the other hand, in Morocco, similar to Tunisia and Egypt, it seems there are fewer innovative services by startups in the sector than in the Sub-Saharan region.
4	Cooperation of C/Ps and other government organizations	Relationships through past JICA projects	Cooperation can be expected from experiences of existing JICA projects.

⁶⁰ The Moroccan government has not formulated any five-year long-term plan since the five-year economic and social development plan (2000 to 2004) and currently, it formulates medium- to long-term strategies and long-term plans according to important issues across ministries, sectors, or sectors. These strategies and plans are put into practice on an annual basis in accordance with annual Budget Law (Loi de Finances) based on the priorities.

	Criteria	Evaluation indices	Details of evaluation
5	Feasibility of the project	Matching development needs with digital technology	Especially, this is a sector where involvement of public institutions is expected, and there is a possibility of creating a project. Since this is a priority sector of the government, and the spillover effect of appropriate and innovative use of digital technology is high. However, in order to enter into the sector as a startup, there may be difficulties to solve challenges.
6	Possible collaboration with JICA scheme	Candidate JICA projects and private sector projects	As government initiatives, in addition to resource management, water management, provision of agricultural and fishery products market information and farming information, support for collaboration between agriculture, commerce and industry and research and development of seeds etc., systems such as the one to turn knowledge from experiences based on "experiences" and "intuitions" of farmers and fishermen into data to make it explicit knowledge can be considered. As private sector initiatives, various products and services such as the ones for agriculture and fishery efficiency improvement, production management, facility management and POS using various data can be considered.
7	Possible collaboration between local and Japanese companies	Expansion status of Japanese companies	• Takasago International Corporation acquired Kananga, a natural material extraction and processing plant in 2012. Extracts vanilla extract in Madagascar and processes in Morocco. • Suntory acquired a Moroccan corporation through the acquisition of French company Orangina Schweppes in 2009. • Nissin Food Products established an instant noodle distribution company in 2014. • Maruzen Tea established a joint venture with Japanese packaging machine company Nasa and local company SITI in 2018. Exports crude tea from Japan, processes and packages it into green tea and roasted tea in Morocco and supplies it to Western tea makers on an OEM basis. • Sakata Seed established a representative office in 2008. • Tottori Resource Recycling, Inc. established a local corporation for the manufacture and distribution of agricultural materials using waste glass. • Maruha Nichiro, which imports crabs and octopuses, established a representative office. • Mitsui & Co. Ltd. invested in Moroccan feed company Zalar Holding in 2018. • Nippon Express opened a branch office in 2017.
Education			
1	Possibility of using the experiences accumulated through the past Japanese cooperation	Number of past JICA projects (excluding third country training) (projects started after 2010)	2 projects <u>Technical cooperation</u> • Project for Promoting Education with Equity and Quality <u>Loans</u> • Basic Education Sector Support Project
2	Priority of the sector in the target country	Whether there is ⁶¹ government policy (long-term plan by sector) of target country and description	Since the long-term plan (Plan Urgence de L'education Nationale (urgent national education plan)) implemented from 2008 to 2012, no long-term plan for the entire education sector has been formulated, however, under 2020 Budget Law, budgets are allocated for various programs implemented in the following three sectors: 1)

⁶¹ The Moroccan government has not formulated any five-year long-term plan since the five-year economic and social development plan (2000 to 2004) and currently, it formulates medium- to long-term strategies and long-term plans according to important issues across ministries, sectors, or sectors. These strategies and plans are put into practice on an annual basis in accordance with annual Budget Law (Loi de Finances) based on the priorities.

	Criteria	Evaluation indices	Details of evaluation
		in 2020 Budget Law.	National education, 2) Training on professionals and 3) Higher education. It is included in the priority issues to be addressed by JICA.
3	Possible outcome by the utilization of digital technology	Trend of digital technology introduction by government and startup status by sector	Challenges which can be addressed by digital technologies In Morocco, utilization of ICT is increasing in the education sector, and the GENIE Programme promoted by the government has been implemented for a long time and has produced results. Utilization of digital technologies is further expected to provide remote learning and quality education more effectively in the future. Response status of Morocco There is a service similar to online prep schools and some companies are invested by VCs. It seems that the number of startups is relatively small compared to other sectors.
4	Cooperation of C/Ps and other government organizations	Relationships through past JICA projects	Cooperation can be expected from experiences of existing JICA projects.
5	Feasibility of the project	Matching development needs with digital technology	Especially, in the sector where public institutions such as Government Education Department or schools are involved, there is a high possibility of creating a project. As of 2018, the National Centre for Evaluation Examination and Career Guidance of the Ministry of National Education has also requested cooperation for the "Project for Promoting Education with Equity and Quality" to use ICT for examinations. The possibility of utilizing appropriate and innovative digital technologies by startups is expected to be difficult to build a sustainable business model.
6	Possible collaboration with JICA scheme	Candidate JICA projects and private sector projects	The following support can be considered for conventional JICA projects. • Introduction of a system that enables digitization of exam questions, analysis and utilization of results (SME support project, etc.) • Introduction of teaching materials and apps to improve understanding and practical ability of mathematics (SME support project, etc.) • Improvement of teaching of teachers through content distribution, teaching material sharing platform, spread of teachers' SNS, etc. (Technical cooperation project, SDGs/SME support project, etc.) • Development and introduction of platform that enables sharing and feedback of classwork videos, experiment videos, etc. (Technical cooperation project, SME support project, etc.) • Expansion of education support to rural areas through content distribution, online teaching, etc. (Technical cooperation project)
7	Possible collaboration between local and Japanese companies	Expansion status of Japanese companies	-

3.3.2. Results of Validity Evaluation by Target Sector

The table below shows the results of validity evaluation based on the review results.

Table 3-6 Summary Table of Validity Evaluation Results by Target Sector (Morocco)

	1	2	3	4	5	6	7
Criteria	Possibility of using the experiences accumulated through the past Japanese cooperation	Priority of the sector in the target country	Possible outcome by the utilization of digital technology	Cooperation of C/PS and other government organizations	Feasibility of the project	Possible collaboration with JICA scheme	Possible collaboration between local and Japanese companies
Agriculture & Fishery	☆☆☆	☆☆	☆☆☆ Applicability over a wide range of value chain	☆☆☆	☆☆ From resource management to higher distribution, there are candidate projects at each stage of supply chain	☆☆ Has a high affinity with JICA scheme	-
Education	☆☆	☆☆	☆☆☆ Morocco has continued ICT and education initiative for many years.	☆☆☆	☆☆☆ Based on lessons learnt from existing projects, multiple projects can be created	☆☆☆ Has a high affinity with JICA scheme	-
Notes				Cooperation through existing JICA projects is evaluated			Just the evaluation of expansion status of Japanese companies

3.4. Tunisia

3.4.1. Results of Validity Review by Target Sector

The table below shows the results of validity review by target sector in Tunisia.

Table 3-7 Results of Validity Review of Candidate Sectors (Tunisia)

	Criteria	Evaluation indices	Details of evaluation
Agriculture and fishery			
1	Possibility of using the experiences accumulated through the past Japanese cooperation	Number of past JICA projects (excluding third country training) (projects started after 2010)	4 projects Technical cooperation • New industry development study through evidence-based development of biological resource seeds in arid lands • Functional analysis and effective use of arid land biological resources • Project on Co-management of Coastal Fisheries in the Gulf of Gabes Public-Private Partnerships • (Preparatory survey for cooperation) a preparatory survey on product development using high functional olives
2	Priority of the sector in the target country	Description in National Development Strategy of target country (Synthèse de la Note d'Orientation du Plan Stratégique)	It is a priority sector for achieving the goal of promoting a green economy. It is also expected to contribute to expanding exports and reducing regional disparities. It is included in the priority issues to be addressed by JICA.

	Criteria	Evaluation indices	Details of evaluation
		de Développement 2016-2020)	
3	Possible outcome by the utilization of digital technology	Trend of digital technology introduction by government and startup status by sector	Challenges which can be addressed by digital technologies - Water resource management - Water resource detection and management - Improvement of various management (water, production, quality, facilities, sales) - Provision of various information (market conditions, farming methods) - Various matching (connections between producers, carriers, processors, consumers, etc.) Response status of Tunisia With the support of development partners etc., efforts are made to improve agricultural productivity, strengthen value chain and manage fishery resources using ICT (e.g., KOAFEC Trust Fund and African Development Bank Drone Project). In the Mediterranean Sea area, there are other cases utilizing digital technologies in fisheries management and joint research with Europe is also being conducted, so it can be said that there are a lot of opportunities to utilize digital technologies. Startups are also emerging in areas such as water resource management and streamlining agricultural work, however, it seems there are fewer remarkable services than in the Sub-Saharan region.
4	Cooperation of C/Ps and other government organizations	Relationships through past JICA projects	Cooperation can be expected from experiences of existing JICA projects.
5	Feasibility of the project	Matching development needs with digital technology	It is an important sector for transition to sustainable and green economy and involves a lot of public institutions. There is a possibility of creating a project. The spillover effect of appropriate and innovative use of digital technology is high. Although there are few innovative services like in Sub-Saharan Africa, since there are some companies targeting agriculture for startup, support can be expected for challenge solving.
6	Possible collaboration with JICA scheme	Candidate JICA projects and private sector projects	As government initiatives, in addition to water management, provision of agricultural and fishery products market information and farming information, support for collaboration between agriculture, commerce and industry, research and development of seeds etc. and fishery resources management, systems such as the one to turn knowledge from experiences based on "experiences" and "intuitions" of farmers and fishermen into explicit knowledge can be considered. As private sector initiatives, various products and services such as the ones for agriculture and fishery efficiency improvement, production management, facility management, e-commerce services for agricultural machinery and seed etc. and POS using various data provide by IOT, satellites, drones, etc. can be considered.
7	Possible collaboration between local and Japanese companies	Expansion status of Japanese companies	Arenabio and others conducted a preparatory survey on product development using high functional olives under the JICA Public-Private Partnerships.
Industrial Development			
1	Possibility of using the experiences accumulated	Number of past JICA projects (excluding third country training)	2 projects Technical cooperation Project on Quality/Productivity Improvement (Phase 2)

	Criteria	Evaluation indices	Details of evaluation
	through the past Japanese cooperation	(projects started after 2010)	Tourism promotion capacity building project
2	Priority of the sector in the target country	Description in National Development Strategy of target country (Synthèse de la Note d'Orientation du Plan Stratégique de Développement 2016-2020)	For the priority goal of achieving development as an economic hub, this sector is expected to contribute to economic diversification, productivity improvement, innovation, investment promotion, and so on. It is included in the priority issues to be addressed by JICA.
3	Possible outcome by the utilization of digital technology	Trend of digital technology introduction by government and startup status by sector	Challenges which can be addressed by digital technologies The following measures are taken to address challenges in the manufacturing industry - Process automation using digital technology - Detection of defective products using AI, creating optimal processing conditions and procedures by monitoring, improving products by monitoring product usage status, cost reduction by product design simulation and productivity improvement and product development utilizing IOT such as remote management by monitoring production equipment - Productivity improvement by production control support system - Introduction of supply chain management system In the peripheral sectors, the challenge is improving corporate support service in the areas such as logistics management, human resources matching/personnel management and accounting as well as improving service in the areas such as distribution and marketing by utilization of digital technologies. - Linkage with European companies and Japanese companies is important in major industries. - From the viewpoint of value-added agriculture, there is a possibility of using ICT to manage GMP and traceability in food processing. Response status of Tunisia The country is addressing productivity improvement through Kaizen activities. Further productivity improvement using digital technologies according to the type and level of Tunisian companies is required. Startups which provide services to contribute to corporate production activities are desired. For startup development measures, it is expected to develop startups in line with this. The Tunisian government also focuses on developing human resources who are familiar with ICT and science and technology, and such human resources are expected to improve the level of corporate digital technologies. Startup development is an area where other donors take a lead.
4	Cooperation of C/Ps and other government organizations	Relationships through past JICA projects	From experiences of existing JICA projects, cooperation can be expected in the field of productivity improvement (Kaizen). Tourism promotion is also possible in past projects.
5	Feasibility of the project	Matching development needs with digital technology	Currently, factories in middle-income and semi-developed countries (especially foreign-affiliated companies) are rapidly investing in automation.

	Criteria	Evaluation indices	Details of evaluation
			There is a strong need to improve productivity at production sites while creating employment opportunities by expanding the base of the industry. It is considered that high effect can be realized through industrial human resource development for improving the technical capabilities of industries IoT technology consulting, creation of corporate support services (startups) and strengthening of production and marketing of small and medium-sized enterprises using ICT technologies. There is also a high possibility of new industries such as the one using digital machining technology to create high value-added products on demand (e.g., aerospace industry and machine industry). As a follow-up to past tourism promotion, it is necessary to consider the possibility of fostering startups in the tourism sector.
6	Possible collaboration with JICA scheme	Candidate JICA projects and private sector projects	The following support can be considered for conventional JICA projects. - Industrial productivity improvement, product development support and marketing support utilizing digital technologies (SME support project, technical cooperation project) - Development of industrial human resources engaging in production utilizing ICT (Industry 4.0) (SME support project, technical cooperation project) - Development of company support services by supporting partnerships with startups and existing companies (SDG/SME support project, etc.) - Logistics improvement using ICT (also related to transport)
7	Possible collaboration between local and Japanese companies	Expansion status of Japanese companies	Sumitomo Wiring Systems and Yazaki Corporation with the production of wire harnesses, Sumitomo Riko with the production of automobile hoses and YKK Corporation with the production of zippers.
Transport			
1	Possibility of using the experiences accumulated through the past Japanese cooperation	Number of past JICA projects (excluding third country training) (projects started after 2010)	2 projects Loans - Gabes-Medenine Trans-Maghreb Corridor Construction Project - Metropolitan Railway Electrification Project (2)
2	Priority of the sector in the target country	Description in National Development Strategy of target country (Synthèse de la Note d'Orientation du Plan Stratégique de Développement 2016-2020)	It is a sector related to infrastructure and logistics development in the priority goal of developing as an economic hub. It is included in the priority issues to be addressed by JICA.
3	Possible outcome by the utilization of digital technology	Trend of digital technology introduction by government and startup status by sector	Challenges which can be addressed by digital technologies There is a potential to make significant contribution to the proper control of urban transport and the realization of comfortable and safe mobility. Operation and maintenance of expressways, improvement of traffic control and traffic demand management, improvement of public services, traffic safety measures, improvement of operation and management of roads and equipment, etc.

	Criteria	Evaluation indices	Details of evaluation
			Response status of Tunisia New investments have been made in the area of MaaS (Mobile Services) utilizing digital technologies (e.g., motorcycle taxi IntiGo and taxi dispatch kapy). However, since the domestic market is smaller than Egypt, it might be disadvantageous for expanding to other countries. There are many car accidents, and it has become a social problem. A solution by utilizing digital technology is desired.
4	Cooperation of C/Ps and other government organizations	Relationships through past JICA projects	Cooperation can be expected from experiences of existing JICA projects (however, it is necessary to build new relationships with counterparty organizations in fields other than roads and public rail transport systems).
5	Feasibility of the project	Matching development needs with digital technology	It is considered that projects utilizing ICT can be created in several sectors (especially maintenance, traffic safety, etc.). Startups utilizing IOT etc. are emerging, and it is considered possible to create a new project to apply digital technology to the transport sector other than MaaS.
6	Possible collaboration with JICA scheme	Candidate JICA projects and private sector projects	The following support can be considered for conventional JICA projects. • Support for the introduction of ITS and information and communication equipment (traffic control, toll collection, etc.) along with the development of expressways, and support for improving capabilities for operation and maintenance • Support for the introduction of a bus operation control system and support for developing transfer facilities associated with strengthening of the bus network • Traffic signal improvement project(technical cooperation project/loan => grant etc.) • Traffic safety technical cooperation project • Technical support for road asset management utilizing IT technology • Transport big data analysis demonstration project (SDGs/SME support project, etc.) • Support for strengthening traffic safety capabilities (vehicle and accident data management, traffic control technical cooperation project, etc.)
7	Possible collaboration between local and Japanese companies	Expansion status of Japanese companies	-

3.4.2. Results of Validity Evaluation by Target Sector

The table below shows the results of validity evaluation based on the review results.

Table 3-8 Summary Table of Validity Evaluation Results by Target Sector (Tunisia)

	1	2	3	4	5	6	7
Criteria	Possibility of using the experiences accumulated through the past Japanese cooperation	Priority of the sector in the target country	Possible outcome by the utilization of digital technology	Cooperation of C/Ps and other government organizations	Feasibility of the project	Possible collaboration with JICA scheme	Possible collaboration between local and Japanese companies
Agriculture & Fishery	☆☆☆	☆☆☆	☆☆☆ Applicability in a wide value chain	☆☆☆	☆☆ There are candidate projects at each stage of supply chain	☆☆ Some candidate projects have a high affinity with JICA scheme	☆
Industrial Development	☆☆	☆☆☆	☆☆☆ In industries, especially in the manufacturing industry, the introduction of digital technology is the focal point of enhancing competitiveness.	☆☆ Current projects specialize in Kaizen activities	☆☆ Extensive application of various digital technologies is possible; however, it is necessary to consider how to select the targets and counterpart organizations.	☆☆ Technical support scheme, SDGs/SME support scheme, etc. can be applied.	☆☆☆ Expansion by automobile parts and sewing materials
Transport	☆☆	☆☆	☆☆☆ Contribution to improving traffic control and mobility	☆☆☆	☆☆☆ Based on lessons learnt from existing projects, multiple projects can be created	☆☆☆ Has a high affinity with JICA scheme	-
Notes				Cooperation through existing JICA projects is evaluated			Just the evaluation of expansion status of Japanese companies

3.5. Selection Result of Target Sectors

As discussed above, the results of evaluation and confirmation of the validity of the target sectors based on the seven evaluation criteria by country, all the evaluated sectors except for the tourism sector of Egypt are selected as target sectors for the survey. The reasons why the target sectors were selected for each country are explained below.

3.5.1. Egypt

In Egypt, five sectors, i.e., agriculture and fishery, transport, tourism, education and health are set as target sectors and validity of these five sectors was confirmed and considered. The evaluation results are shown in Table 3 - 4, and since the agriculture and fishery, transport and education sectors have sufficient track record of past JICA cooperation and because the experiences accumulated through the past Japanese cooperation can be expected and also in Egypt's national development strategy, Vision 2030, these sectors are listed as main pillars,

the JICA Study Team confirmed that utilization of ICT is expected in these sectors. Also, because high evaluations are given to the factors such as “cooperation of counterpart organizations and other government organizations,” “feasibility of the project” and “possible collaboration with JICA scheme”, these are selected as target sectors. Regarding the health sector, although there is only one cooperation project with JICA which was implemented after 2010, the JICA Study Team determined that it is appropriate to include the health sector in target sectors because the development of ICT healthcare system is proposed in the Vision 2030 and the government actively promotes e-health. As for the tourism sector, although acceleration of digitalization to promote tourism is considered to be important issue for the country, there are several factors to be considered. As for projects other than the Grand Egyptian Museum, building new relationship with counterpart organizations is necessary. Possible collaboration with JICA scheme may be limited because private sector initiatives are the main focus in the areas of tourism promotion and tourism services. As a result of considering these factors, it is decided that the tourism sector is excluded from target sectors.

Table 3-9 Evaluation Result of Target Sectors (Egypt)

Candidate sectors to be evaluated	Agriculture and fishery	Transport	Tourism	Education	Health
Selection result	Acceptable	Acceptable	Not acceptable	Acceptable	Acceptable

3.5.2. Morocco

In Morocco, two sectors, i.e., agriculture and fishery and education, are set as candidate sectors and the validity of these two sectors was evaluated and confirmed. As a result, both sectors are selected as target sectors. Especially in the agriculture and fisheries sector, there has been a long track record of JICA’s cooperation, and because “possibility of using the experiences accumulated through the past Japanese cooperation” can be expected and also because many Japanese companies have expanded their business in Morocco, “possible collaboration between local and Japanese companies” is considered to be high, the JICA Study Team determined that this sector is appropriate as a target sector. Also, for the education sector, ICT utilization is increasing in the country, and since utilization of digital technologies is further expected to continue to provide remote learning and quality education more effectively in the future, the JICA Study Team determined that education is appropriate as a target sector.

Table 3-10 Evaluation Result of Target Sectors (Morocco)

Candidate sectors to be evaluated	Agriculture and fishery	Education
Selection result	Acceptable	Acceptable

3.5.3. Tunisia

In Tunisia, three sectors, i.e., agriculture and fishery, industrial development and transport, are set as candidate sectors and validity of these three sectors was examined and confirmed. In the agriculture and fisheries sector, efforts have been already made to improve agricultural productivity, strengthen value chain, manage fishery resources, etc. using ICT through the support of development partners and needs to solve challenges using digital technologies are expected to increase further in the future. Also, in the industrial development sector,

productivity improvement (*kaizen*) by utilizing digital technology and fostering startups which provide services to contribute to corporate production activities are needed. In the transport sector, new investments have been made to MaaS (Mobility as a Service) area which utilizes digital technology, it is highly expected that digital technology will greatly contribute to the proper control of urban transport and the realization of comfortable and safe mobility. From these evaluation results, the JICA Study Team found that each sector has high priority in Tunisia and since the experiences accumulated through the past Japanese cooperation can be used. Therefore, the JICA Study Team has selected all three sectors as target sectors.

Table 3-11 Evaluation Result of Target Sectors (Tunisia)

Candidate sectors to be evaluated	Agriculture and fishery	Industrial Development	Transport
Selection result	Acceptable	Acceptable	Acceptable

Chapter 4 Current Status and Issues in the Surveyed Sectors

4.1. Egypt

4.1.1. Overview

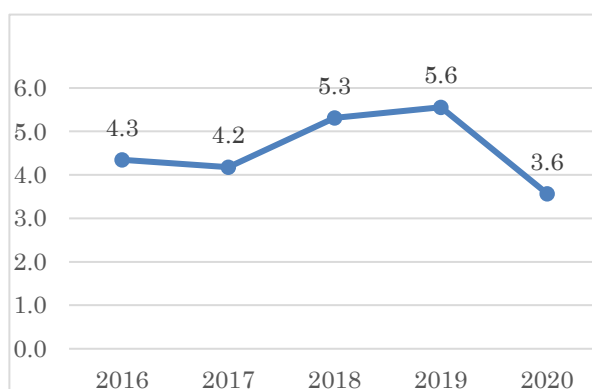
(1) Economic Outline

Due to the political change in 2011, large trade deficit continued due to a drop in tourism and investment. However, IMF has supported Egypt since 2016 and foreign currency revenue has increased steadily. President Elsihi worked on large national projects after his inauguration in June 2014, and the new Suez Canal was opened in August 2015. Though the GDP rate fell from 5.6% in 2019 to 3.6% in 2020 due to the impact of COVID-19, the new capital city and special economic zones are currently under construction.

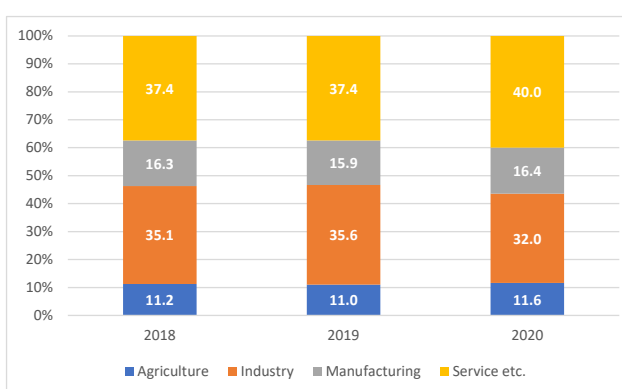
Table 4-1 Economic Outline (Egypt)

Population	Approx. 0.1 billion (2020) Of which 66.1% are over 15 years old Of which 20 million are in Cairo and Giza
Land size	Approximately 1,000,000 km ² 95% of the land is desert. Most people live in Nile valley and a delta area.
Nominal GDP	Approximately 365 billion USD (2020) This is larger amount than nominal GDP of Kanagawa Prefecture (335.7 billion USD).
GNI per capita	2,700 USD (2019)
Unemployment rate	7.9% (2020)
Language	Arabic (Official), English (widely used in urban area)
Politics	Republic (President Mr. Elsihi, second inauguration in June 2018)
No. of Japanese living in Egypt	719 people (2021) The number of Japanese tourists was 42 thousand people in 2018
No. of Japanese companies in Egypt	49 companies (2020)

Source: Central Agency for Public Mobilization and Statistics (CAPMAS), World Bank and Ministry of foreign affairs in Japan



Source: World Development Index, World Bank
Figure 4-1 GDP Growth (annual,%) (Egypt)



Source: World Development Index, World Bank
Figure 4-2 Percentage of Main Industries in GDP (Egypt)

(2) JICA's Supporting Plan and Major Projects

JICA has implemented many projects in 1) transport, 2) agriculture and rural area development, 3) education, and 4) resources and energy. Currently, many projects and trainings for adoption of Japanese style education and human resources development are being implemented.

Table 4-2 JICA's Supporting Plan and Major Projects (Egypt)

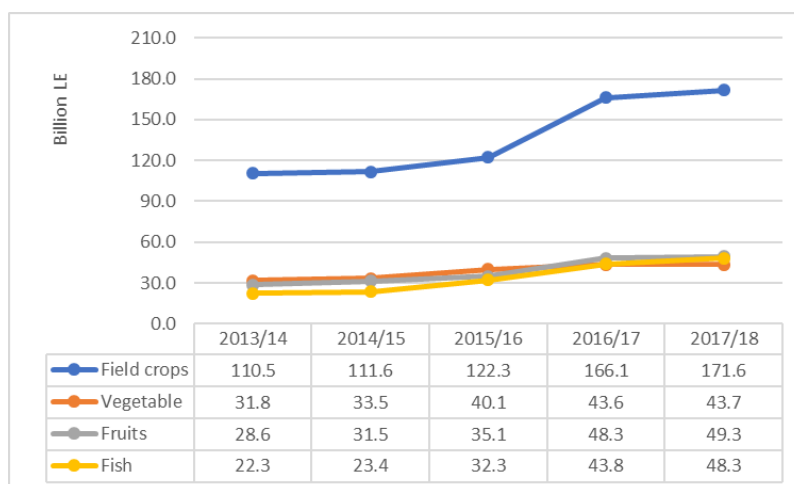
Challenges tackled by JICA	Target	Main Sector
Sustainable Economic Development and Job Creation	Investment and Business Environment Improvement Export Promotion and Industry Development	- Electricity (Supply, Efficiency) - Transport (Reduction of traffic jam and Improvement of infrastructure) - Private Sector Development (To tackle unemployment rate) - Tourism (Job creation)
Poverty Reduction and Improvement of Quality of Life	Improvement and Expansion of Public Services Development of Agriculture and Rural Area Improvement of Social Welfare	- Healthcare (Improvement of service) - Agriculture (Reduce the gap among regions) - Education (Japanese style/Human Resource Development (Improve quality of education)) - Public Services (Capacity Building for government officers) - Regional Development
Human Resources Development for Stabilization in the Region	Support for peace and development in the Middle East Support for Promotion of Regional cooperation in Africa	- Program for Promotion of Regional cooperation in the Middle East - Support for Promotion of Regional cooperation in Africa

Source: JICA Country Analysis Paper for the Arab Republic of Egypt (2016)

4.1.2. Agriculture and Fishery

(1) Current Status

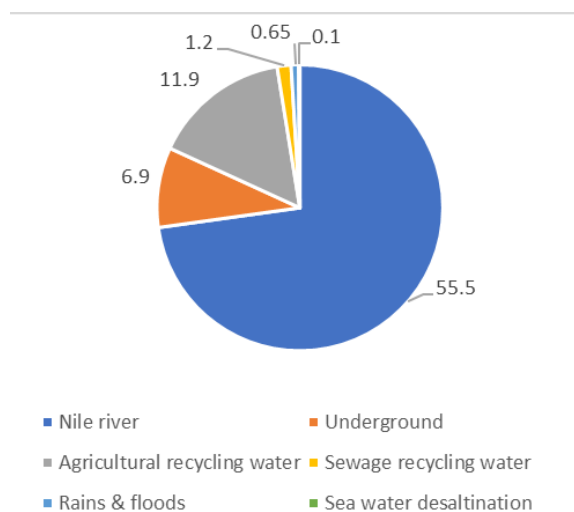
Although deserts cover about 95% of Egypt's land area, the agriculture and fisheries are one of the main economic activities. A quarter of the working population are engaged in those two sectors and GDP from the sectors account for 11% of total. The land for agriculture is concentrated on limited areas along shores of the Nile River and delta located at the mouth of the river. Land for agriculture accounts for only 3.6% of total land dimension. Farms can be categorized into two groups, a small number of large-scale farms and a vast number of impoverished small-scale farms.



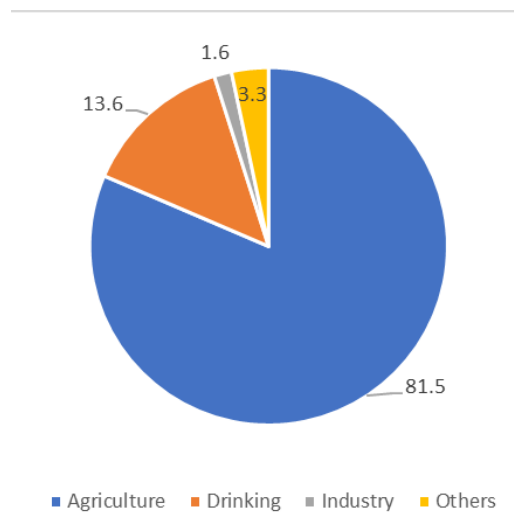
Source: “Yearbook 2019 (Agriculture, water resource)” (CAPMAS)

Figure 4-3 Production Value of Agriculture and Fisheries

After the agricultural reform of 1987 (liberalization and opening of land for production, abolishing supply obligations, and liberalization of circulation), both yield and output tended to increase. According to FAO statistics of world agricultural production yields for 2017, yields of tomato, onion, orange, rice, and grape in Egypt were give would ranks of 5th, 5th, 7th, 15th, and 15th, respectively. On the other hand, the amount of wheat, a main staple food, imported into Egypt is the largest in the world. Because it hardly rains in the desert, half of the required water resource is dependent on the Nile River and around 80% of that is used for agriculture.

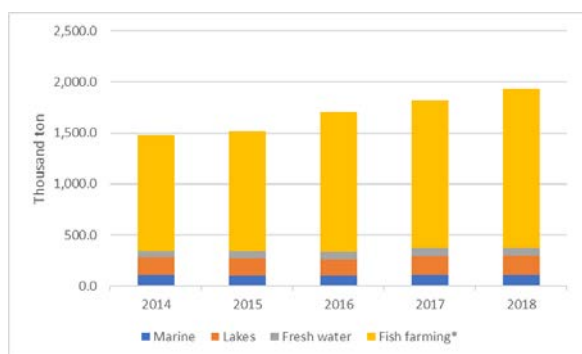


Source : Yearbook 2019 (Agriculture, water resource), CAPMAS
Figure 4-4 Water use in 2015/16 by purpose



Source : Yearbook 2019 (Agriculture, water resource), CAPMAS
Figure 4-5 Type of Water Resource in 2015/16

Fishery is a promising industry as a source of protein. The main caught fish is bony fish (sardine and Spanish mackerel) and shellfish (clam). The types of fisheries can be divided into sea fishery, inland fishery and aquaculture. Sea fishery is often seen on the Mediterranean Sea and Red Sea and inland fishery is on the Nile River and Lake Nasser. Techniques for inland aquaculture (mainly tilapia) is rather matured, though the price of those are low. Marine aquaculture, however, still has room for improvement.



Source : Yearbook 2019 (Agriculture, water resource), CAPMAS

Figure 4-6 Fish Production by Place

Thousand ton	2014	2015	2016	2017	2018
Borrry fish*	1426.8	1473.7	1663.8	1772.9	1897.6
Cartilaginous fish	1.8	1.1	1.3	1.4	1.3
Crustaceans	25.8	18.6	17.1	20.8	14.3
Mollusks	2.5	1.9	1.9	2.1	2.6
Other varieties	24.9	23.6	22.3	25.5	21.9
Total	1481.8	1518.9	1706.4	1822.7	1937.7

*includes 4.8 tons grass carp

Source : Yearbook 2019 (Agriculture, water resource), CAPMAS

Table 4-3 Fish Production by Fish Group

Due to rapid population growth, caught fish is for domestic consumption and Egypt is a net importing country of fish.

As a measure to prevent the spread of COVID-19, restrictions on the movement of people have been imposed since March 2020, which has resulted in a more pronounced shortage of labor for agricultural production (and some processing). This has had a particularly serious impact on the production of value-added crops (vegetables and fruits), which are labor-intensive⁶². In addition, even if a certain amount of labor can be secured, the cost is higher than usual due to the preparation of masks and sterilizing alcohol to prevent COVID-19 infection and harvesting work in a way that avoids 3Cs⁶³. The slowdown in global distribution has also led to higher prices for fertilizers, feed, and other products. As for the fishing industry, COVID-19 has had a negative impact on many fishermen due to the following external factors

- Hotels and restaurants have been blocked, reducing the number of places to sell fish.
- Export of fishery products has been stagnant due to the blocked border.
- As a result of the above, the demand for fish has decreased and the selling price has fallen.
- Some fish markets in Alexandria were closed to avoid 3 Cs.

(2) Challenges in Agriculture and Fisheries Sector

The challenges in Agriculture and Fisheries sector in Egypt can be described as follows.

1) Agriculture

Small farmers engage in farming manually at low wage and many of the aquaculture operations are not stable or efficient as it is done manually. Machinery is expected to be introduced.

Due to population growth and industrial development, the demand of water rapidly increases and an equitable distribution of water resources according to the demand is required. Also, sprinkler irrigation, desalination of sea water as well as improvement of irrigation facilities are required.

The improvement of the irrigation facilities is necessary to utilize the limited water resources efficiently.

⁶² https://www.unido.org/sites/default/files/files/2020-09/IGGE_Agrifood_and_COVID19.pdf

⁶³ Three conditions, closed spaces, crowds and close contact, are pointed as factors that facilitate the transmission of infectious diseases.

2) Fishery

Because many aquaculture operators over feed the fish. The cost becomes high, and the quality of water becomes low. It is important that information of water quality and timing of feeding is visualized.

Promotion of aquaculture is required, but the number of seeds is insufficient. The production system to secure a sufficient amount of seeds is necessary.

3) Common to Agriculture and Fishery

Because of the construction of dams, soil is no longer renewed by the flooding of the Nile River. Some lands (especially in the north of Nile and Delta area) are accumulating salt, which does not allow people to continue agriculture. Actions such as transformation of those lands for aquaculture should be taken.

The main food products are fresh or simple processed ones such as frozen or dried. The advanced food processing industry is necessary to increase additional value to the products.

Reducing logistical loss occurred during transport of products from warehouse to retail shops is important.

Vegetables and fruits which have bad shape or color are often circulated. Improvement of quality management is necessary to increase exports.

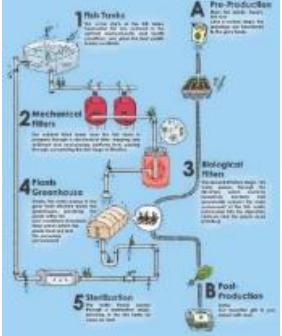
There are many small farmers and fishermen, who have to carry their products to market by themselves. Service for connecting and delivering products to consumers is required.

(3) Current status of companies and startups

In Egypt, the World Bank's support to agricultural startups has resulted in the creation of startups in the following fields, and these companies are playing an important role in contributing to the agriculture and fisheries sector in the COVID-19 pandemic.

Table 4-4 Examples of Agricultural and fisheries Startups in Egypt

Name of startups	Overview	Reference image
FreshSource	A startup that has built a platform and logistics system to connect farmers and retailers to deliver agricultural products in a short value chain and has also launched a system to deliver agricultural products directly to households in response to the curfew issued to prevent the spread of COVID-19.	
Tomatiki	A startup that builds and sells a variety of management systems to improve the efficiency of farming.	

Name of startups	Overview	Reference image
Agrimatic	A startup that aims to contribute to improving the production of both agriculture and fisheries by combining aquaculture and vegetable cultivation through the successful circulation of water.	

Source: JICA Study Team

4.1.3. Transport

(1) Current Status

Road transport is the major means of transport, constituting more than 90% of passenger and freight traffic.

The total road length is approximately 60,000 km in Egypt and there are the ring roads, i.e., inner ring road and outer ring roads in the Cairo metropolitan area. The radial roads connect the regional cities such as Alexandria and Suez and these basic roads are increasingly being improved to high standard roads.

The Egyptian public railway connects Cairo and major regional cities. There are currently three (3) lines of Cairo Metro, part of which is under construction, with Cairo Metro line 4 under development by a Japanese ODA loan.

A new capital is under development in a spacious area 50km east of Cairo, and mass transit, e.g., metro, monorails, etc. are planned between Cairo and the new capital.



Source: Wikipedia

Figure 4-7 Cairo Metro



Source: Practical Technology on ITS, JICA

Figure 4-8 New Capital Construction Site

The majority of city buses are operated by the government, and some of the city buses are operated by private sector. The private bus operator uses bus control system and is now conducting trial projects of Park & Ride using smart card assisted by UNDP.



Source: Practical Technology on ITS, JICA

Figure 4-9 City Bus Control Center

The ITS Committee is a decision-making body for ITS, has been formulated in Egypt. It is constituted of related government organizations, MOI, MOD, MOT, MOC, etc.

‘ITS Project Phase1’ will be implemented in Egypt. It targets approximately 1,000km trunk roads which are shown in black and red in the above map. The highway traffic management system and toll collection system are planned to be introduced.



Source: GARBLT

Figure 4-10 Trunk Roads in North Area of Egypt: Target Roads of ITS Project Phase-1

In response to the spread of COVID-19, the government imposed a curfew and other measures to prevent infection. As a result of these measures, the transport sector has been severely affected by the slump in passenger and cargo demand. The aviation sector in particular is said to have been hit hard by the suspension of passenger traffic. According to an announcement by EgyptAir, the loss after COVID-19 is estimated at 2.25 billion Egyptian pounds (about 15 billion yen). Although information on specific figures such as the amount of losses has not been disclosed, it is said that public passenger transport, including land transport such as city buses, intercity buses, Cairo Metro, and Egyptian National Railways, were also greatly affected by the restrictions on business hours. Thus, road transport operators have been negatively affected by the decline in demand, and it is reported that Careem, a company providing car-dispatch services in Cairo, has taken measures to reduce its workforce by almost 30% due to the slump in customer numbers.

(2) Challenges in Transport Sector

The challenges in transport in Egypt can be described as follows

1) Congestion in the City

In urban areas, the road network is relatively well-developed with intra-city elevated roads and intra-city tunnels. However, the Cairo metropolitan area experiences heavy traffic congestion on a regular basis. An overview of the road and traffic situation in the metropolitan area shows that the infrastructure side is relatively well supplied, with the existence of elevated roads in the city and the development of a high standard road network in the suburban areas. However, there are some problems such as inadequate connections between elevated roads and ordinary roads, and inefficient detours due to one-way traffic. Under these circumstances, it can be said that the main cause of constant traffic congestion is due to traffic management problems. In addition, in order to solve the problem of constant traffic congestion, it is necessary to take a multitude of measures such as traffic management in the city and measures to shift traffic demand to public transport.



Source: Country Report of Participant from Egypt in ITS Training Program in 2019, JICA
Figure 4-11 Congestion in Cairo

2) City Traffic Control and City Road

Traffic signals are limited in number in spite of heavy city traffic. Also, many signals are out of order. Those traffic signal locations that do work often suffer from improper signal timing. These are major traffic congestion causes must be addressed for improvement of traffic flow control. The Improvement of roads, e.g., flyovers, humps, etc. are also important.



Source: Practical Technology on ITS, JICA
Figure 4-12 Broken Traffic Lights

3) Improvement of Public Transport

Commuters are heavily dependent on urban road traffic. More mass transit networks in the Cairo metropolitan area and special economic zones in regional areas are needed. Many buses and minibuses randomly stop on the roads, worsening city traffic congestion further. The improvement of public transport operations as well as public transport infrastructure are required.

4) Traffic Safety

Approximately 12,000 traffic fatalities are reported in Egypt yearly and this is the worst in the Middle East and North Africa region⁶⁴. This situation requires that enhancement of the traffic safety measures be implemented so that highways can be developed in Egypt and traffic accidents reduced.



Source: Country Report of Participant from Egypt in ITS Training Program in 2019, JICA
Figure 4-13 Traffic Accident on the Highway

⁶⁴ International Statistics Rating Center, etc.

5) Operation and Maintenance of Highway and System

The ITS on highways will be increasingly introduced in Egypt by such projects as ITS project phase 1. However, the actual operation and maintenance of such facilities would be a challenge for Egypt as its almost Egypt's first experience. The proper and sustainable O&M of system and highways are of increasing importance.



Source: Practical Technology on ITS, JICA
Figure 4-14 ETC Planned Toll Gate

6) Parking Measures in the City

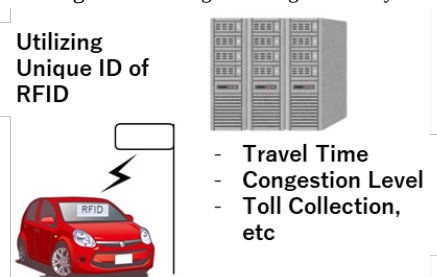
The roads in Cairo city are full of illegal parking. Private vehicles are parked in double or triple rows on roadsides everywhere in the city and are a major factor of the congestion. Improved parking measures that include both existing cities and the new capital are important.



Source: Practical Technology on ITS, JICA
Figure 4-15 Illegal Parking in the City

7) Traffic Data Utilization

The RFID Tag⁶⁵ has been mandated to be installed on vehicles for the purpose of vehicle management since January 2019 in Egypt. The RFID-based ETC will be introduced for highways. The RFID is a technology, with which gathered data can be utilized for various purposes such as estimating actual travel time, not only for ETC, but also for improving the accuracy of traffic recording. The utilization of big data for traffic flow is of critical importance.



Source: JICA Study Team

Figure 4-16 Traffic Data Utilization based on RFID

(3) Current Status of Companies and Startups

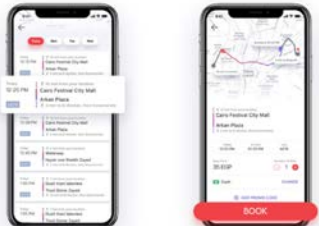
There are also a number of private companies and startups using digital technologies in the Egyptian transport and traffic sector. Major examples are described below.

In Egypt, ridesharing services are provided by startups such as SWVL and Halan (see below), as well as major companies such as Uber and Careem. These companies are expected to accumulate data on the movement of people and vehicles, and there is a possibility of collaboration between the public and private sectors, or between the private and public sectors, to utilize this data for urban transport measures.

Table 4-5 Examples of Startups in Transport Sector in Egypt

Name of startups	Overview	Reference image
El Sewedy Electric	A purely local Egyptian power infrastructure construction company. It is the main player in the El Sewedy Group, which consists of about 95 companies. It is a major player in the private sector as it is the contractor for the Advanced Traffic Information System project, which is a major digital project in the Egyptian transport sector, although it is mainly involved in infrastructure projects.	

⁶⁵ RFID: 'Radio Frequency Identifier' is a technology that uses ID information recorded in the tag which is obtained through the near field communication. The applied cases include automated toll collection on the highway, transport IC card as well as e-money, employee ID card, commodity management for logistics and etc.

Name of startups	Overview	Reference image
SWVL	A bus ridesharing (matching customers with bus drivers) startup in Egypt. It provides a service that tells app users the best routes and matches them with bus drivers. Users can check fares, reserve seats, and make payments all through the application.	
Halan	The company provides ridesharing and home delivery services using "tuk-tuks" (three-wheeled autos) and motorcycles. Since its establishment in 2017, the company has grown rapidly and was one of the top five startups in Egypt in terms of funding in 2018, thanks to its business model of dispatching and delivering cars on two and three wheels in urban areas with heavy traffic congestion and its partnerships with major food service companies such as Kentucky, Pizza Hut, and McDonald's.	

Source: JICA Study Team

4.1.4. Education

(1) Current Status

The education system in Egypt is composed of the following: pre-primary education (Nursery school: 4 years, Kindergarten: 2 years); primary education (6 years); lower secondary education (3 years) and upper secondary education (3 years).

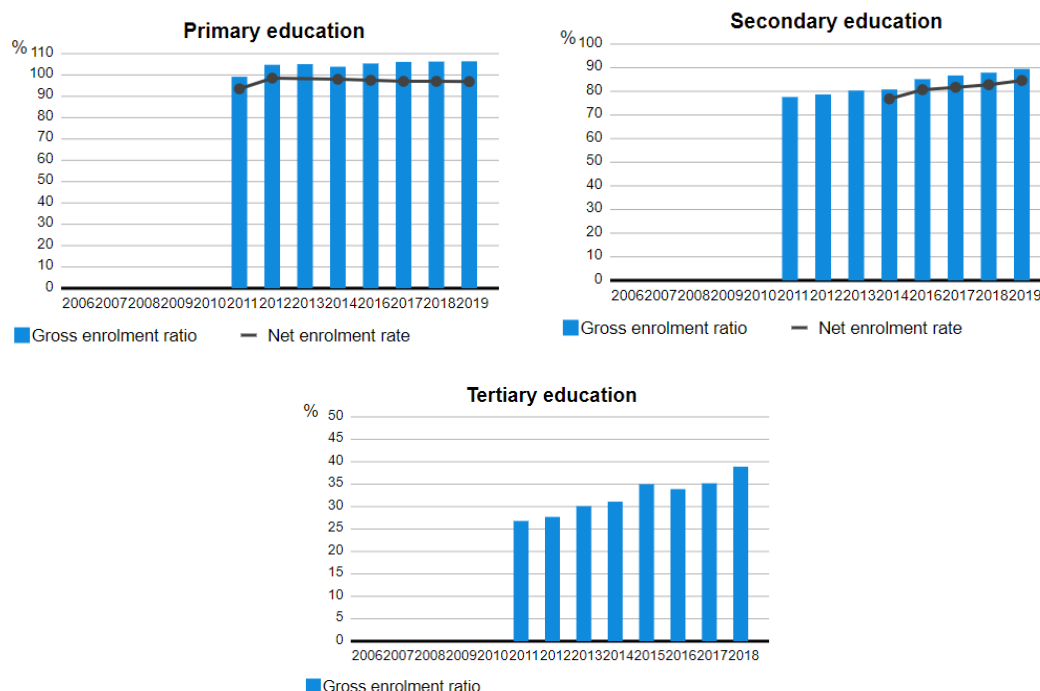
Public education is free up to the completion of higher education or to the equivalent level. In addition, education is mandatory for 9 years as basic education consisting of primary and lower secondary education. Education in Egypt is also characterized by memorization, elite education, and an academic career-based society, which are created by the rigor of graduation and promotion exams.

The enrolment rate of basic, lower secondary and higher education in Egypt is increasing year by year. The net enrolment ratio of primary education was high at 96.9%⁶⁶ as of 2019 (UNESCO Institute Statistics, 2019). On the other hand, the enrolment rate after secondary education remains an issue; the net enrolment ratio of lower secondary education was 84.6%⁶⁷ in 2019, and the gross enrolment ratio of upper secondary education was 38.9% in 2018 (UNESCO Institute Statistics, 2018).

The unemployment rate, especially for young people, was high at 23.4% in 2020 (World Bank, 2020).

⁶⁶ The gross enrolment ratio of primary education was 106.41%

⁶⁷ The gross enrolment ratio of lower secondary education was 89.48%



Source: UNESCO Institute Statistics (<http://uis.unesco.org/en/country/eg>)
Figure 4-17 Transition of Enrollment Rate in Primary and Secondary Education

Given the above issues, the government in Egypt has placed great importance on strengthening education in recent years. The 2014 Egyptian Constitution regulate that the budget of pre-university education, university education, and scientific research shall be more than 4%, 2%, and 1% of Gross National Product (GNP), respectively (Article 23). Education is selected as a priority item in the Vision 2030, with the goal of "Enable everyone to access high-quality education without any discriminations under an effective system by 2030." The public spending on education in the academic year of 2019/2020 accounted for about 132 billion Egyptian pounds, which was equivalent to 10.6% of the total public spending⁶⁸.

On March 11, 2020, immediately after the spread of COVID-19 infection became a problem, the Ministry of Education decided to close all schools in Egypt up to the end of the academic year (July), and all schools were called off on and after March 15th. It applied to all schools from public and private pre-school to higher education and vocational schools of industry, agriculture, commerce, etc. Judging from the number of pupils/schoolers/students⁶⁹ in the academic year of 2019/2020 announced by the Ministry of Education, this decision affected about 55,000 schools, 22 million pupils/schoolers/students (89% of which are those of public schools), and 1 million teachers in Egypt⁷⁰. The school closure period was as long as over 6 months up to October, in which the academic year of 2020/2021 started⁷¹. During the school closure period, pupils/schoolers/students were obligated to study at home. Online study at home and distributed attendance with about half the current number of students in each class were combined in the next academic year.

⁶⁸ http://www.eces.org.eg/cms/NewsUploads/Pdf/2020_4_2-10_48_52Education%20%201-4-2020%20english%20.pdf

⁶⁹ In this report, "pupils," "schoolers," and "students" are used to indicate elementary school students, junior high school and high school students, and students of higher education institutions such as vocational schools and universities, respectively, according to the School Education Act.

⁷⁰ <http://emis.gov.eg/Site%20Content/matwaya/2020/matwaya2020.pdf>

⁷¹ Due to the spread of COVID-19, the semester in 2020/21 started in October, which was one month delay.

(2) Challenges in Education Sector

The challenges in Education in Egypt can be described as follows.

1) Preschool education (Nursery school: 0 - 3 years old)

- i) Raising awareness of the importance of preschool education and improving the capacity of nursery teachers

Attendance rate of preschool education in 2019 was low at 26% (UNESCO Institute Statistics, 2019). Several causes, such as the lack of solvency, the lack of awareness of the importance of preschool education among parents and/or the lack of the capabilities of nursery staff were pointed out. This needs to be improved.

2) Primary education

- i) Improvement of the learning environment

It is difficult to learn and study in urban areas due to an excessive number of students.

The total pupil/schooler density of primary and lower secondary education has increased by 11.5% and 3% in public and private schools respectively, from 2015 to 2020⁷². In addition, classrooms are too small for teachers to move between desks. As a result, teachers cannot pay attention to each pupil/schooler, which makes studying difficult.

The promotion of online education, which prevailed in response to the spread of COVID-19 infection on and after March 2020, is keenly anticipated as a countermeasure against the problem of too high a pupil/schooler ratio. However, according to the survey on the impact of COVID-19 conducted in this Project, various issues have been revealed such as expansion of the studying gap associated with the promotion of online education and concerns about the low achievement levels of pupils/schoolers, etc. The promotion of online education alone is insufficient to solve the problem. The overall learning environment should be improved, including how to deal with the issues associated with the expansion of online education.

- ii) Improvement of teachers' teaching skills

According to the classroom observation conducted during the JICA Data Collection Survey on Basic Education Sector in the Arab Republic of Egypt conducted in 2015 - 2016, teachers only asked pupils/students simple questions of Yes/No type or memorized names and did not ask them questions that make them think. There were few group activities and/or activities that encourage dialogue among students. Both class preparation and the opportunity to learn among teachers were extremely limited. There were few opportunities for improvement of teachers' capacities.

The rapid shift to online education caused by the spread of COVID-19 infection may deprive the future opportunities for improvements in the capabilities of teachers and there is a concern about the sluggish growth of the capabilities of teachers in the future. Measures to improve teachers' capacities are necessary.

- iii) Correction of too much emphasizing of academic achievement

Educational activities put a too much emphasis over actual academic achievement. However, parents want to see visible results from academic bias and examinations, and dealing with this issue has become a challenge. It

⁷² http://www.eces.org.eg/cms/NewsUploads/Pdf/2020_4_2-10_48_52Education%20%201-4-2020%20english%20.pdf

is desirable to shift from a cramming style of education with a strong emphasis on academic skills to an education that emphasizes not only academic skills but also personality development.

iv) Improvement of students' achievement

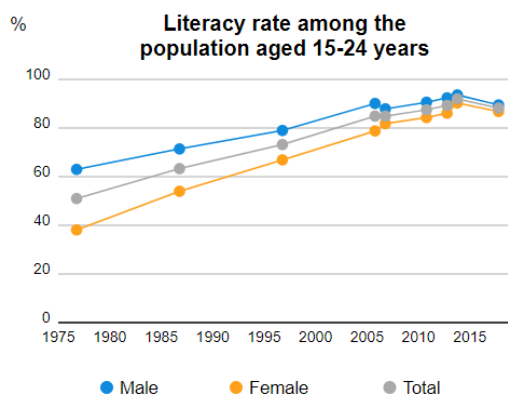
Poor academic performance is also an issue. In TIMSS, 2007, more than 50% of grade 8 students did not reach “low” level in three categories: high, medium or low as an international benchmark. Likewise, in TIMSS, 2019, 45% of grade 8 students did not reach “low” level.

In response to the spread of COVID-19 infection, the tests were suspended in many grades and research projects by individuals or groups were used as alternative evaluation indicators. However, in the case of research projects, the pupils/schoolers were evaluated positively as long as they submitted it, so many pupils/students did not make serious efforts. Thus, there is a concern about the achievement level of studying under the circumstances of the problem of COVID-19. As online education is expected to expand in the future, it is required to accurately measure the pupils/students' leaning achievements, and to utilize its data for improving the quality of learning.

3) Literacy education

i) Improving literacy

The low literacy rate is an issue that needs to be addressed. In particular, in 2017, illiteracy averaged 32.2% in rural areas, which was significantly different from that of urban illiteracy (17.7%) (Egypt Independent, Newspaper, 2020). The gender gap is particularly large for older people. As of 2017, the literacy rate of women aged 65 and over was approximately 21% (UNESCO Institute Statistics, 2017). Measures are required to improve the literacy rate, especially for women in rural areas.



Source: UNESCO Institute Statistics (<http://uis.unesco.org/en/country/eg>)
Figure 4-18 Literacy Rate by Gender from 15 to 24 years old

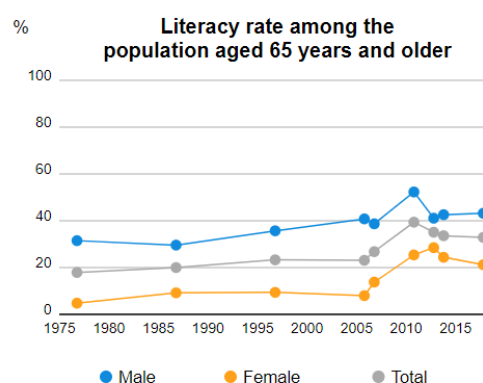


Figure 4-19 Literacy Rate by Gender over 65

4) Technical education and higher education

i) Strengthening collaboration with industries

The unemployment rate, especially among young people, is very high. Education that leads to employment and demand-supply matching with the labor market (strengthening cooperation with companies) are necessary.

ii) Improvement of educational environment

Even in faculties that require practical education such as the Faculty of Engineering, the Faculty of Pharmacy, the Faculty of Medicine, and the Faculty of Agriculture, the amount of equipment is limited. Also, the equipment is aging in many cases. It has been pointed out that this makes it difficult for students to acquire the practical skills needed in the labor market. There is a need to improve the educational environment in university education, including the provision of equipment.

iii) Improvement of teachers' educational skills

In general, sufficient support and education for students to acquire practical skills were not provided. Therefore, it is necessary to improve the educational capacity of teachers so that they can provide practical education.

(3) Current Status of Companies and Startups

In the education field, startups using digital technologies are being founded one after another. Especially after the appearance of COVID-19, there has been opportunities for many education-related startups trying to solve issues by digital means to develop new markets. Their major services are study contents and teaching services; an EdTech startup reported that the number of online students of its education course doubled because of the impact of the COVID-19 problem⁷³.

The following shows an example of services which are drawing attention in Egypt.

1) Study contents and teaching service (contents delivery)

In Egypt, private lessons outside schools had prevailed even before the occurrence of the COVID-19 problem, but the needs for study contents and teaching services have been increasing because the period of studying at home has been prolonged due to the school closure measure. The main business of Nafham, which is one of the most famous EdTech in Egypt, is online delivery of education videos. After the spread of COVID-19 infection, users have been increasing significantly.

2) Study contents and teaching service (online teaching)

Online teaching services have also been getting familiar. For example, Orcas, which is a startup founded in 2013, provides a matching service to connect those with needs for learning with those with needs for teaching. On the platform, parents select tutors suitable for their purposes and can get progress reports from the tutors after the lessons. Tyro also provides a matching service for online teaching on a one-on-one basis or in a group.



Source: <https://www.orcas.io/>

Figure 4-20 Tutoring Services of Orcas

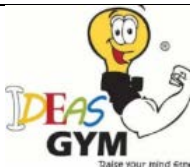
⁷³ <http://english.ahram.org.eg/NewsPrint/376813.aspx>

3) Study contents and teaching service (other)

Entlaaq provides Massive Open Online Courses (MOOCs) using free and charged online education videos. Tqweem (<https://tqweem.com/>) run services to provide practice exercises and examination questions of the subjects according to the school curriculum for the fourth grades of elementary schools to the ninth grade.

In addition to the above, various local companies are providing various Ed-Tech services in Egypt. The table below shows some examples.

Table 4-6 Examples of Startups in Education Sector in Egypt

Name of startups	Overview	Reference image
Belarabyapps	The company develops educational apps for children. It provides a variety of apps, including "Arabic Letters" to teach children letters using animal names and voices.	
Skolera	The company provides an integrated management platform for schools. The integrated management platform makes it easier for schools to manage student learning status, timetables, finances, human resources, and communication.	
Academix	The company provides online learning courses in English and Arabic to government agencies, corporations, schools, and individuals.	
PraxiLabs	The company provides educational institutions and their students with a system that allows them to conduct chemistry experiments virtually. Students can avoid the hazards associated with experimentation and can learn through experimentation without the high cost.	
Ideas Gym	The company offers mobile and web-based courses and face-to-face courses in Science, Technology, Engineering, and Mathematics (STEM) to school students, as well as online courses for teachers.	
IT Smart	The company offers EdusmartLMS, a learning management system for educational institutions. Its features include curriculum management, assignment management, exam management, grade management, attendance management, news, and messaging. The company also offers EdusmartERP for educational institutions.	
Smart Schools	The company offers cloud-based ERP software for school management. Features include attendance management, assignment management, virtual classrooms, school bus tracking, exam scheduling, and campus management.	

Source: Created by JICA Study Team based on the information provided on each company's website

4.1.5. Health

(1) Current Status

Indices of the health sector in Egypt have improved and a higher level than the world average as well as the eastern region of the WHO-defined Mediterranean. The mortality rate of children under 5 years old was 8.1% in 1995 but decreased to 2.0% in 2019. The mortality rate of newborns has improved from 6.0% in 1995 to 1.1% in 2019.

Table 4-7 Indexes of Health in Egypt (2018)

	Life Expectancy at birth in 2016	Mortality rate of children under 5 years old in 2017	Mortality rate of newborns in 2017
Egypt	71.8 years	20 persons	11 persons
Eastern Mediterranean	69.7 years	46 persons	25 persons
World	73.3 years	38 persons	17 persons

Source: WHO, World Health Statistics 2021

In the 2014 Constitution, all citizens have a right to have high quality and comprehensive medical treatment for a healthy life. To realize that, the government decided to allocate 3% of GDP to the health sector every year.

The Ministry of Health and Population manages the central health administration and regional health offices manage a various centers and units related to health and public hospitals in the region.

Around 60% of medical institutions in Egypt (1,300 institutions) are operated by the Ministry of Health and Population. Others are under the Health Insurance Organization, Ministry of Advanced Education and private sector.

The Universal Health Insurance Act, which prescribe the public health insurance system for the whole nation was established in Dec 2017 and is to be put into force gradually between 2018 and 2032.

After the first case of COVID-19 was reported on February 14, 2020, schools were closed on March 15, and airports were closed, and flights suspended on March 19, 2020. After that, it showed a declining trend and has been stable at around 100 cases per day since August. In the face of the nationwide pandemic of COVID-19, the Ministry of Health and Population announced a three-phase plan for coexistence with COVID-19 on May 13, 2020, which focuses on balancing COVID-19 preventive measures with a return to normal life. In the face of the nationwide pandemic of COVID-19, the importance of integrating various forms of health services to strengthen the Egyptian health care system and to provide urgent medical services to a wide range of citizens was reaffirmed. It is also recognized that the use of digital technology is important to solve these issues. As a service for residents, the Ministry of Health and Population has established a free hotline to provide consultation services on COVID-19. In March, the Minister stated that the hotline was receiving 20,000 calls per day. Also, on April 14, the Ministry of Health and Population released Sehat Misr (Egypt Health), a mobile application that provides COVID-19 consultations, case reports, location of medical facilities, and medical information from citizens.

(2) Challenges in Health Sector

The challenges in the health sector in Egypt can be described as follows.

i) Necessity of expanding medical services

Public medical institutions have difficulty in supplying equipment and quality medical services are not guaranteed. To meet rapid growing expansion of medical needs, medical services by private sector as well as public hospitals are required.

ii) Necessity of filling a regional gap

There is a regional gap on access to medical centers and standards of medical services. Especially people in the villages of Upper Egypt don't have wide access to good medical services.

iii) Necessity of establishment of the universal health insurance program

The coverage rate is around 55% (2018) of medical insurance in Egypt in the early 2010s. The establishment of universal health insurance program is one of the main policies and adoption of a pilot program in some regions is planned in cooperation with related ministries (Health Sector Cooperation Planning Survey, 2017).

iv) Insufficiency of healthcare professionals

The number of doctors and nurses /midwives are 7.5 and 19.3 per 10,000 persons. It is lower than the average for other eastern Mediterranean areas (10.9 and 16.4) and that of the world average (17.5 and 39.0) (WHO, World Health Statistics 2021). Another serious issue is doctor migration to the Middle East. In addition to the training of medical professionals, the spread of telemedicine and the improvement of medical practice are also issues to be addressed.

The government of Egypt formulated a guidance "Health White Book", which explains health policies and strategies in 2014. In the book, various goals are listed such as development of programs for UHC, expansion of coverage of health insurance and improvement of the quality of health services.

In Egypt Vision 2030, the national masterplan, health sector is one of the main issues for realizing SDGs goals and programs to be implemented below.

Table 4-8 Egypt Vision 2030

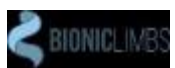
Programs in Egypt Vision 2030
▪ Inclusive healthcare coverage ▪ Improvement of quality of healthcare ▪ Development of health and sanitary precautions program ▪ Improvement of governance of health sector ▪ Decentralization of health services ▪ Building information and infrastructure to support the healthcare system ▪ Establishment of a system to manage personnel at health sector ▪ Development of medicine

Source: Egypt Vision 2030

(3) Current Status of Startups

Also, in the health sector of Egypt, startups using digital technologies are being founded one after another. Various services are provided; especially many hospital and medicine platforms introduce medical services and medicines to patients and consumers. The following shows representative startups in the health sector.

Table 4-9 Example of Startups in Health Sector in Egypt

Medical service	
	Diagnostics focusing on hepatitis C virus (HCV)
	Telemedicine for mental health
	Customized and discounted health care
	Integrated medical service to patients
Medical devices	
	Medical wearable for blind people
	Customized and fast production of prosthetic limbs
	3D printing for dental industry
Platform of medicine and hospital	
	Arabic parenting portal directed to mother
	Platform of medical search and appointment
	Medical-social platform that aims to link patients, care providers, and personal medical records
	Web portal and mobile application for medicine information
	Online platform connecting pharmacies, labs, clinics and their patient
	Healthcare comparison platform for patients
	Health care service matching doctors and patients
	Online pharmacy
	Online marketplace for medical tourism

	Online pharmacy for beauty & health
	Online pharmacy platform
Treatment	
	Virtual reality-based software for therapy
Hospital management	
	Platform to improve medical claim management process
App for healthcare	
	Data analytics for workout in gyms

Source: <https://www.dr-hempel-network.com/>, <https://tracxn.com> etc.

4.2. Morocco

4.2.1. Overview

(1) Economic Outline

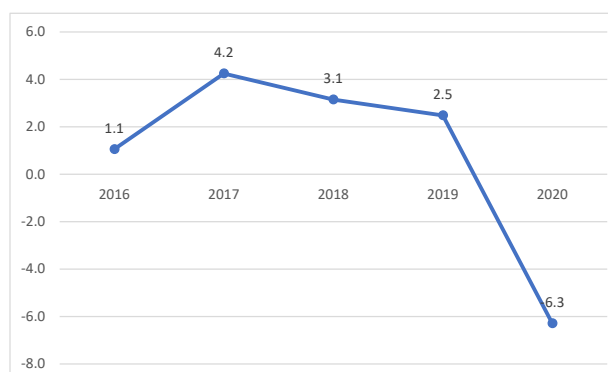
The current King emphasizes policies that focus on social and educational challenges (e.g., poverty reduction, unemployment and job creation). The government of Morocco stopped to formulate a long-term national development plan and instead designs the medium- to long-term strategy and plan based on ministerial, sectoral and cross-sectoral important issues with special focus on strengthening the national economy and reducing income disparity.

Table 4-10 Economic Outline (Morocco)

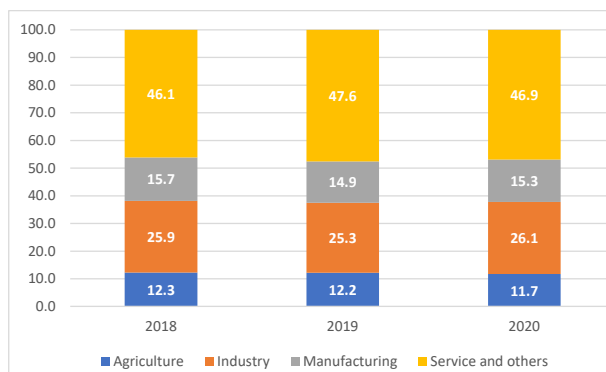
Population	36.91 million (2020)
Nominal GDP	114.7 billion USD (2020) This is almost same amount as that of Hiroshima and Ibaraki Prefecture.
GNI per capita	3,190USD (2019)
Unemployment rate	11.5% (2020)
Language	Arabic and Berber (Official language), French
Politics	Constitutional monarchy (King Mohammed VI, assumed the throne in July 1999)
No. of Japanese living in Morocco	355 people (2021)

No. of Japanese companies in Morocco	70 companies (2020)
--------------------------------------	---------------------

Source: World Bank, Ministry of foreign affairs, JETRO



Source: World Development Index, World Bank
Figure 4-21 Real GDP Growth Rate (Morocco)



Source: World Development Index, World Bank
Figure 4-22 Percentage of Main Industries in GDP (Morocco)

(2) JICA Support Plan and Major Projects

JICA has implemented several technical cooperation projects, loan/grant aid, and proposal-based programs by private companies in the above sectors.

In the last five years, many proposals were submitted to JICA by private companies and have been implemented in the industrial development of agriculture and fisheries sector such as “Verification Survey with the Private Sector for Disseminating Japanese Technologies for Adding Value to Fishery Products through the Introduction of an Advanced Refrigeration System in the Kingdom of Morocco” (mainly fisheries), “Verification Survey with the Private Sector for Disseminating Japanese Technologies for Recycling of Olive Mill Waste by use of Oil Temperature Decompression Drying Machine” (agriculture) and “Feasibility Survey for SDGs Business on Production and Sales of Argan Oil for Creation of Women’s Employment”.

Table 4-11 JICA Support Plan and Major Projects (Morocco)

Priority issues addressed by JICA	Target	Focus
Strengthening economic competitiveness & Sustainable economic growth	- Industrial Development of Agriculture and fisheries - Infrastructure for industries - Water & Environment	- Cooperation that contributes to the development of fisheries in Japan and Morocco, especially the enhancement of the value addition of agricultural and fisheries - Utilization of Japanese technology in large-scale infrastructure such as electric power and ports - Utilization of technologies owned by Japanese companies and local governments
Reduction of regional & social disparity	- Human Development - Regional Development	- Improvement of education and maternal and child health (especially in rural areas) - Improvement of development capacity for local governments
Facilitating South-South cooperation	Support the Africa region	Achievements of technical cooperation for Morocco, especially its expansion of fields with Japan's uniqueness to neighbouring countries

Source: JICA Country Analysis Paper for the Kingdom of Morocco (Nov 2014)

4.2.2. Agriculture and Fishery

(1) Current Status

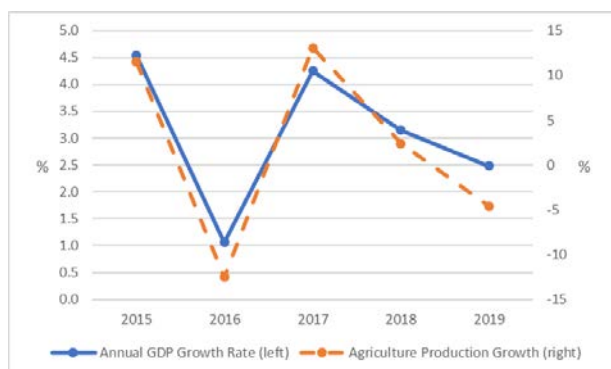
1) Agriculture

Agriculture, engaging over 4 million people and accounting for 19% of GDP, is a key industry in Morocco. Approximately 80% of people in rural areas has a relatively higher poverty rate than urban areas, are engaged in farming.

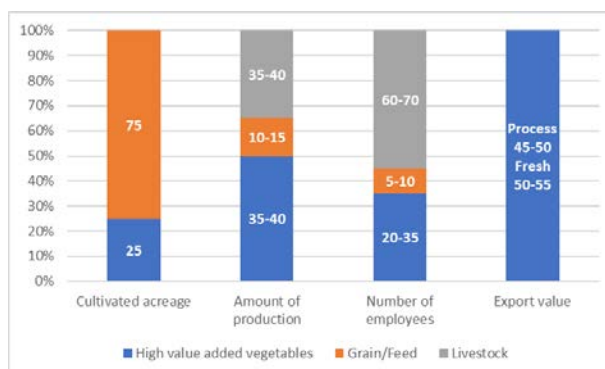
Because rainfed agriculture is the main type of farming in the country, the yields vary greatly due to rainfall, which even affects the overall GDP growth rate.

The farmers can be divided into two types: many small-scale farmers mainly for self-sufficiency, and a small number of large-scale farmers to grow high-value-added agricultural products, e.g., export crops such as citrus fruits, tomato, strawberry, grapefruit and melon.

In 2008, the Green Morocco Plan (Plan Maroc Vert) was formulated, and an agricultural modernization plan is being promoted with the aim of creating a higher degree of self-sufficiency and increasing agricultural exports. Currently, a new strategy “Green Generation 2020-2030 (Génération Green 2020-2030)” further promotes agriculture.



Source: Ministry of Agriculture, Fisheries, Rural Development, Water and Forests in Morocco, JICA
Figure 4-23 Actual GDP Growth Rate and Changes in Agricultural Production Growth Rate



Source: Ministry of Agriculture, Fisheries, Rural Development, Water and Forests in Morocco, JICA
Figure 4-24 Percentage of Production Type of Cultivated Acreage, Amount of Production, Employees and Export Value

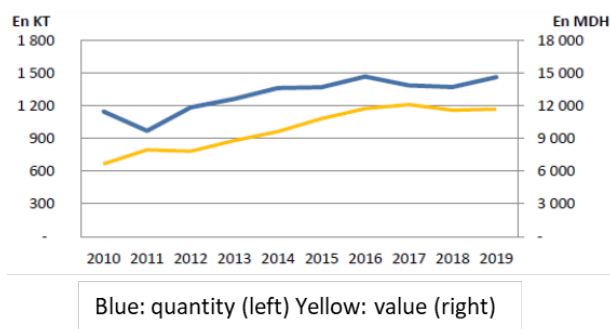
2) Fisheries

Because of a cold current flowing through the Atlantic coastal zone with abundant plankton, Morocco has advantages in fishery resources, (e.g., migratory fish such as sardines as well as white fish, octopus/squid and crustaceans). Morocco is one of the world’s leading fishing nations in terms of fishery yield and ranked as the 1st in Africa and the 16th in the world.

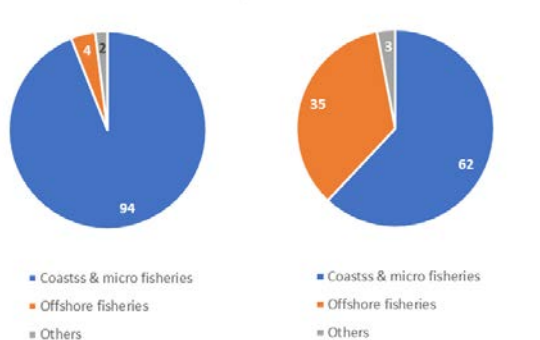
In 2009, the Moroccan Fisheries Strategy (Plan Halieutis) was formulated, and the fisheries sector was developed with three core strategies: sustainable fisheries management, improved quality of marine products, and the strengthening of product competitiveness by enhancing value addition.

Both Morocco's fishery production and value increased from 2010 to 2016; however, both the production and value have been sluggish since 2016 due to excessive landings and illegal fishing. Also 95% of production volume and more than 60% of production value is handled by people engaged in coastal and micro fisheries.

In Morocco, seafood accounts for 5.4% of the export value in 2017 and both export volume and value are increasing.



Source: Ministry of Agriculture, Fisheries, Rural Development, Water and Forests in Morocco
Figure 4-25 Fishery Production Volume & Value



Source: Ministry of Agriculture, Fisheries, Rural Development, Water and Forests in Morocco
Figure 4-26 Production Volume (Left) and Value (Right) by Fishery Type

Since the agriculture and fisheries sectors are directly related to the food security of the people, the Ministry of Agriculture, Marine and Fisheries, Rural Development, Water and Forestry is making efforts to maintain prices and logistics in the COVID-19 pandemic. As a result, although the impact of the pandemic is considered to be limited compared to other sectors, production, fishing, processing, distribution and sales have been affected to a certain extent, as follows

- (In particular, in the harvesting of labor-intensive fruits and vegetables) demand exists, but there is not enough labor to harvest the products for market, resulting in lost opportunities⁷⁴.
- Supply in Morocco's domestic fish markets is insufficient. This is mainly because: (1) fish commonly sold in local markets (sardines, mackerel, etc.) are caught at night, but emergency measures have prevented fishermen from traveling from their homes to the ports where their boats are located; and (2) most of the fish caught during the day are high-end fish for hotel restaurants and for export, but restaurant and border closures have reduced demand. However, due to the closure of restaurants and the blockade of borders, the demand for these fish has decreased and the selling price has fallen, and some fishermen have decided to stop fishing because they cannot cover the cost of fishing (gasoline for boats, etc.)⁷⁵.
- Many factories have become the source of COVID-19 clusters and have been forced to shut down their operations (the first cluster of COVID-19 cases in Morocco was in a strawberry factory). The impact on marine products in particular was limited during March and April 2020, when fishing was slow (some factories were originally scheduled to close for maintenance), but from July onwards, the busy season, the closure of factories during this period has had a ripple effect not only on factory workers, but also on

⁷⁴ <https://www.medias24.com/coronavirus-les-fruits-et-legumes-marocains-tres-prises-en-europe-8732.html>

⁷⁵ The catch of small floating fish (sauri, sardines, mackerel, etc.) has already decreased by about 20 percent compared to the same period last year.

fishermen who have lost a source of income to sell their catch. In addition to the employees of the factory, the fishermen who lost a place to sell their catch were also affected.

- “Salon International de l’Agriculture au Maroc (SIAM)”⁷⁶, an international agricultural fair held every year in Morocco, which was an important marketing channel for agricultural products, was cancelled. This has had a direct impact on more than 300 agricultural cooperatives that secure 60 to 80% of their annual sales at the fair. The total damage is estimated at 12 million Moroccan dirhams⁷⁷.
-

(2) Challenges in Agricultural and Fisheries Sectors

The challenges in the agriculture and fisheries sector in Morocco can be described as follows.

1) Agriculture

Rain-fed agriculture has traditionally been the main mean of agricultural production but is highly dependent on weather. Above all, the major goal is to improve the productivity and quality of small-scale farmers who produce wheat and barley.

As for processing, Morocco has been working on long-term irrigation development since the 1980s and has achieved 1.5 million ha of irrigated agriculture. However, there remain problems such as insufficient of water for agricultural use and it is anticipated that water shortages will not be resolved. Effective utilization of water resources and improvement of irrigation technology are required.

In order to diversify export destinations, information on market trends outside Europe and consumer preferences are required. It is necessary to add value to the agricultural industry by reducing losses during transport and maintaining freshness.

2) Fisheries

Appropriate management of fishery resources is required for sustainable growth, and it is necessary to establish a sustainable quota system and prepare a resource management system based on proven scientific data.

The percentage of small floating fish in the coastal fishery is the largest, but its share in production value is small. For this reason, the challenge is improving the productivity/adding value of small-scale fishermen engaged in the catching of small floating fish in the coastal fishery.



Source: Ministry of Agriculture, Fisheries, Rural Development, Water and Forests in Morocco
Figure 4-27 Fishery in Morocco

⁷⁶ The 15th edition of SIAM was scheduled to be held in Meknes from April 14-19, 2020 but was cancelled due to COVID-19 (the first time a trade fair was cancelled). There are reports that it will be replaced by an online trade fair, but as of October 2020, it has not been held.

⁷⁷ <https://fnh.ma/article/actualite-economique/annulation-du-siam-les-cooperatives-durement-impactees>

(3) Current Status of Companies and Startups

With regard to the application of digital technologies in agricultural production, since 2018, the OCP Group⁷⁸, together with the Ministry of Agriculture, Marine and Fisheries, Rural Development, Water and Forests, has been working on the digitalization of agriculture, especially for smallholder farmers. In addition, in response to the COVID-19 pandemic, examples of the use of digital technology have emerged in the Moroccan agro-industrial sector, particularly in distribution and marketing, in the form of collaboration between food retailers and startups providing delivery services.

Table 4-12 Examples of Startups in Agriculture and Fisheries sectors in Morocco

Name of startups	Overview	Reference image
OCP Group	With the aim of providing farmers with data-driven advice on agricultural production, the company examined a support package called Al Moutmir, which has just started a demonstration to provide six major services.	
Collaboration between Marjane (supermarket) ⁷⁹ and Glovo (delivery startup) ⁸⁰	The company has started a service to deliver its own fruits, vegetables, bread, dairy products, etc. to customers in a non-contact manner as much as possible.	
Collaboration between Carrefour market Label'vie ⁸¹ and Jumia	The partnership will be signed in 2019 and is working to expand home delivery services.	

Source: JICA Study Team

4.2.3. Education

(1) Current Status

The education system in Morocco consists of the 2-6-3-3 system, meaning 2 years of pre-primary, 6 years of primary, 3 years of lower secondary and 3 years of upper secondary. Nine years of basic education from primary to lower secondary are compulsory.

⁷⁸ Founded in 1921 as a phosphate mining company, the company has since diversified into phosphate processing and fertilizer plants. The company was acquired by the Moroccan government and the Banque Populaire du Maroc in 2008 and became a public corporation.

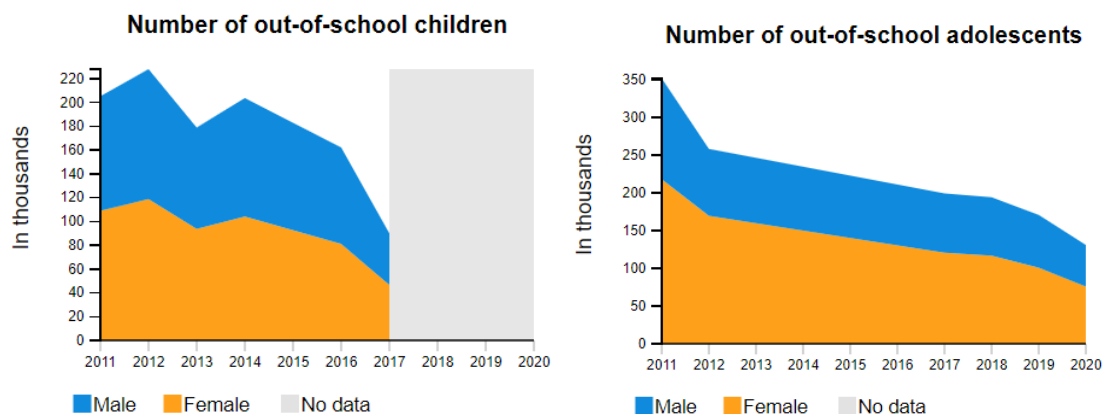
⁷⁹ A retailer with 38 stores across the country with sales of about 990 million euros.

⁸⁰ Startup from Spain offering delivery services expanding to Morocco in 2019

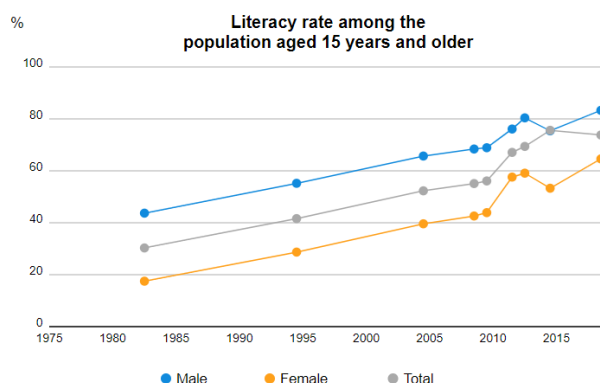
⁸¹ Formerly the Label'vie Group, a major food retailer that signed an exclusive franchise agreement in Morocco with French food retailer Carrefour in 2009.

Morocco's primary education net enrolment ratio was at 99.2%⁸² in 2020, and completion ratio was 93.7% in 2019 (UNESCO Institute Statistics, 2020). On the other hand, the spread of secondary education has been slow, which means that the net enrolment ratio in lower secondary remained 68.5%⁸³ and the gross enrolment ratio in upper secondary was 40.6%.

The government of Morocco has been putting effort into education since the “Education Emergency Program” was launched in 2009 and the enrolment and literacy rates throughout the country have significantly improved. However, girls’ enrolment and literacy rates tend to be lower than those of boys.



Source: UNESCO Institute Statistics
Figure 4-28 Number of Out-of-School Children and Adolescents



Source: UNESCO Institute Statistics
Figure 4-29 Literacy Rate among the Population aged 15 years and older

In March 2020, the Ministry of Education decided to close all schools in Morocco in response to the declaration of a state of emergency against the spread of the COVID-19 infection. It affects all range of education from primary to higher education of both private and public institutions. Based on a rough estimate from the number of registered pupils/schoolers/students of the Ministry of Education in the academic year of 2019/2020, about 12,000 schools and 9.9 million pupils/schoolers/students (86% of which are those of public schools) were affected⁸⁴. This measure was continued up to September, in which the academic year of 2020/2021 started, and

⁸² The gross enrolment ratio for the primary education was 115.15%.

⁸³ The gross enrolment ratio for the lower secondary education was 82.45%

⁸⁴ MoE, 2019 (https://www.men.gov.ma/Ar/Espresso/Documents/Comm_Presse_Rentree_Scolaire_201-2020.pdf)

pupils/schoolers/students were obligated to study online at home during the school closure period. As of October 1, 2020, 100% online education was continued in Casablanca, Marrakech and Tangier, where the infection conditions were severe, and face-to-face education and online education were combined in the other cities.

(2) Challenges in Education Sector

The challenges in the education sector in Morocco can be described as follows.

1) Primary education

i) Improvement of students' study performance

For TIMSS test in 2019, Morocco's Year 4 mathematics and science achievement were ranked 54th and 55th out of 58 countries. In addition, the achievement of Year 8 mathematics and science was 39th and 36th out of 39 countries. The issue is that students do not acquire basic academic ability and have a lack in basic calculation ability. Under these circumstances, the quality of the online education provided in response to the COVID-19 problem is considered problematic and the achievement level of studying of pupils/schoolers is becoming more and more concern. Actually, in the remote platform (TelmidTice) provided by the Ministry of Education, the contents studied in the past are not reviewed so it is difficult for pupils/schoolers to follow classes. It is also difficult for teachers to grasp the levels of understanding of pupils/schoolers and provide follow-up to them. According to the survey conducted by the High Commission for Planning of Morocco (HCP) in June 2020, approximately 40% of pupils/schoolers were dissatisfied with the quality of online education⁸⁵. It is an urgent issue to improve the academic capabilities of pupils/schoolers by the new education methods.

ii) Correction of the gap in studying

The expansion of online education may exacerbate the problem of the gap, which had existed before the spread of the COVID-19 infection. According to the survey conducted by HCP in June 2020, only 40% of pupils/schoolers could study continuously using the remote education platform promoted by the Ministry of Education as a tool for studying at home during the school closure period and as much as 20% of them could not participated in the remote education at all⁸⁶. This trend is noticeable especially in rural areas. For example, in an elementary school in Sefrou, it turned out in a survey of the impact of Covid-19 that teachers could not follow up with most of the pupils doing remote education due to lack of means to contact pupils. Even with access to the necessary education, there still remains an issue in terms of the capability to study appropriately. Especially as for online education, there is no special support for those who initially required individual support and those who require special support due to disabilities, inability to follow the education level, etc., which spreads concerns.

iii) Improvement of teaching ability of teachers

According to the Project for Promoting Education with Equity and Quality (PEEQ), a technical cooperation in mathematics education supported by Japan, schools do not sufficiently provide lessons that make use of students'

⁸⁵ HCP, "Enquête sur l'impact du coronavirus sur la situation économique, sociale et psychologique des ménages Note de synthèse des principaux résultats", 2020

⁸⁶ HCP, 2020 (<https://www.hcp.ma/file/217998/>)

ideas including wrong answers. A scientific approach is not adopted in science education (based on the learning of exploration and experiment). Because of it, classes are not effective, and it is necessary to improve the capabilities of teachers to run classes. In addition, though the Ministry of Education conducted training for in-service teachers ahead of online education, the training contents were limited to how to use the system and no training has been conducted to enable teachers to handle the new style of the education system such as the specific method to proceed with classes combined with online education and how to motivate pupils/schoolers. Since the training on how to use the system was provided online, some teachers could not participate in the training in rural areas in which they cannot access a computer. It is necessary to improve the capabilities of teachers suitable for new class methods.

iv) Necessity of improving of teaching materials for experiments to meet the realities of schools

The experiments in teaching materials use equipment that is not available at elementary schools in Morocco, which makes impossible to conduct experiments at schools.

v) Analysis and utilization of evaluation results

The questions of the final qualification exam target a comprehensive assessment and mistakes made by students are not analyzed, which prevents teachers from finding the reasons behind the mistakes.

Analysis of test results and utilization of the results in the field of education are not sufficient.

vi) Improvement of the current teacher training system

The core capacity-building system for teacher training is that the inspector in each school district visits the school individually and gives direct advice and guidance to the teachers. However, the frequency of visits and the quality of advice/guidance are dependent on each inspector's qualifications and awareness level.

Another challenge is the cost performance since it takes time and money for inspectors to go to school.

2) Lower and upper secondary education

i) Improvement of access to secondary education in rural areas (especially girls)

As of 2019, enrollment rate of girls in rural areas in lower and upper secondary school are 39.7% and 12.5%, respectively (80.2% and 57.4% in urban areas)⁸⁷. The dropout rate for girls in rural areas is approximately 17%, which is around four times that of urban areas⁸⁸. The reasons are a lack of schools, poor quality of education, security issues caused by lack of infrastructure such as dormitories, school buses, etc. as well as socio-cultural factors (understanding by parents and communities)

According to the sampling survey conducted by HCP for 2,350 households in April 2020, 34% of households lost their revenue sources and the revenues of 49% of households decrease due to COVID-19⁸⁹. Especially in the lower secondary education, there is a concern that the dropout rate of schoolers will increase mainly among families with low income due to this problem⁹⁰.

⁸⁷ <https://thearabweekly.com/report-raises-alarm-over-rural-moroccan-womens-access-education-and-health-care>

⁸⁸ <https://thearabweekly.com/report-raises-alarm-over-rural-moroccan-womens-access-education-and-health-care>

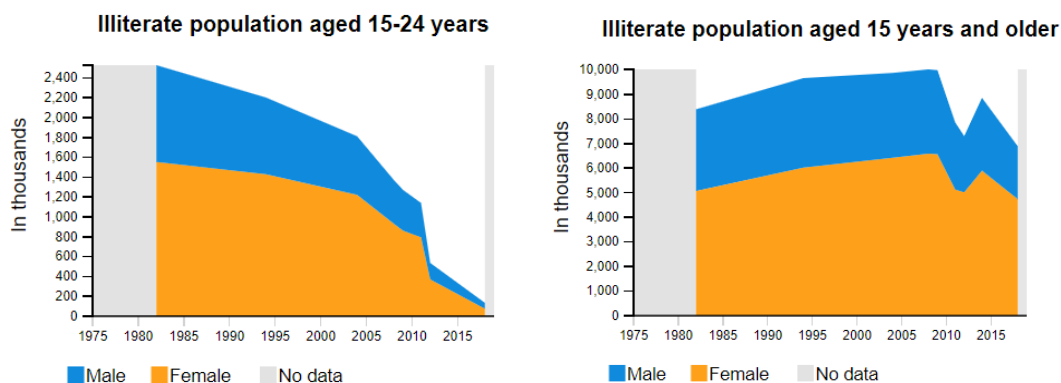
⁸⁹ HCP, "Enquête sur l'impact du coronavirus sur la situation économique, sociale et psychologique des ménages," 2020

⁹⁰ World Bank, 2020 (<http://pubdocs.worldbank.org/en/862901586546293432/COVID19-Education-Sector-Guidance-Note-Version-II-Tracked-Changes-Final-March26-for-WEB-POSTING-French.pdf>)

3) Literacy education

i) Improvement of literary rate among females in rural areas

Although the literacy rate of young people has improved dramatically in recent years, many women are still unable to read and write. The increase in the literacy rate of women in rural areas is the pressing issue.



Source: UNESCO Institute Statistics
Figure 4-30 Illiterate Population by Gender

4) Higher education

i) Improvement of unemployment rate

The unemployment rate is high especially among young people. The unemployment rate in 2019 was 9%⁹¹. The unemployment rate of young people was 22.29%⁹². Consideration should be taken towards education that leads to matching education to employment supply and demand requirements.

(3) Current Situation of Startups in the Education sector

In the education field, startups using digital technologies are being founded one after another. Especially after the appearance of COVID-19, there has been opportunities for many education-related startups trying to solve issues by digital means to develop new markets. The following shows an example of services which are drawing attention in Morocco.

1) Study contents and teaching service (contents delivery)

The needs are increasing for online courses, studying contents, and teaching services to enable to study individually while there are concerns about the deterioration of the quality of the school education and the expansion of the gap. For example, Kiffeslesmaths provides video education materials over 600 hours which cover the mathematics curriculum of the upper secondary



Source: <https://kiffeslesmaths.com/>
Figure 4-31 Kiffeslesmaths Website

⁹¹ <https://www.statista.com/statistics/502794/unemployment-rate-in-morocco/>

⁹² <https://www.statista.com/statistics/812261/youth-unemployment-rate-in-morocco/>

education and a total program to enable practice exercises, quiz to check the level of understanding, progress management, and communication with other students.

2) Study contents and teaching service (online teaching)

Learning services such as eDukaty (<https://edukaty.ma/>) which enable multiple schoolers of lower secondary education to take the same course and enable teachers to provide mutual classes by providing face-to-face or online live private lessons and group lessons are drawing attention.

3) Teacher and school data management tool (school affair support system)

There are also great needs for a school affair support system to compensate for the lack of communication among stakeholders caused by the school closure measure. Botischool develops a system to optimize school affairs management and communication among schools, teachers, and parents and drew attention for providing a simplified form of the system as a free tool to schools in Morocco during the school closure period. Teachers can use a mobile application for sharing of education materials, support for homework and tasks, attendance management, etc. In addition, schools can quickly convey information to parents through a mobile application.



Source: <https://boti.education/>

Figure 4-32 Botischool Website

laxial (<https://www.laxial.com/>) also draws attention for granting licenses and providing installation services and training for a school affairs management tool, which is one of its products, under the declaration of a state of emergency.

Table 4-13 Examples of Startups in Education Sector in Morocco

Name of Startups	Overview	Reference Image
IDEO	The company offers a wide range of online courses, mainly for corporate clients. Courses offered include general business (management, accounting, marketing, project management, etc.), languages, computer skills, and information security. The company also offers online courses specialized for specific industries (banking and securities, public services, local government, education, etc.), and can also provide custom-made online courses upon request.	
Tokouine	The company provides an e-learning platform that allows those who develop and create training to offer online courses. The training provider uses the platform's video conferencing tools to list the courses and provide live interactive training.	

Name of Startups	Overview	Reference Image
Galactis Education	The company offers a cloud-based school management system. Functions include school administration and financial management, education management, enrollment management, student activities and campus management, communication and collaboration, quality assurance, reporting and analysis, messaging, and more.	
Derbyware	Derbyware offers school management software to manage staff, teachers, students, grades, classes, and more. It has custom configurations for schools in the US and Morocco.	
Koolskools	The company provides an online education platform. The platform facilitates the digitization of school education and smooth communication between schools, teachers, students, and parents.	

Source: JICA Study Team

4.3. Tunisia

4.3.1. Overview

(1) Economic Outline

Successive attacks occurred in 2015 heavily impacting the main sectors such as tourism and foreign investment, which decreased real GDP growth to 1.2% and 1.3% in 2015 and 2016 respectively. However, as the new investment law was enforced and activities were conducted based on the development plan “Tunisia 2020”, the growth recovered to 1.8% and 2.7% in 2017 and 2018 respectively. In 2020, the growth fell negatively due to the impact of the new coronavirus

Five-year National Development Plan (2016-2020) aims to reach at 4% annual GDP growth and to create jobs for 0.4 million people (unemployment rate: 13%) by 2020.

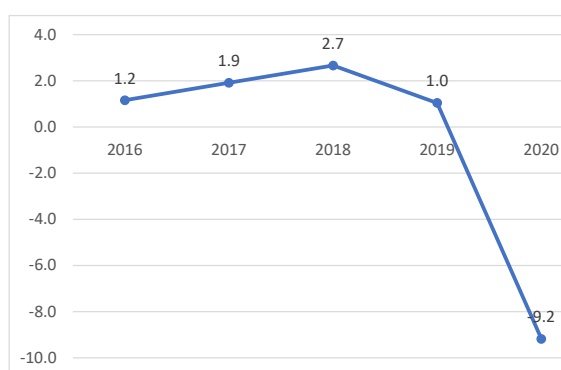
The urgent challenges are high unemployment rate among the youth (especially those with higher education) and the regional disparities between coastal areas with tourist resorts and factories and inland areas with agriculture as main industries.

Table 4-14 Economic Outline (Tunisia)

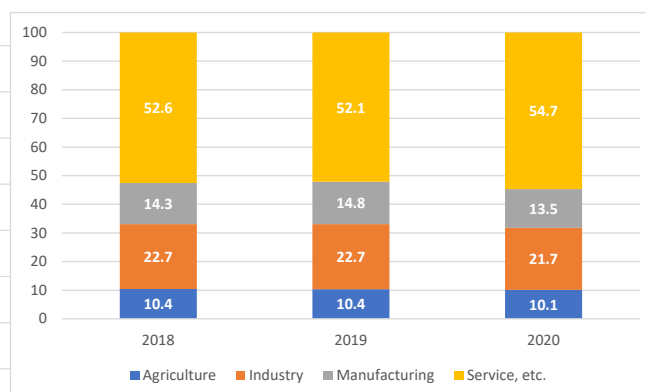
Population	11.82 million people (2020) of which, 75.7% are over 15 years old
Land size	Approximately 0.16 km ²
Nominal GDP	41.62 billion USD (2020) This is almost same amount as that of Oita Prefecture
GNI per capita	3,370 USD (2019)
Unemployment rate	16.6% (2020) (28.2% among people with higher education)
Language	Arabic (Official), French (widely used)
Politics	Republic (President Mr. Said, inaugurated in Oct. 2019)

No. of Japanese living in Tunisia	174 people (2021)
No. of Japanese companies in Morocco	24 companies (2020)

Source: World Bank, Ministry of Foreign Affairs in Japan, and JETRO



Source: World Development Index, World Bank
Figure 4-33 GDP Growth (Tunisia)



Source: World Development Index, World Bank
Figure 4-34 Percentage of Main Industries in GDP (Tunisia)

(2) JICA's Supporting Plan and Major Projects

JICA has implemented several technical cooperation projects, loans, grants, and private partnerships in the field of 1) agricultural / rural development and fishery, 2) industrial development, 3) transport, and 4) water resources and disaster prevention, etc.

For sustainable industrial development, JICA has mainly supported development of economic infrastructure with the resources and characteristics of each region, and development of human resources to promote domestic industry. For reduction of regional disparities, JICA has supported maintenance of water and sewer networks in rural areas.

Table 4-15 JICA's Supporting Plan and Major Projects (Tunisia)

Challenges tackled by JICA	Main Sectors	Relationship with Tunisian Government Development Policy (5 Policy Axis)
Sustainable Industrial Development	- Economic infrastructure (Power/transport infrastructure development) - Investment environment (Industry-government-academia collaboration, Industrial human resource development)	Economic growth and hub (Axis 2) - Economic diversification, job creation and infrastructure development, etc.
		- Human development and social inclusion (Axis 3) - Improvement of quality of education, increase employment potential, social security enhancement, etc. - Green economy and sustainable development (Axis 5) - effective use of resources, modernization of agriculture, ensuring food security, etc.
Reduction of Regional Disparities	- Reduction of regional disparities (support for strengthening and adding value to the first industry in rural areas) - Water resources and disaster prevention (stable water supply, improvement of water and sewer)	Strengthening regional development (Axis 4) - promotion of decentralization, infrastructure development, improvement of regional economies and living standards, etc.

Challenges tackled by JICA	Main Sectors	Relationship with Tunisian Government Development Policy (5 Policy Axis
	networks in rural areas, flood control projects, etc.)	

Source: JICA Country Analysis Paper for Republic of Tunisia (March 2017)

4.3.2. Agriculture and Fishery

(1) Current Status

The agriculture sector still accounts for about 10% of GDP, though the service sector is increasing due to the recent economic diversity. Twenty five percent of the working population is in agriculture and 6% of export is agricultural products. Major export products are olive oil, dates, fish, and citrus.

Tunisia has approx. 1,300 km of coast lines. Fish resources plays an important role to provide animal proteins as well as to be a source of acquisition of foreign currencies. Approx. 46,000 people are engaged in fishery.

Main types of fisheries are round haul fishery using fish lamps, trawl net fishery, and coastal fishery. The annual volume of landings in the country slightly is increasing from 0.12 million ton to 0.13 million ton in the past three years. Major products are fish including tuna, sardine and horse mackerel, family of mollusks like octopus and squid, crustacean like shrimp and other shells, which shows the rich marine resources in the Mediterranean.

Fresh water aquaculture only slightly changed from 1,000 ton to 1,300 ton between 2005 and 2017, while marine aquaculture rapidly increased from 1,000 ton in 2005 to 20,000 ton in 2017. Fresh water aquaculture is for domestic consumption, while most of the products from marine aquaculture is for export.

Table 4-16 Major Agricultural Production

(Thousand ton)	2015	2016	2017	2018
Cereals	1,307.8	1,287.8	1,603.9	1,582.3
Vegetables	3,049.0	3,273.0	3,196.0	3,059.0
Beans	54.4	77.8	82.4	94.4
Fruits excluding citrus	668.1	674.1	654.7	636.5
Olive	1,700.0	700.0	500.0	-
Dates	223.0	241.0	260.0	305.0
Citrus	432.0	378.7	559.6	346.0

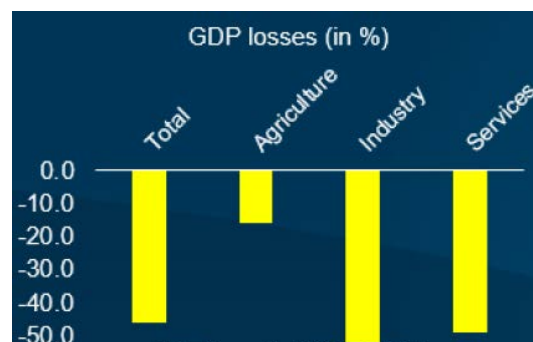
Source: Statistiques Tunisie

Table 4-17 Volume of Fish Landings by Fishery Type

	2015	2016	2017	2018
Trawl net fishery	27.5	26.7	21.3	22.6
Round haul fishery	54.5	47.4	49.9	51.0
Coastal fishery	32.1	32.3	33.8	38.3
Tuna fishery	1.4	1.6	0.3	2.1
Aquaculture	14.7	16.9	22.4	22.3
Shells	1.4	1.5	0.7	-
Others	0.1	0.1	0.1	0.0
Total	131,705.0	126,526.0	130,289.0	136,236.0

Source: Statistiques Tunisie

In the early days of the lockdown due to the spread of COVID-19, the supply of flour, sugar, and other commodities was temporarily disrupted due to disruptions in the distribution network as people ran out to buy, and the curfew reduced the harvest volume due to the inability to secure labor for labor-intensive agricultural work (especially fruit harvesting), but the production volume has been sufficiently secured, and the impact of COVID-19 on agricultural production for the current crop season has been limited.



Source: IFPRI¹

Figure 4-35 Impact of COVID-19 on GDP

On the other hand, according to the Union Tunisienne de l'agriculture et de la pêche (UTAP), the impact of COVID-19 has limited marketing channels and lowered the prices of agricultural and fishery products, making it difficult to earn sufficient profits in the current crop season. As a result, it is difficult to purchase seeds and fertilizers for the next crop, and without support from the government, the harvest of the next crop is likely to be significantly reduced.

In the fisheries sector, the Ministry of Agriculture, Fisheries and Aquatic Resources has put in place various restrictive measures to prevent the spread of COVID-19 infection on board. As a result, fish catches fell by about 60% in March 2020 and by about 50% in April 2020 compared to the previous year, which had a significant impact on trawl and coastal fisheries, especially those that catch bluefish. As a result, exports of marine products have also declined, affecting Tunisia's ability to secure foreign currency. In particular, the impact on the economies of the provinces located along the coast has been significant. On the other hand, from the perspective of fishery resource management, the reduction in fishing pressure may have a positive impact on natural fishery resources.

The lockdown has also disrupted distribution channels, affecting a wide range of products from grains and fruits and vegetables to marine products. In particular, in late March 2020, when the declaration was issued, the distribution volume of vegetables and fruits decreased by about 10% and 40%, respectively. In addition, the distribution of fishery products decreased by about 30% during the entire period when the emergency declaration was in effect. In addition, restrictions on various types of fishing led to a decrease in the distribution of fish catches. On the other hand, prices also fell due to restrictions on going out, which reduced demand from restaurants and hotels. Sand borer prices fell by about 40%, red mullet by about 50%, horse mackerel by about 60%, sea bass by about 70%, and onions and butterfly thistle by about 40%.

(2) Challenges in Agriculture and Fisheries

The challenges in the agriculture and fisheries sector in Tunisia can be described as follows.

1) Agriculture

Traditionally, farmers conduct Rain-fed agriculture and irrigation is introduced 40%. The increase in using the irrigation system is necessary to improve the production. Also, it is important to establish a mechanism to collect fees and maintain the irrigation after the irrigation is introduced.

Agri-processing companies need to find a way to procure raw materials constantly. Agricultural production in the country varies depending on the amount of rain and the companies struggle to make their products especially when the rain does not fall sufficient.

The system/structure that gives information on financial access or market prices to agri-processing companies (e.g., dried fruit, olive oil, fruits and vegetables) needs to be established.

2) Fisheries

As recent excess of fishing and illegal fishery impacts the decrease in fish resources, it is essential to plan how to fish and predict the volume of landings, as well as the establishment of Illegal, Unreported and Unregulated (IUU) system and Vehicle Monitoring System (VMS).

It is important to give value addition to blue-backed fish. Though its volume is sufficient, the price keeps low, and values are not added. Also, knowing how to utilize crabs and mantis shrimp, which currently are dumped.

(3) Current Status of Companies and Startups

The agriculture and fisheries sector have been shunned by young people compared to other sectors, and the number of workers in this sector has been aging and digitalization has not progressed. In addition, there are a number of issues that must be overcome in order to introduce digital technology into the sector, such as the development of digital infrastructure and legislation. However, COVID-19 has triggered a reassessment of the importance of agriculture and fisheries from the perspective of food safety, and some young people are beginning to use digital technology to revitalize the sector, as shown below.

Table 4-18 Examples of Startups in Agriculture and Fisheries sector in Tunisia

Name of startups	Overview	Reference image
NABDA.TN ⁹³	They have been covering agritechs who are trying to set up agritech businesses while working with farmers, making short documentaries and uploading them to Facebook since June 2020. The media business was launched by the brothers to get more young people interested in agriculture by making a documentary on the impact of agritech on agriculture.	
BioAgrihelpers ⁹⁴	During the lockdown, a platform to introduce sustainable organic farming methods was developed on the Internet. It provides training to those who are not familiar with organic farming methods, as well as an opportunity to learn from each other by connecting farmers who are currently involved in organic farming on an individual basis.	

⁹³ <https://www.facebook.com/nabdastories/>

⁹⁴ <https://www.facebook.com/BioAgrihelpers/>

Name of startups	Overview	Reference image
NextProtein ⁹⁵	Founded in 2015. A start-up company that produces feed and fertilizer from larvae of horsefly bred on organic food waste; despite being a COVID-19 pandemic, it has received over 10 million Euros in investment and is expanding.	
Ezzayra ⁹⁶	Founded in 2011. The company provides systems for agricultural operations, produce management, human resource management, business management, etc., aiming to improve competitiveness and sustainable agriculture. sales are expected to reach 100,000 euros in 2019 and double that in 2020.	

Source: JICA Study Team

Also, in April 2019, the Ministry of Agriculture, Water Resources and Fisheries agreed with the African Development Bank and Busan Technopark⁹⁷ to start a demonstration experiment to improve agricultural productivity using drones in the Sidibjd province in central Tunisia later that month. The loan from the African Development Bank, through the Korea-Africa Economic Cooperation Fund, is for funding the introduction of drones and technology transfer for their utilization and will contribute to the policy of improving agricultural productivity. By October of the same year, about 40 drone pilots had been born. However, under the current legal system, private companies are not allowed to operate drones. For example, if a private company hopes to use a drone to spray pesticides on its own farm, the company must contact the government to ask an officer of the Ministry of Agriculture to fly a drone owned by the Ministry of Agriculture.

4.3.3. Industrial Development

(1) Current Status

1) Overview

The manufacturing sector accounts for 13.5% of total GDP (2020) and has a low industrialization rate⁹⁸. However, manufacturing sector has become an important sector, absorbing 18% of employment. In terms of industry, the three sub-sectors, namely machinery & electrical equipment, construction materials, and food processing, account for 70% of the total. In terms of value added, machinery & electrical equipment accounted for 29%, food processing 25%, and textiles 18%, accounting for 72% of the total. In terms of the number of employees, machinery and electrical equipment accounts for 24%, food processing 25%, and textiles 36%, accounting for 75% of the total. These three industries also have higher growth rates than the other industries.

The manufacturing industry can be roughly divided into state-owned enterprises, large local private enterprises represented by major business groups, foreign enterprises, and small and medium-sized private enterprises (SMEs). In terms of the number of employees, state-owned enterprises account for about 20% of the workforce,

⁹⁵ <http://nextprotein.co/>

⁹⁶ <https://www.ezzayra.com/>

⁹⁷ This is a techno-park created by the Ministry of Small and Medium Venture Business, a Korean governmental organization, and Busan City.

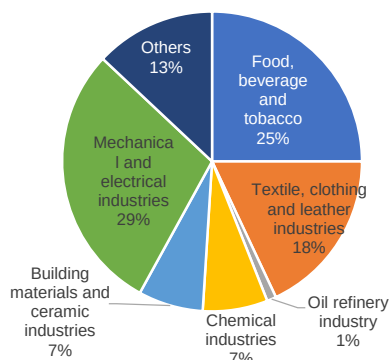
⁹⁸ <http://www.ins.tn/>

while private enterprises account for the remaining 80%. Among these, SMEs account for more than 90% of the total. Of the approximately 84,000 companies in the manufacturing industry, about 5,000 employ 10 or more people.

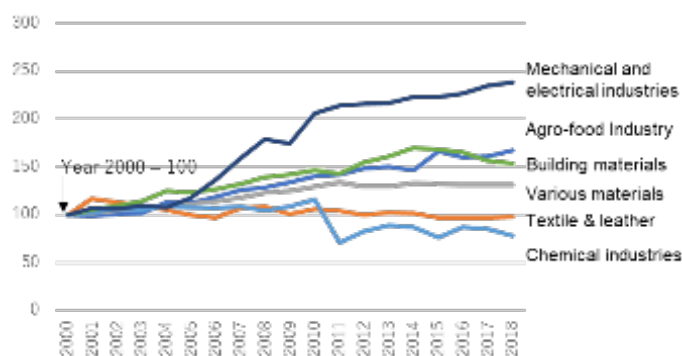
Forty-four percent of the firms with 10 or more employees are export-oriented, indicating that Tunisia has an export-oriented development pattern. Eighty percent of manufactured goods exports are to the EU.

Food, textiles, and leather account for only 40% of all enterprises, while automobiles, electrical machinery, and metal processing account for nearly 20%, indicating a relatively high degree of diversification.

Of the 84,283 private companies in the manufacturing sector (2018), 4,127 are foreign companies. The largest number of foreign companies are in textiles with 1,596, electrical and machinery with 426, metal products with 338, food and beverage with 254, and leather and footwear with 247. Foreign companies, which account for only 5% of the total number of companies, account for 32% of the total number of employees. In the automotive and other transport equipment sector in particular, 71% of the workforce is employed by foreign companies. In addition, foreign companies account for 40% of employment in textiles, 50% in leather and bags, and 44% in electrical and machinery.



Source : Statistique Tunisie
Figure 4-36 Value Added to Manufacturing by Sector (2020)



Source : Statistique Tunisie
Figure 4-37 Change in Value Added to Manufacturing by Sector (Real basis)

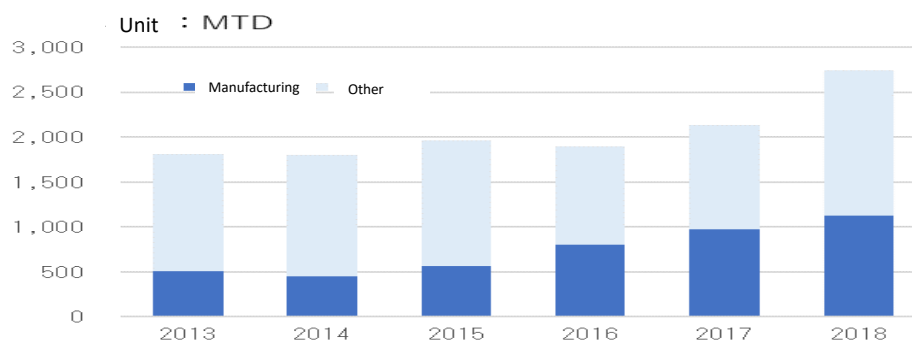
2) Manufacturing driven by foreign investment

The growth of manufacturing is driven by electrical and electronics industry, automobiles and aircraft, and agro-food industries. ICT and out-sourcing industries are growing, too.

Foreign investment contributes to the growth. Since 2015, foreign direct investment (FDI) in the manufacturing sector has been growing steadily.

Tunisia attracts FDI due to its location close to EU, cost competitiveness, the presence of engineers and well-maintained infrastructure.

Foreign-owned enterprises account for about 18%, which mainly deal with textiles, electricity/electronics and basic metals. France, Italy and Germany are main sources.



Source: Banque Central de Tunisie

Figure 4-38 Trends of FDI

Tunisia has 9 assembly plants and 260 parts manufacturers. More than half of the parts manufacturers export their products to EU and other countries. German and French are leading supporters as there are 29 German manufacturers and 25 French manufacturers. EU companies are outsourcing Tunisia to cut their cost. There are more than 2,000 IT companies, which are engaged in various businesses.

Large companies are digitizing on their own. Equipment for factory digitization is being adopted from advanced countries. System design is also being done by international companies, including those from France and the United States, which provide system integration solutions. There are Tunisian companies that also provide high quality system integration (TMI is an example).

Large foreign exporters are increasing their productivity to compete internationally and are also making the necessary digitalization (refer to photos from FIPA). On the other hand, small and medium enterprises are said to be lagging behind in digitization.



Source: FIPA

Figure 4-39 Tunisia Companies Utilizing Digital Technology

The Ministère de l'Industrie, de l'Energie et des Mines is also trying to advance Industry 4.0 in Tunisia and has plans to develop a roadmap. It has set up Industry 4.0 capacity building centers in Novation City and Technopôle Sfax with support from GIZ. GIZ will support the diffusion of Industry 4.0 in Tunisia over a three-year period from October 2019 to September 2022.

In order to advance Industry 4.0 in Tunisia, system integration for factories is necessary, providing various systems and devices such as ERP, manufacturing execution systems (MES), programmable logic controller (PLC), industrial robots and various sensors. However, GIZ officials also believe that Industry 4.0, which has

been introduced by large companies in Germany, will be difficult to implement in Tunisia, and they intend to support a simplified version.

The COVID-19 pandemic after February 2020 is also having a serious impact on the industrial sector in Tunisia. In March, when the restriction during the first wave was imposed, about 80% of the manufacturing industry suspended operations (food processing and textiles continued to operate); by the end of June, when the COVID-19 pandemic had settled down, most factories had resumed operations. However, due to the rapid increase in the number of infected people, curfews were imposed again in October, and this situation has continued into January 2021. The manufacturing sector faced challenges such as the closure of factories due to curfews in March, difficulties in obtaining imported raw materials due to supply chain disruptions, and a drop in exports due to lower demand from overseas markets. To cope with the COVID-19 crisis, companies have increased their use of ICT, including administrative tasks, telecommuting, online sales and marketing, and online payments. In particular, large companies in the mechanical and electronic industries and ICT have increased their use of digital platforms. On the other hand, micro enterprises and non-exporters were less adaptable to the use of digital platforms. In the short term, it is necessary to use digital technology to counter With-COVID-19, but in the long term, it is necessary to continue efforts to introduce digital technology to strengthen the production system and competitiveness of major industries in anticipation of post-COVID-19.

(2) Challenges in Industrial Development

The challenges in the Industrial Development in Tunisia can be described as follows.

1) Industrial diversification

Diversification is progressing from textile, agro-food, phosphoric acid, oil, etc. to more advanced industries such as machinery, electricity / electronics and ICT. It is required to maintain the progress in diversification of the industrial structure.

2) Shift to higher value-added

Over 50% of exports of automotive parts are wire harnesses and cables, which are labor-intensive products. Shift to higher value-added products such as electronic and engine parts is next challenge.

3) Expansion of industrial linkage

Imports of parts and components is necessary for automobile assembly. The situation is similar for clothing and electrical equipment. It is required to foster domestic parts manufacturers and expand industrial linkage.

4) Strengthening international competitiveness

Tunisia competes with the neighboring countries in terms of exports and attracting FDI. The challenge is to improve international competitiveness by improving productivity, training advanced engineers, and improving infrastructures such as customs and logistics.

4.3.4. Transport

(1) Current Status

The transport sector is expected to contribute to economic activities by vitalizing the flow of people and goods inside and between cities/regions.

1) Road sector

The road transport is the major land transport, constituting more than 90% of passenger traffic and 80% of freight traffic, and the road development has a great impact on the economy.

A long-term strategy of the road sector is set in 'Strategie de la DGPC: A l'horizon 2030' and the mid-term plans are revised every 5 years. The emphasis is placed on the development of highways development and developing the highways of 1,210km, which is currently 360km, by 2030 is planned.

The road development comes under the jurisdiction of the Directorate General of Bridges and Roads, Ministry of Infrastructure, Housing and Land Planning and the highway under the Tunisia Highway Company (the urban roads are under the individual municipalities). The foreign companies have not participated in the road operations yet.



Source: Information Collection and Verification Survey for Maghreb Regional Growth and Stability Promotion, JICA

Figure 4-40 Highway Network in Tunisia



Source : Wikipedia

Figure 4-41 Highway Toll Plaza



Source : Wikipedia

Figure 4-42 Highway Section in Service

Table 4-19 Total Length of Developed Roads by Road Type

Road Category	Length in Service
Autoroutes	360km
Voies Express	540km
Pistes Rurales	50,000km

Source: Information Collection and Verification Survey for Maghreb Regional Growth and Stability Promotion, JICA

2) Public transport sector

There are urban and inter-urban railways. The metro and Tunis-Goulette-Marsa (TGM) are major urban railways in Tunis city. The metro has 6 lines, totaling 45km. TGM has one line of 20km, and it connects Tunis and other sub-urban cities.

The construction of new lines, modernization of inter-urban railways and development of trams in sub urban cities are planned.



Source: Wikipedia
Figure 4-43 Tunis Suburban Railway



Source: Wikipedia
Figure 4-44 Tunis Metro

3) Traffic situation in Tunis

Although there are some areas in Tunis that are locally congested during the peak hours in the morning and evening, chronic traffic congestion is not a serious problem due to the size of the city and its population (e.g., the main arterial roads in the city).

On the other hand, on-street parked vehicles occupy a lot of road space in the city, especially in the streets, and hinder the traffic.

From the perspective of traffic management in the city, there are a number of problems in terms of proper traffic flow and safety, such as inappropriate traffic signal locations and lack of proper pedestrian and vehicle signal functions to separate pedestrians and vehicles.

In addition, while the Metro operates relatively frequently in the city, citizens rely heavily on their own cars for transport, and it can be said that the convenience of traveling by public transport is low. For example, there are no timetables or route information available at bus stops or metro stations. There are also concerns about safety, as there are many places where traffic is obstructed by bus passengers getting on and off on the streets. Payment for public transport is based on the sale of tickets in cash and is not electronic.

Other operational aspects of the highway include the crackdown on overloaded vehicles, the need to ensure traffic safety, and the need for proper traffic control.

The traffic situation in the city is shown in photos below.



Vehicles parked on streets in the city



Intersections and Traffic Lights



Bus stop



Getting on and off the bus



Metro Station



Metro ticket sales (cash)

Source: JICA Study Team

Figure 4-45 Traffic Situation in Tunis

4) Others

In the port sector, the World Bank is supporting the introduction of a port operation system, the Smart Gate system, at the Port of Rades.

The transport sector in Tunisia was severely affected by the government's lockdown measures in response to COVID-19, the sealing of borders during the declaration of a state of emergency, and changes in people's behavior such as social distancing. In particular, the aviation sector was severely affected: from mid-March to late June 2020, the border closure measures resulted in a significant reduction in air traffic. As a result, the Tunisian aviation industry is expected to incur a loss of about \$600 million in FY2020, which is about 47% of the revenue stream compared to FY2019. While the shipping sector has been impacted by weak international demand, it has been reported that the transport of goods was a necessary measure even under the lockdown and was relatively less affected than the aviation sector. Land transport operators were severely impacted by the lockdown and curfew. For example, due to a slump in the number of passengers, intercity bus operators reported a 43% drop in sales from April to June 2020 compared to the same period last year. Although no specific figures have been announced, it is presumed that intra-city bus operators have been similarly affected in terms of revenue and expenditure, and the cab industry has also experienced a significant decline in the number of customers.

(2) Challenges in Transport Sector

The challenges in the transport sector in Tunisia can be described as follows.

1) Congestion in the city

Severe congestion occurs in the city in the peak-hours. Considering the middle size city with approximately 750 thousand population already facing chronic congestion, there might be major critical factors of the congestion. Under the situation of increasing demand of motor vehicles, the measures to alleviate the congestion needs to be taken as soon as possible.

2) Proper road asset management

The proper maintenance of roads and road assets will be increasingly important as more roads including general roads and highways will be developed in Tunisia.

The asset management includes planning and executing maintenance of such properties as bridges, tunnels, road ancillary equipment, etc., and these activities need to be properly carried out.

3) Highway management

The highways are spaces that are intended to travel at high speed. It is important to maintain the required 'service level' of highway to be offered to the road users and assure traffic safety. The proper operation and maintenance of highways is necessary to achieve these.

It is important to realize the nationally unified highway services under the situation where the highways will be increasingly developed in Tunisia as targeted by 'Strategie de la DGPC: A l'horizon 2030'.

The highway management consists mainly 'highway traffic management' and 'toll collection', and both of these need to be properly realized.

Highway Traffic Management

- Realtime traffic information provision to road users
- Swift actions to cope with traffic accident
- Maintenance of facilities, etc.

Toll Collection

- Automated toll collection for alleviation of congestion at off-ramp
- Proper toll collection for securing budgets for road maintenance, etc.

4) Ensuring convenience and efficient management of public transport

It is important to shift the road traffic demand to public transport by enhancing public transport services and network under the situation that the traffic congestion becomes increasingly serious.

In order to realize this, (i) enhancing efficiency of transfer and convenience of public transport, (ii) providing public transport services which match public transport demand by proper operation of public transport are required.

5) Realizing efficient logistics

Enhancing logistic network and making logistic management efficient are important for revitalizing economy, e.g., correcting economic disparities, creating jobs, etc.

The logistics mainly consists of transport, storage, cargo handling, packing, distributive processing, and logistics information processing and all of these shall become efficient.

In particular as for transport, efficient commercial vehicle management, customs clearing processing, efficient operation of port and airport and their facilities are important.

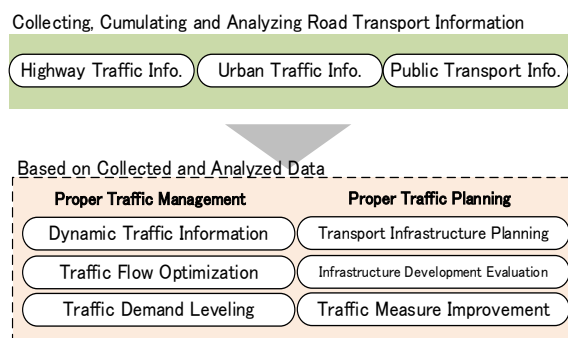
6) Effective utilization of quantitative traffic data for road and transport measures

It is important to objectively comprehend the traffic situation for proper planning and execution of traffic management and other traffic measures.

The purpose of CCTV⁹⁹ is to monitor and confirm the traffic condition on site and it does not save traffic data.

Realizing the mechanism which enables to quantitatively comprehend the traffic in terms where, when and how much it is congested, and utilize the cumulated traffic data for road and traffic measures is important.

⁹⁹ Abbreviation for Closed-circuit Television. In a broad sense, it refers to the entire surveillance/crime camera system.



Source: JICA Study Team
Figure 4-46 Collection, Storage and Analysis of Road Traffic Information

(3) Current Status of Companies and Startups

There are several private companies and startups in the Tunisian transport and traffic sector that are using digital technology. Some of these operators are offering unique services in response to the new needs that have emerged in the wake of the COVID-19 pandemic. Some of the major examples are listed below.

Table 4-20 Examples of Startups in Transport Sector in Tunisia

Name of startups	Overview	Reference image
Intigo	A startup that provides a motorcycle cab service. In response to the COVID-19 pandemic, they have started to offer new services such as delivery service of goods and pick-up service for parents to take their children to nursery school and elementary school. The service can be booked through an app and offers a fixed price service.	
Wassalni	Vendor of public transport information. Provides public transport information mainly in Tunis.	
RTTN	A vendor of applications that provide transport information. In addition to streetcars and the national rail network, it also covers information on city buses, school buses, and airport buses. The national version was released in response to the growing demand for transport information in the wake of the COVID-19 pandemic.	

Source: JICA Study Team based on various documents.

Chapter 5 Cases of the Utilization of Digital Technology by Sector

5.1. Agriculture and Fisheries Sector

5.1.1. Agriculture Sector

Cases of utilization of digital technology to solve issues of the agriculture sector extracted at the local workshop are shown. The table below summarizes utilization cases, and specific examples are introduced on the following pages.

Table 5-1 Cases of the Utilization of Digital Technologies in the Agriculture Sector

Target areas	Technology	Utilization cases
1. Production	(1) Business management technology	By recording work plans and results on digital devices such as personal computers, tablets and smartphones, utilization for visualization of production costs, improvement of cultivation plans and methods, yield prediction, etc. is possible.
	(2) Production management technology	By analyzing videos and images of fields and crops taken by drones and smartphones using AI, it is possible to effectively manage the growth of crops and improve yields.
		Drones equipped with tanks and nozzles for pesticides and fertilizers flying over crops and spraying pesticides and fertilizers appropriately to reduce the control operation in places where human operations are difficult, and yield can be improved by eliminating variations in pesticides and fertilizers.
	(3) Water management technology	Using the sunlight and land data collected by sensors, the system can predict when to water and how much fertilizer to apply based on the weather and plant status, which makes optimal water management possible.
2. Logistics and Marketing	(1) Sales channel establishment technology	Using a trading matching platform for agricultural produce on the web, buyers can pre-order and purchase fresh produce at direct prices and farmers can reduce anxiety for procuring. A new sales channel to directly sell products to consumers and restaurants is established which contributes to sales increase.
	(2) Ordering technology	Utilizing a system that provides one-stop support for marketing process from ordering, contacting production sites, shipping to billing enables to minimize the effort of administrative work.
		The system to digitize and automate the purchase order and data entry increases speed to deliver products and minimizes man-made mistakes.
3. Others	(3) Logistics technology	Cargo container with a chilled and freezer system enables to control the temperature of the cargo by utilizing external power supply for storage and a storage battery for transport and to keep the products fresh for long time.
		The work and decision making which are “casually performed” by skilled farmers are extracted and analyzed by viewpoint analysis and environmental sensors, and they are visualized by using learning materials, remote guidance, and a simulated experience environment with VR to make them available for new farmers and unskilled farmers to acquire the skills.

Source: Created by JICA Study Team based on various documents

(1) Production

1) Business management technology

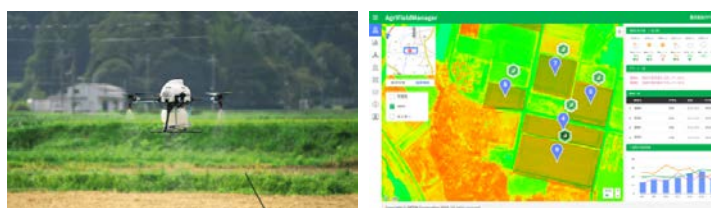
By recording work plans and results on personal computers, tablets, smartphones, etc., utilization for visualization of production costs, improvement of cultivation plans and methods, yield prediction, etc. is possible (ESK Ink.¹⁰⁰, SB Technology Corp.¹⁰¹, E-supportlink, Ltd.¹⁰² and many others).



Source: Website of E-supportlink, Ltd.
Figure 5-1 Farming Support System

2) Production management technology

By analyzing videos and images of fields and crops taken by drones and smartphones using AI, it is possible to effectively manage the growth of crops (OPTiM Corporation¹⁰³, Kokusai Kogyo Co., Ltd.¹⁰⁴).



Source: Website of OPTiM Corporation
Figure 5-2 Farm Analysis by Drone and AI

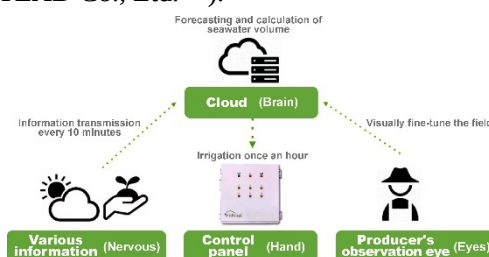


Source: Website of TEAD Co., Ltd.
Figure 5-3 Spraying Pesticides by a Drone

Drones equipped with tanks and nozzles for pesticides and fertilizers flying over crops and spraying pesticides and fertilizers appropriately to reduce the control operation in places where human operations are difficult and to grasp variations among fields which improve yield by spraying appropriate fertilizers and eliminating variations among fields (SAITOTEC¹⁰⁵, TEAD Co., Ltd.¹⁰⁶).

3) Water management technology

Using the sunlight and land data collected by sensors, the system automatically predicts when to water and how much fertilizer to apply based on the weather and plant status (Routrek Networks, Inc.¹⁰⁷, Data Process Co., Ltd.¹⁰⁸, Nishimu Electronics Industries Co., Ltd.¹⁰⁹, SenSprout Inc.¹¹⁰)



Source: Website of Routrek Networks, Inc.
Figure 5-4 Zero Agri Mechanism

¹⁰⁰ <http://www.hata-nikki.jp/>

¹⁰¹ <https://new.agmiru.com/>

¹⁰² <https://www.e-supportlink.com/service/farmstory/>

¹⁰³ <https://www.optim.co.jp/agriculture/services/>

¹⁰⁴ <https://agriculture.kkc.jp/>

¹⁰⁵ <https://saitotec.com/utility/agriculture/>

¹⁰⁶ <https://www.tead.co.jp/service/>

¹⁰⁷ <https://www.zero-agri.jp/product.html>

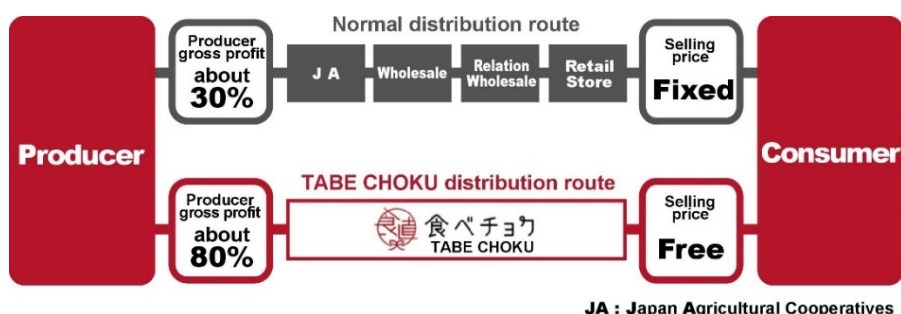
¹⁰⁸ <https://www.odp.co.jp/solution/agrleaf/index.html>

¹⁰⁹ <https://www.nishimu-products.jp/miharas/>

¹¹⁰ <https://sensprout.com/irrigationcontrolsystem-2>

(2) Logistics and Marketing

1) Sales channel expansion technology



Agricultural produce trading matching system. Pre-ordered direct sales greatly reduce the storage period of agricultural produce, and fresh agricultural produce can be purchased at direct

Source: Website of vivid garden Inc.
Figure 5-5 Tabe Choku Mechanism

sales prices. In addition, by pre-ordering stable quality and quantity of agricultural produce, anxiety for procurement is eliminated. For sellers, establishment of new sales channels and sales increase can be expected. A platform which enables farmers to directly sell their products to consumers and restaurants. (vivid garden Inc.¹¹¹, Tsunagu Inc.¹¹²)



Source: Website of NTT DOCOMO, INC.
Figure 5-6 Automated Purchase Order Entry

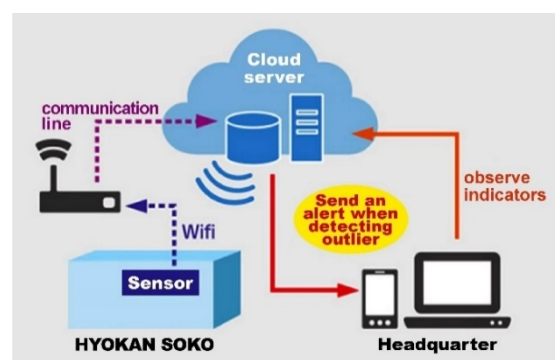
2) Ordering technology

A field-born farming support system that provides one-stop support for marketing process from ordering, contacting the production site, shipping to billing, and minimizes the effort of administrative work. (Inaba Kabushiki Kaisha¹¹³)

The system to digitize and automate the purchase order and data entry increases speed to deliver products and decreases man-made mistakes (NTT DOCOMO, INC.¹¹⁴).

3) Logistics technology

A cargo container with a chilled and freezer system enables to control the temperature of the cargo by utilizing external power supply for storage and a storage battery for transport and to keep the products fresh for long time (O's&Tec¹¹⁵).



Source: Website of O's&Tec
Figure 5-7 A Cargo Container with a Chilled and Freezer System

¹¹¹ <https://www.tabechoku.com/>

¹¹² <http://tsunagu.cc/corp/index.html>

¹¹³ <http://www.agrihands.com/>

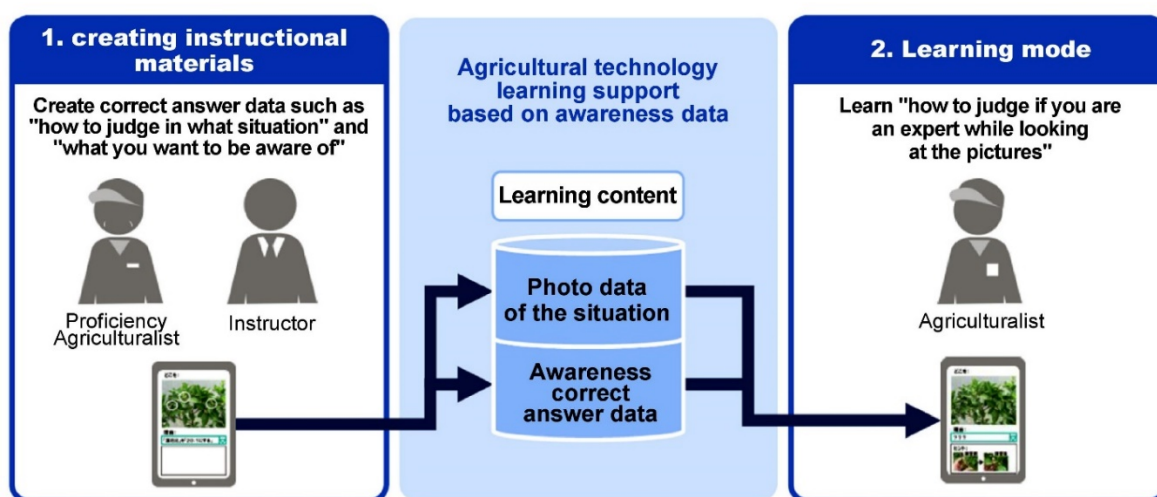
¹¹⁴ https://www.nttdocomo.co.jp/biz/casestudy/shimonoseki/?icid=CRP_BIZ_CS_panel_to_shimonoseki

¹¹⁵ <http://www.ostec.co.jp/hyokan/>

(3) Others

1) Cultivation skill succession technology

The work and decision making which are casually performed by skilled farmers are extracted and analyzed by viewpoint analysis and environmental sensors to “visualize” using learning materials, remote guidance, and a simulated experience environment using VR to make them available for new farmers and unskilled farmers to acquire the skills. (Keyware Solutions Inc.¹¹⁶, NEC Solution Innovators, Ltd.¹¹⁷).



Source: Introduction example material of NEC Solution Innovators, Ltd.

Figure 5-8 Utilization Image of Learning System

5.1.2. Fisheries Sector

Cases of utilization of digital technology to solve fisheries sector issues extracted at the local workshop are shown. The table below summarizes utilization cases, and specific examples are introduced on the following pages.

Table 5-2 Cases of the Utilization of Digital Technologies in the Fisheries sector

Target areas	Technology	Utilization cases
1. Production (micro fishery)	(1) Information collection technology	By utilizing buoys equipped with simple CTD ¹¹⁸ which enables fishermen themselves to acquire sea state data, sensors, etc., and self-propelled underwater gliders, sea area data (water temperature, salt content, dissolved oxygen content, chlorophyll concentration, etc.) is regularly measured, which makes it possible to establish wide and highly accurate sea area observation network.
		More sophisticated fish finders or airplane-type drones are used to determine the amount of fish school by type and size of fish. It leads to labor saving by expanding a school of fish search range and shortening the search time.
		By digitizing the operation logbook and combining it with the Global Positioning System (GPS) data of the ship, the catch location and exact catch amount by fish type can be grasped which is useful for resource management described later.

¹¹⁶ https://www.keyware.co.jp/products_solution/object/agri.html

¹¹⁷ <https://www.nec-solutioninnovators.co.jp/sl/nougaku/index.html>

¹¹⁸ Abbreviation for Conductivity Temperature Depth profiler. A device that observes electrical conductivity, temperature and water depth. It calculates salinity from electrical conductivity, water temperature and pressure.

Target areas	Technology	Utilization cases
	(2) Information sharing technology	A system that allows to see high-precision water temperature maps and weather information from offshore fishing boats and an app that provides information on tides and water temperature distribution which is the key to the formation of fishing grounds are developed and fishery employees check real-time data by their smartphones and mobile phones. By supplementing the experience and intuition of fishermen with data, it can be used to improve the fish production, and it is also possible to reduce fuel costs and on-site operations for checking the condition of fishing grounds.
		A system for sharing real time information for ships (response of a school of fish of other ships and current position and wake of each ship) enables to eliminate duplication of search areas and to reduce fuel cost and required time to catch. In addition, providing fishing operation data to young fishermen and reviewing fishing help develop successors.
		By creating guidance to encourages linking API119 and data standardization to link sea data on one platform, it can be utilized not only for fishing, but also for port management and conservation of the ocean.
	(3) Fishing area and catch quantity prediction technology	A system which predicts catch quantity in an area by analyzing previous ocean current and catch data can optimize the number of boats and manpower when going out for fishing.
		Performing AI analysis based on past fishing logbook and marine weather data to make pinpoint fishing ground proposals and to take over knowhow of experienced fishermen by data enables even inexperienced fishermen to engage in fishing.
		A system which predicts what types of fish can be caught under which conditions by analyzing previous ocean current and fishing data is utilized for selecting fishing ground.
2. Production (aquaculture)	(1) Aquaculture management technology	A system which measures water temperature, etc. by installing buoys at fish farm for checking data onshore remotely and hourly can reduce the fuel costs for checking the condition of the fishing ground and on-site operations.
		Utilizing underwater drones enables to quickly inspect the aquaculture facility for items such as dirt and tears on the net and the presence of drifting objects, and it is possible to reduce the workload as compared to the past.
	(2) Growth management technology	Taking images of a seaweed farm from the sky with a drone and analyzing the images with AI enable to grasp the growth status of seaweed and the occurrence of diseases without going out to the farm by a boat. Notifying fishermen of the situation in a timely manner makes it possible to take appropriate measures at an early stage.
		A system which sends an emergency email to the mobile phone of the producer registered in advance when red tide occurs can prevent or mitigate red tide damage.
		By acquiring data such as water temperature and dissolved oxygen in deep water and automatically floating and sinking farming cage by remote control based on the data, it is possible to take measures to reduce the risk in bad weather as well as on-site operations.
	(3) Feeding management technology	Linking a communication control device such as an underwater camera to the automatic feeder for checking the feeding status of cultured fish and residual feed in real time by a smartphone or personal computer and remotely operating the feeder make it possible to reduce feed cost and fuel cost to travel to fish farm.

¹¹⁹ Abbreviation for Application Programming Interface. A specification of the interface used by software components to exchange information with each other.

Target areas	Technology	Utilization cases
		Analyzing the correlation between environmental data and growth data by AI technology enables to optimize feeding volume and feeding timing, control feeding costs, and design appropriate feeding plans.
	(4) Production management technology	Utilizing high-performance underwater drones and acoustic curtains enables to accurately count the number of cultured fish in the cage, which makes it possible to reduce the burden on divers who used to count the fish underwater and to have more accurate business management.
		By making it easy for aquaculture companies to input environmental data and aquaculture management data from above the cage using a tablet terminal, the production process (feeding amount, growth amount, survival rate, etc.) and environmental information (water temperature, etc.) for each cage can be integrated and managed
3. Others	(1) Poaching monitoring technology	A camera is installed for AI to determine whether it is a fishing boat or a poaching boat from the image of the camera, and if it is found to be a poaching boat, an alarm is automatically sent to the related fishery cooperatives, etc., so that poaching can be reduced as well as the burden of monitoring poaching boat.
		A technology of receiving very high frequency (VHF) from an automatic identification system (AIS) by an artificial satellite and monitoring the behavior of vessels is utilized to grasp the movement of the IUU fishing boat. It is useful to identify boats and countries suspected of IUU fishing and take measures such as import restrictions.
	(2) Maritime accident countermeasure technology	It is possible to develop an application with AIS function to prevent collisions and capsizing accidents.
	(3) Training technology for new fishermen	By analyzing boat movements and the state of fishing of experienced fishermen with AI etc., it is possible for young fishermen to acquire skills even in fishing which requires advanced skills.

Source: Created by JICA Study Team based on various documents

(1) Micro Fishery

1) Data collection technology for production

As technologies utilized to collect information necessary for fishing, there are simple CTD (JFE Advantech Co., Ltd.¹²⁰) that allows fishermen to acquire sea condition data, buoys equipped with sensors, etc. (AND-EX, S-Vans and NTT Docomo Co., Ltd.¹²¹) and a self-propelled underwater glider (TeledyneWebb¹²², USA). By utilizing these technologies to regularly measure sea area data (water temperature, salt content, dissolved oxygen content, chlorophyll concentration, etc.), it is possible to establish wide and highly accurate sea area observation network.

Also, more sophisticated fish finders or airplane-type drones are used to determine the amount of fish in school by type and size of fish, which leads to labor saving by expanding the search range and shortening the search

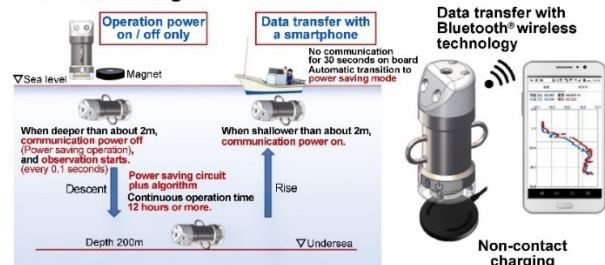
¹²⁰ <https://www.jfe-advantech.co.jp/assets/img/news/smart-act.pdf>

¹²¹ <https://and-ex.co.jp/service/> and <http://www.s-vans.com/ict-bui/index.html> and https://www.nttdocomo.co.jp/biz/service/ict_bui/

¹²² <http://www.teledynemarine.com/slocum-glider>

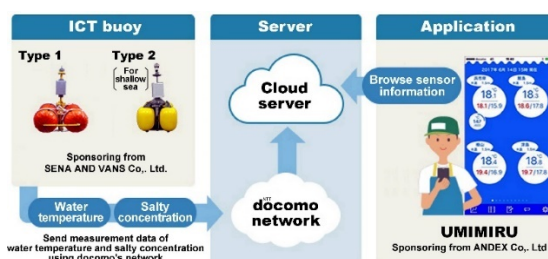
time (AquaFusion Inc.¹²³ and Sonic Corporation¹²⁴). In addition, by digitizing the operation logbook and combining it with the GPS data of the ship, the catch location and exact catch amount by fish type can be grasped which is useful for resource management described later. (Ocean Solution Technology Co., Ltd.¹²⁵, Autonomous Control Systems Laboratory, Tokoro, Furuno Electric Co., Ltd., etc.¹²⁶).

Observation image



Source: Website of JFE Advantech Co., Ltd.

Figure 5-9 Utilization Image of Simple CTD



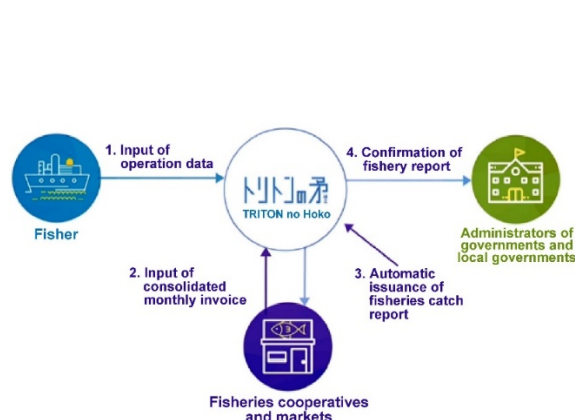
Source: Website of Ocean Policy Research Institute

Figure 5-10 Underwater Glider



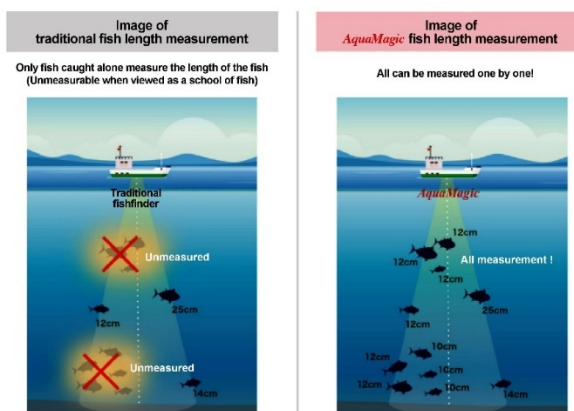
Source: Website of NTT Docomo

Figure 5-12 Utilization Image of ICT buoy



Source: Website of Ocean Solution Technology Co., Ltd.

Figure 5-13 Utilization Image of Triton's halberd



Source: Website of AquaFusion Inc.

Figure 5-11 Fish Length Measurement Image

¹²³ <https://aquafusion.jp/product/aquamagic>

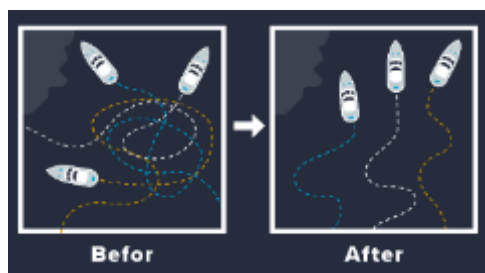
¹²⁴ <http://www.u-sonic.co.jp/product/category/detail/sid:9a803235-cd94-11e9-b11b-9ca3ba0232db/pid:54aab726-050b-11ea-bcc9-ae9f117a2f7b>

¹²⁵ <https://www.ocean5.co.jp/service/>

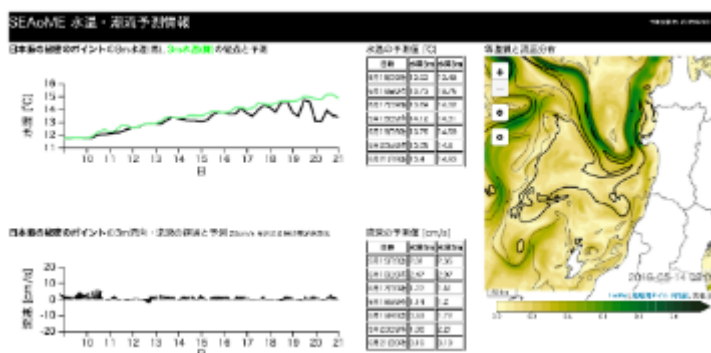
¹²⁶ http://www.naro.affrc.go.jp/laboratory/brain/h27kakushin/files/subject7_05.pdf

2) Data sharing technology for production

A system that allows to see high-precision water temperature maps and weather information from offshore fishing boats (Japan Fisheries Information Service Center¹²⁷) and an app that provides information on tides and water temperature distribution (Ocean Eyes Co., Ltd.¹²⁸) which is the key to the formation of fishing grounds are developed and fishery employees check real-time data by their smartphones and mobile phones. By supplementing the experience and intuition of fishermen with data, it can be used to improve the fish production, and it is also possible to reduce fuel costs and on-site operations for checking the condition of fishing grounds.



Source: Website of Lighthouse Inc.
Figure 5-14 Mapping Function of ISANA



Source: Website of Ocean Eyes Co., Ltd.
Figure 5-15 Commissioned Development of Sea Condition Forecasting System "SEAoME"

A system for sharing real time information for ships (response of a school of fish of other ships and current position and wake of each ship) enables to eliminate duplication of search areas and to reduce fuel cost and required time to catch. In addition, providing fishing operation data to young fishermen and reviewing fishing help develop successors.

(Lighthouse Inc.¹²⁹).

By creating guidance to encourages linking API and data standardization to link sea data on one platform, it can be utilized not only for fishing, but also for port management and conservation of the ocean. (Umishiru of Japan Coast Guard¹³⁰).



Source: Umishiru website
Figure 5-16 Screen on Umishiru

¹²⁷ <https://www.jafic.or.jp/service/ebisukun/>

¹²⁸ <https://oceaneyes.co.jp/overview>

¹²⁹ <https://isana.lighthouse-frontier.tech/>

¹³⁰ <https://www.msil.go.jp/msil/htm/topwindow.html>

3) Fishing ground and catch prediction technology for production

A system which predicts catch quantity in an area by analyzing previous ocean current and catch data can optimize the number of boats and manpower when going out for fishing.

Performing AI analysis based on past fishing logbook and marine weather data to make pinpoint fishing ground proposals and to take over knowhow of experienced fishermen by data enables even inexperienced fishermen to engage in fishing.

A system which predicts what types of fish can be caught under which conditions by analyzing previous ocean current and fishing data is utilized for selecting fishing ground.

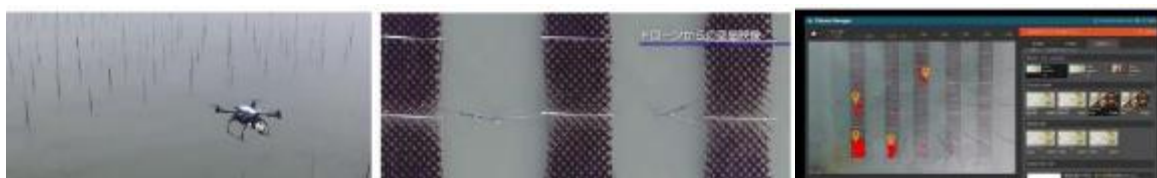
(2) Aquaculture

1) Fish farm management technology for Production

A system which measures water temperature, etc. by installing buoys at fish farm for checking data onshore remotely and hourly can reduce the fuel costs for checking the condition of the fishing ground and on-site operations. Also, utilizing underwater drones enables to quickly inspect the aquaculture facility for items such as dirt and tears on the net and the presence of drifting objects, and it is possible to reduce the workload as compared to the past.

2) Growth management technology for production

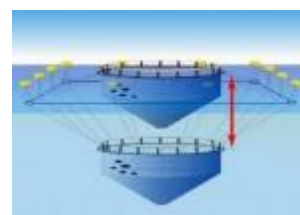
Taking images of a seaweed farm from the sky with a drone and analyzing the images with AI enable to grasp the growth status of seaweed and the occurrence of diseases without going out to the farm by a boat. Notifying fishermen of the situation in a timely manner makes it possible to take appropriate measures at an early stage. (OPTiM Corporation and others¹³¹).



Source: Website of DRONE WORKERS.jp

Figure 5-17 Analysis of the Growth of Laver by Drone

By acquiring data such as water temperature and dissolved oxygen in deep water and automatically floating and sinking farming cage by remote control based on the data, it is possible to take measures to reduce the risk in bad weather as well as on-site operations. (Nitto Seimo Co., Ltd.¹³²).



Source: Website of Nitto Seimo Co., Ltd.

Figure 5-18 Float-sink Type Farming Cage

3) Feeding management technology for production

Linking a communication control device such as an underwater camera to the automatic feeder for checking the feeding status of cultured fish and residual feed in real time by a smartphone or personal computer and remotely

¹³¹ <https://www.optim.co.jp/news-detail/21348>

¹³² <https://www.nittoseimo.co.jp/38/92/>

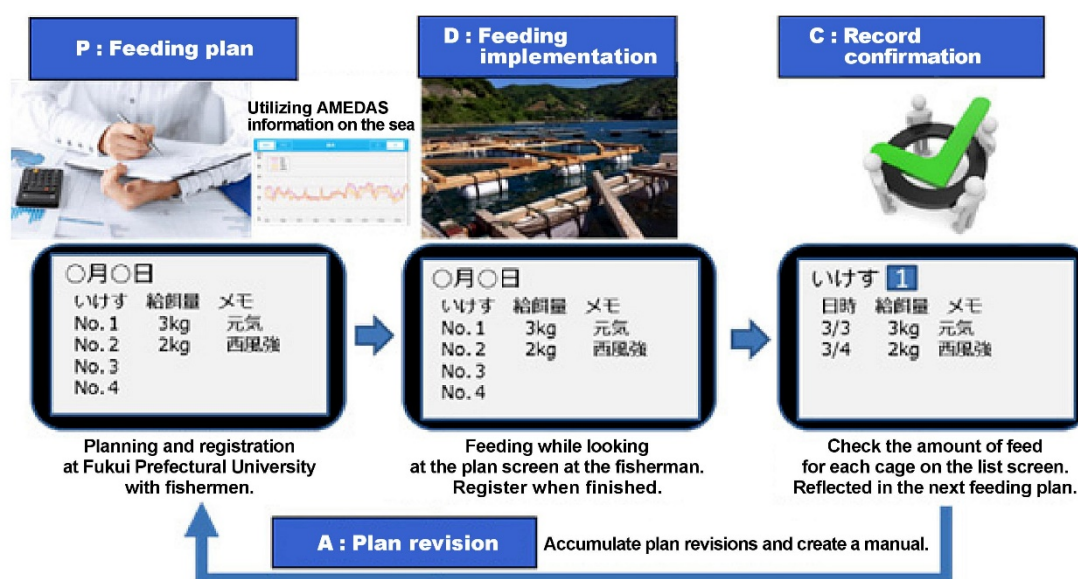
operating the feeder make it possible to reduce feed cost and fuel cost to travel to fish farm. (Umitron K.K.¹³³).



Source: Website of Umitron K.K

Figure 5-19 Smart Feeding System for Aquaculture “UMITRON CELL®”

Analyzing the correlation between environmental data and growth data by AI technology enables to optimize feeding volume and feeding timing, control feeding costs, and design appropriate feeding plans. AI (KDDI Corporation and others¹³⁴).



Source: Website of KDDI

Figure 5-20 Utilization Flow of Digital Operation Logbook

4) Production management technology for production

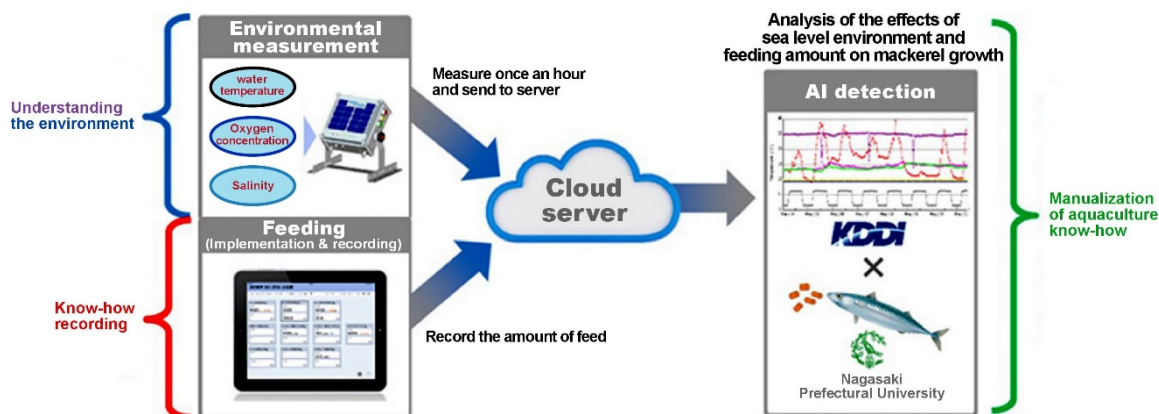
Utilizing high-performance underwater drones and acoustic curtains enables to accurately count the number of cultured fish in the cage, which makes it possible to reduce the burden on divers who used to count the fish underwater and to have more accurate business management.

By making it easy for aquaculture companies to input environmental data and aquaculture management data from above the cage using a tablet terminal, the production process (feeding amount, growth amount, survival

¹³³ <https://umitron.com/ja/index.html>

¹³⁴ <https://news.kddi.com/kddi/corporate/newsrelease/2017/11/20/besshi2801.html>

rate, etc.) and environmental information (water temperature, etc.) for each cage can be integrated and managed (KDDI Corporation and others¹³⁵).



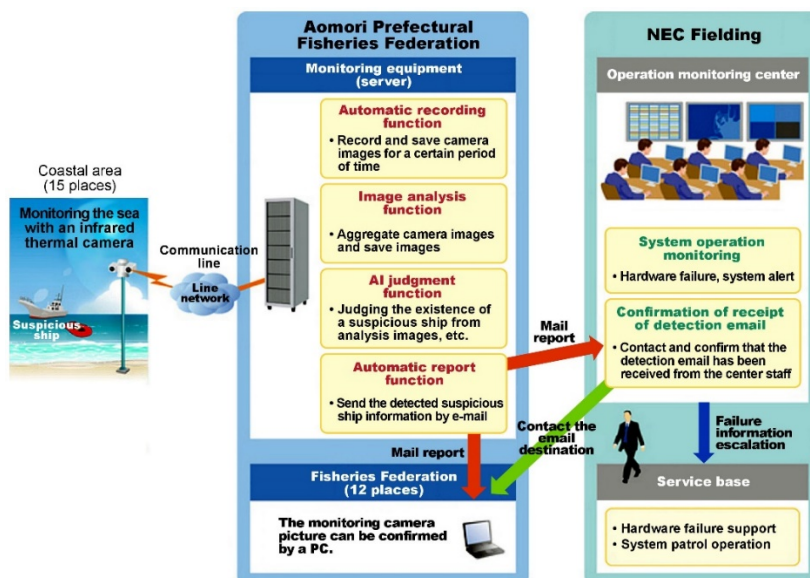
Source: Website of KDDI

Figure 5-21 Making Aquaculture Know-How into a Manual by AI Analysis

(3) Others

1) Poaching monitoring technology

A camera is installed for AI to determine whether it is a fishing boat or a poaching boat from the image of the camera, and if it is found to be a poaching boat, an alarm is automatically sent to the related fishery cooperatives, etc., so that poaching can be reduced as well as the burden of monitoring poaching boat (NEC Fielding, Ltd.¹³⁶).



Source: Website of NEC Fielding, Ltd.

Figure 5-22 Overview of Poaching Monitoring System

A technology of receiving VHF from an AIS by an artificial satellite and monitoring the behavior of vessels is utilized to grasp the movement of the IUU fishing boat. It is useful to identify boats and countries suspected of

¹³⁵ <https://www.kddi.com/corporate/csr/regional-initiative/case-study/case23/>

¹³⁶ <https://www.fielding.co.jp/jirei/137.html>

IUU fishing and take measures such as import restrictions. (Ocean Policy Research Institute¹³⁷).

2) Maritime accident countermeasure technology

To develop an app to display and notify the status of surrounding ships, to make it possible to display not only ships equipped with AIS but also ships equipped with smartphones that have the app installed so that ship collision accidents can be reduced. (Japan Radio Co., Ltd.¹³⁸).



Source: Website of Global Fishing Watch
Figure 5-23 A Map Showing Fishing Boats

3) Training technology for new fishermen

By analyzing boat movements and the state of fishing of experienced fishermen with AI etc., it is possible for young fishermen to acquire skills even in fishing which requires advanced skills.

5.2. Industrial Development Sector

5.2.1. Application of Digital Technology to Industrial Development

Since the introduction of automation in the US automobile industry in the early 20th century, the manufacturing industry has been addressing automation. Especially since 1960, automation technology has been advancing day by day in line with the progress of technologies such as mechatronics and integrated circuits (ICs).

Since 1980s, computer-aided production management, computer-aided design and manufacturing (CAD/CAM), and robots were introduced to the production sites. In 2000s, the use of digital technologies in factories rapidly advanced due to the spread of the Internet, the improvement of processing capacity of ICT equipment and the spread of low-priced ICT devices. In 2011, the concept of the smart factory named “Industry 4.0” was announced in Germany, and efforts toward smart factories have become common in Europe, the United States and Japan.

With the development and spread of such digital technologies, these digital technologies are being used at manufacturing sites as shown below.

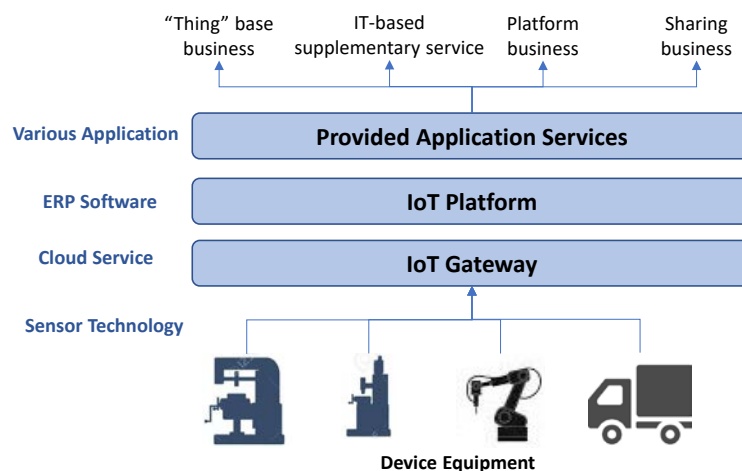
- Maximized factory productivity by utilizing sensing technology, networking FA equipment and introducing robots.
- In accordance with the development from MRP (Material Requirement Planning) to ERP, the system to control all corporate activities, such as product development, supply chain management, manufacturing, human resource, finance and sales has been introduced.
- Expanded network with business partners and customers under open and globalization.
- Developed the product with IoT technology.
- Shifted the source of value added from “goods” to “services” and “solutions.”

Smart factories feature a cyber-physical system (a system which collects data in the real world, analyzes it in cyber space and utilizes the value created there), IoT and cloud computing. Utilization of digital technologies in

¹³⁷ https://www.spf.org/opri/newsletter/431_3.html

¹³⁸ <https://www.jrc.co.jp/jp/about/news/2020/0304-1.html>

the manufacturing industry is applied to not only at manufacturing sites but also to the creation and provision of various services. The following figure depicts such situation.



Source: JICA Study Team

Figure 5-24 Structure of Introducing Digital Technologies to the Manufacturing Sector

5.2.2. Steps to Introduce Digital Technologies to Manufacturing Site

The application of digital technologies based on the cyber-physical system is rapidly advancing in the production sites of large companies in the world. On the other hand, there are still a lot of companies whose digitalization is not progressing well and produce products using stand-alone machines. In addition, the level of automation varies depending on the type of industry. For example, in chemical plants and food processing business, production is commonly performed on the integrated automation lines, while industries such as metal processing, there are many small and medium-sized enterprises which are not fully automated. In addition, many subcontractors are conducting marketing which is nothing to do with serving products utilizing digital technologies and direct-to-consumer sales (D2C).

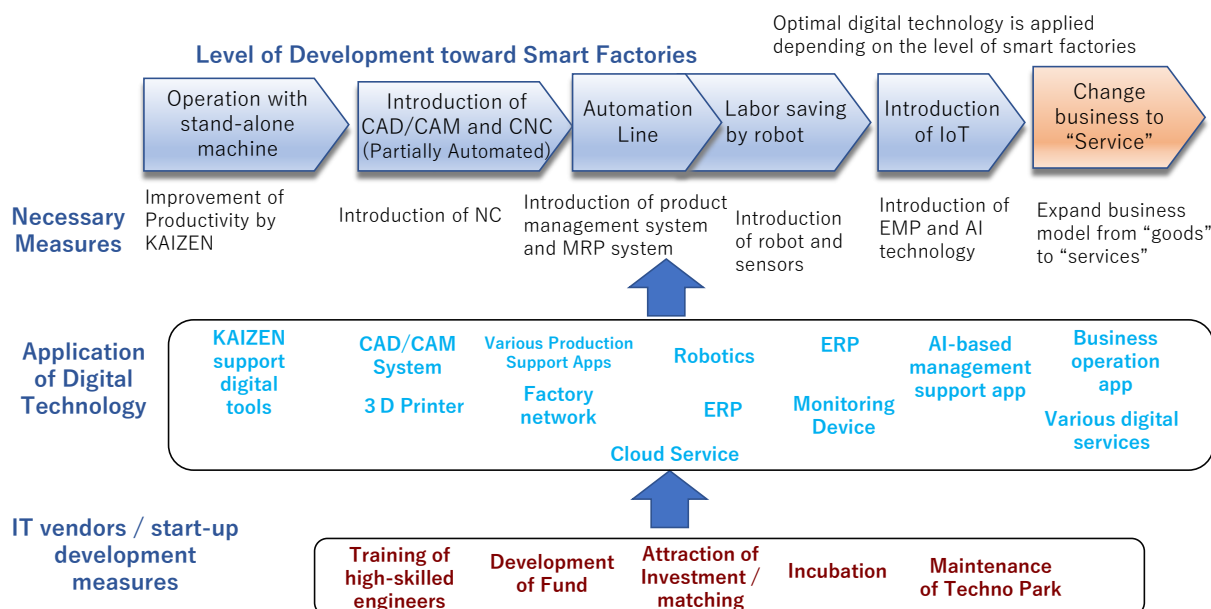
In view of such situation, it is important to introduce digital technologies according to the characteristics of the business of the company. Especially in developing countries where the technological level of the manufacturing industry is low, it is necessary to thoroughly examine the application process of digital technologies.

Table 5-3 Steps to Introduce Digital Technologies to Manufacturing Industry.

Development level of smart factory	Necessary measures	Available digital technologies	Support base
Operation with stand-alone machine	Improve productivity by Kaizen	Kaizen support digital tool Monitoring machine operation status by sensors	- Training of advanced engineers - Attract investment from high tech companies - Incubation support (startup ecosystem development) - Developing techno park - Loan system for equipment renewal - Venture funding/fund
Introduction of CAD/CAM and CNC (partially automated)	Introduction of NC machines	CAD/CAM system Machining center 3D printer	
Production line automation	Production management system Materials management system	Factory network Introduction of MRP system Various production support Apps	
Labor saving by robot	Robot technology	Introduction of Robotics	
Overall smart factory	Overall optimization of manufacturing	Product Cycle Management (PCM)	

Development level of smart factory	Necessary measures	Available digital technologies	Support base
		Introduction of ERP Utilization of AI	
Business optimization	Shifting business model from goods to services	Various digital services Business operations application	

Source: JICA Study Team



Source: JICA Study Team

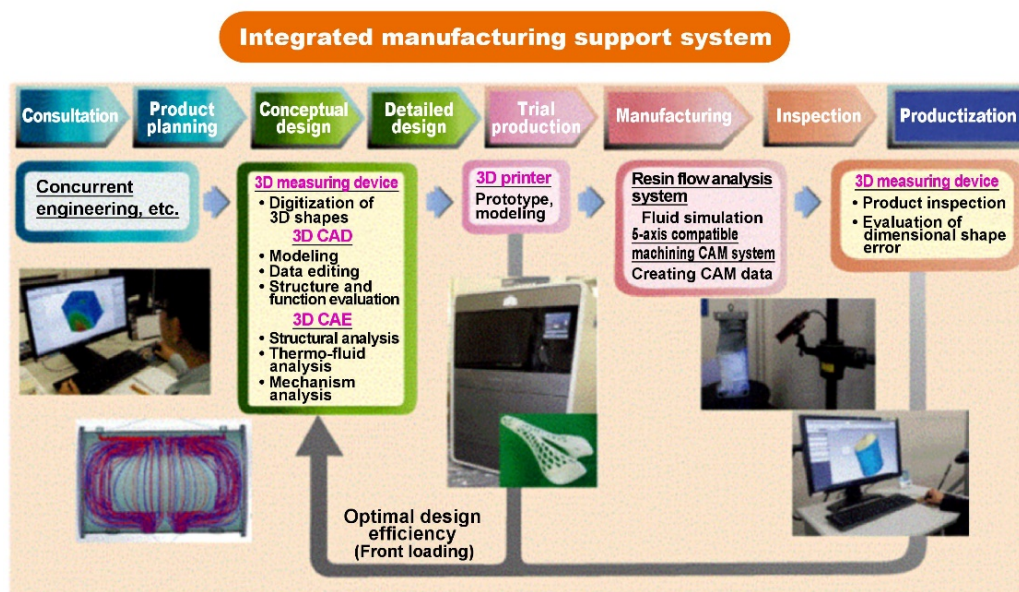
Figure 5-25 The Process of Applying Digital Technology to Manufacturing

5.2.3. Cases of the Utilization of Digital Technology to Contribute to Industrial Development

The following cases are considered for the utilization of digital technology applicable to manufacturing in developing countries.

(1) Prototype Design and Production Utilizing Digital Technology

To enable design with simulation by introducing 3D-CAD and CAE (Computer-Aided Engineering), and to enable 3D manufacturing with equipment such as 3D printers.



Source: Monozukuri Prototype Development Support Center

Figure 5-26 Process to Develop Prototypes

Example of Prototype Development Support by a Public Institution: Kobe City

Kobe Monozukuri Factory is a large-scale public rental factory and there is the Kobe Liaison Laboratory (industry-academia-government-private partnership research workshop) in it. The Kobe Liaison Laboratory aims to support technological advancement through industry-academia exchange and joint development initiative through inter-company networks. The “Monozukuri Prototype Development Support Center,” the core facility of the Kobe Liaison Laboratory, supports Monozukuri of small and medium-sized enterprises using 3D CAD. The Center has built a “Monozukuri integrated support system” which enables step by step support from product planning to prototype production and commercialization in the product development to support advancement of Monozukuri technologies, shortening of product development period and reduction of development costs for small and medium-sized enterprises. It also provides technical and design consultation services.



Source: Monozukuri Prototype Development Support Center

Figure 5-27 Activities of the Monozukuri Prototype Development Support Center

(2) Introduction of Digital Technology to Support *KAIZEN*

To conduct a time study by importing the video taken in the field to a computer, and to create visual work manual.



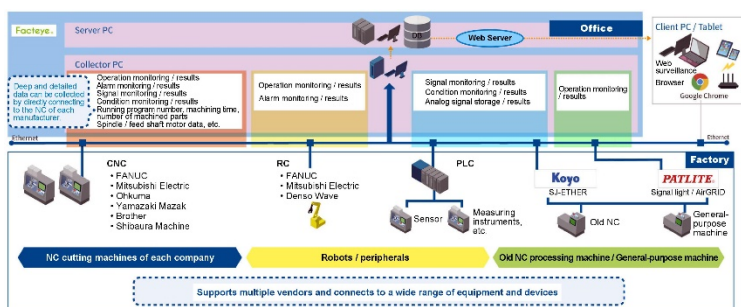
Source: Kobayashi Engineering Works, Ltd.
Figure 5-28 Kaizen by Utilizing a Camera at a Production Site



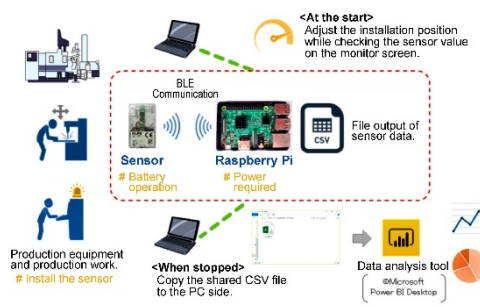
Source: EXS Co., Ltd.
Figure 5-29 Software for Work Analysis

(3) Embedding Sensors in Machines

To introduce technology for measuring data such as work progress, vibration and pressures by embedding sensors in factory machines.



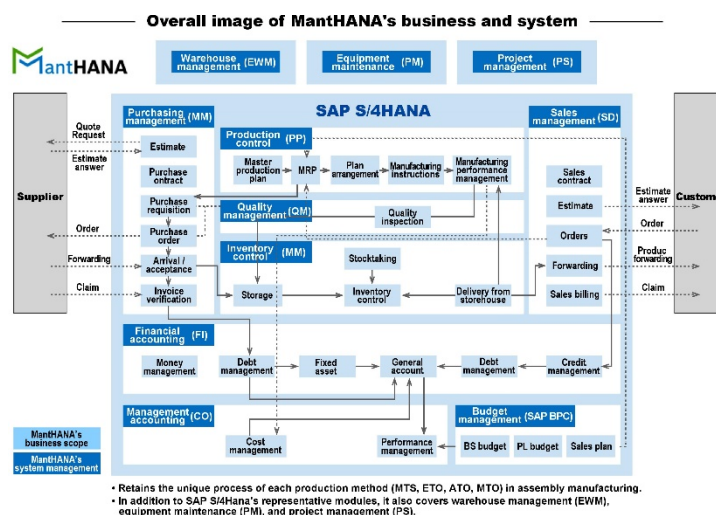
Source: Computer Engineering & Consulting Ltd.
Figure 5-30 Factory Facility Operation Monitoring and Performance Management System



Source: <https://ictinnovate.jp/>
Figure 5-31 Schematic Drawing of IoT Sensor Data Collection Tool

(4) Introduction of ERP

Through networking and digitalization, not only the manufacturing process but also overall optimization from the product development to sales is aimed for.



Source: <https://onetech.jp>

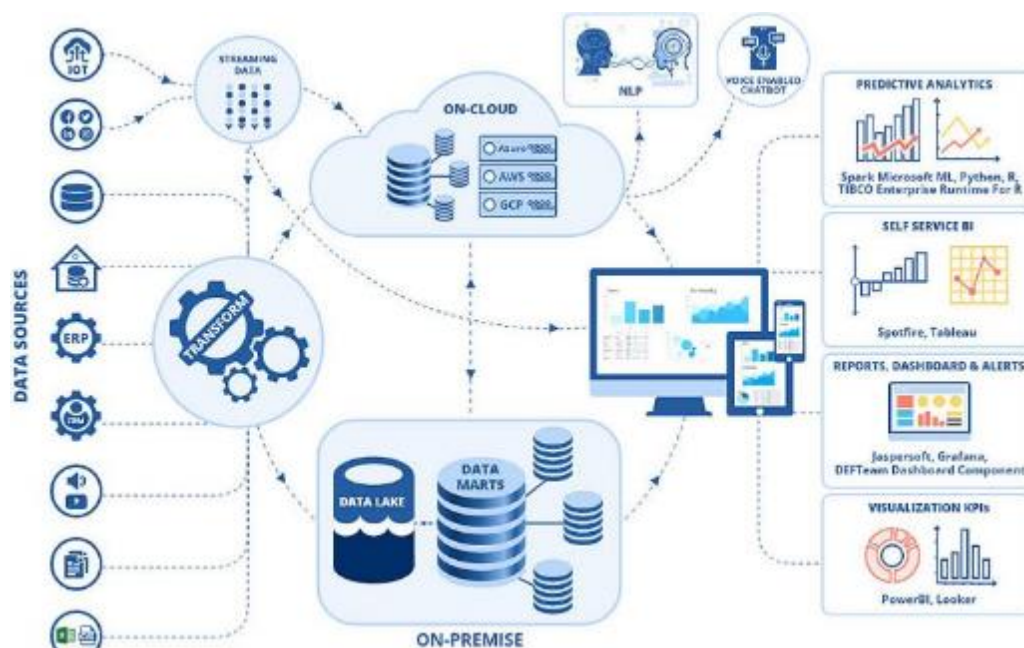
Figure 5-32 Configuration of ERP

Figure 5-33 ERP example

Figure 5-33 ERP example

(5) Business Intelligence (BI) such as Demand Forecast Using Big Data

By analyzing customer data stored in-house to be reflected by AI technology, more accurate demand forecast can be made and used in production plans.

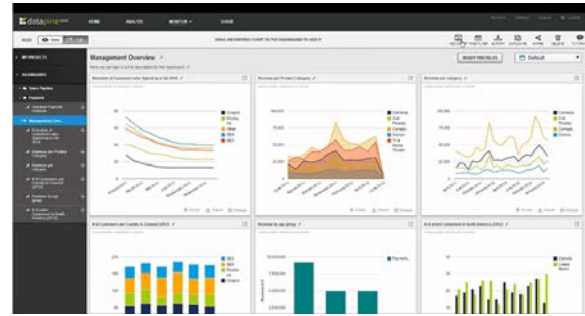


Source: DEFTeam

Figure 5-34 Example of BI (DEFTeam)



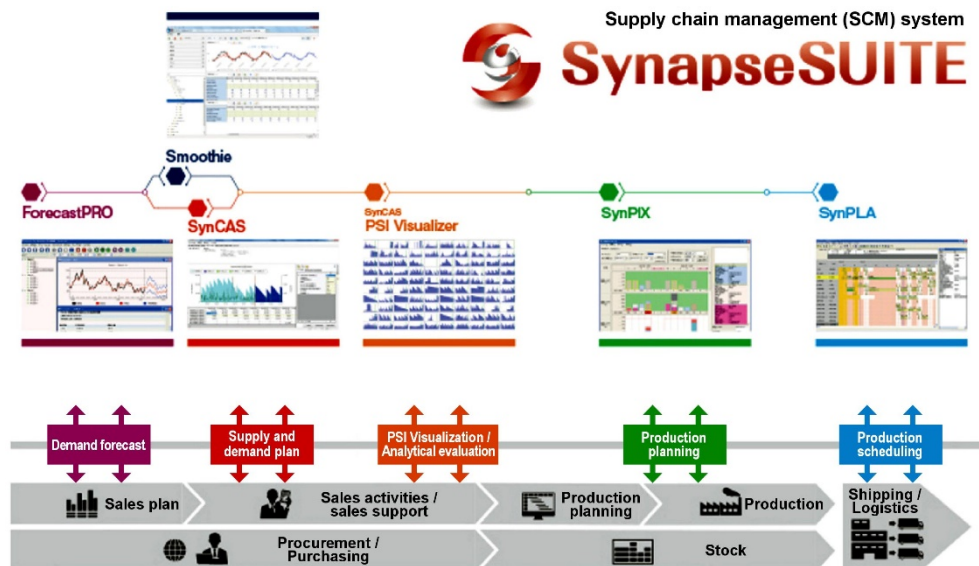
Source: SAP
Figure 5-35 Example of BI (SAP Analytical Cloud)



Source: Datapine
Figure 5-36 Example of BI (Datapine)

(6) Supply Chain Management

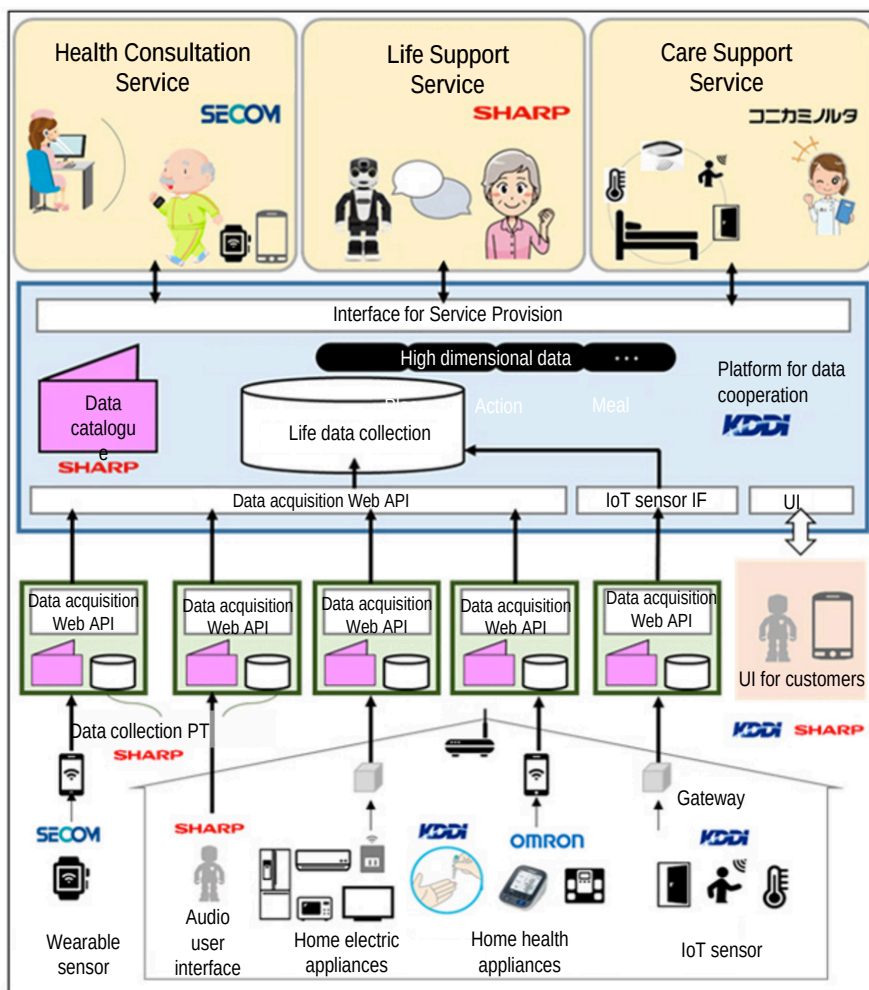
Overall optimization and efficiency of logistics, such as material procurement and delivery, are promoted based on real-time data, and so on.



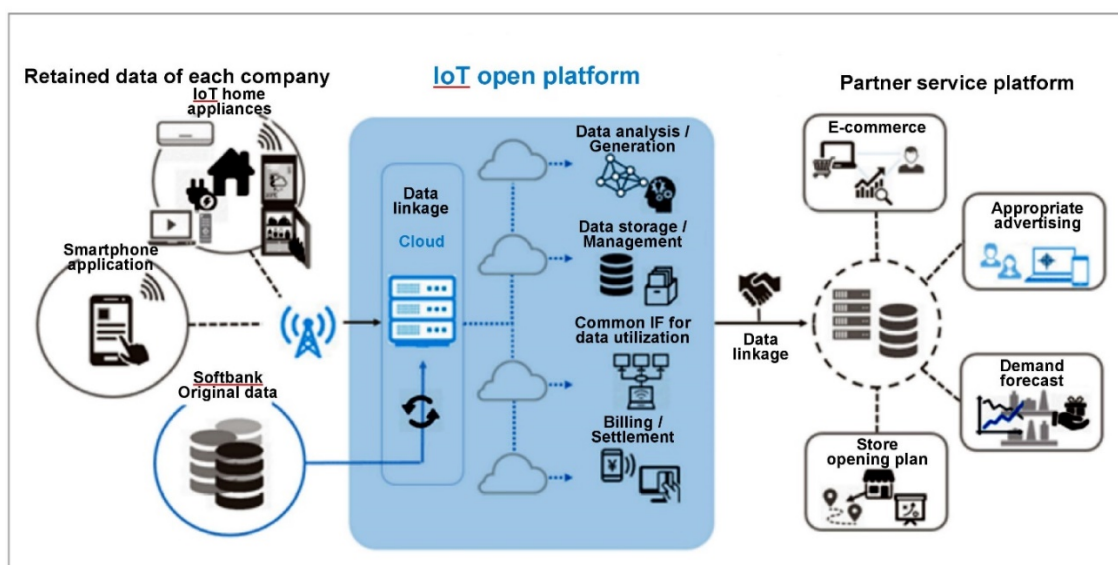
Source: Hitachi Solutions East Japan, Ltd.
Figure 5-37 Example of Supply Chain Management System

(7) Providing After-sales Service Using IoT

To provide after-sales service and information service for customers by embedding devices in products.



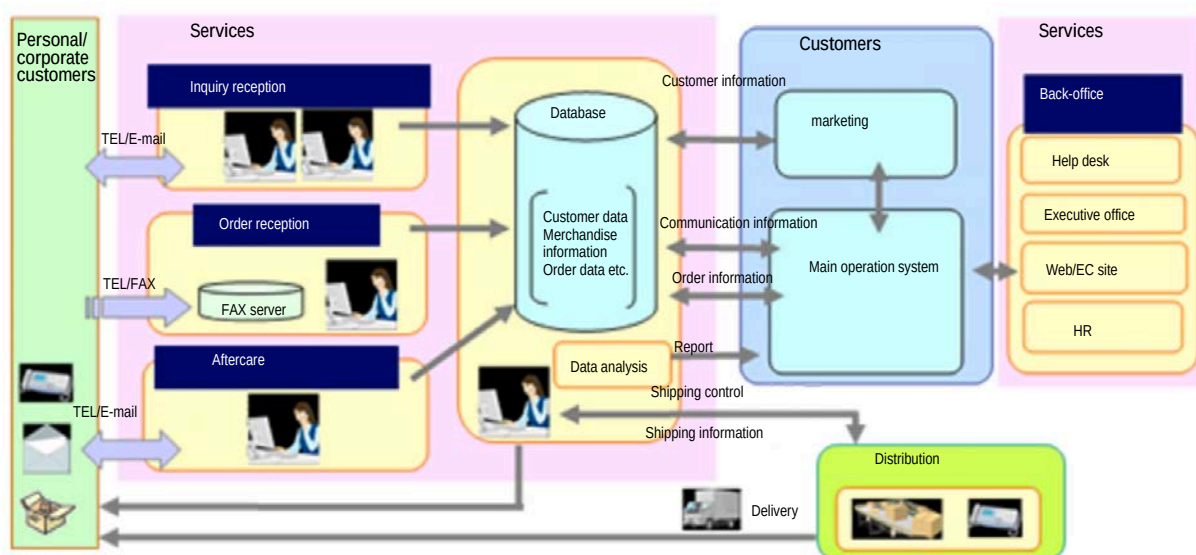
Source: New Energy and Industrial Technology Development Organization
Figure 5-38 Verification of Project Utilizing Information Obtained from IoT Home Appliances



Source: SoftBank
Figure 5-39 Example of Open Platform for Utilizing IoT Home Appliance Data

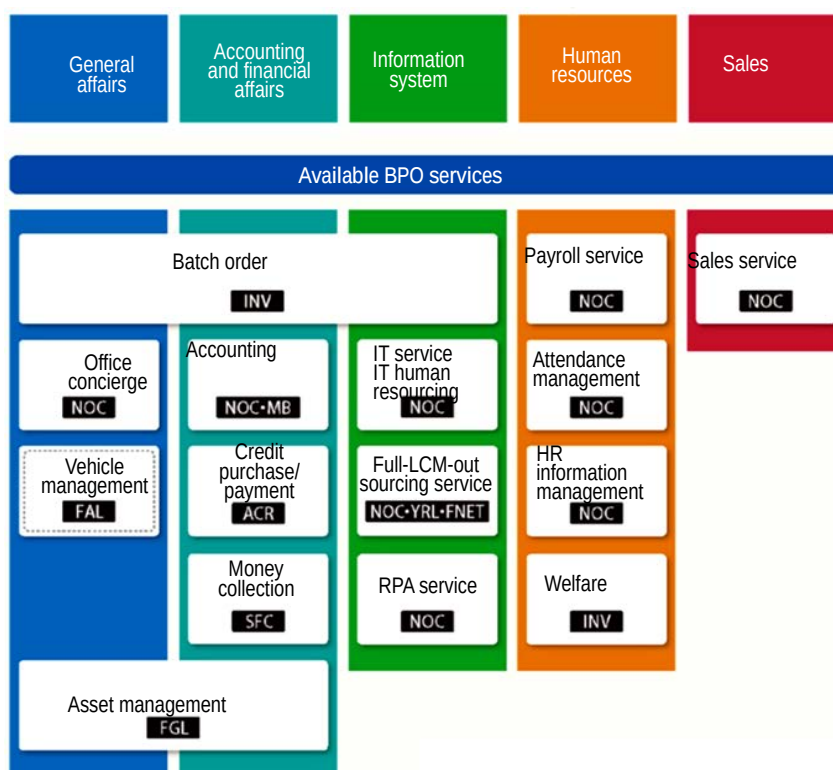
(8) Use of Outsourcing

Taking advantage of high-speed networks and progressing digitization, try to have overall optimization by outsourcing work to the provider of BPO. Also, BPO business is expected to grow as a new business field.



Source: NEC

Figure 5-40 Example of BPO Service



Source: Fuyo General Lease Co., Ltd.

Figure 5-41 Example of Available BPO

5.3. Transport Sector

Cases of utilization of digital technologies in the transport sector are shown. The table below summarizes utilization cases, and specific examples are introduced on the following pages.

Table 5-4 Cases of the Utilization of Digital Technology to Transport Sector

Item	Technology	Specific Examples
Utilization technology of transport Big Data	Utilization of probe data	The movement of vehicles and people can be quantitatively comprehended by cumulating and analyzing probe data (the data which has movement record obtained by vehicle GPS devices and smartphones). It can be used for generating real-time traffic congestion information as well as historical data to be utilized for various traffic management and planning.
	Utilization of mobile station data	Based on the mobile station data held by communication carriers, people's movement can be grasped (people flow analysis). It can be used for various purposes such as road network planning, reorganization of bus networks and examination of core public transport networks.
	Image analysis and AI technology utilization	In addition, by analyzing images taken by the CCTV camera installed on the roadside using AI technology, the image data is utilized as quantitative traffic data. Such data can be used for various applications such as providing traffic information, evaluating locations where accidents occur frequently, and taking countermeasures.
Traffic control and management	Traffic signal control system and relevant technologies	The optimum green traffic signal time according to traffic demand is synchronized between multiple adjacent intersections for system control or planer control. It is also possible to utilize image analysis technology for crackdown on drivers ignoring traffic signals. In addition, emergency vehicle priority signal control can be performed by installing on-board device and roadside communication equipment.
	Utilization of RFID technology ¹³⁹	From RFID tags mounted on vehicles, traveling locus information is collects via roadside antennas. This is utilized in various applications such as grasping moving speed and determining the degree of congestion, as well as crackdown measures such as tracking offending vehicles and collecting tolls.
Highway Management	Highway Traffic Management System	It collects the data/information on various traffic events (such as traffic volume, traffic flow, accident and weather), processes the collected data, and provides highway users with necessary information.
	Electronic Toll Collection System	It is a system to automatically collect the toll fees of highways. Dynamic toll fare becomes possible, and therefore, it is also used for measures such as environmental road pricing and traffic demand management (TDM).
	Overload detection system and application of probe technology	Overloaded vehicles are detected by analyzing data collected from GPS on-board units and smartphones. By collecting traveling locus information, it is also applied to monitoring travel route of large vehicles and consideration of measures against overload.
Management of Public Transport Operation	BRT system	It is a system to assist operation of BRT (Bus Rapid Transit). It consists of multiple components including BRT operation system and e-payment system.

¹³⁹ Technology for exchanging information from tags with embedded ID data via short-range wireless communication using radio waves, etc.

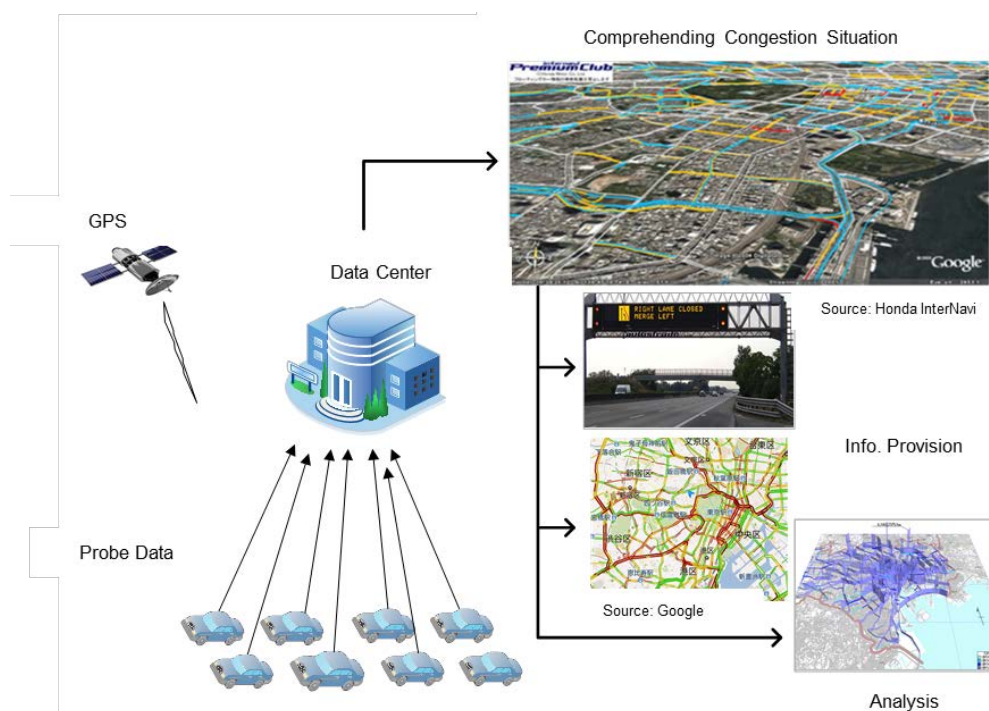
Item	Technology	Specific Examples
	Public transport Priority system for bus	The system is generally known as PTPS (public transport priority system) and aims to ensure smooth operation and punctuality of mass transport such as bus. It works with traffic signal control system. The on-board unit installed in the vehicle communicates with the roadside antenna.
Others	Combination with common smart card and transport measures	A combined utilization with transport measures, for example, by utilizing e-payment system which can be used for different transport modes such as metro and bus, to apply to discount service such as Park & Ride so that road traffic demand can be controlled.

Source: Created by JICA Study Team based on various documents

5.3.1. Traffic Big Data Utilization Technology

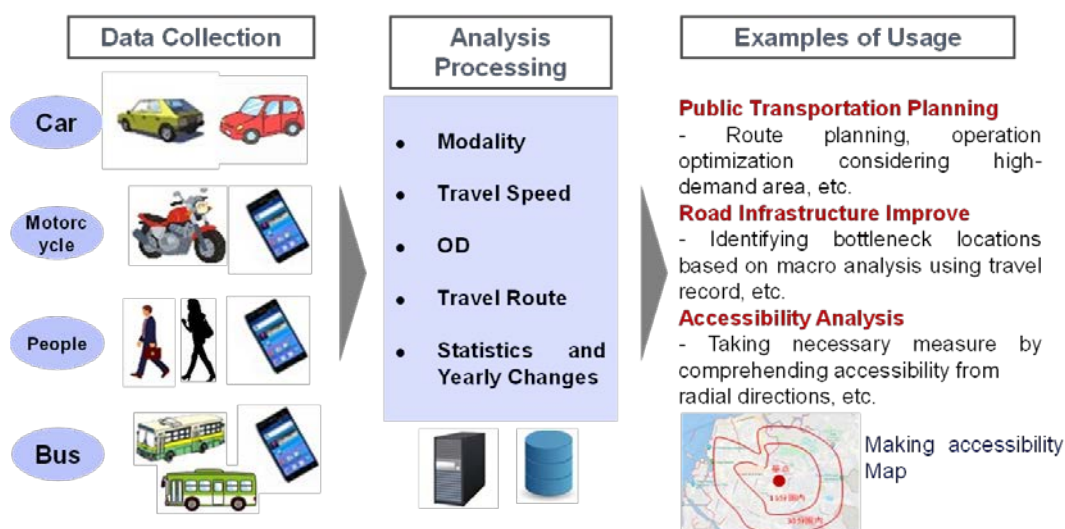
(1) Probe Data Utilization

The movement of vehicles and people can be quantitatively comprehended by cumulating and analyzing probe data (the data which has movement record obtained by vehicle GPS devices and smartphones). The main application to the traffic sector is the generation and provision of traffic congestion information which is also provided by many private services such as Google and Honda. It can be used for various traffic management measures and planning as historical data. (Examples: Google, Honda, SmartDrive and Hitachi).



Source: Honda Internavi, edited by JICA Study Team based on Google materials

Figure 5-42 Probe Data Utilization (1)

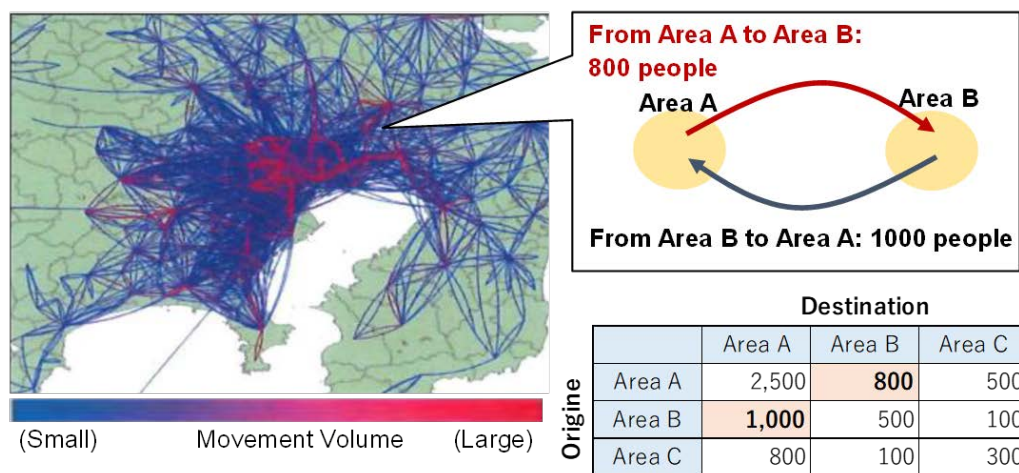


Source: JICA Study Team

Figure 5-43 Probe Data Utilization (2)

(2) Mobile Station Data Utilization

By grasping people's movement based on the mobile station data held by communication carriers (people flow analysis), various uses are possible. The example in the figure below simply shows the statistics of the movement of people per unit time. Such statistic data can be utilized for various purposes including road network planning, reorganization of bus networks, examination of core public transport networks and pre and post evaluation of infrastructure development project (examples: OneForAll Labs Co., Ltd., NTT Docomo).

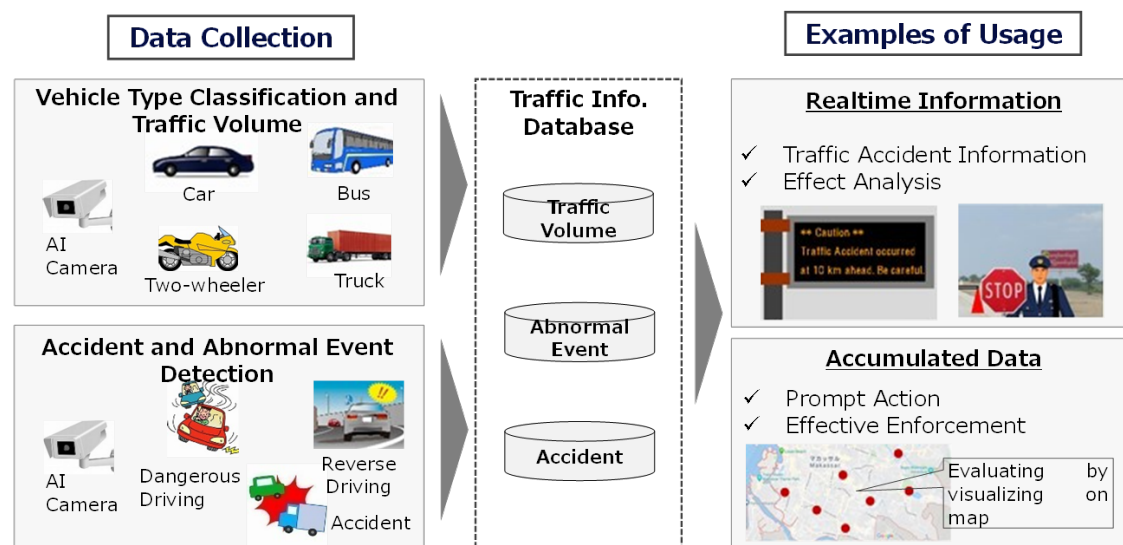


Source: Edited by JICA Study Team based on the material provided by OneForAll Labs Co., Ltd.

Figure 5-44 Mobile Station Data Utilization

(3) Image Analysis and AI Technology Utilization

In addition, by analyzing images taken by the CCTV camera installed on the roadside using AI technology, it is possible to utilize the image data as quantitative traffic data. It can be used for various purposes such as providing traffic information, evaluating locations where accidents occur frequently, and taking countermeasures (examples: Hitachi, Toshiba, NEC).



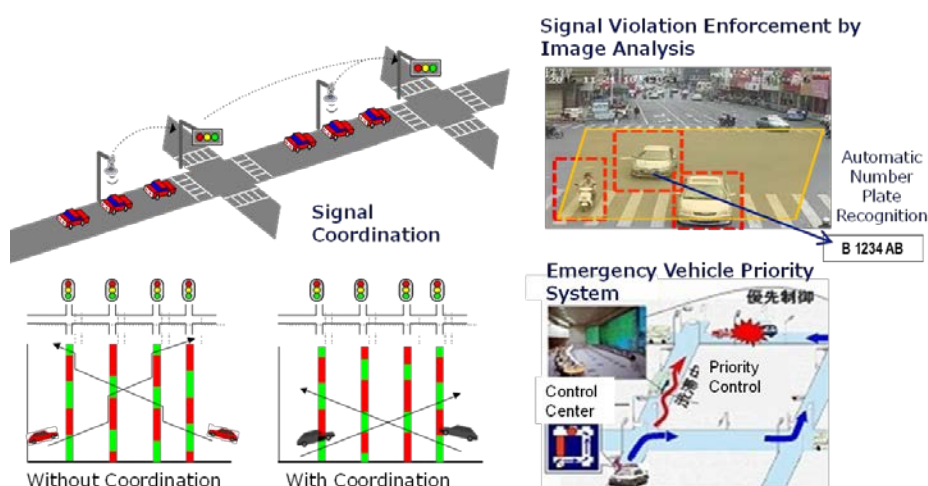
Source: JICA Study Team

Figure 5-45 Image Analysis and AI Technology Utilization

5.3.2. Traffic Control and Management

(1) Traffic Signal Control System and Relevant Technologies

The optimum green traffic signal time according to traffic demand is synchronized between multiple adjacent intersections, and system control or planer control is performed to rectify the traffic flow. It is also possible to utilize image analysis technology for crackdown on drivers ignoring traffic signals. In addition, emergency vehicle priority signal control may be performed by installing on-board device and roadside communication equipment. (Nippon Signal, Sumitomo Electric Industries, Koito Manufacturing, Kyosan Electric Manufacturing, Omron, etc.)



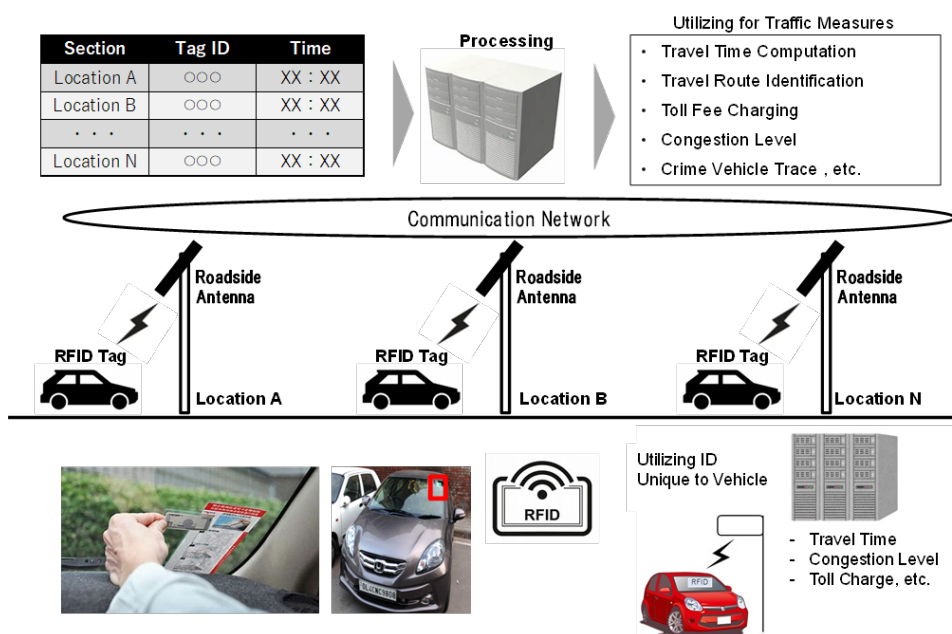
Source: National Police Agency, JICA Study Team

Figure 5-46 Traffic Signal Control System and Relevant Technologies

(2) RFID Technology Utilization

Utilization of RFID technology makes application to various transport measures possible. From RFID tags mounted on vehicles, traveling locus information (ID and transit time) is collected via roadside antennas. This

makes transport engineering applications available such as grasping moving speed between locations (travel speed) and traveling route for each vehicle and determining the degree of congestion, as well as crackdown measures such as tracking offending vehicles, and charging measures like collecting tolls. Charging is conducted not only for collecting road maintenance costs but also for the purpose of traffic demand management as a countermeasure for traffic congestion (example: Mitsubishi Heavy Industries).

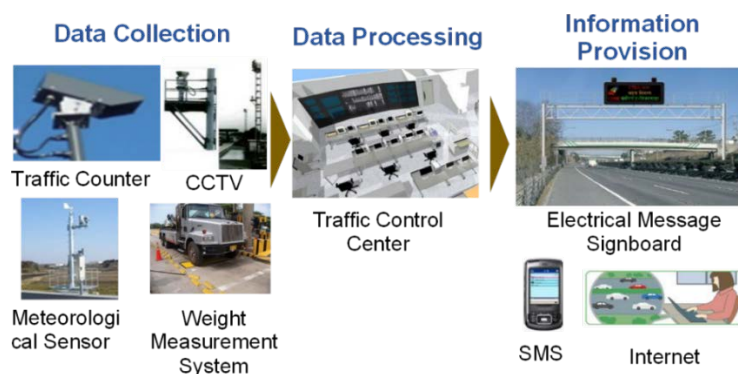


Source: Ctimes.com (photos) and JICA Study Team (figures)
Figure 5-47 RFID Technology Utilization

5.3.3. Highway Management

(1) Highway Traffic Management System

It is a system to assist highway operation. It collects the data/information on various traffic events (such as traffic volume, traffic flow, accident and weather), processes the collected data, and provides highway users with necessary information. Collection means include various devices and sensors such as traffic counters, CCTV cameras, and weather measurement (examples: Highway Traffic Management Systems of Fujitsu and Toshiba).



Source: JICA Study Team
Figure 5-48 Highway Traffic Management System

(2) Electronic Toll Collection System

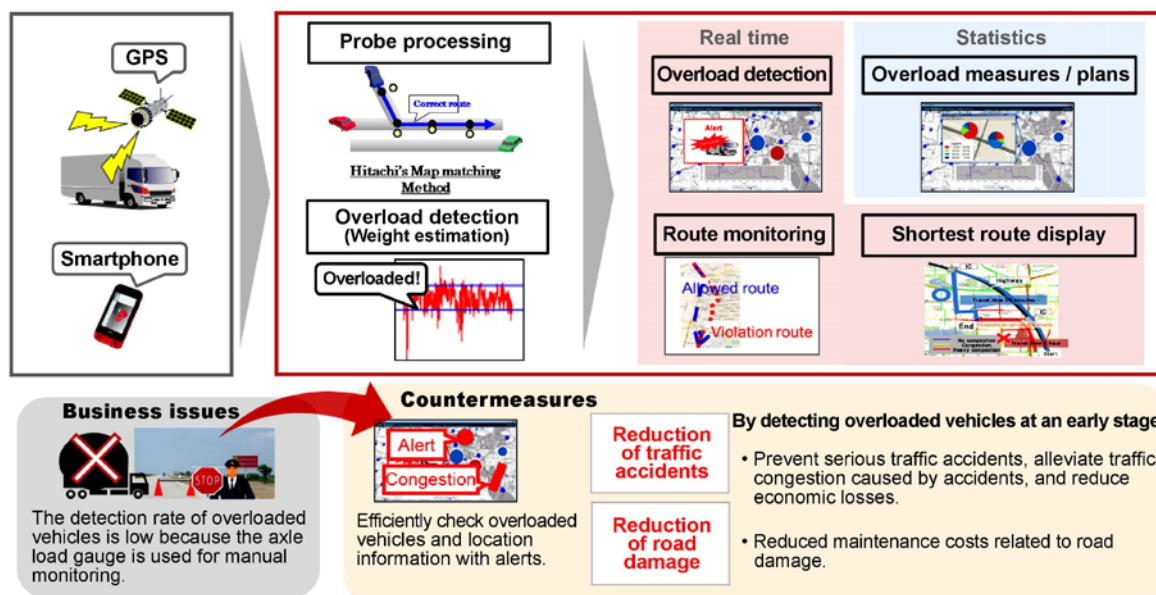
It is a system to automatically collect the toll fee. There are several different types of toll collection systems according to the telecommunication method adopted by individual countries. The type to be adopted is determined by various factors such as national standard policy, cost, technology level, etc. Dynamic toll fare becomes possible, and therefore, it is also used for traffic demand management (TDM) such as environmental road pricing (examples: Electronic Toll Collection Systems of Hitachi and Mitsubishi Heavy Industries).



Source: Edited by JICA Study Team based on the materials of Metropolitan Expressway Co., Ltd.
Figure 5-49 Electronic Toll Collection System

(3) Overload Detection System and Application of Probe Technology

A technology to detect overloaded vehicles by analyzing data collected from GPS on-board units and smartphones (acceleration etc.). Traveling locus information is also collected at the same time so that it is applied to monitoring travel route of large vehicles. In addition, it is used for the calculation and display of more efficient shortest routes as well as for countermeasure considerations by using statistical data such as overload detection results. This technology is also available for roads other than highways (example: Hitachi etc.).



Source: Edited by JICA Study Team based on the materials of Hitachi
Figure 5-50 Overload Detection System and Application of Probe Technology

5.3.4. Management of Public Transport Operation

(1) BRT System

It is a system to assist operation of BRT. It consists mainly of BRT operation system and e-payment system. The BRT operation system is composed of control facility and system such as traffic signal control system, and the management system such as operation management system. The e-payment system includes smart card system. These systems are controlled by the management center (example: BRT operation system of NEC).



Source: Transport Politic, IBM, Lumiplain)

Figure 5-51 BRT System

(2) Public Transport Priority System for Bus

It is referred to as the Public Transport Priority System (PTPS) which is introduced to facilitate smooth passage and ensure punctuality of mass transport such as bus.

It works with traffic signal control system. The approaching vehicle is detected by beacon information obtained from on-board unit installed in the car, and the green light is preferentially given, thereby the vehicle movement is smoothened (examples: Omron and Nippon Signal).



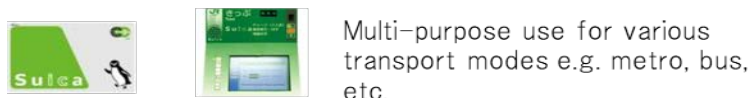
Source: Seibu Bus, citytransportinfo, the National Police Agency)

Figure 5-52 Public Transport Priority System for Bus

5.3.5. Others

(1) Combination with Common Smart Card and Transport Measures

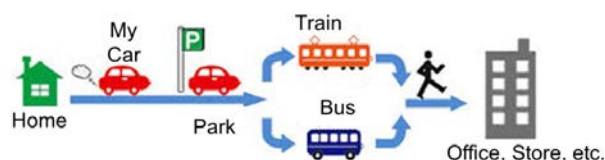
It is an e-payment system which can be used for different transport modes such as metro and bus. It is also generally used for other purposes such as shopping. It is necessary to establish the rules among transport operators or retailers, apart from standardization and preparing clearing mechanism, etc. The system can be flexibly used, such as providing discount services, in accordance with Park & Ride and Electric Vehicle use, etc. (example: SUICA of SONY).



Multi-purpose use for various transport modes e.g. metro, bus, etc.

Source: Tokyo Metro, Seibu Bus

Figure 5-53 Common Smart Card



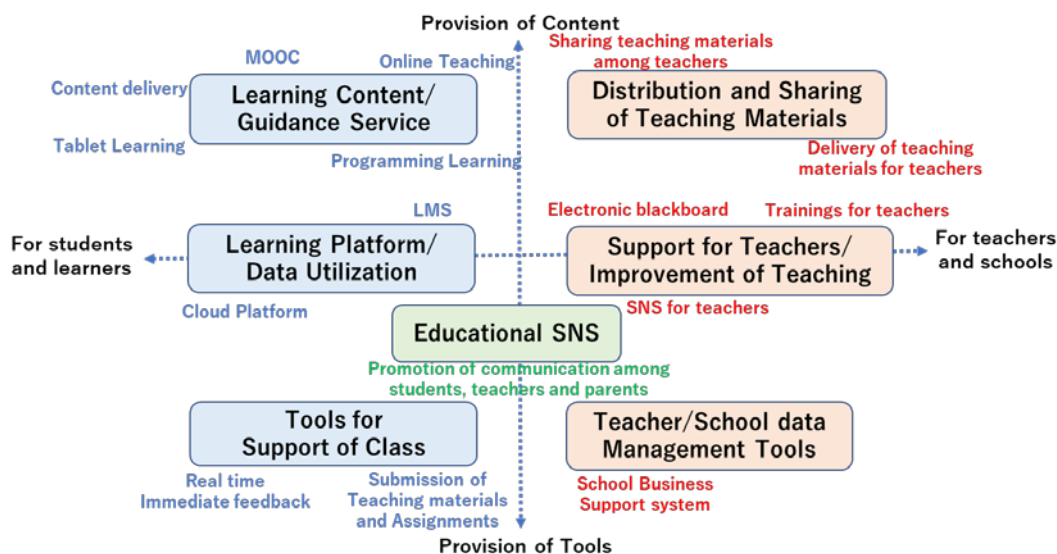
Source: Park24 Co., Ltd., Toyota Motor and MOTA Corporation

Figure 5-54 Combination of Park and Ride Measure and EV

5.4. Education Sector

5.4.1. Education Sector (General)

Utilization of digital technologies in the education sector in general is arranged as follows:



Source: Created by JICA study team based on “Research on advanced ICT utilization measures in education sector (Fujitsu Research Institute)”

Figure 5-55 Overview of Digital Technology in the Education Sector

In accordance with the arrangement in the above figure, utilization examples of digital technologies in the education sector are shown as follows.

Table 5-5 Utilization Examples of Digital Technologies in the Education Sector

Target	Item	Technology	Specific example
Learners	Learning Content/Guidance Service	Digital Textbook and Rich Content	By adding digital textbooks, digitalized versions of textbooks, in addition to rich content, related videos and content with a link function that allows users to jump to the necessary web pages are provided when users turn the page.
		Learning Content Delivery	Learning content distribution to tablets, PCs and smartphones. Not only distributing learning content, but there are functions of workbook and testing, which allows to encourage learning in accordance with proficiency level of individual students. There are some content which has gamification element to make students enjoy learning without being bored.
		Massive Open Online Courses	Providing large and open lectures which can be participated by everyone on the Internet. In the past efforts were made only in higher education, however, in recent years, there are some initiatives in primary education area as well to eliminate educational inequality.
		Online Teaching (Matching)	A service that connects people who need to learn and those who need to teach through video calling tools.
	Learning Platform/Data Utilization	Education Big Data utilization	By collecting, visualizing and analyzing so-called educational Big Data including various learning history and behavior history related to learning, evaluation of learning, various predictions and relationship between grades and learning behavior are clarified and also problems can be found.
	Tools for Support of Class	Immediate feedback	Collecting opinions of class (or training) participants on a real-time basis and showing it in a list enable immediate feedback, leading to active exchange of opinions in class.
Teachers and schools	Distribution and Sharing of Teaching Materials	Distribution and Sharing of Teaching Materials	There are various ways of its utilization. For instance, teachers share their own teaching materials and curriculum with other teachers, distribute the materials to students to use for repetitive learning. The form is not

Target	Item	Technology	Specific example
			limited to the document format, but also disseminated in a wide variety of formats such as movies, games, etc.
	Support for Teachers/Improvement of Teaching	SNS for teachers	Connects teachers who tend to lack communication among them via the Internet across school and community boundaries to realize an environment where teachers support and mutually enhance one another.
	Teacher/School data Management Tools	Integrated School Business Management System	In school business, in addition to usual tasks such as handling grades and creating report cards and timetables, there are a lot of duties such as school registration related procedures including transfers, creation of cumulative guidance reports, management of attendance and preparation of various reports and letters. Introducing the Integrated School Business Management System enables school staff to centrally manage and share information necessary for school and class operations and grasping the situation of children and students so that workload of teachers can be reduced.
For both	SNS for education	SNS for schools	A highly secure communication function among teachers, students and parents is provided. With shared teaching materials, bulletin board function, and shared timetables, communication among related parties is activated.

Source: Created by JICA Study Team based on various documents

Specific examples of utilization cases of digital technologies summarized in the above table are shown as follows.

(1) For Learners

1) Learning content/guidance service

i) Digital textbook and rich content

Begal Co., Ltd. provides a digital book production and distribution service “Wisebook Cloud” as a system for distributing educational materials. Wisebook Cloud is a cloud service which converts a PDF file used as a teaching material into a digital book with a two-step operation for web delivery by selecting public release or limited release. Not only converting paper media such as books into digital books, but it has many functions such as attaching lecture videos prepared in advance and distributing simple quiz using a hide function. It is available as digital teaching material for schools.



Source: Begal Co., Ltd.¹⁴⁰

Figure 5-56 System Configuration Diagram and Usage Image of “Wisebook Cloud” of Begal Co., Ltd.

¹⁴⁰ Begal Co., Ltd. “Wisebook” <https://wisebook.jp/>

ii) Learning content delivery

“SuRaLa,” a peripheral content distribution service provided by SuRaLa Net Co., Ltd., is an ICT teaching material that allows elementary school to high school students to study five subjects: Japanese, mathematics, social studies, science and English. It allows individual students to learn in accordance with their own understanding level. With the lecture, drill and test functions, the cycle of understanding => retention => utilization is repeated according to each person's proficiency level to promote retention of what is learned. As a utilization method in a school, following the introduction of learning unit by a teacher, assignments are confirmed and distributed in “SuRaLa,” and “SuRaLa” learning unit is distributed to children for their preparation. In addition to introduction to elementary schools, junior high schools and high schools in Japan, it has also expanded into Sri Lanka, India and Indonesia. In Indonesia, the Indonesian version of “SuRaLa” has been introduced in the two elementary schools attached to the Indonesia University of Education.



Source: SuRaLa Net Co., Ltd.¹⁴¹

Figure 5-57 Screen Image of “SuRaLa”

“SoroTouch” is a mental calculation learning app which has been installed in more than 100 classrooms of leaning institutes in 6 countries around the world with about 4,000 learners as of July 2020. With SoroTouch, students can acquire the ability to read and understand numbers by learning the four basic arithmetic operations in a well-balanced manner by “looking at to solve and listening to solve.” “SoroTouch Verification Project on the effectiveness of Malaysian/Indonesian Version,” an overseas expansion project of “SoroTouch” was adopted as a demonstration project of 2020 Ministry of Economy, Trade and Industry's Learning and Social Cooperation Project (“Future Classroom” (place of learning) Overseas expansion support project).” Outside of Japan, SoroTouch has been deployed in the United States, China, Hong Kong, Malaysia, Vietnam and Uzbekistan, and has already been released in English, Vietnamese, and Uzbekistan.



Source: Digika Co., Ltd.¹⁴²

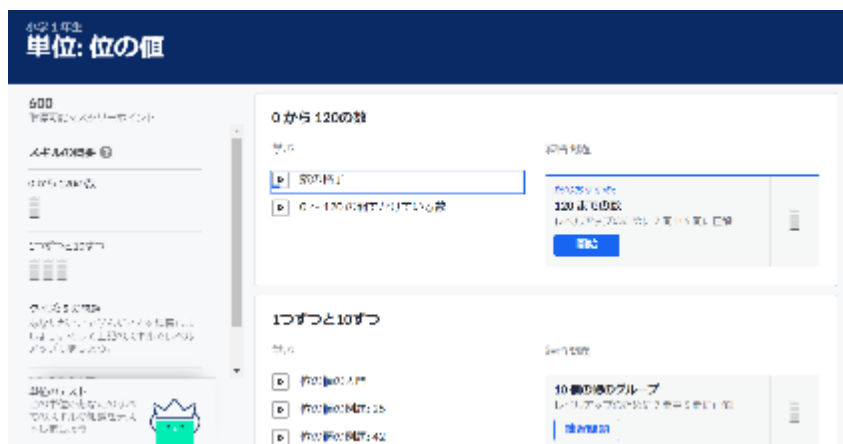
Figure 5-58 Screen Image of “SoroTouch”

¹⁴¹ <https://surala.jp/>

¹⁴² <https://www.sorotouch.jp/index.php>

iii) Massive open online courses

Khan Academy offers online courses which are designed to motivate students to learn, such as asking questions according to each learner's level and giving badges when they achieve a certain level. It also has a function that allows teachers to check the progress of learners in real time, therefore, it is expected to contribute to the elimination of educational inequality by being utilized as flip learning materials and support materials for children who cannot attend school.



Source: Khan Academy¹⁴³

Figure 5-59 Screen Image of “Khan Academy”

iv) Online teaching (Matching)

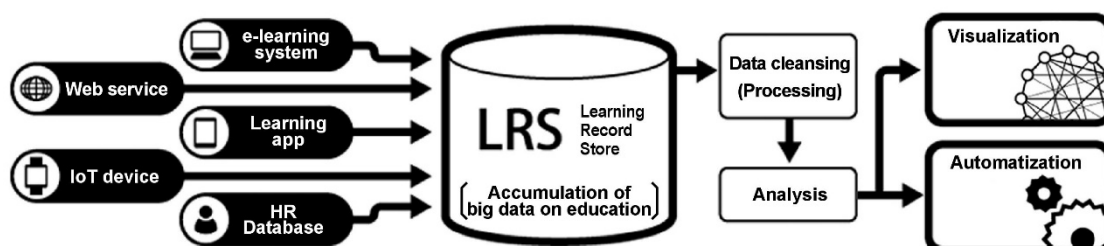
InstaEDU provides a service that connects people who need to learn and those who need to teach through video calling tools such as Skype. Instead of one-on-one class, two or more people can take the same class on a real-time basis on the WEB and can conduct interactive classes.

2) Learning platform/data utilization

i) Utilization of educational Big Data

The learning history and behavior history independently generated and stored by various applications and services such as e-learning, web services and learning apps are passed on to the Learning Record Store (LRS), a service to store learning history, and LRS accumulates such data collectively. This realizes to visualize learning status, and by looking at the analysis results, it is possible to obtain various realization. In addition, by performing automatic processing based on the numerical values and algorithms obtained from the analysis, various services are available, for example, “recommendation function” which recommends next recommended subject based on the current study status, “adaptive” which promotes efficient learning by analogizing areas which learners are not good at as well as points to be learned next, and “detection of dropout signs” which predicts dropouts in advance. Digital Knowledge Co., Ltd. provides a comprehensive Learning Analytics service with these functions.

¹⁴³ <https://ja.khanacademy.org/>



Source: Digital Knowledge Co., Ltd.¹⁴⁴

Figure 5-60 Concept of Educational Big Data / Learning Analytics

3) Tools for support of class

i) Immediate feedback

“Respon” provided by respon, Inc. is able to aggregate, visualize and distribute the opinions of participants in real time at places where many people gather, such as classes lectures and events. In addition to the use to check the level of understanding of students, it is also possible to collect questions before class or collect impressions and mini-reports after class.



Source: respon, Inc.¹⁴⁵

Figure 5-61 Screen Image of “respon”

(2) For Teachers and Schools

1) Distribution and sharing of teaching materials

i) Distribution and sharing of teaching materials

Forestanet provided by SPRIX is a limited information sharing site for teachers and students of teacher training course to prepare for lessons. Currently, more than 400,000 contents are shared, and information that can be used as a reference for daily lessons and class management is provided free of charge. Forestanet was also used in the “Primary Education Mathematics Ability Improvement Project” which is currently implemented by JICA in Senegal, and training and instruction videos are shared between Senegalese and Japanese teachers. Forestanet has been adopted to “2020 Ministry of Education, Culture, Sports, Science and Technology ‘Promotion of Japanese-style education introduction to overseas (EDU-Port Nippon)’ support project” and its business development is promoted in Vietnam.

¹⁴⁴ <https://www.digital-knowledge.co.jp/>

¹⁴⁵ <https://respon.jp/index.html>



Source: SPRIX¹⁴⁶

Figure 5-62 Screen image of “Forestanet”

2) Support for teachers/improvement of teaching

i) SNS for teachers

“SENSEI NOTE” operated by ARROWS Inc. is an SNS for elementary, junior high and high school teachers, and provides services that can be provided to teachers nationwide who have registered their consultations on how to proceed with classes and problems with student guidance. In this service, not only exchanging opinions with teachers from all over the country, but also seeing teaching materials and materials shared and registered by teachers from all over the country is possible.



Source: ARROWS Inc.¹⁴⁷

Figure 5-63 Screen image of “SENSEI NOTE”

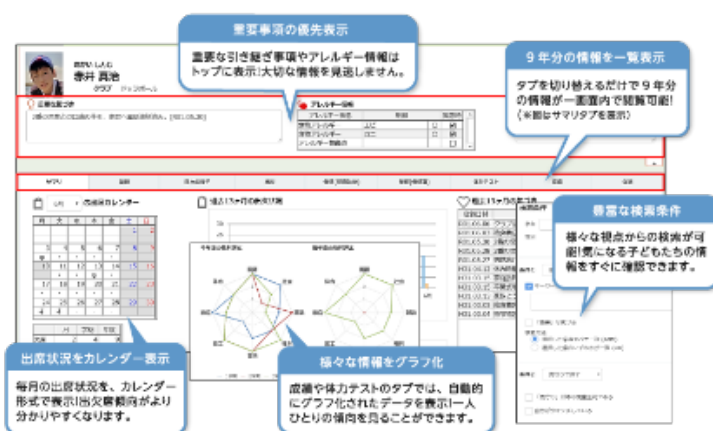
¹⁴⁶ <https://foresta.education/>

¹⁴⁷ <https://senseinote.com/>

3) Teacher/school data management tools

i) Integrated School Business Management System

An Integrated School Business Management System has functions for academic affairs (grading, attendance management, time management, etc.), health affairs (management of health diagnosis slips, infirmary visit, etc.), school registration affairs (cumulative guidance report, etc.), school administrative affairs and so on. Including information sharing by utilizing groupware, it is a school business management system which has the functions necessary to carry out all the duties generally referred to as “school business.” The advantage of introducing the school business support system is, in addition to the fact that the use of the information system can reduce the workload in school business, it makes central management and sharing of information possible. Integrated School Business Management System is developed and provided by many companies such as Cyberlinks Co., Ltd., F1 Co., Ltd., Uchida Yoko Co., Ltd., Suzuki Educational Software Co.,LTD. and Vorax Education Co. Ltd.



Source: Uchida Yoko Co., Ltd.¹⁴⁸

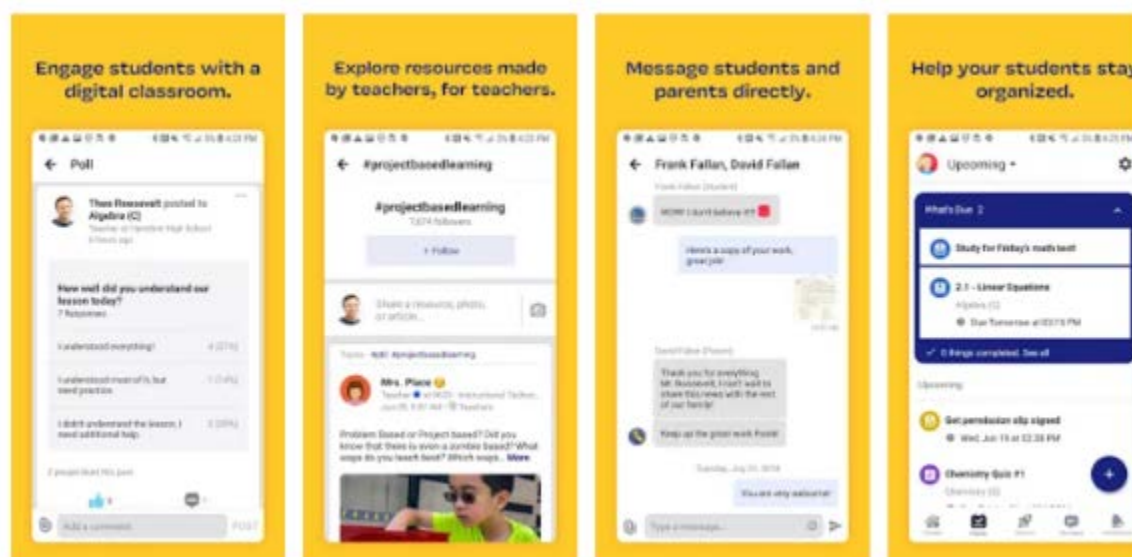
Figure 5-64 Screen image of “Digital School Business of Integrated School Business Management System”

(3) For Learners and Both Teachers and Schools

1) SNS for schools

“Edmodo” is an SNS that allows to share lesson content and assignments only by students, teachers and parents. It provides an environment where teachers can create groups for each lesson and only students and parents with a set password can access to the group. “Edmodo” provides not only communication among students, but also functions for providing information from teachers and posting questions from students to teachers. Parents can monitor lesson trends and communicate with teachers through SNS. A distinguishing feature is that only class participants and parents can participate in the SNS.

¹⁴⁸ <https://www.uchida.co.jp/education/koumu/digitalkoumu.html>



Source: Edmodo¹⁴⁹

Figure 5-65 Screen Image of “Edmodo”

5.4.2. Vocational/Skill Training

In the field of Vocational/Skill training, utilization of VR and AR¹⁵⁰ technologies is advancing to realize more efficient and effective learning. Specific examples are introduced on the following pages.

(1) Vocational Training Program “ActiVaR” Utilizing VR and AR (Ecuador)¹⁵¹

The government of Ecuador adopts the vocational training program “ActiVaR” which utilizes VR and AR. “ActiVaR” aims to improve the efficiency of learners' skill acquisition by using VR and AR and is intended for university and vocational school students in Ecuador. ActiVaR is being promoted with the support of the World Bank, and the IT company “Visyon” based in Barcelona, Spain, has also joined in a partnership. In addition to the Ministry of Higher Education, Science, Technology and Innovation of Ecuador, various public institutions also provide support the program. For VR, head-mounted displays of Oculus Rift, Oculus Go and HTC VIVE are used, while for AR, head-mounted displays of Magic Leap One, Microsoft HoloLens and moverio are used.

¹⁴⁹ <https://new.edmodo.com/>

¹⁵⁰ VR (virtual reality) is a technology that allows a user to experience a virtual space with 360-degree panoramic images by wearing a headset. The realistic image guides the user's field of view covered by the head-mounted display to a different space, making the user experience an immersive feeling. AR (augmented reality) is a technology that expands the real world by superimposing virtual visual information on the real space. The information displayed on the monitor and transparent goggles overlaps with the reality that is spreading in front of the user and becomes a part of it. Furthermore, in recent years, research on the application of MR technology has been advanced. MR (Mixed Reality) is a technology that projects virtual 3D data corresponding to the real space and crosses the reality. MR device recognizes the outer shape and position of the object existing in the real space and projects an image that fits the size and positional relationship, which is different from AR.

¹⁵¹ <https://blogs.worldbank.org/latinamerica/activar-ecuador-launches-its-first-immersive-training-program>



Source: World Bank Blog¹⁵²

Figure 5-66 Vocational Training Utilizing “ActiVaR”

(2) Development and Introduction of Teaching Materials for Construction Work Training Utilizing AR Technology in the Construction Field

At the Polytechnic University, combining software such as AR technology with hardware such as smartphones and tablet terminals, they worked on the development of teaching materials for construction work practice which are easy for beginners to understand, and as a tool for beginners to experience the world seen by skilled workers, “Polytechnic University AR App” was developed. Activating “ARcube” app and holding a built-in camera of tablet or smartphone over a 2D drawing of the teaching material, 3D completed model saved in advance on the cloud and its construction procedure are loaded and displayed on the screen of the device. With this app, students can work at actual construction site while displaying the completed model and structures which they are building. In addition, by overlaying the image on the bar arrangement which has already been constructed, it is possible to compare and check with the completed model. In addition, since images can be freely resized or rotated, complicated places where students are uncertain about during on-site assembly work can be enlarged to check with detailed work procedure. The result of the verification experiment of the effectiveness of this app showed that assembly time of the construction practice was shortened by 35% and the construction practice has become more efficient. Also, after students experienced, it becomes easier for them to imagine arrangements to specific work procedure by imaging 3D shape from 2D drawing even without using the app, which shows that there is an effect to retain knowledge.

¹⁵² <https://blogs.worldbank.org/latinamerica/activar-ecuador-launches-its-first-immersive-training-program>

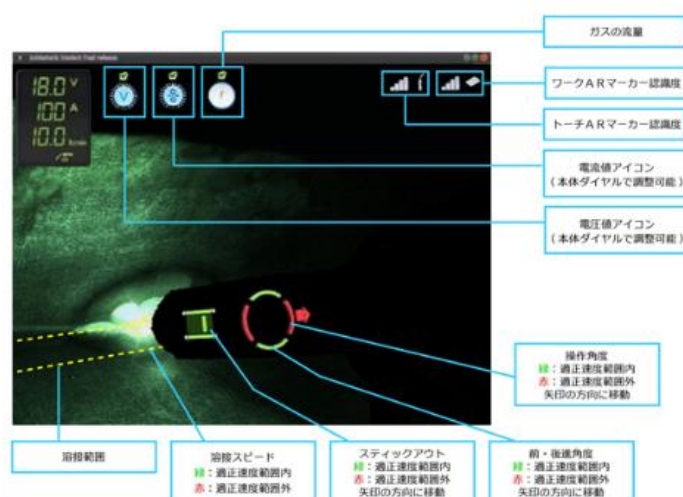


Source: Stakeholdercom Ltd.¹⁵³

Figure 5-67 Screen Images of “Polytechnic University AR Bar Arrangement Drawing & Steel Frame Drawing App”

(3) AR Welding Training

The “AR Welding Skill Training System” marketed by Asahi Electronics Co., Ltd. is an AR-integrated e-learning system for welding developed by the Spanish IT company “SOLDAMATIC,” and is the world’s only welding skill simulation using AR. Since no expensive consumables are required, the cost can be significantly reduced. In addition, since it is possible to select the optimum program according to the user’s level, learners can acquire advanced welding skills in a short time while improving learning efficiency, and they can acquire on-site feeling and skills which are only learned on site as well as right knowledge required for welding. Since the work procedures and movements of advanced welders are converted into data in the software built into the AR Welding Skill Training System, by repeating the training, advanced skills are acquired naturally. Over 3,000 units of the company’s AR Welding Skill Training System have been operated globally, and in Germany, the system is also used for welding training by Mercedes-Benz AG.



Source: Asahi Electronics¹⁵⁴

Figure 5-68 Operation Screen of “AR Welding Skill Training System”

¹⁵³ <https://www.sh-com.jp/portfolio097/> (commissioned by Polytechnic University, Stakeholdercom Ltd. developed “Polytechnic University AR bar arrangement drawing & steel frame drawing App” for Android)

¹⁵⁴ <http://www.aec.co.jp/solution/ss/products/soldamatic/information.html>

5.5. Health Sector

5.5.1. Utilization of Digital Technology in the Health Sector

Today, digital technologies are used in a wide range of areas of the health sector. Typical areas alone, they have been applied from upstream to downstream of health services and examples are seen in product development of medical device manufacturers, new drug development by pharmaceutical manufacturers, efficiency in hospital management, digitization of medical information, diagnosis and treatment such as AI diagnosis, remote diagnosis and remote treatment, health monitoring using wearable devices, provision of medical and pharmaceutical information and education of medical profession. Utilization of digital technologies in the health sector has been penetrated with terms such as “eHealth,” “healthtech” and “smart healthcare.”

Table 5-6 Utilization of Digital Technology in the Health Sector

Fields	Cases of utilization of digital technology
Health/medical management system	- Formulation and implementation of health policy based on HMIS - Building an effective medical service provision system through an inter-hospital network - Management of emergency transport by AI - Prediction of prevalence of infections - Management of health insurance program
Medical HR development	- Educational software content for medical profession - Training system utilizing VR - Remote education system
Development and production of diagnostic/therapeutic devices	- Development of medical tools using the latest digital technology - Development of medical robot - Development of wearable devices
Development and manufacturing of medicine	- Development of medicine by AI and Big Data analysis - Utilization of digital technology for clinical trials
Hospital management	- Utilization of IoT for hospital management - Digitalization of hospital procedures - Digital monitoring of prescription and medication - Health insurance program management system - Electronical medical record/patient data management
Diagnosis/Treatment	- Remote diagnosis and remote treatment - AI assisted diagnosis - 3D operation support software
Monitoring health/Prevention	- Application for keeping health - Monitoring health by wearable devices (mHealth)
Medical/health platform	- Portal site for introducing and booking hospitals - Portal site of medicine

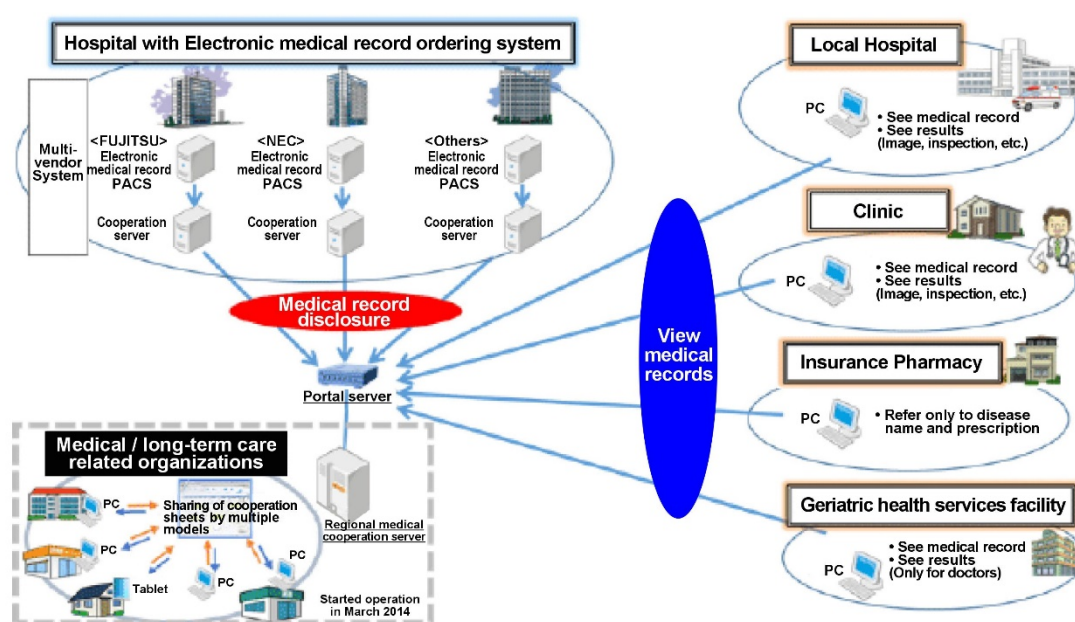
Source: JICA Study Team

5.5.2. Cases of the Utilization of Digital Technology in the Health Sector

Specific examples of utilization of digital technologies in the health sector are as follows.

(1) Medical Information Collaboration Network

In order to provide high-quality medical care services to residents, a network is constructed in which medical institutions such as hospitals, clinics, pharmacies, home nursing providers, and home visiting care providers share patient information via ICT. In Japan, such collaboration network is constructed and operated by region.

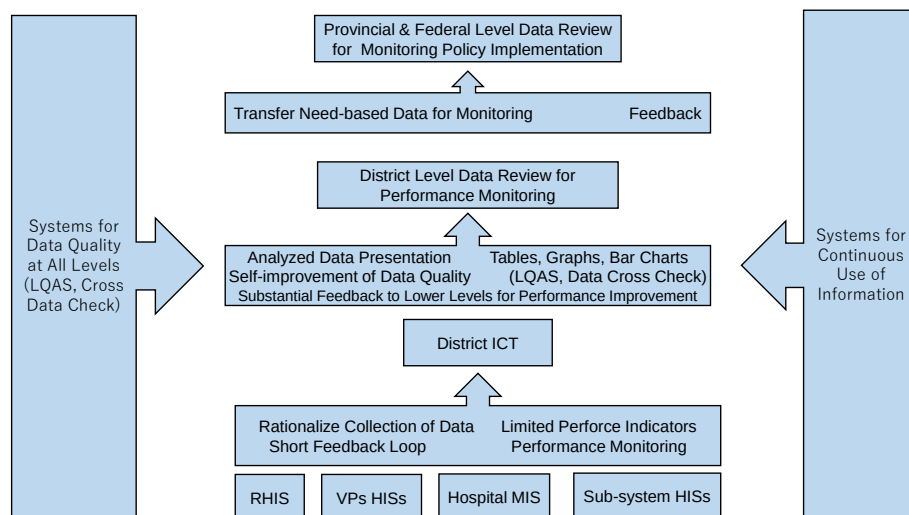


Source: Medical Network Okayama Council
Figure 5-69 Case of Medical Information Collaboration Network

(2) Health Management Information System (HMIS)

Health and medical information system collects, analyzes, disseminates, and utilizes instantly reliable information on health determinants, performance of health and medical institutions and health status of residents. Of which, HMIS is a system which reports information from health and medical institutions. HMIS aims to collect quality health information from health and medical institutions on a regular basis and to use that information to improve the performance of medical service provision. The information collected includes patient and client information (symptoms and conditions, history of treatment and vaccination, diagnosis results, etc.), medical institution information (number of patients, bed occupancy rate, scope of service, human, financial and physical resources, quality of health services, prevalence and incidence of illness, etc.) and medical system information (morbidity, mortality, number of births and deaths, etc.).

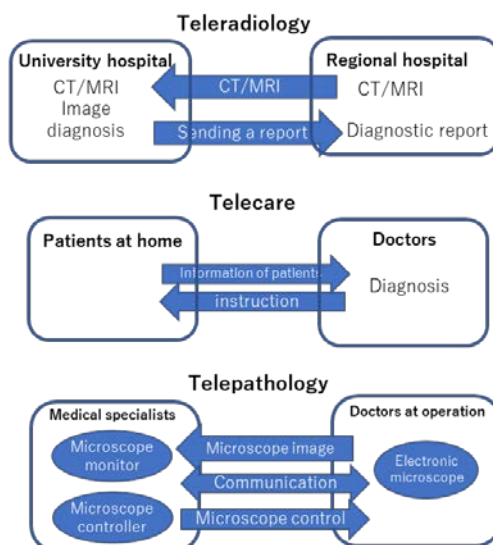
District Health Information System (DHIS) is a districtwide HMIS that collects, processes, and analyzes data of district level medical institutions and provides that information to primary and secondary level medical facilities. DHIS provides baseline data for the implementation and monitoring of district plans for key indicators such as disease patterns, preventive services and physical resources. Showing below is a case of DHIS in Pakistan.



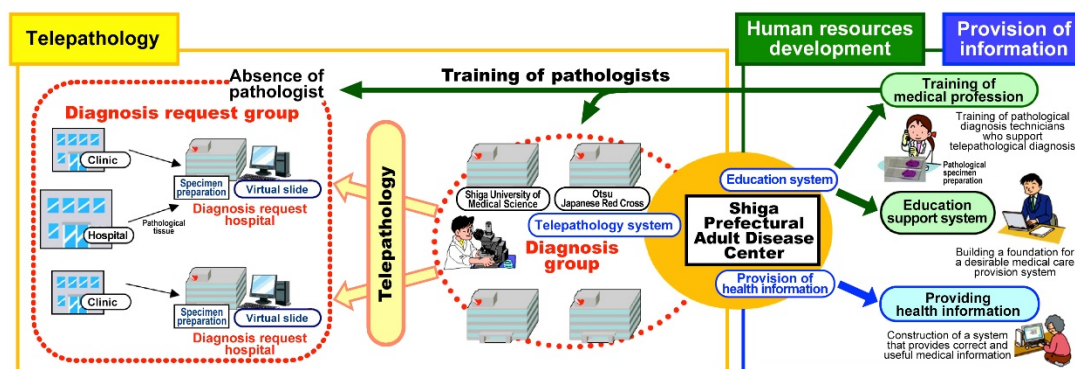
Source: DHIS Project for Evidence-Based Decision Making and Management
Figure 5-70 Case of District Health Information System

(3) Remote Medical Services

Remote medical services are becoming more widespread in many countries in order to correct regional difference in medical services and improve the quality of medical services and convenience for patients while capacity of communication networks is increasing and information and communication equipment has been available at lower prices. Remote medical services are classified into teleradiology, telecare and telepathology.



Source: Ministry of Health, Labor and Welfare (Japan)
Figure 5-71 Case of Remote Medical Services



Source: Shiga Medical Center Research Institute
Figure 5-72 Case of Telepathology Network



Booking system

Source: CLINICS

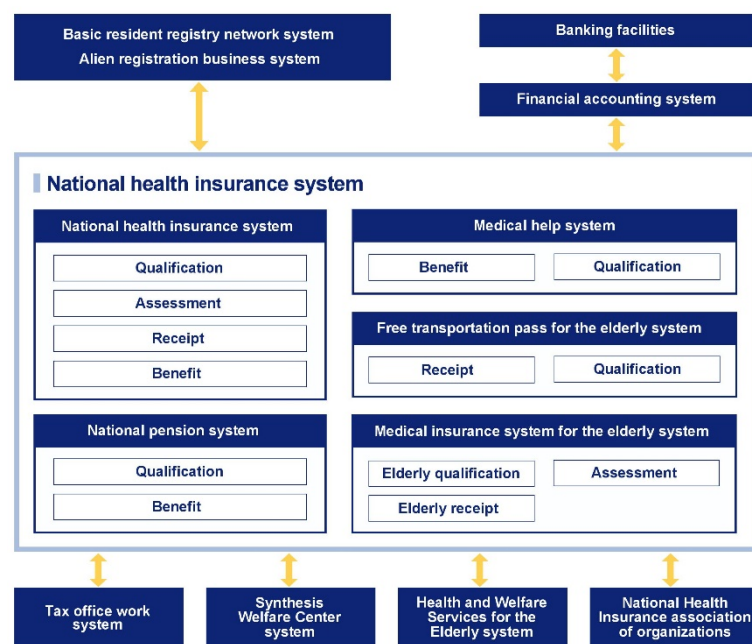
Telemedicine

Electronical medical record

Figure 5-73 Case of Cloud Medical Care Support System

(4) Health Insurance Program

The public health insurance system for the whole nation differs from country to country due to differences in medical systems and administrative systems. However, in any country, a large-scale system covering medical institutions and health insurance institutions nationwide related to claim payment is required. In the case of Japan, the system shown below is used, and it is roughly divided into a system related to insurance premium payment of insured and a system related to the billing and payment of medical expenses when receiving medical services.

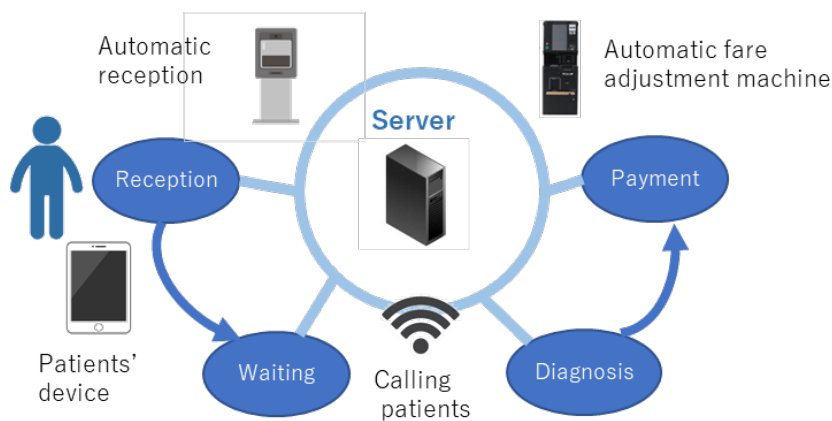


Source: NTT Data Kansai

Figure 5-74 Case of Health Insurance System

(5) Hospital Management System

The system consists mainly of an electronic medical record server and an outpatient information server, and provides services from appointment management, reception, calling patient in the waiting room, examination support, prescription preparation to payment of medical expenses.

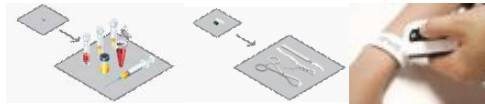


Source: Fujitsu GENERAL

Figure 5-75 Case of Hospital Management System

(6) Utilization of RFID at Hospitals

Attaching RFID to medical devices, medicines, supplies, patients, etc., helps perform simple and efficient management, prevent medical malpractices and wandering about of patients.



Source: Murata Manufacturing Co., Ltd., AINIX Corporation
Figure 5-76 Case of Utilizing RFID at Hospitals

(7) Application for Keeping Health

It is an application which can record and manage information for keeping health such as weight, blood pressure, exercise and diet, and is used for maintaining health.



Source: Tanita
Figure 5-77 Case of Application for Keeping Health

Chapter 6 Development Issues and Applicable Digital Solutions Identified through Local Workshops

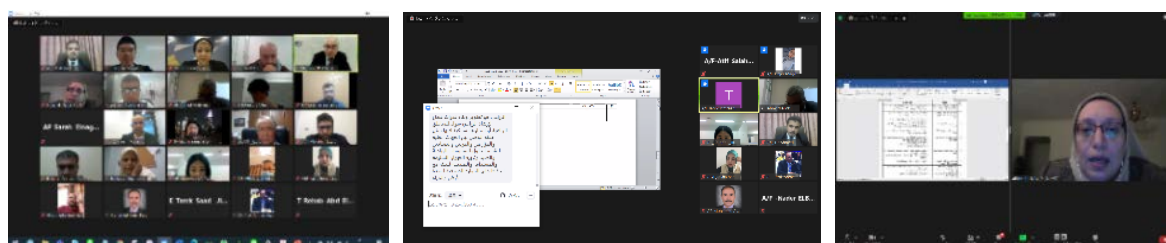
6.1. How to Extract Development Issues and Digital Technologies Applicable to Resolution

Chapter 4 formulated some hypotheses of development issues in the survey target sectors. The JICA Study Team narrowed down development issues by having local institutions and knowledgeable persons discuss the real issues and present new issues using these hypotheses as a basis for discussion through online workshops and interviews.

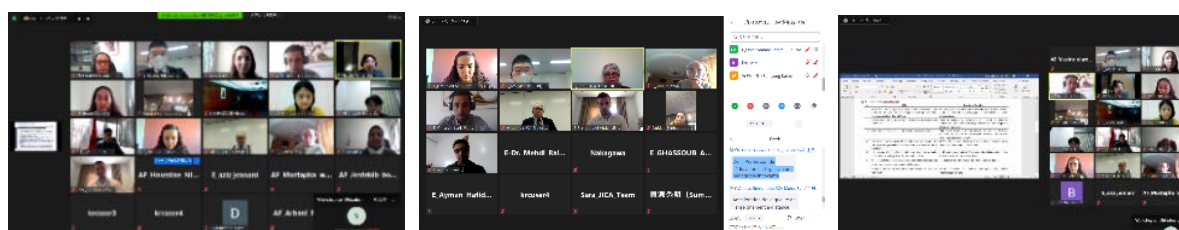
Then, the JICA Study Team collected ideas of local institutions and knowledgeable persons about the utilization of digital technologies to solve the issues of the target sectors through online workshops and interviews.

Only for Tunisia, the JICA Study Team held the first workshop (extraction of issues) in the field on March 4, 2020. However, the survey became difficult to continue due to the COVID-19, so the JICA Study Team returned in the middle of the survey.

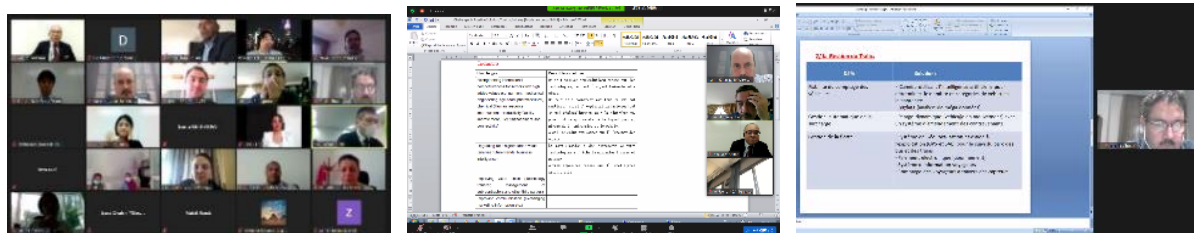
The JICA Study Team continued to monitor the possibility to visit the three countries paying attention to the conditions of COVID-19. However, even in September 2020, there was no prospect of resuming a trip. Therefore, the JICA Study Team agreed with JICA to hold the following workshops online according to JICA's policy of shifting a field work to a work in Japan under the Covid-19 pandemic. The second workshop in Tunisia (utilization of digital technologies) was held online by connecting to Tunisia by Internet from Japan on November 11, 2020. As for Morocco and Egypt, the JICA Study Team extracted issues and discussed utilization of digital technologies online on November 19th and 22nd, respectively.



Overall scenes of the Zoom meeting Scene of discussion Presentation by attendees
Figure 6-1 Scenes of the Workshop with the Local Persons Concerned in Egypt (November 22, 2020)



Overall scenes of the Zoom meeting Scene of discussion Presentation by attendees
Figure 6-2 Scenes of the Workshop with the Local Persons Concerned in Morocco (November 19, 2020)



Overall scenes of the Zoom meeting

Scene of discussion

Presentation by attendees

Figure 6-3 Scenes of the Workshop with the Local Persons Concerned in Tunisia (November 11, 2020)



Overall view of the venue

Scene of discussion

Presentation by attendees

Figure 6-4 Scenes of the Workshop Held in Tunisia (March 4, 2020)

6.2. Egypt

6.2.1. Agriculture and Fisheries Sector

(1) Confirmation of the Priority Development Issues and Proposed Solutions

1) Issues presented in the workshop

In the workshop, mainly the following issues were confirmed.

Agriculture

- It is not possible to monitor the conditions of farms.
- It is not possible to predict weather, which hinders the improvement in the productivity.
- Water resources are yet to be used effectively.
- Farming input is not performed appropriately.
- Agricultural producers are not improving the values added to their products.

Fishery

- Overfishing is getting severer.
- Wrong fishing methods are applied (such as use of a trawl net in a coral reef area).
- Problem of plastic wastes
- Negative impact of foreign species on the ecosystem
- Illegal fishery
- Aqua farming technologies are yet to be developed.

- A lot of agricultural and fishery products are wasted.
- Bleeding of juvenile fish is yet to be developed.

2) Solutions proposed through the workshops

Mainly the following solutions were proposed in the workshops.

Agriculture

- The conditions of farms can't be monitored.
 - Construction and development of sensors which can collect data such as the atmospheric temperature, humidity, and soil conditions (humidity and salt concentration) and systems which can analyze such data (for example, Nile Bot was already commercialized)
 - Visualization of the affluent experiences and track records of agricultural extension workers and development of a sharing system
 - Construction of an agricultural land bank
- Weather can't be predicted, which hinders the improvement in the productivity
 - Weather forecasts focusing on narrower areas
 - Development of a system which can make prior warnings such as low rainfall/high rainfall forecasts and dry weather advisory
- Water resources are yet to be used effectively
 - Visualization of the water volume of water sources
 - Development of desalination technologies and recycling systems
 - Introduction of drip irrigation
 - Utilization of rainwater and groundwater
- Farming input is not performed appropriately
 - Development of a system to notify the timing to use fertilizers
 - Development of organic fertilizers
 - Provision of timely advices by agricultural extension workers
- Agricultural producers are not improving the values added to their products
 - Construction of cold chains (to prevent agricultural products from becoming rotten)
 - Learning of food processing technologies and introduction of equipment for it

Fishery

- Overfishing is getting severer
 - Training for fishers regarding long-term impacts of over fishing
 - Collection of correct information of each fishing grounds (grasping of fish schools, etc.)
 - Improvements in fishing nets (not catching juvenile fish, increasing the mesh size, etc.)
 - Selection and announcement of fish allowed to be caught

- Wrong fishing methods (such as use of a trawl net in a coral reef area)
 - Training for fishers
- Problem of plastic wastes
 - Training for fishers regarding impacts of dumping of plastic wastes
 - Development of containers made of materials which revert to nature
 - Cracking down on polluted water from plants (installing sensors, etc.)/Development of methods to clean polluted water
- Negative impact of foreign species on the ecosystem
 - Collection of foreign species
 - Execution of surveys on the impacts of foreign species (whether sensors, etc. can be utilized)
 - Consideration of how to use foreign species
- Illegal fishery
 - Development of systems to confirm fishery in illegal places (installation of beacons to ships, etc.)
- Aquaculture technologies are yet to be developed
 - Introduction of water quality management systems
 - Support for the shift to aquaculture by small-scale fishers
 - Introduction of technologies to farm multiple types of fish depending on water depths
 - Automation of feeding
 - Introduction of systems combining aquaculture and hydroponic culture
 - Promotion of marine culturing
- A lot of agricultural and fishery products are wasted
 - Development of comprehensive systems to manage all of production, storage, delivery, and processing
- Bleeding of fry (young fish) is yet to be developed
 - Learning of aqua farming technologies of fry (young fish)
 - Thorough water quality management

(2) Assumed Stakeholders

Considering these, the JICA Study Team assumed the following stakeholders as shown in the following table.

Table 6-1 Assumed Stakeholders (Agriculture and Fishery Sector in Egypt)

Institution name	Overview
Ministry of Agriculture and Land Reclamation	Ministry which has jurisdiction over agriculture and fishery in Egypt.
General Authority for Fish Resources Development (GAFRD)	The agency which is responsible for the fisheries industry in Egypt. It has been decided in 2021 that it will be separated from the Ministry of Agriculture.
National Institute of Oceanography and Fisheries (NIOF)	Institution to maintain and develop ocean and freshwater resources under the umbrella of the Ministry of Science and Technology of Egypt
National Research Centre	Main laboratory under the umbrella of the Ministry of Science and Technology of Egypt

Institution name	Overview
Ministry of Water Resources & Irrigation	Ministry which has jurisdiction over water resource management in Egypt.

Source: JICA Study Team

6.2.2. Transport Sector

(1) Confirmation of the Priority Development Issues and Proposed Solutions

1) Issues presented in the workshop

In the workshop, mainly the following issues were confirmed.

Improvements in traffic safety

Various factors to hinder improvements in traffic safety. The following shows the main factors:

- Traffic manners and lack of awareness of traffic safety among drivers and pedestrians
- Vehicles broken due to poor maintenance
- Defects of road structures, etc.

Problems related to commercial vehicles

- Traffic jam in expressway tollgates caused by commercial vehicles
- Wait time due to inefficiency of customs clearance
- Damage of roads caused by overloaded vehicles
- Hindrance of traffic and accidents due to entrance of large vehicles and lanes dedicated to ordinary vehicles

Problems related to Cairo Metro

- Outdated vehicle parts whose manufacturing has been discontinued (Cairo Metro line 1 and line 2)
- Inefficient connection between Metro and other traffic networks
- Insufficient communication among the related departments in Metro operators
- Management and maintenance associated with increases in the number of operations of Metro

Traffic jam

- Various factors which cause traffic jam
- Air pollution, time loss, etc. caused by traffic jam

Utilization of traffic data

- Traffic measures using traffic data appropriately (planning and execution)
- Sharing of data among the related institutions, etc.

2) Solutions proposed through the workshops

Mainly the following solutions were proposed in the workshops.

Improvements in traffic safety

- Arrangement of an accident database and its utilization by the related departments (countermeasures against various accidents, emergency services and firefighting, etc.)

- Improvements in road infrastructures in sectors and points where accidents occur frequently through utilization of accident data
- Provision of information about the traffic conditions of the roads to road users through various media including radio and information boards
- Extension of traffic signals
- Smart hump to prevent the driving speed from becoming too high
- Improvements in road structures
- Utilization of IT for education curriculum, training courses, etc. regarding traffic safety

Problems related to commercial vehicles

- Streamlining of vehicle management, operation management, and transport management using RFID and other digital technologies
- Tracking of and cracking down on vehicles violating traffic regulations using RFID and digital technologies

Problems related to Cairo Metro

- Replacement of the current Metro systems (Line 1 and line 2)
- Unification of the available electronic payment methods among different transport facilities
- Digitization of in-house management of Metro operators, etc.

Traffic jam

- Introduction and promotion of clean energy mobility such as EV vehicles
- Improve the service quality (convenience, comfort, and reliability) of public transport to shift the road traffic demands to public transport
- Systematization of the salary management of drivers and introduction of a system to grant points to the drivers in coordination with their driving manners

Utilization of traffic data

- Digitization of traffic management, traffic survey using information technologies, arrangement of a database of accident information, and utilization of data for accident countermeasures
-

(2) Assumed Stakeholders

Considering these, the JICA Study Team assumed the following stakeholders as shown in the following table.

Table 6-2 Assumed Stakeholders (Transport Sector in Egypt)

Institution name	Overview
Ministry of Transport	Has jurisdiction over Transport in Egypt
Ministry of Interior	Has jurisdiction over traffic management, security, etc.
Ministry of Defense	Management of important infrastructures in addition to the defense operations
General Authority of Roads, Bridges and Land Transport (GARBLT)	Management of construction of roads and bridges
National Authority for Tunnels	Management of Cairo underground tunnel, Cairo Metro, etc.
New Urban Communities Authority	Management of new urban development (including traffic)

Institution name	Overview
Land Transport Regulatory Authority	Permits and approvals related to land transport (permits and approvals of bus operation, etc.)
National Telecom Regulatory Authority	Permits and approvals related to telecommunication
National Road Company	Construction and management of tolled roads and intercity roads
MWASALAT Co., Ltd.	Private bus operator
Swvl Co., Ltd	Private bus operator
EL SWEDEY Co., Ltd.	Local general contractor in Egypt (contractor of large-scale ITS business)
Egyptian Transport and Commercial Services Company (Egytrans)	Logistics operators
Halan, Raye7, Wasel, Careem	Taxi dispatch service/Ride-sharing operators
Slyde	Micro mobility operator (electric scooter ride-sharing service)

Source: JICA Study Team

6.2.3. Education Sector

(1) Confirmation of the Priority Development Issues and Proposed Solutions

1) Issues presented in the workshop

In the workshop, mainly the following issues were confirmed.

General issues

- The education system of Egypt is very rigid (All pupils and schoolers are evaluated by a one-size-fits-all approach and the contents of the education is not arranged to improve the capabilities and good points of each pupil and schooler based on their interests).

Issues which emerged together with propagation of remote education

- The policies on “remote education” are not unified among persons concerned.
- In some regions, Internet is not available.
- Some schoolers and guardians are resistant to remote education.
- Persons concerned feel anxiety about the rapid changes in the circumstances of education such as propagation of remote education caused by COVID-19.
- The measure for shift from remote learning (e-learning) to remote education (e-education) are unclear.
- In many schools, Internet is not available; some schools have no classroom with PCs, etc.
- Most households do not have the devices necessary for participation in remote education.

Issues related to teachers

- Teachers have not gotten sufficient training for the methods of instruction using digital technologies

Issues related to the curriculum and education contents

- The education curriculum for remote education is yet to be standardized.

Issues related to career development of schoolers

- The utilization of digital tools is insufficient for job training.
- The curriculum in higher education (university) do not match the needs of the labor market.

2) Solutions proposed through the workshops

Mainly the following solutions were proposed in the workshops.

General issues

- Incorporate the concept of “Object-based Learning” (providing independent education materials for each chapter and making students pick up the necessary ones for them instead of collectively creating and packaging education materials for each course).

Issues which emerged together with propagation of remote education

- Introduce gamification (application of game design elements and game principles to education) to enable pupils and schoolers to learn from education materials like enjoying a game.
- Set up a computer laboratory (computer room) in schools to enable pupils and schoolers to access remote education contents.
- Enlighten guardians of pupils and schoolers about remote education using digital technologies. Develop digital tools (apps) with which guardians can follow the achievement levels of learning of their children to incorporate guardians into the flow of remote education.
- Provide training to not only pupils and schoolers who will get remote education but also the households including guardians. Hold online meetings.
- Teach the ethical rules regarding the use of Internet.
- Arrange the infrastructures of schools including Internet connection, etc.

Issues related to teachers

- Hold workshops for teachers to sweep away the concerns about propagation of remote education (including mental, social, and technical ones).
- Provide training to teachers to encourage them to use digital technologies in their classes in order to improve their capabilities.
- Allocate Information Technology Officers to schools.

Issues related to the curriculum and education contents

- Introduce AR (augmented reality) technologies.
- Introduce design simulators.
- Standardize the contents of remote education. Clarify course titles, achievement targets, and test and evaluation methods, etc.
- For the development of remote education curriculums, keep a good balance among the three elements: 1. lecture time, 2. office hours (when schoolers can ask questions to teachers, etc.), and practical hours. Get advice from experts in development of remote education curriculums.
- Standardize the education curriculum in accordance with remote education through cooperation between the government and private companies.
- Include a “E-marketing” course to learn marketing methods on Internet in the curriculums of vocational schools.

- Develop curriculums which meet the needs of the labor markets.
- Identify the measures to motivate pupils and schoolers to prevent them from dropping in the middle of the remote education course. For example, system to grant a point every time a pupil or schooler access the remote education platform.

Issues related to career development of schoolers

- Hold competitions for university students to encourage them to found startups which will develop education-related solutions using digital technologies.
- Provide appropriate career guidance to schoolers.
-

(2) Assumed Stakeholders

Considering these, the JICA Study Team assumed the following stakeholders as shown in the following table.

Table 6-3 Assumed Stakeholders (Education Sector in Egypt)

Institution name	Overview
Ministry of Education and Technical Education	Ministry which has jurisdiction over primary and secondary education and technology education.
Ministry of Higher Education	Ministry which has jurisdiction over higher education.
Information Technology Institute (ITI)	Humans resource development institution of the information communication technology field under the umbrella of the Ministry of Communication Information Technology (MCIT).
Egypt-Japan University of Science and Technology (E-JUST)	National university which was founded under the support of Japan and provides engineering education making use of the Japanese-style features.

Source: JICA Study Team

6.2.4. Health Sector

(1) Confirmation of the Priority Development Issues and Proposed Solutions

1) Issues presented in the workshop

In the workshop, mainly the following issues were confirmed.

Problems of regional gaps (some regions including the Siwa region):

- The number of doctors working in medical facilities are insufficient for the population in some prefectures.
- In some prefectures, the expertise of doctors working in medical facilities is insufficient.
In most of the other prefectures than the capital city (Cairo), not only the number of medical staff of hospitals is insufficient but also some of them are less skilled, so patients seek for another hospital in a nearby prefecture or visit a hospital in Cairo. As a result, the treatment is delayed, and the symptoms become severe in some cases.
- In some regions of Egypt (Upper Egypt-Southern Sinai), experts of occupational safety and health in hospitals are lacking.
Hospitals in these regions cannot secure safe working environments for medical staff.
- Some prefectures lack universities qualified to teach doctors and nurses
As a result, some prefectures in Egypt have no qualified medical staff.
- Lack of drugs in medical facilities in some states (e.g., Siwa)

In certain regions, hospitals cannot provide good services to either outpatients or inpatients due to lack of drugs.

- The awareness of routine physical examinations is low among residents in rural areas
Residents tend not to go to hospitals until their diseases get worse. As a result, treatment may be difficult in hospitals in rural areas.

Realization of the national health insurance system:

- The core of the national health insurance system is assumed to be family doctors. However, the number of family doctors is limited.
Under the national health insurance, firstly patients receive a diagnosis of family doctors and are referred to a specialist, if necessary.

Issues of the health information system:

- Lack of medical files unified for patients is not available.
Since medical files are not unified, medical institutions cannot find histories of patients, which may lead to misdiagnoses and treatments.
- Information regarding medical institutions and medical results is too massive to be used for decision of policies.
- Health information is sometimes insufficient and unreliable.
Data collected from patients by medical staff and data on medical facilities are unreliable. Therefore, measures to improve medical facilities cannot be implemented.
- The infrastructures such as the internet networks of public (governmental) medical facilities are inefficient.
- Sufficient information regarding drugs is not provided to doctors (e.g., information such as comparison with other drugs, adverse effects, and characteristics of drugs).
There are cases that drug companies did not provide completely correct information regarding drugs to doctors. Such cases may cause wrong prescription of drugs to patients and high adverse effects.

Problems of the quality of medical services/doctors:

- Doctors are not trained about the cutting-edge medical equipment available in medical facilities.
- Doctors do not provide complete information of diagnosis results to patients.
Therefore, patients may not be able to get appropriate care and preventive measures necessary for quick recovery.
- It is difficult to improve the knowledge of medical staff regarding new technologies in medical staff and medical fields.
Medical staff do not understand the whole picture of new technologies and development projects in the medical field sufficiently.
In addition, medical staff do not recognize how to follow the new rules of the development process.
- The tuitions of graduate schools for doctors are high.
This leads the existence of low-quality doctors and difficulty to get qualifications.
- There is a migration of doctors to overseas due to low wages.
Many competent doctors leak to overseas, so the quality of domestic doctors dropped and the number of doctors decreased.

- There is an increase in malpractice due to lack of awareness of medical staff regarding high-quality medical services.
Information about high-quality medical services is not provided to medical staff.
- It is difficult to perform group training of medical staff due to COVID-19.
Due to COVID-19, medical staff cannot get medical training courses gathering in a training facility for the preventive measures considering the necessity for preventive measures such as social distance in a training facility and the low attendance rate.

Problems related to the execution of the E-health project of the Ministry of Health and Population:

- There is a lack of cooperation with the persons concerned in the projects of the health field conducted by the Ministry of Health and Population.
The association among the development projects conducted by the Ministry of Health and Population is insufficient due to lack of adjustments among stakeholders. Therefore, a project may hinder another project.
- There is a delay of planning and execution of the health projects due to COVID-19 (due to delay of the supply of the necessary resources).
- It is difficult to communicate with other ministries (and it takes much time).
- It is difficult to process and use healthcare data useful for decision making.
- There are problems with the technical support for the projects of the Ministry of Health and Population (for example, a lack of qualified technical support and facilities) and increase in the research and development costs to support the projects
Though the Ministry of Health and Population plans many improvement projects, resources (human resources, technologies, and facilities) are lacking so the projects are difficult to execute.
- There is a lack of IT companies which can provide technical solutions in the health sector in Egypt.
Most IT companies are not dedicated to system development for the health sector, which causes problems such as lack of use of cutting-edge technologies, high system costs, and existence of medical staff who do not get technical training.

High medical costs:

- Dependence of some pharmaceuticals on expensive imported drugs
In Egypt, some pharmaceuticals cannot be manufactured domestically, and such imported goods are expensive.
- In Egypt, medical costs such as clinical inspections, scanning, and X-ray are high.
- Necessary raw materials for manufacturing of pharmaceuticals are insufficient in Egypt
There are problems and difficulty related to import of the necessary raw materials for manufacturing of pharmaceuticals.

2) Solutions proposed through the workshops

Mainly the following solutions were proposed in the workshops.

Problems of regional gaps (some regions including the Siwa region):

Lack of doctors working in medical facilities in some prefectures

- Utilization of technologies of remote diagnosis (telemedicine). By using such technologies, hospitals in prefectures where doctors are lacking can get support of specialized physicians, professors, and consultants of large hospitals in other prefectures. Doctors of such hospitals can also experience patient treatment.

Lack of expertise of doctors in medical facilities in some prefectures

- Obligate all doctors to get fellowship training after graduation. Also provide fellowship training through online lectures.

Note: Fellowship training for doctors after graduation has already been obligated.

Realization of the national health insurance system:

Lack of family doctors

- Recruit and train doctors with attractive salaries from other prefectures. Also provide other incentives to attract doctors. Use online education and training to train doctors.
- Increase the interests of universities in the home doctor field. Perform orientation for people about the importance of home doctors.

Issues of the health information system:

Necessity for medical files unified for patients

- Creation of data and systems of patient information (medical records) using information technologies and development of systems to display data with terminals of medical institutions.

Note: There is an information that the Ministry of Health and Population decided to develop such systems in cooperation with digital service companies.

Difficulty to process and use healthcare data

- Construct a data warehouse to link and analyze data.

Inefficient communication infrastructures of public (governmental) medical facilities

- Improve communication infrastructures from the viewpoint of streamlining. Especially it is necessary to construct Internet networks with remote areas. It required funding by the government.

Problems of the quality of medical services/doctors:

Lack of training about cutting-edge medical equipment

- Provide training for medical staff online. Especially, provide training to support medical staff who could not get training during the COVID-19 period. Also provide remote diagnosis services.

Group training for medical staff regarding responses to COVID-19

- Provide online training for medical staff using video conference, telemedicine (remote diagnosis), etc.

Note: The adviser to the MOH minister (Eng. Aysam) said that this measure was conducted for MOHP during the COVID-19 period.

Problems related to the execution of the E-health project of the Ministry of Health and Population:

Lack of coordination among projects of the Ministry of Health and Population

- The Ministry of Health and Population will set a total strategy for coordination among all information technology projects of the health sector.

- Make adjustments with the information center of the Ministry of Health and Population and the related institutions to execute technology projects.

Necessity for improvements in knowledge of medical staff on new technologies

- Perform orientation (awareness-raising campaign) for the programs of the Ministry of Health and Population to medical staff using technologies of digital marketing.

Delay of planning and execution of the Health projects due to COVID-19

- The Ministry of Health and Population discussed to proceed its projects using video conferences during the period of COVID-19. A webinar for doctors was also held.

Difficulty to communicate with other ministries

- The information center of the Ministry of Health and Population makes adjustments with the related institutions.
- Provide programs and applications to connect ministries.

Technical support for the projects of the Ministry of Health and Population

- Employ qualified technical support staff.

Lack of IT companies which can provide technical solutions

- Cooperation between the Ministry of Health and Population and IT companies to develop systems which provide all kinds of medical services.

High medical costs:

- Remote diagnosis reduces costs to move patients.
-

(2) Assumed Stakeholders

The following shows the assumed stakeholders of the health sector in Egypt.

Table 6-4 Assumed Stakeholders (Health Sector in Egypt)

Institution name	Overview
Ministry of Health and Population (MoHP) - General Authority for Healthcare Provider (GAHP) - Universal Health Insurance Authority (UHIA) - General Authority for Healthcare Accreditation and Regulation (GAHAR)	Ministry in charge of health administration of the Egyptian government Independent institutions in charge of hospital management, health insurance, and certification of medical institutions, respectively.
Health Insurance Organization	Health insurance organization of Egypt.
Egyptian Unified Procurement Authority (UPA)	Institution which procures pharmaceuticals and medical equipment.

Source: JICA Study Team

6.3. Morocco

6.3.1. Agriculture and Fisheries Sector

(1) Confirmation of the Priority Development Issues and Proposed Solutions

1) Issues presented in the workshop

In the workshop, mainly the following issues were confirmed.

Agriculture

- The necessary data for improvements in the productivity is lacking, or difficult to use because it is stored in paper form or personal PCs.
- Agricultural management resources (water and soil) are not managed.
- The farming input is used more than necessary, so the production cost is high.
- No information about market prices is available
- Lack of traceability
- There is much food loss between farms and markets
- The sufficient quality for export cannot be secured

Fishery

- Data related to small ships (small-scale fishers) is yet to be collected
- It is necessary to visit fishing grounds just for confirmation of the necessity for arrangements of fishing grounds (positions of buoys, etc.).
- Trading in the fish market for small-scale fishers is yet to be activated.
- Information regarding the oceanic conditions, etc. is not distributed timely.
- The reliability of data is low.
- Marine culturing is yet to be developed.

2) Solutions proposed through the workshops

Mainly the following solutions were proposed in the workshops.

Agriculture

- The necessary data for improvements in the productivity is lacking, or difficult to use because it is stored in paper form or personal PCs.
 - > Some private companies provide various services using IOT technologies (technology to timely confirm irrigation management, management of soils, etc. using temperature and humidity sensors, and weather observation). The information regarding the start of the agriculture period is shared through the platform called Mosaïque.
 - > As for the production volume of cereal crops, a weather forecast system is available (Crop Growth Monitoring System)
- Food loss and quality management
 - > To manage quality and reduce food loss, a technology to confirm the conditions during harvesting, delivery, and storage is desirable.

Fishery

- Data related to small ships (small-scale fishers) is yet to be collected
 - > Development and construction of the port management system

-> Development of a system like VMS for small ships (GPS has been introduced, so something is possible using GPS). Large ships can be managed because they are equipped with VMS systems.

-> Construction of a system which can share the conditions of fishing grounds and catches with the persons concerned. However, for introduction, the level of understanding of small-scale fishermen on digital technologies is low, so firstly intensive training is necessary.

- Reliability of data

-> Development of complicated analysis and AI, deep learning, etc. which avoid human arbitrariness.

Other

- Digitization requires massive costs, and it should be considered whether the systems can be updated along with the fast technology innovation.

Fishery has already been digitized (though some vulnerabilities of information security are found). It is also necessary to pay attention to the importance of the following ongoing projects.

- A project to collect data of saltwater using sensors is in progress in the EU project.
- The traceability of fishery products has been digitized (system called Samak (Arabic word which means information)).
-

(2) Assumed Stakeholders

Considering these, the JICA Study Team assumed the following stakeholders as shown in the following table.

Table 6-5 Assumed Stakeholders (Agriculture and Fishery Sector in Morocco)

Institution name	Overview
Ministère de l'Agriculture et de la Pêches Maritime, du Développement rural et des Eaux et Forêts	Ministry which has jurisdiction over agriculture and fishery in Morocco.
Institut National de Recherche Halieutique (INRH)	Research institution under the umbrella of Ministère de l'Agriculture et de la Pêches Maritimes which perform research activities related to oceanic fishery and provide suggestions based on scientific basis.
Fédération des Industries de Transformation et de Valorisation des Produits de la Pêche (FENIP)	Organization which organizes fishermen all over Morocco
Département des Pêches Maritimes	Institution in charge of promotion and regulations of fishery under the umbrella of Ministère de l'Agriculture et de la Pêches Maritimes
Agence nationale pour le développement de l'aquaculture (ANDA)	Ministry under jurisdiction of Ministère de l'Agriculture et de la Pêches Maritimes to promote oceanic farming in Morocco.

Source: JICA Study Team

6.3.2. Education Sector

(1) Confirmation of the Priority Development Issues and Proposed Solutions

1) Issues presented in the workshop

In the workshop, mainly the following issues were confirmed.

General issues

- There is a gap in access to education between urban areas and rural areas (especially in female education).

- The female literacy rate is low.
- School equipment necessary for experiments in science and mathematics is lacking.

Issues which emerged together with propagation of remote education

- Internet is not available (or the connection is unstable) in some regions.
- Some households and schoolers have no digital equipment which can connect to Internet for remote education.
- New activities using digital technologies such as remote education are difficult to be accepted by teachers and schoolers.

Issues related to teachers

- Opportunities of training of teachers are lacking.
- Teaching capabilities of teachers are insufficient.
- The burdens of teachers related to management of schools are big.

Issues related to the curriculum and education contents

- The quality of remote education is low (not standardized).
- The curriculum and education contents do not match the needs of the labor market.

Issues related to career development of schoolers

- Even for graduates from higher education, it is not easy to find employment.
- No appropriate career guidance is not performed in secondary education.

2) Solutions proposed through the workshops

Mainly the following solutions were proposed in the workshops.

Solutions for general issues

- Diffuse remote education further to enable all pupils and schoolers all over the country to remotely get better education.
- The Ministry of Education provides remote education through the online platform called TelmidTice. It will be continued to expand functions and enhance contents to enable all pupils and schoolers to enjoy remote education through the online platform.
- (For the issue that the school equipment necessary for experiments in science and mathematics) Use virtual simulation using digital education materials as an alternative to enable schoolers to experience experiments in science and mathematics.

Solutions for issues which emerged together with propagation of remote education

- Construct a high-speed Internet access network all over Morocco.
- Construct an Internet connection environment in all schools.
- Develop a remote education system accessible from mobile terminals such as smartphones (instead of PCs).
- For regions without Internet access, consider alternative means.

- Perform enlightenment activities to not only teachers and pupils/schoolers but also guardians and ordinary citizens to understand the utilization of digital technologies for education.
- Teachers, pupils, and schoolers not accustomed to information communication technologies and operations of digital terminals provide support so that they can be timely accustomed to fast propagation of remote education (provision of training opportunities for digital technologies, etc.)
- Introduce gamification (application of game design elements and game principles to education) to enable pupils and schoolers to learn from education contents with interests and affinity.

Solutions for issues related to teachers

- Enhance the training opportunities for teachers and improve especially the skills for the utilization of digital technologies necessary for execution of remote education.
- Construct an online platform where on-site practical workers such as teachers to realize the functions to get technical advice from experts on the platform in addition to sharing of good (bad) practices and introduction of useful instruction methods (case database).
- Introduce the education support system using AI. Efficiently perform simulations of experiments in education of science and mathematics, feedback to wrong answers and difficult points of pupils and schoolers, etc. using AI.
- Introduce a school affairs support system for efficient management of schools.

Solutions for issues related to the curriculum and education contents

- Develop curriculums and education contents to support remote education (reconsider curriculums and education contents suitable for remote education instead of making online the current ones which assume face-to-face classes as they are).

Solutions related to career development of schoolers

- Actively proceed with the utilization of digital technologies in education sites for development of human resources which meet the needs of the labor market.
- Make practical instructions about digital technologies.
- Construct a career consultation system for schoolers by chatbot, etc. using AI.

Other proposed solutions

- Formulate comprehensive strategies for the way of post-coronavirus education in Morocco.
- Construct an online forum for schoolers to exchange opinions as well as diffuse education using technologies through the forum.
- Support entrepreneurs and startups as well as construct cooperative relationships with them to seek for the new way of education. Provide incentives setting up awards for entrepreneurs and startups. In addition to it, also consider awards for teachers using remote education effectively.
- Construct an online platform which gather issues related to education and solutions using digital technologies in one point. Enable matching among persons concerned, startups, etc. of the education sector through the same platform.

(2) Assumed Stakeholders

Considering these, the JICA Study Team assumed the following stakeholders as shown in the following table.

Table 6-6 Assumed Stakeholders (Education Sector in Morocco)

Institution name	Overview
Ministère de l'Éducation nationale, du Préscolaire et des Sports	Ministry which has jurisdiction over primary and secondary education, occupational training, higher education, and scientific research.
Office de la Formation Professionnelle et de la Promotion du Travail (OFPPT)	Organization under the umbrella of Ministère de l'Education Nationale, de la Formation Professionnelle, de l'Enseignement Supérieur & de la Recherche Scientifique. It provides occupational training through training centers.

Source: JICA Study Team

6.4. Tunisia

6.4.1. Agriculture and Fisheries Sector

(1) Confirmation of the Priority Development Issues and Proposed Solutions

1) Issues presented in the workshop

In the workshop, mainly the following issues were confirmed.

i) Common to agriculture and fishery

- Training of extension workers, etc. (attractive training using E-learning, etc., enhancement of expertise, etc.)
- Effective advice to farmers and fishermen (unification of information, timely advice, etc.)

ii) Agriculture

- Management of farming input (when and how much fertilizer and agricultural chemicals were used, etc.)
- Access to market information (provision of fertilizer and agricultural product information, etc.)
- Management of crops (system to prevent theft, etc.)

iii) Fishery

- Technical and office work management systems (document and fishery resource management using ICT, enlightenment of technologies, etc.)
- Establishment of the fishery cooperative system (smooth sharing of information, resource management, improvement in access to subsidiaries and loans, etc.)
- Securing of traceability (expansion of export by compliance with the rules of the export destination, etc.)
- Responses to climate change (protection of native species from red tides and foreign species, prediction of the atmospheric temperature, water temperature, etc.)

2) Solutions proposed through the workshops

The following shows the countermeasures proposed in the workshops for the issues pointed out in the workshops.

i) Common to agriculture and fishery

- Unification of data

It urgent in both agriculture and fishery to unify data scattered among departments and construct a database where anyone (at least those in the ministry of agriculture and fishery) can confirm the latest data. After that, it will be possible to use the unified data for weather forecast, communication from the ministries to farmers and fishermen for promotion of use of subsidies, etc., construction of a platform to connect experts with farmers and fishermen, etc.

- Technical instructions:

Construction of a platform which enables agricultural extension workers to remotely make technical instructions and farmers to ask questions for more efficient and effective technical instructions to farmers by a limited number of agricultural extension workers.

ii) Agriculture

- Production

Input management system, sowing seeds based on analysis of climate data, etc., spraying of fertilizers and agricultural chemicals, advice of the harvesting timing, etc.

- Selling

Introduction of the information provision system for price information and selling locations, etc.

iii) Fishery

- Production and selling:

Reinforcement of the capabilities for fisheries management and introduction of traceability, etc.

(2) Assumed Stakeholders

Considering these, the JICA Study Team assumed the following stakeholders as shown in the following table.

Table 6-7 Assumed Stakeholders (Agriculture and Fishery Sector in Tunisia)

Institution name	Overview
Ministère de l'agriculture, des ressources hydrauliques et de la pêche	Ministry which has jurisdiction over agriculture, water resources, and fishery in Tunisia.
Agence de Promotion des Investissements Agricoles (APIA)	Governmental institution which promotes investments in agriculture.
L'Agence de la Vulgarisation et de la Formation Agricoles (AVFA)	Governmental institution to perform occupational training for those who are engaged in agriculture and fishery and training for agriculture and fishery extension workers
Union tunisienne de l'agriculture et de la pêche (UTAP)	Organization which organizes farmers and fishermen all over Tunisia
Agence des Ports et des Installations de Pêche (APIP)	Governmental institution that maintains ports and fishery facilities and provides services to fishermen.
Food and Agriculture Organization (FAO)	International institution which aims to develop the world economy and free human being from starvation through improvements in the production and distribution of agricultural products, etc.

Source: JICA Study Team

6.4.2. Industrial Development Sector

(1) Confirmation of the Priority Development Issues and Proposed Solutions

1) Issues presented in the workshop

In the workshop, mainly the following issues were confirmed.

- Reinforcement of international competitiveness (development of human resources, improvements in productivity and quality, logistics, and infrastructures) (major target industries: sewing, mechanical engineering, food processing, pharmaceuticals, and chemistry)
- Improvement in added values (trend analysis and business intelligence)
- Reinforcement of value chains (technology transfer and subcontractor/third-party supplier management)
- Communication (digital communication and E-marketing)
- Utilization of byproducts (bio products, waste management/recycling, and energy)

2) Solutions proposed through the workshops

Reinforcement of international competitiveness (development of human resources, improvements in productivity and quality, logistics, and infrastructures)

Development of human resources:

- The quality of engineers in Tunisia is world-class but it is necessary to develop young engineers.

Improvement in productivity:

- Improvement in the productivity using IoT technologies.
- Introduction of intelligent systems to automate production lines.
- Promotion of promising foreign investments.
- Introduction of global standard technologies.
- Improve the administration system so that it will not hinder business (promotion of E-government).
- Improve the understanding levels of company managers about IoT.
- Logistics support systems using GPS can be used effectively (in both companies and overall logistics networks). IoT technologies are also considered to contribute to reinforcement of competitiveness.

Quality improvement:

- Kaizen activities are effective approaches to quality improvement.

Logistics improvement:

- Logistics support systems using GPS can be used effectively (in both companies and overall logistics networks).

Improvement in added values

Market trend analysis:

- It is difficult to know cutting-edge technologies by participating in international technology events such as industrial fairs.

Business intelligence

- In Tunisia, some startups are using AI and providing services which improve added values.

Reinforcement in value chains

Technology transfer:

- Raise the awareness of the necessity for R&D for differentiation even in small companies with one or two employees.

Cultivation of subcontractors and third-party suppliers:

- Provide fund support such as funding for R&D activities for reinforcement of capabilities (quality and productivity) of small vendors and expansion of the use of the credit guarantee system.
- Propose digital solutions (production control system) suitable for small and medium companies.

Reinforcement of marketing

- Improve marketing communication using digital technologies.
- It is important to select effective online marketing tools and it is also necessary to solve institutional constraints. The development of E-commerce requires support from persons concerned such as the ministries, the central bank, the post office, etc.
- It is also necessary to construct reliable infrastructures.
- Introduction of a tracking system of collection and delivery.
- Introduction of Chat Pod.

Utilization of byproducts

Technologies to use byproducts:

- Currently, startups are proceeding with business for use of byproducts (especially in the cosmetics field).

Waste recycling:

- Use digital technologies for waste disposal management.

Optimization of resource costs

- Digital technologies to improve energy efficiency have been developed. The National Energy Management Agency (ANME) have formulated many effective measures. ANME provides funds for surveys and development for the company-level use of sunlight.
- Practical technologies have been introduced for monitoring of utilization of resources (water, fuel, and energy consumption), etc. In Tunisia, this field has only just begun but startups which provide solutions in this field have been founded.
- Control of heat and cooling systems by automation of plant lines

COVID-19 countermeasures

- The introduction of digital technologies is proceeding in online conference tools, e-commerce, digitization of operations, etc.

(2) Assumed Stakeholders

Considering these, the JICA Study Team assumed the following stakeholders as shown in the following table.

Table 6-8 Assumed Stakeholders (Industrial Development Sector in Tunisia)

Institution name	Overview
Ministère de l'Industrie, de l'Energie et des Mines	Ministry in charge of industrial development
Unité de Gestion du Programme National de Promotion de la Qualité (UGPQ)	Department under management of the Ministry of Industry and Small and Medium Companies which is in charge of the Kaizen project
Agence de Promotion de l'Investissement Extérieur (FIPA)	Governmental institution which promotes foreign investments
Union Tunisienne de l'industrie, du commerce et de l'artisanat (UTICA)	Chamber of commerce and industry in Tunisia
Association Cluster Mécatronique Tunisie	Association of the mechatronics sector in Tunisia
UNIDO Tunisia Office	International institution which promotes industrial development
GIZ Tunisia Office	German institution which provides technological support

Source: JICA Study Team

6.4.3. Transport Sector

(1) Confirmation of the Priority Development Issues and Proposed Solutions

1) Issues presented in the workshop

In the workshop, mainly the following issues were confirmed.

- Improvement in the traffic safety (traffic safety education, enlightenment activity through media, etc., reinforcement of monitoring and crackdown, etc.)
- Maintenance of road infrastructures (maintenance of road ancillary equipment, bridges, etc. using information technologies)
- Realization of appropriate traffic control (objective grasping of the traffic flow and traffic volume, utilization of data, etc.)
- Management and crackdown of overloaded vehicles (securing of safety of roads and maintenance and management of road equipment)
- Appropriate operation and management of expressway (fare collection and traffic control)
- Countermeasures against parking in the city and utilization of traffic data (provision of information, formulation of traffic plans using data, etc.)
- Enhancement of public traffic services and improvements in convenience (provision of information, etc.)
- Law revision to realize these. etc., if necessary

2) Solutions proposed through the workshops

The following countermeasures are assumed for the issues pointed out in the workshop.

- System to use traffic data:
Utilization of human flow data and traffic system big data (data of mobile phone base station owned by communication carriers, probe data obtained from vehicles such as buses and taxis, location information obtained from smartphones, etc.) -> Industry-government-academia R&D assuming utilization of such data, construction of a data platform, formulation of traffic plans, reinforcement of capabilities and construction of an organization for sustainable time point update, etc.
- Traffic control in the city:
Construction of a traffic management center in the city using the above-mentioned measures, etc.
- Road infrastructure maintenance:
Introduction of maintenance of road and bridge infrastructures using digital technologies
- Expressways:
Traffic control equipment, equipment for crackdown on overloading, reinforcement of capabilities for management of expressways, etc.
- Parking countermeasures:
For example, a measure to reduce “hanging-around traffic” in the city by integrating parking space business with reservation services. However, parking countermeasures require various adjustments such as legislation of obligation of addition of parking space, parking space arrangement plans, and execution of such plans.
- Public transport:
Informatization of railroads, metros, and buses, sophistication of operation management (it is necessary to confirm the current situation again), introduction of electronic payment, etc.
- Other improvements in the mobility in the city:
Realization of the ride-sharing service, MaaS, arrangement of park and ride, utilization of information and data obtained from these services, etc.

(2) Assumed Stakeholders

Considering these, the JICA Study Team assumed the following stakeholders as shown in the following table.

Table 6-9 Assumed Stakeholders (Transport Sector in Tunisia)

Institution name	Overview
Ministère du Transport	Has jurisdiction over transport in Tunisia (land traffic, maritime traffic, aviation, logistics, etc.)
Intelligent Transport Systems Unit (STI)	Department of Ministère du Transport It is in charge of digitization in the transport field
Direction Générale des Ponts et Chaussées, DGPC (Ministère de l'équipement, de l'habitat et de l'aménagement du territoire)	Has jurisdiction over the policies of the road business and the formulation of the road arrangement plan

Institution name	Overview
Societe Tunisie Autoroutes (STA)	Has jurisdiction over construction, operation, and maintenance of expressways in Tunisia
Direction generale des transports terrestres	Vehicle registration, management of licenses, etc.
Société des transports de Tunis (TRANSTU)	Has jurisdiction over public transport in the urban area of Tunis. It manages buses, metros, and TGM (Tunis urban railroad).
Smart Mobility	Startup of mobility-related services
World Bank	Support in the transport field, etc.
TCV	Operates and manages buses

Source: JICA Study Team

Chapter 7 Specification of Applicable Digital Solutions to Development Issues through Workshop in Japan

7.1. How to Extract Applicable Digital Technologies

On December 22, 2020, the JICA Study Team held an online workshop in Japan for the purpose of providing experiences and knowledge of Japan regarding the issues in using and development with digital technologies, while sharing the development issues in the target countries and the target sectors pointed out in the local workshops, ideas of solutions utilizing digital technologies with domestic experts. There were 35 experts of the corresponding sectors attend the workshop.

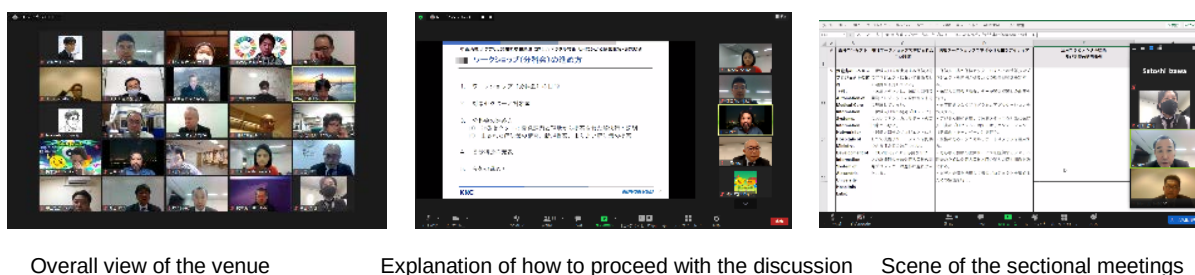


Figure 7-1 Scenes of the Workshop in Japan (December 22, 2020)

The contents of the discussion about proposals of knowledgeable persons for utilization of digital technologies are shown in 7.2 and later sections.

7.2. Agriculture and Fisheries sector

7.2.1. Agriculture Sector

The agriculture sector is a target sector in all of the three target countries of this survey. Among the issues pointed out by the participants in the online workshops in the three countries, the discussion focused on the following issues that were recognized as common issues among the three countries.

(1) Visualization of Farms to Improve the Productivity of Agriculture

- The consensus of this sectorial meeting is that it should be noted that (as with Japan) careless introduction of digital technologies may just increase costs. The agricultural environments of the three countries are different so the needs for digital technologies must be different. The solution for achievement of smart agriculture will not be as simple as just introducing automatic equipment.
- The necessity for digital technologies depends on the country and crop. It is important to narrow down the themes to be solved in each country and investigate the issues and their causes. It is recommended to utilize typical digital technologies (even if they are not cutting-edge technologies) to solve the issues.
- Even for the same product, the aim might be different: large number of crops (or high yield) or quality improvement (for example, increase in the sugar degree of fruits), so the same system is not necessarily appropriate for the same product.

- The needs should be carefully examined. For example, the introduction of sensors is inappropriate if the aim is to improve the skills of employees. For skill improvements, it is necessary to get work records and confirm which work improves the productivity.
- “Peasants” are conducting the assigned work at hand and their awareness of agriculture is not strong (they are not regarding agriculture as business). To make them consider introducing digital technologies, it is necessary to confirm with the top management of agriculture what kind of agriculture they want to do (for example, labor saving if they want to do large-scale agriculture, careful production of products with high added values even for high labor costs if they want to achieve high added values, etc.).
- There is a system called Vegetaria¹⁵⁵ which enables to make immediate responses when sensing abnormal data in combination with the growth calendar and monitoring data. Currently, it is mainly applied to rice cropping, but it is said that finally it could be applied to various other crops. However, before that, it is important to grasp the actual conditions. Without a standard, it is difficult to understand what is abnormal. Firstly, introduce the system in a model region or model crop and make results of an improvement in the yield. Use sensors when collecting data for grasping of the actual conditions and carefully record the inputs, outputs, and processes in digital form. It is necessary to grasp what is the standard through such steady work.
- As for crops with much additional fertilization, it is tended to be thought that automation can save labor (=reduce labor costs), but most farmers do not record labor costs (do not recognize them as production costs), so they tend to regard investments in machines as pure increases in costs (they do not regard the introduction of machines as labor saving). Even in Japan, this mentality is prevailing even though labor costs are high, so the cost effectiveness tends to be underestimated more in developing countries, in which labor costs are low. Few farmers will consider the introduction. The issues (factors which hinder development) of the agriculture field pointed out are also pointed out in Japan and the usability of the technologies of smart agriculture has been recognized, but still few farmers have introduced them (it will be relatively a good result if 10 out of 100 farmers introduce any of such technologies).
- Stable increase in production of crops is a priority. In Japan, many digital technologies usable for optimization of farming and improvements in the usage volume and timing of farming input are developed. The list of agricultural products and services using new technologies created by the Ministry of Agriculture, Forestry and Fisheries of Japan is useful as a reference.
- Though it varies between open culture and greenhouse farming, it cannot be judged from satellite images how a small amount of water is used, so there are many cases of drip irrigation that the moisture contents are confirmed by installing field sensors 3 and 10 cm under the ground. In Japan, the conditions of the Minami-Daitojima Island of Okinawa such as there being no river are similar to those of North Africa, so there may be useful cases for reference.
- The development of dryland agriculture in North Africa requires stable water supply. It is considered that the utilization of ICT can be proposed for water resource management of a wide agricultural land over a certain scale for agricultural corporations and agricultural cooperatives (including irrigation associations).

¹⁵⁵ <https://www.vegetalia.co.jp/>

- Momo¹⁵⁶ develops and sells the agricultural sensor system, AgriPalette, (measuring instrument for soil pH, EC, soil moisture contents, atmospheric temperature, amount of sunlight, etc.). In Japan, it is desirable to secure a certain area of an agricultural land where business by agricultural corporations or land accumulation is possible considering profitability, but it is necessary to grasp what kinds of business is suitable in the target countries.
- For the grasping and forecast of the growth situation, the service called “Iroha”¹⁵⁷ might be usable.
- As for protected horticulture, there is also a technology to control the excess growth environment of a leaf¹⁵⁸.
- It is worth consideration to not only observe agricultural meteorology and water resources by satellites and provide the obtained information but also construct a safety net system such as agriculture insurance, etc. using such information.
- Agriculture for the purpose of food production is a basic industry and infrastructure. It would be important for the government to support mainly the farming of crops with which citizens can live and establish supply networks to prevent conflicts for foods though profits are also important. In Japan, the problem of food wastes is often talked about, but in reality, the number of wastes in production sites is greater.

(2) Reinforcement of Agricultural Cooperatives to Improve the Productivity of Agriculture

- Digital technologies required in the level of individual farmers and that of agriculture public corporation and agricultural corporations are different (for example, the farming system is for individual farmers while a wide range of water management resources are for agricultural corporations, local governments, and the central government).
- If any system is introduced, basically the manufacturer will make instructions of the management, etc. but in Japan JA may purchase a system and make instructions to each farmer in some cases. If an agricultural cooperative (or a local company with a license contract, etc.) can perform such a role, Japanese manufacturers will be able to get into the market more easily.

(3) Improvements in the Added Values of Agricultural Products

- A company engaged in strawberry cultivation in Egypt for export to Turkey pointed out that the productivity was the bottleneck though they managed the soil by drip irrigation and compound sensors. There is a limit on cultivation without irrigation in dryland like North Africa. While it is necessary to form a large production area, small-scale farmers with weak capital strength have no other choice than becoming peasants of large-scale farmers. For the introduction of cutting-edge technologies, it is also necessary to consider contributions to the poor.
- In Awajishima island, farmers are engaged in production of vegetables, but the situation will become complicated without sufficient consideration of the necessity for digital technologies and careful judgment.
- North Africa is close to the market so there is great room for development, but it requires instructions to establish the use of technologies.

¹⁵⁶ <https://momo-ltd.com/>

¹⁵⁷ <https://smx-iroha.com/>

¹⁵⁸ <https://www.agleaf.jp/>

- If it is to be performed as a state policy, it is strongly recommended to create an information platform to connect farmers through consumers.

7.2.2. Fisheries Sector

The fisheries sector is a target sector in all of the three target countries of this survey. The participants mainly discussed support for small-scale fishermen recognized in common among the three countries among the issues pointed out by attendees in the local online workshops held for each country.

(1) Difficulty in Grasping Actual Conditions of Small Ships (Small-scale Fishers)

- Collection of data to grasp the current situation will fail if data provider is aware of providing data. For example, fishermen return to a port and sell fish no matter whether data is collected. It is recommended to collect data in the process of this behavior. The best way is to construct a system which can collect data while data providers act as usual without awareness of providing data.
- A project is being implemented in a fishing village with many small-scale fishermen in Indonesia; at the start, it was difficult to know when they went fishing and returned to the port and how many ships there were in the port. What is more, ships which went out of the port through a fixed location account for less than 30% and it was difficult to know through where the rest of the ships went out of the port. The introduction of IoT for outboard engines was discussed a little, but only fishermen with a certain level of financial power have outboard engines. Real small-scale fishermen convert mowing machines which are initially designed to be waist-mounted as outboard engines. Such ships go out into the open sea surprisingly far away from the port for fishing. Some ships get lost and do not return but statistics are not taken, so it was difficult to grasp the actual conditions correctly. Therefore, firstly it was started to count the number of ships flying drones along the coastline during the time of day when fishermen did not go fishing.
- There is an example of successful sharing of information. A short while ago, the prices of fish were transmitted in Kerala in India. (Compared with farmers) Fishermen can move between ports by their ships, so they could select a port based on the information. However, this example is more applicable to medium- and large-scale fishermen. The movement range of small-scale fishermen with ships equipped with an outboard engine alone is limited by the fuel cost and cannot go to a fishing port slightly farther even if they know the prices of fish are higher in the port.
- Though this is a case of Southeast Asia, basically small-scale fishermen have a weak standpoint. For example, fish buyers lend funds for purchase of fishing equipment and ships to fishermen and beat down the prices of fish. This makes small-scale fishermen equivalent to peasants of buyers. To solve this situation, it is important whether they can get information such as market prices of fish. As of now, in most cases, fishermen cannot access such information and it goes without saying that buyers do not share such information with fishermen, so a mechanism for fishermen to share such information is necessary. For the creation of such a mechanism, it is very important not to only construct a technical system but also to confirm whether there are networks among people.
- It is essential to consider both the introduction of technologies and the existence of (human) organizations to use them. In addition, the way of support depends on whether there is any existing organization. Since there was a cooperative in Kerala, so the above-mentioned system succeeded.

- Cases of reinforcing the organization of a cooperative using digital technologies are rare even in Japan. Some Japanese fishery cooperatives are digitized but others are not. Even in the case of digitized cooperatives, multiple companies deliver separate systems to one cooperative, so the data of the systems is not integrated in many cases. It will be very difficult without successful design at the time of introduction.
- Even in Japan, it is necessary to collect various information for monitoring and evaluation for the Revised Fisheries Act. On the other hand, in countries where the top-down style is more effective than in Japan, the introduction itself may be easy with successful initial design. In that case, it is also important to educate personnel of the related ministries who will be engaged in the design and introduction. In the case of Morocco, personnel of the related ministries often do not know the current conditions of small-scale fishermen.
- The order of support would be as follows: reinforcement of the capabilities of the cooperative to enable it to fulfill its roles, introduction of the necessary technologies, and arrangements to enable to use the technologies. For example, though the degree varies, the fishery cooperative system is prevailing among small-scale fishermen. In addition, the penetration of mobile phones is high even in rural areas. Therefore, firstly it is worth consideration to firstly execute a technical cooperation project for reinforcement of the organization of a fishery cooperative and introduce a mechanism to share information using mobile phones, whose penetration is high when the organization becomes manageable.
- In a successful case in Japan, an information sharing app was created and information including fishing grounds was shared “within” a cooperative to promote competition “among” cooperatives, which improved the productivity. In Japanese fishery, fishermen had been hiding their fishing grounds because fishermen can get the ownership of all of the fish they caught, but it was proven that with information shared in the cooperative, the prices were kept higher, the overall productivity improved, and finally the revenues of each fishermen increased. There are still few cases in Japan, so it is difficult to introduce right now, but if this mechanism can be explained and made understood, it can be introduced in other countries.
- Since fishery is hunting, competition is motivation for many fishermen. By collecting successful cases in Japan, how to manage fishery is researched by introducing a good balance of cooperative matters for improvements in the overall productivity and making fishermen voluntarily preserve resources (because fishery is business to hunt natural resources). Someday, it would be introduced using schemes such as SATREPS in Morocco.
- Though this is a case of farming village support, Microsoft Japan started to provide the basic information necessary for agriculture such as weather as support for farming villages suffering from depopulation and then elderly farmers aged 70 to 80 accessed the information using tablets and the distribution became active.
- When training is provided in Japan, common issues are that they had no statistics (they cannot grasp the current situation) and they cannot save a life because they do not know the locations of the people to be saved. As for provision of products and services for small-scale fishermen, the buying motive may rise if data can be collected by adding a simple sensor to the outboard engine. Moreover, the availability of remote fault diagnosis as manufacturer support may increase the added value.
- In the case of SATREPS of Indonesia, every day it is written on paper by hand which ships caught what and how much and then it is entered into Excel to create weekly and monthly reports after returning to the office. So, a simple digital entry form was created to enable to enter information on-site. As a result, it became possible to display statistical information in real-time with signage. Before that, such statistical information

was tallied about every three months and displayed in the bulletin board. It was started to collect data for the introduction of the fishing quota system, but the result was not limited to it; the importance of resource management was continuously promoted by showing numbers to persons concerned in real-time. Thanks to accumulation of statistical information, the catches per ship can be calculated. Resources can be roughly evaluated based on it.

- Digital technologies are used for resource management of sea cucumbers in Rumoi in Hokkaido. There, when the button of the app is pressed when starting and finishing fishing, the departure or arrival time is entered and the catches in the time period can be recorded by recording the catches. A mechanism has been established which can collect records of when, where, and how much fish were caught by integrating the information of VMS. By knowing when, where, and how much fish are caught, resources can be evaluated at high accuracy which cannot be achieved by knowing the overall catches. In addition, teaching successors showing data and showing the results of activities for resources contribute to maintenance of motivation (or persuasion) of fishermen.
- It will be successful if a government makes a request of a loan to development partners for the introduction of equipment with useful functions (for example, outboard engine with a sensor) from various angles (lifesaving, collection of statistical information, etc.) after reinforcing the organization of cooperatives by technical cooperation project.
- To establish best practices, it is important to agree to the introduction of digital technologies and select two to three cooperatives which are not so large and have a leader with strong leadership. If such cooperatives succeed, the surrounding cooperatives will follow them. Moreover, the fishery of Morocco is like a leader for the surrounding countries such as Senegal, so if Morocco succeeds, Morocco may develop human resources in the surrounding countries.

(2) Slow Development of the Aquaculture Industry (Especially Marine Culturing)

- Aqua farming cannot be profitable unless the water temperature is high and products with high unit prices for which there is a market in the export destination are farmed. For example, shrimps and shells. As a field to which digital technologies can be applied, there would be a great demand for a system which can record the necessary information (feed, etc.) to get eco label (environment certification) and disclose it to consumers.
- For export of farmed products, EU has markets for various fish species, but the hygiene standard (EU HACCP) is severe. Digital technologies may be useful for collection of the data necessary to meet the standard. On the other hand, the Japanese hygiene standard is not so severe that export itself is not so difficult, but there is no market for fish species which are not used as foods in the Japanese cuisine culture (such as tilapia and catfish), which cannot be solved by digital technologies.
- Digital technologies might be useful in preparation of aqua farming. For example, there might be a technology which can be used to grasp where the wave is weak in the port, where seawater circulates, and where equipment is easy to install (not costly).
- Aqua farming requires initial investments. Some fishermen who hope for starting with seaweed cultivation, whose cost is relatively low, and then shifting to aqua farming of fish, but if they borrow money from buyers, they will become peasants as mentioned above. Therefore, it is important to set up support measures and

roadmaps so that small-scale fishermen can start with seaweed cultivation and then step up to aqua farming of fish.

- In Morocco, the government prepares aqua farming sections and provide places for aqua farming to small-scale fishery cooperatives. However, before considering digital technologies, they do not know how to do aqua farming, so JICA is also required to provide support. Though it is not a digital technology, the Japanese aqua farming technology is likely to be useful.
- There are few ocean areas suitable for aqua farming, but it is important to establish a system to enable to shift to aqua farming as an option when some fishermen lose job as small-scale fishery is streamlined in the future.

(3) Notes on the Introduction of Digital Technologies

- The level of education of fishermen tends to be lower than those of workers in other industries. It is necessary to note that the introduction of technologies streamline fishery as a whole, improved the productivity, and increase the total size of the pie, but in terms of individuals some negative impacts occur such as expansion of gaps or loss of job. The same tendency is also seen in Japan, in which the number of small-scale fishery forms is the greatest among the developed countries. If the introduction of technologies expands gaps, it will be necessary to investigate the cause and take measures to solve the gaps or support raise the bottom line. If technologies are introduced without considering measures for gaps, poor people will get poorer, so firstly gap reduction measures should be considered when examining the introduction of technologies.
- DX just means that certain work can be done faster than by manual. In addition, thanks to DX, anyone can share/utilize know-how of experts/craftsperson. However, in this case, it is necessary to note that some experts/craftsperson's may show a rejection to DX if who will receive benefits from it is not considered.
- For the introduction of technologies, the implementation will be faster if a method is considered to reuse what is already used in another sector, etc. For example, if there is a place like a port (ships do not come alongside anywhere such as a coast) and the route through which ships pass is fixed to some extent, the system which monitors access to a plant site, power plant, etc. can be reused. Converting a system for monitoring of cars to a one for ships can reduce costs in terms of both time and money. Cameras equipped with AI are manufactured by Hitachi, Panasonic, etc. in Japan.
- When considering reusing technologies, it is important to identify the issues and understand what to be solved. Therefore, matching between needs and technologies will not succeed if those who know the conditions of the site cannot explain the conditions to those who do not.
- For the following two reasons, the roles of the government are important in the introduction of digital technologies.
 - A generation ago the ownership of digital technologies itself directly lead to wealth. However, in the current world of cloud/data, technologies are difficult to hold, and values are generated by sharing technologies. For example, even without PC or smartphone, just sharing collected data by SMS of a flip phone is of value. Even under such circumstances, only those organizations which arranged infrastructures can get wealth by digital technologies. To increase the wealth of a country, it is meaningful for the government to proceed with the introduction of digital technologies as infrastructure arrangement.

- Though there are many technical methods to collect the same data, it is important to unify the formats and methods into one, if possible, in order to proceed with the utilization of data after that (on the contrary, if data is collected separately, there will be another burden to integrate the data before using it). The government can proceed with the standardization.

7.3. Industrial Development Sector

The industrial development sector is a target sector only in Tunisia in this survey. The participants discussed the issues pointed out by attendees in the online workshop in Tunisia.

(1) Factory Digitization

- In the case of a labor-intensive industry, the introduction of IT technologies may rather increase the costs, which may deteriorate competitiveness. In such cases, human resource training is more effective. Therefore, it is necessary to judge whether to introduce IT technologies considering the business category and growth stage of the target company.
- The degree of freedom of IoT varies between production of final products and that of parts/components. The degree of strategic freedom varies between the case of following drawings or instructions provided by the client and the case of performing design and marketing in-house. As in Germany, small and medium companies can change marketing and clients relatively freely. For such companies, it can be recommended to implement highly advanced IoT or digital strategies. On the other hand, what is required of subcontractors of manufacturers in EU is efficiency and low prices, the direction will be different. It is important to grasp this point.
- It will be a good idea to firstly improve the productivity and then proceed to the next step such as in-house development and development of sales channels when the industry grows to a certain extent.
- It is quality that directly contribute to IoT in the production site and there is a potential in reduction of defective goods and checking them as soon as possible. Digitization is costly, so it does not pay if quality loss is greater than the cost. Basically, considering the condition of Tunisia, it would be better to proceed with analog Kaizen activities a little more before starting digitization.

(2) Relationship between IoT and *Kaizen*

- As for African companies, the merits of digitization and the degree of cost reduction are unknown. It is necessary to reinforce the basic capabilities of companies before introducing IoT. It is desirable to introduce IoT in the step following *Kaizen*.
- However, it does not mean that *Kaizen* should be performed firstly and then IoT. There is a conventional approach to get rid of waste by stepwise *Kaizen* and then perform digitization. The reason for adopting this approach is that if digitization is performed forcibly while the ways of operations are bad, the bad points may be fixed. However, it is different in the case of IoT. *Kaizen* does not necessarily have to be performed before IoT and they can be proceeded with at the same time; in some cases, IoT is performed firstly, and the data obtained through it can trigger *Kaizen* activities.

- IoT tends to be recognized as an approach for big companies because it tends to be big in scale and costly. Industry 4.0, which is advocated by Germany, is also recognized as such. The reason why recently IoT have been attracting attention is that such devices as Raspberry Pi and Arduino have become readily available. For example, they can start with collecting various data using microcomputers and sensors whose prices are about 3,000 yen. For example, easy usage methods of 3D printers, methods to get sensor information using Arduino, etc. are taught in public lectures of universities, etc., so it is recommended to use a curriculum picking up good points.
- The contact point between *Kaizen* and IT is “visualization.” In the past, monitoring of workplace have to be done on-site by using a stopwatch, etc. but now remote monitoring is possible with sensors, etc. so digitization is possible. Thanks to it, IT enables “visualization.” Thanks to digitization, it becomes possible to notice important things and educate workers on-site by showing the circumstances of the site. However, it is still important that finally people work on-site. In this sense, IoT is an extension of the same concept as *Kaizen*. Thanks to *Kaizen*, just changing Post-it and analog tools used so far into digital tools will significantly streamline the work and realize reproducibility. IoT is rather effective enough by just using digital technologies for *Kaizen* than the step following *Kaizen*.
- In the Japanese style of IoT, IoT has come to be used as a tool of *Kaizen*. It requires almost no investment to get data from a sensor. The problem is that data is useless without knowledge on how to use data for improvements in productivity, quality, or operating ratio of equipment and maintenance. Therefore, *Kaizen* and various education for it are required.
- The point is that the *Kaizen* approach is sufficient and IoT can be started even without proceeding with the process in a leap. In this sense, IoT is not “followed by *Kaizen*”; the past image of digitization of plants was a style to design an information system for production, but now tools are given by IoT and then on-site workers use them freely.
- Even in Tunisia, it may be possible to their own style of IoT if competent on-site engineers lead IoT after teaching how to get and use data of production site.
- The factory scientist lecture is useful as a reference. The lecture provides training to teach how to create IoT devices which enables on-site workers to do *Kaizen* combining reasonable easy-to-use technologies. The lecture teaches a series of know-how from how to select sensors and how to use data storage servers to how to use analytic tools and then prototype items which can be actually used after participants return to their plants. It is a short-term lecture to develop human resources who can create homemade IoT tools at low cost. Through such lectures, IoT can be introduced in the world of *Kaizen* and then sensors and devices are used for *Kaizen* by IoT while participants created jigs and procedures in *Kaizen* activities before. This style can be introduced by even small and medium companies.

(3) Production Management Systems for Small and Medium Enterprises

- Support for development of production management systems easy for small and medium companies to introduce would be possible. It means that the government supports open-source system development, arrangement of documentation, demonstration experiments, third-party assessments, etc. for the purpose of propagation to small and medium companies.

(4) Industry 4.0 and Japanese Approach

- The honest conclusion is that ideas are going ahead, and on-site operations have not changed in both Japan and Germany. However, there is a critical difference between Germany and Japan, that is thorough standardization and formulation of rules in Germany. The good point of Japan is that the skills of on-site workers are so high that they can implement IoT and analyze data for Kaizen by themselves. This is only impossible in foreign countries. It seems that Germany focuses on standardization and preparation of manuals like Industry 4.0 so that anyone can implement digitization because the levels of on-site workers are low. Though it is yet to proceed so much, it will proceed at a stretch when it reaches a certain level of advancement. However, Industry 4.0 will not become the world standard.
- When it comes to the level of on-site workers, PLCs, in other words on-site controllers, are used for control in Japan but they have been replaced with PCs one after another in Germany. PCs are closer to IoT and smart apps because PLCs are good at logic operation but can just operate data and cannot process images, etc.
- In Germany, it seems that thorough standardization is performed in the whole company like only using Siemens products to surely establish the foundation. In Japan, it seems that known issues are handled in a patchwork style, but the establishment of the foundation does not proceed, and the skills of on-site workers fill the gap.
- Standardization of smart factory is about to be performed all around the world including Japan and CEFAC of the United Nations is also proceeding with standardization. However, it is not like the thorough DX advocated by Siemens, etc. The targets include, for example, processes such as automatic order reception and placement, preventive maintenance, and collecting very low-level data like TLC and processing it by PC. It is still unknown whether finally the whole plant will be written with the same protocol.
- Recently, Industry 4.0 has not been talked about so much in Germany, so it is like a short-term boom. However, looking back on that time, Industry 4.0 had a meaning as a national strategy against GAFA. The whole EU has been taking various measures such as the data law and GDPR; especially in Germany, manufacturing is a basic industry, so the strategic program as a preemption to protect the industry was Industry 4.0. The current GAFA countermeasure is designing of data distribution using cross-industrial data not limited to manufacturing in the data-drive economy, GAIA-X.
- In Industry 4.0, Siemens and Bosch are focusing on manufacturing but the persons in charge are making strategic approaches from the viewpoint of their head offices without knowing on-site operations so much. They seem to be not interested in trouble of workers in plants. When I talked about various things with experts, I often feel that they do not the on-site operations. On the other hand, all managers of plants know TPS. Kaizen, TPS, and 5S have really become global standards. However, in the current discussion of Industry 4.0, IoT and ERP are directly mentioned without talking about such standards of on-site operations. In this sense, it is true that the standards of EU and Germany are powerful and their architectures are firmly established, so it is likely that if this continues, Japan will lose. However, there are theories which must be surely practiced in manufacturing such as Kaizen and TPS in order to promote implementation by on-site workers. The approach to reinforce the basic factors such as TQM by IT is a must. I feel that the approach to start with implementation by on-site workers will be possible only in Japan. In this sense, the point is not whether the bottom-up style is good or bad but that the approach upon understanding real operations well is important

and it should be considered after such an approach which of the bottom-up style, the top-down style, or the middle-up-down style to adopt. Anyway, it requires certain levels of theories and approaches to securely operate plants.

- Industry 4.0 is rather a connecting mechanism, so it is a layer of connection to the upper level in the hierarchical structure. If this layer connects in about three hierarchies and generates values, Industry 4.0 will be effective. Tunisia is still in the level of one or two hierarchies, so Industry 4.0 is not suggested but approaches suitable for the conditions of their on-site operations.
- The bottom-up approach based on on-site operations is the strength of Japan, but it cannot be transferred to overseas without transferring the high skills of on-site workers at the same time. In the case of Tunisia, it will be possible to bring and educate talented young people to Japan for skill improvements and then transfer Japanese technologies.

(5) Introduction of Robots

- What robots should do is the processes where workers are working under harsh conditions. For example, carrying very heavy items or working in dangerous places. The first process in which industrial robots were introduced in Japan is the car welding process. In the industrial structure of Tunisia, fiber, car parts, etc. account for large proportions, so not 6-axis robots with arms with multiple joints but mounters, small automation machines, etc. will be suitable. For example, the following approaches will be effective: automating the process of wire harnesses or introducing automation as well as getting the data of on-site operations from it by IoT, making Kaizen in an analog way based on the data first, and then feedback to automation machines in the next step to establish a mechanism combining inspection devices for automatic prevention of defects.

(6) Utilization of AI and Diagnostic Imaging

- Probably, diagnostic imaging will be suitable for the inspection process because it involves much manual work. Image recognition tends to be useful in inspection, so technologies can be utilized for situations of raising accuracy and improving the quality by supporting manual work.

(7) Support for R&D Activities by Companies

- New product development and new service development can also be streamlined by digitization. Quick prototyping using digital manufacturing technologies is also possible. The utilization of simulation technologies enables to streamline the development process. In addition, the introduction of IoT in product development enables to investigate the actual conditions of usage.
- As for the utilization of Fab Lab, resources are allocated outside a company. Fab Lab is utilized considering the industrial structure and the company scale.

(Note: There are 14 Fab Labs in Tunisia.)

(8) Utilization of Digital Technologies for Effective Utilization of Resources

- The power consumption can be measured easily by installing a cheap microcomputer. I experienced acquisition of sensor information using various microcomputers in a workshop. Such methods can be applicable for propagation.
- It is expected that they can find ingenuity suitable for their on-site operations by encouraging Kaizen introducing meters with which the usage conditions of water, electricity, etc. is easily checked. It is better to enable to not only visually check but also record and analyze the data. Kaizen is effectively especially when the causes are overspending, low awareness of saving, etc. and there remains much room for improvements by on-site efforts. It is also effective to collect and share ideas of ingenuity.

(9) Utilization of Digital Technologies in Non-production Sites

- There are many things to do before digitization of manufacturing sites. Small and medium companies, etc. can reduce and streamline workloads by outsourcing the back-office operations. They can accelerate and streamline order reception and placement, etc. by using external digital services. Digital services to support the operations of such companies are important.

(10) Possibility of the BPO Business

- Tunisia is characteristic in that the unemployment rate is high while the education level is high and the business of outsourcing of call centers is active. In addition, Tunisia is a French-speaking country, so there may be a business opportunity for BPO for French-speaking countries making use of affluent engineers. Domestically digitization of slip management, etc. is also proceeding rapidly and the back-office operations are becoming online, so the demands for BPO business are also expanding.

(11) Possibility of Japanese Technologies for E-government

- Leading Japanese IT vendors aim at big companies and are unlikely to deploy business for small and medium companies in Tunisia. However, Japanese companies may be interested in such business as delivery of a system of an e-government for the tax payment procedures.

7.4. Transport Sector

The transport sector is a target sector only in Egypt and Tunisia in this survey. Among the issues pointed out by the participants at the local online workshops held in each country, the discussion focused on the issues that were cited as common issues between the two countries.

(1) Utilization of Transport Data (in the context of Mobile Payment, MaaS)

- In Egypt, etc., there are private ride-sharing services such as Careem and data is increasingly accumulated. Measures and mechanisms for collecting such data from a "public" standpoint will be important. An approach in the context of MaaS is also an option.

- How well and appropriately mobile payment and transport data utilization are connected is important, especially in the early stages. Since records are accumulated, demands can be grasped. By doing so, what kinds of measures cause what kinds of behavior changes can be understood. For example, making mobile payment licensed and providing data to public for improvement of transport would be one of conceivable measures for utilization of increasingly available transport data.
- It is important to establish a mechanism which is convenient for users as well as keeps data intended to be useful for transport measures. In other words, it is important for the public side to clearly show the stance to ensure “governance” for utilization of transport data.

(2) Utilization of Transport Data (Possibility and Approach of RFID)

- In Egypt, recently it has been obligated to mount an RFID tag to a vehicle. Eventually, it will be mounted to all vehicles. It has a big potential for utilization in various aspects.
- For example, commercial vehicle management, ETC, TDM (Traffic Demand Management) like ERP (Electronic Road Pricing), grasping of the traffic volume (including utilization as an alternative for the traffic survey), payment of parking fees by associating vehicles with owner information, accident history management and related peripheral services (insurances, etc.), etc. can be considered.
- (Though this is out of the scope of RFID) There is a possibility that it can be deployed to MaaS-like services by sharing unique IDs between different transport modes and devices.
- Like this, various services are possible, but it is important to make proposals to the target country to set the direction by showing various possibilities in association with such measures before discussing individual services.
- Especially in Egypt in which the Ministry of Interior and the Ministry of Defense have strong power, utilization of data may be proceeded with in a top-down style. It will be important from the viewpoints of national defense and security to grasp behaviors of vehicles. So, it will be necessary to make such approaches as incorporating utilization for transport measures associated with it.

(3) Arrangements of the Environment for Utilization of Transport Data

- To realize various services as mentioned above, it is necessary to correctly arrange vehicle information and associate it with owner information. These are also closely related to the vehicle inspection system and tax system. For example, for the update of owner information of vehicles, a mechanism/system to surely impose taxes on owners is necessary to ensure application to the authorities by the owners themselves when they renew their vehicles. Such arrangements of the environment are essential.
- In addition, systemic identification and tracking of violating vehicles require standardized number plates. After these are properly maintained, billing and violation control will function, and systematization will become possible.

(4) Traffic Safety and Traffic Accident Countermeasures

- As for accident statistics information, in Japan, data is collected, organized, analyzed, and shared under the determined rules and in the unified format among the National Police Agency, the headquarters, and the traffic accident analysis center. It is also necessary to prepare such a mechanism and an organization.
- In developing countries, it is often the case that accident records have not been properly arranged, and it is assumed that this applies to Egypt and Tunisia. In addition to these, it will be effective to arrange the environment and reinforce the capabilities for investigation of causes of accidents and consideration of countermeasures and provide support considering the additional effects in the information field.

(5) Operation and Maintenance of ITS Facilities

- In Egypt, the project of development of ITS is in progress for highways of about 1,000km. In this country, the full-scale introduction of ITS facilities is yet to be started, so they don't have experience of operation. Therefore, it will be questioned how to operate and maintain the introduced equipment, how to use data, how to arrange the organization, etc. The situation of Tunisia would be similar to that of Egypt of a short time ago (expressways are increasingly developed and equipment is yet to be deployed).
- Considering these, there may be possibilities of support for future planning (formulation of MP, etc.), support for reinforcement of capabilities by technical cooperation projects, etc.

(6) Countermeasures against Overloaded Vehicles

- To proceed with countermeasures against overloaded vehicles, it is important to arrange the environment in terms of systems and legislation such as obligation of installation of on-board devices with GPS. Considering the situation that almost no equipment is introduced, it seems that there is room to develop a system and equipment in parallel on a zero basis.
- In addition, it will be important to consider it from the viewpoint of "how to start the measures" together with the target country such as starting with the introduction of many simple camera-based systems and expanding them. As a simple method, for example, there is a technology for estimating the weight using the acceleration sensor of a smartphone.

(7) Traffic Management and Signals in the Urban Areas

- Considering the situation in the urban areas such as Cairo, there may also be a possibility for support related to traffic lights as a measure to improve traffic in urban areas. MODERATO is a Japanese representative traffic light technology, but it will be meaningful to consider the possibility of support for signals including whether a Japanese-style should be brought as it is. The motivations for Japanese manufacturers to enter the market of the target country is also important.
- There is also a possibility to develop inexpensive traffic light technologies for developing countries and research and development of traffic light based on the probe technology is underway.

(8) Improvement in Public Transport

- Considering that metros and city buses are operated in Cairo and there are metros in Tunis, it is meaningful to consider the utilization of digital technologies from the viewpoint of MaaS as well to promote the existing public transport services and improve public transport services.

(9) Necessity for Policy Discussion

- In both countries (especially Egypt), VIPs and government officials related to information communication are eager and active to informatization of the country. On the other hand, the interests in the transport field seem to be low. It will be important to consider various things including transport measures together with them from the vision level. Since young people are highly talented, it is also an option to proceed with policy discussion, etc. as well from the viewpoint of human resource development.

(10) Other

- In this workshop, issues were pointed out but the reasons such as causes, and backgrounds are unclear. It is also unknown who is involved and how, including the planning and implementation of each policy and measure. When it comes to the utilization of digital technologies for resolution of issues, these should be mentioned and pursued before discussing solutions and technical theories.

7.5. Education Sector

The education sector is a target sector only in Egypt and Morocco in this survey. The participants mainly discussed the following issues recognized in common in both countries among the issues pointed out by attendees in the local online workshops held for each country.

(1) Arrangement of the Communication Environment for Propagation of Remote Education (Infrastructure, Facilities, Equipment, etc.)

- Even in rural areas without Internet environments, it is possible to provide learning contents by synchronization with the Learning Management System (LMS) using the 3G mobile phone network. Learning contents can be managed in local environments using a client PC available at a reasonable price, so an always-on connection environment is not necessarily a must.
- Though it is not necessarily interactive, it is possible to provide uniform learning contents by storing learning contents in USB sticks and distributing them to pupils and schoolers. It is also a good idea to provide learning materials which teachers in rural areas without Internet connection can use devising quiz, assignment, etc.
- Securing of power supply is also an issue.
- As for the realization of remote education, it is not so difficult to create a platform using open-source materials, but it is necessary to prepare learning contents suitable for the country upon confirmation with the government of the target country.
- Even in urban areas in Japan, there still remain technical issues in simultaneous provision of remote education to pupils and schoolers. Countermeasures must be considered from different viewpoints for different

countries: for example, considering utilization of Japanese technologies in urban areas and constructing an environment (e.g., stick PC)/system which can be operated in the local environment even in regions without Internet connection like rural areas.

- It is doubtful that the target countries can implement what is yet to be realized due to many technical issues even in Japan (propagation of remote education).
- Byju's is a startup in India which provides EdTech and proceeding with the activity to distribute devices by itself without depending on the government though it is a private company. Active consideration should be given to the method to support activities of Japanese private companies by ODA.
- What private companies expect for JICA and Japanese ODA in penetration to overseas is the arrangement of Internet infrastructures. With support such as an improvement in the Internet access speed, provision of Wi-Fi, and distribution of tablets, Japanese private companies will be able to provide various learning contents.
- There may be a risk of theft, etc. in the case of distribution of tablets.
- JICA is expected to arrange the network infrastructure by ODA before discussing the assistance to each sector. After that, it can be considered what each sector including private ones can do.

(2) Revision of the Curriculum for Remote Education/Development of Education Materials (Primary and Secondary Education)

- Some items can achieve learning effects through learning experiences without Internet connection. It should be carefully considered separation between what should be made online and what should not. It is not reasonable to introduce Internet and tablets for everything.
- Remote education and ICT education materials have not value without learning effect. It needs to fully examine it without making leapfrog itself the goal. It enables selection and concentration of investments.
- For maximization of learning effects in capacity building in childhood, the best ratio between online inputs and offline outputs is 9:1. The inputs of SoroTouch¹⁵⁹ can be completed online with tablets using gamification. Before the coronavirus problem, facilitation and coaching by facilitators and construction of an environment with peer pressure among children were performed offline, but now all of them can be completed online. It is not necessarily successful to consider remote education with the same time allocation as before the coronavirus problem. Learning effects can also be achieved by making inputs outside schools (flipped classroom).
- Careless revision of curriculums may cause confusion in schools.

(3) Improvements in Skills and Development of Capabilities of Teachers for Promotion of Remote Education

- In the case of SoroTouch, facilitators do not have to know how to use the abacus. The role to provide skills and knowledge can be transferred to IT.

¹⁵⁹ New learning method of mental calculation applying the mechanism of the abacus developed and provided with the iPad by Digika Co.,Ltd. Thanks to a mechanism of automatic repetitive learning of missions in accordance with the learning level, each child can proceed with learning at an appropriate pace.

- It will be necessary to keep the ICT technology separately from teachers in charge of classes and allocate personnel who can support remote education. In this aspect, JICA can provide some support. In Japan, ICT supporters are allocated to some schools. On the other hand, it is desirable that teachers can handle ICT as well.
- The most difficult obstacle was the capabilities of teachers in the attempt to introduce remote education in Japanese universities. If local teachers in the target country have anxiety about propagation of remote education, some support for them will be necessary.

(4) Development of Human Resources Which Meet the Needs of the Labor Market (Job Training and Higher Education)

- The capabilities of teachers were also the bottleneck in achievement of learning effects in Rwanda. The cause of low capabilities of teachers is the lack of an environment where teachers can learn. It might be necessary to consider support for teachers before support for schoolers.
- In Egypt, Nafham delivers free education contents in YouTube. The same activity will be possible in Morocco as well. It is also possible to introduce stick TV or any other similar equipment to deliver education contents to a whole school so that the contents can be used for not only learning of pupils and schoolers but also training of teachers. It should be also considered a mechanism to collect and provide existing contents with low technology and low cost.

(5) Other

- It is desirable to set up a scheme for co-creation between Japanese private companies and local startups.
- Penetration of Japanese private companies to Africa is a part of branding. A mechanism to make known activity results in Africa inside and outside Japan will motivate Japanese private companies.
- If there is a prototype demonstration experiment field, it will be helpful. It is desirable that local information is available even in Japan.
- The effects of Japanese technologies are difficult to confirm just with specific pilot schools. Overseas expansion is difficult for private companies to consider unless the scale reaches a certain level such as the whole area of a certain region.
- It is recommended to refer to Learning Compass 2030 of OECD about how JICA should support the education sector.

7.6. Health Sector

The health sector is a target sector only in Egypt in this survey. The participants discussed the issues pointed out by attendees in the online workshop in Egypt.

(1) Utilization of Digital Technologies for Correction of Regional Gaps

- Remote diagnosis is usable. However, diagnostic imaging requires the arrangement of a digitization environment such as IT infrastructures and existence of high-level doctors and hospitals which make instructions and perform diagnostic imaging.

- In Egypt, there is a gap in the level between private hospitals and public hospitals, so it is necessary to consider the gaps in the construction of networks and systems. The possible issues to be noted are the problem with the connection of AWS, the arrangement of the health management information system (MHIS), power supply, and installation locations of servers.
- As with remote diagnosis, other support for hospitals in rural areas is also possible. It is necessary to grasp the current situation of IT of Egypt and consider support in accordance with the level.
- For remote diagnosis, the lack of infrastructures can be covered by the image communication system of Allm and it is possible to make a proposal as a best practice. In addition, it will also be possible to make use of the experience of Castalia.
- The lack of pharmaceuticals in rural areas is difficult to examine with the currently available information. It is necessary to grasp the cause of the problem: for example, logistics, order system, funds, or capabilities of staff. If the problem is identified, the utilization of appropriate IT tools can be designed.
- The cause of the lack of pharmaceuticals is unlikely to be a problem with logistics. It is considered that unlike Japan, the on-time order system is not adopted in Egypt so the order method may be the cause. Moreover, in developing countries, the budget is the biggest cause of the problem of pharmaceuticals. The bottom line is that it may become an issue of this problem how to allocate the limited budget.

(2) Family Doctor Problem for the Health Insurance System

- Information is required on how important the role of family doctors (primary care doctors) is in primary medicine in Egypt. It is necessary to clarify the number of family doctors and the needs for family doctors. Based on it, it is possible to design digital tools suitable for the needs.
- If the number of patients treated per day is limited due to lack of family doctors and this limitation causes tightness, possible support will be supply of OTC, chatbot-based medical consultation, etc.
- There already exists a medical interview system using AI, so by using it, it is possible to expand the patient services in rural areas suffering from lack of family doctors. For this issue, LEBER in Japan has know-how.
- The health insurance system requires collection of premiums and charging medical costs using HIS effectively. In this aspect, knowledge accumulated in Japan may be useful.
- WHO, etc. is promoting family doctors because they can reduce medical costs in developing countries. However, in reality, patients tend to go to large hospitals. It is often the case that when they cannot receive an examination in a hospital of a lower level, they go to a hospital with an examination capacity. In Japan, it is possible to receive a certain level of diagnosis and examination with the same NHI points and the same medical fee regardless of the region as long as the level is the same. This leads to a sense of security to believe that any hospitals are acceptable. The biggest problem is that citizens have no such a sense of security in developing countries. The issue of universal health coverage is which hospital is the first to be accessible and whether the level of the hospital is acceptable. The levels of family doctors and nearby hospitals and clinics will become an issue. Alternatively, a sense of security has to be secured by making available acceptable diagnosis using AI even when the levels of nearby doctors are unacceptable.

(3) Electronic Medical Record System

- It is desirable to construct an electronic medical record and MHIS locally (in Egypt) considering the problems of language, etc. As for the method to support from Japan, it is recommended to provide technical support related to the whole system and make local vendors elaborate the system.
- As for electronic medical record, private hospitals are going a step further. The future issue is the integration of private hospitals into the electronic medical record system in the process of digitization of the government. You should also consider supporting the establishment of the system for it, etc.
- Judging from the current situation of Egypt, the development of a large-scale electronic medical record system is considered to be difficult. It is stupendous work, to cover all hospitals in Egypt with HMS. In the case of the HMS project in Pakistan, it was difficult to cover tertiary medical institutions because there were too many hospitals. The targets were set to the primary and secondary public institutions, but it took about 8 years to introduce the system in 18,000 places. Even in this procedure, the support from Japan was limited to technical advice and the actual construction was up to local personnel.
- You can focus on development for accumulation of medical data rather than charts. As for development, it will be easy to accumulate patient data in real-time using Fitbit and iPhone.
- In many developed countries, various solutions are introduced in on-site operations, and it is rather a problem how to integrate them. On the contrary, in developing countries, it is a possible option to deal with EMR together in the context of the electronic government. The Egyptian government may have such needs and Japan may support a part of the needs.
- In reality, private hospitals hesitate to provide data. This is because if the government grasps the number of patients and the sales, they will impose taxes. It is very important how to set up laws to make them provide data.

(4) Improvements in the Quality of Medical Services/Doctors

- Changing the awareness of medical services among citizens is important and it is desirable to enlighten them using IT as a tool.
- As with (1) above, the IT tools of remote diagnosis are considered to contribute to improvements in the quality of medical services effectively.
- Possible measures upon confirmation of the current levels of doctors by survey are, for example, improvements in education curriculums to improve the levels of doctors in accordance with the current situation, construction of a system to provide medical information, utilization of education and information provision systems using IT, etc.
- Improvements in the quality of medical services or doctors are large-scale activities covering the whole country and it is necessary to examine the education of medical faculties. Therefore, the extent of utilization of IT for education of medical faculties has to be examined. The first thing to do is to surely grasp the current situation; after that, consider the suitable tools and customize those which can be adapted to Egypt.

(5) E-health Project of the Ministry of Health and Population

- As a short-term operation, it is important for the core hospitals such as Cairo University to lead hospitals of lower levels.
- The issue is how to link urban areas with rural areas using E-health. It is also necessary to investigate and consider the methods to connect private image centers with each facility.
- PACS (image transfer system) must have been introduced in major hospitals, so it is possible to hold a conference linked with PACS. However, a survey to grasp the specific needs is necessary. In Brazil, a project to improve the medical level of Brazil was conducted connecting Sao Paulo with Belem over a distance of about 3,000 km.
- Existing devices (iPhone, etc.) are likely to be usable with less constraints in developing countries. It is also possible to procure and supply reasonable devices by yen credit, free financial aid, etc.

(6) Utilization of Private Digital Services

- Since the aging rate of Egypt is not so high, elder care may not be an important issue yet, but home care may become important even in Egypt depending on the consequence of COVID-19. In the case of the UK, the specialized operator, RL Radix, provides medical evaluation services of patient safety of nursing care. There is a possibility that some support can be provided using this case as a reference.
- The startup of geocoding, what3words, in the UK has a technology to identify locations accurately at the level of 3mx3m. The South African government purchased this service and used it for the identification of patients' addresses. It is used for such purposes as identifying the location and dispatching an ambulance care in the event of an accident.
- Data business, which is a business model to provide digital services using services of platformers such as Google and Amazon, has appeared. This is also a new possibility realized in the medical field. The startup, Syounika Online, is a Japanese example. It provides a consultation service which customers can use easily with smartphone.
- In developing countries, there is a business model to cooperate with a telephone company to make the telephone company to distribute devices for free or for a telephone company to cooperate with the World Bank, ADB, etc. to periodically deliver medical information and make residents receive regular checkups, etc. for maternity medical examination, which is often performed in Japan, etc. Users are attracted to such information services subscribing services of telephone companies being, so this business model is profitable for telephone companies.
- In South Africa, USAID conducted a project to distribute PALM to facilities and gather information from the facilities. Now devices are advanced and very reasonable, which enables a business model to distribute devices for mutual exchange of information.

(7) Suggestion about Medical Costs

- Above-mentioned remote diagnosis and remote education using IT are also expected to reduce medical costs. If remote diagnosis is available without going to a hospital, users will also enjoy the merit of cost reduction.

(8) Timeframe of Support

- The time frame varies among the discussed contents: for example, the time frame is long for the contents of human resources but short for the contents of utilization of digital devices. The arrangement of infrastructures is mid-term work.
- From a short-term viewpoint, Fitbit was mentioned. It is a fresh idea to collect data with devices. Though problems may appear, this idea would be executed immediately. It is necessary to gather and consider a comprehensive range of actual cases in developed countries such as usable digital technologies including these.
- Development of human resources is 20- to 30-year work, but if it is important, a long-term commitment will be required.

(9) Awareness Raising for Medical Services among Egyptian Citizens

- Initially, the current awareness of medical services among Egyptian citizens is important. It is necessary to investigate whether there are needs and trust for western-style medical services and then consider how to raise the level of national education and match it with medical services and enable to use IT tools for communication and enlightenment.
- In Africa, it seems that culturally the knowledge of citizens on medicine is very limited. In some regions, there is no culture to consult a doctor even when getting a cold and feeling ill, to feel a fever, or to check the bodily temperature. This may apply to Egypt, but the culture to consult a doctor when feeling ill has to be coordinated well with medical services by raising the level of education.
- On the other hand, health checkups with facilities like health offices in schools are performed in the school health system in Egypt, so this aspect seems to be more advanced than other countries. On the other hand, it is doubtful whether traditional medical services match modern medical services in the Islamic culture. In this sense, the medical enlightenment activity for citizens is very important.

Chapter 8 Evaluation and Narrowing of Digital Solutions Applicable to Development Issues

8.1. Setting Evaluation Criteria

Based on the development issues and solution ideas raised at the first workshops in the target countries, and the proposed digital solutions at the domestic workshop, the JICA Study Team evaluated and narrowed down the promising digital solutions by subject sector. The evaluation of digital solutions was conducted according to the following evaluation criteria. The results of the sector-specific review are presented in the next sections (see also Appendix 4).

Table 8-1 Evaluation Criteria for the Selection of Candidate Projects

No.	Criteria	Description of the criteria	Evaluation indices
1	Direct Involvement of Digital Technology	Confirm whether digital technologies can be used for the extracted issues and solutions.	Presence of similar cases
2	Feasibility of the project	To proceed with implementation as a project, confirm whether there exist any assumptions.	Presence of assumptions
3	Priority of the sector in the target sectors	Considering the priority of each policy and plan and confirm whether the content contributes to the achievement of the priority.	Description in the development plan of the target country, the policy of the target sector, etc.
4	Possible outcome by the utilization of digital technology	Based on lessons learned from similar case studies in other countries, confirm whether any challenge can be resolved by utilizing digital technology.	The trend of digital technology introduction and donor support by government and startup status by sector
5	Cooperation of C/Ps and other government organizations	Confirm whether it is possible to receive the cooperation of C/Ps and other government organizations.	Relationships established through past JICA projects and cooperative stance at local workshops, etc.
6	Availability of various schemes	Considering support recipients, support scale and schedule, etc., consider the schemes assumed to be used.	Loan, grant, technical cooperation, SATREPS, Public-Private Partnerships
7	Possibility of using the experiences accumulated through the past Japanese cooperation	Maintain consistency with government development cooperation policies, etc., and confirm whether there is a track record of Japanese research and support such as the ones conducted by JICA.	Number of past JICA projects (excluding third-country training) (in and after 2010)
8	Possibility of using Japanese technologies	Based on lessons learned from similar case studies in other countries, confirm whether technologies of Japanese companies can be used.	Confirmation of the situation through domestic workshops and individual interviews

Based on the above-mentioned evaluation criteria, the JICA Study Team discussed feasibility as projects of the issues and solutions presented in local workshops for each target sector. The next section shows the review result of each target sector (Also see Attachment 4).

8.2. Agriculture and Fisheries Sector

8.2.1. Review Results

(1) Agriculture Sector

The following shows the result of the analysis of the agriculture sector.

Issue		Solution		Evaluation Criteria							
				1	2	3	4	5	6	7	8
Egypt											
1 The productivity of agriculture is difficult to improve											
1	The conditions of farms are not monitored.	1	1	Construction and development of sensors that can collect data such as the atmospheric temperature, humidity, and soil conditions (humidity and salt concentration) and systems that can analyze such data	○	○	○	○	○	○	○
			2	Visualization of the affluent experiences and track records of agricultural extension workers and development of a sharing system	○	△	○	○	○	○	○
			3	Construction of an agricultural land bank	X						
2	Weather cannot be predicted	2	1	Weather forecasts focusing on narrower areas	○	○	○	○	○	○	○
			2	Development of a system that can make prior warnings such as low rainfall/high rainfall forecasts and dry weather advisory	○	○	○	○	○	○	○
3	Farming input is not performed appropriately	3	1	Development of a system to notify the timing to use fertilizers	○	△	○	○	○	○	○
			2	Development of organic fertilizers	X						
			3	Provision of timely advice by agricultural extension workers	△	△	○	△	○	○	○
4	Water resources are yet to be used effectively	4	1	Visualization of the water volume of water sources	○	○	○	○	△	○	⊗
			2	Development of desalination technologies and recycling systems	X						
			3	Introduction of drip irrigation	△	○	○	○	○	○	⊗
			4	Utilization of rainwater and groundwater	X						
2 Agricultural and fishery producers are not improving the values added to their products											
1	A lot of agricultural and fishery products are wasted	1	1	Construction of cold chains (to prevent agricultural products from becoming rotten)	X						
			2	Development of comprehensive systems to manage all of the production, storage, delivery, and processing	○	△	○	○	△	○	○
2	Added value technologies are insufficient	2	1	Learning of food processing technologies and introduction of equipment for it	X						
Morocco											
1 The necessary data for productivity improvements are lacking, or difficult to use because it is stored in paper form or personal PCs.				○	△	○	○	△	○	×	△
1	Agricultural management resources (water and soil) are not managed.	1	1	Service using IOT technologies (There already exist several private companies)	○	○	○	○	○	○	△
			2	As for the production volume of cereal crops, a forecast system is available (Crop Growth Monitoring System)	○	○	○	○	○	○	△
2	The farming input (fertilizer and agricultural chemicals) is used more than necessary, so the production cost is high.				△	△	○	○	○	○	△

Issue			Solution		Evaluation Criteria									
					1	2	3	4	5	6	7	8		
	3	No information about market prices is available.			○	△	△	△	○	○	△	△		
	4	Traceability is insufficient.			○	○	○	○	○	○	△	△		
2		There is much food loss between farms and markets	2	1	To manage quality and reduce food loss, a technology to confirm the conditions during harvesting, delivery, and storage is desirable.	○	△	○	○	△	○	△	△	
3		The sufficient quality for export cannot be secured				○	△	○	○	△	○	△	△	
Tunisia														
1 Training for extension workers, young people, etc. is outdated.														
1	1	The program is not attractive for young people.	1	Development of programs attractive for young people	○	○	○	○	◎	○	×	○		
				1	Theoretical training and hands-on training are provided through e-learning and on-site, respectively	○	○	○	○	◎	○	×	○	
				2	Shortening of the learning period	○	○	○	○	◎	○	×	—	
	2	There is no class for cutting-edge technologies.	2	Implementation of classes for new technologies such as smart agriculture	○	○	○	○	◎	○	×	△		
				1	Introduction of equipment in training schools	○	○	○	○	◎	○	×	△	
2				Education of teachers	△	△	○	△	◎	○	×	—		
2		Advice to farmers and fishers is not timely or appropriate.	1	1	Consideration of the use of SNS in addition to spread of information through TV and radio	○	△	△	△	○	○	×	△	
				2	Construction of a database that can be accessed at any time when advice is required	○	△	△	△	○	○	×	○	
3		The management of the agricultural input is grasped.	1	1	Construction of a farming system that can be managed uniformly for the agricultural input, workers, and delivery	○	△	○	○	○	○	×	○	
				2	Development of an application that issues warnings regarding risks (weather, etc.) in advance	○	○	○	○	○	○	×	○	
				3	Development of a platform with which expertise and know-how can be shared	○	△	△	△	○	○	×	○	
4		Access to market information is insufficient.	1	1	Development of a tool/application that can secure traceability	○	○	○	○	△	○	×	△	
				2	Implementation of online training for branding to improve the product value (e.g., package)	△	○	○	△	○	○	×	△	
				3	Stabilization of prices of fertilizers, etc. and sharing of information	○	○	△	○	○	○	×	△	
				4	Promotion of e-commerce of agriculture products	○	○	△	△	△	○	×	△	
				5	Construction of a system with which market prices can be confirmed	○	○	△	△	△	○	×	△	
				6	Promotion of direct sales using an online platform	○	○	△	△	△	○	×	△	
5		Agricultural products, etc. are often stolen.	1	1	Introduction of a subsidiary system for costs for the provision of security cameras and microchips for livestock to be installed in farms	×								
				2	Consideration of joint management	△	○	△	△	○	○	×	△	

Issue		Solution			Evaluation Criteria							
					1	2	3	4	5	6	7	8
6	The technical and office work management system is complex, and information is not organized.	1	1	Electronification of procedures (being introduced little by little though it will take several years in total)	○	○	○	○	△	△	×	△
			2	It is better to also consider simplifying the procedures for electronification.	○	○	○	○	△	△	×	△

■ Top priority
■ Second priority
 ◎ Very high ○ High △ Medium × Low

(2) Fisheries Sector

The following shows the result of the analysis of the fisheries sector.

Issue		Solution		Evaluation Criteria									
				1	2	3	4	5	6	7	8		
Egypt													
1	Overfishing due to Illegal fishery is getting severer		1	Training for fishers regarding long-term impacts of overfishing	X								
	1	Fishing is performed in protected regions.	1	1	Development of systems to confirm fishery in illegal places (installation of beacons to ships, etc.)	O	△	△	O	O	O	△	△
				2	Selection and announcement of fish allowed to be caught	O	O	△	O	O	O	△	O
	2	Fishing is performed out of the fishing seasons.	1	1	Collection of correct information before fishing (grasping of fish including the sizes of fish, etc.)	O	O	△	O	O	O	△	O
				2	Improvements in fishing nets (not catching juvenile fish, increasing the mesh size, etc.)	X							
2	Wrong fishing methods are applied (such as the use of a trawl net in a coral reef area)		1	Training for fishers	X								
3	The increase in wastes has a negative impact on the ecosystem.		1	Training for fishers regarding impacts of dumping of plastic wastes	X								
			2	Development of containers made of materials that revert to nature	X								
			3	Cracking down on polluted water from plants (installing sensors, etc.)/Development of methods to clean polluted water	△	△	△	△	O	O	△	△	
4	Foreign species have a significant impact on the ecosystem			Execution of surveys on the impacts of foreign species (whether sensors, etc. can be utilized)	△	△	△	△	O	O	△	△	
	1	Domestic species are weeded out	1	1	Introduction of an effective mechanism to collect foreign species	△	△	△		O	O	△	△
	2	Foreign species are disposed of because people do now know how to cook them.	2	1	Consideration of how to use foreign species (especially pufferfish)	X							
5	The development of the aquaculture industry is slow												
	1	Workers of aquaculture are insufficient	1	1	Support for the shift to aqua farming by small-scale fishers	X							
	2		2	1	Introduction of water quality management systems	O	O	O	O	O	O	△	O

Issue			Solution		Evaluation Criteria									
					1	2	3	4	5	6	7	8		
	Aquaculture technologies (especially sea culture) are insufficient		2	Introduction of technologies to farm multiple types of fish depending on water depths	X									
			3	Automation of feeding	○	○	○	○	○	○	△	○		
			4	Introduction of systems combining aqua farming and hydroponic culture	○	○	○	○	○	○	△	○		
3	Reproduction of juvenile fish is not successful	3	1	Learning of aqua farming technologies of juvenile fish	X									
			2	Thorough water quality management	○	○	○	○	○	○	△	○		
Morocco														
1	Data related to small ships (small-scale fishers) is yet to be collected		1	1	Development and construction of the port management system	○	○	○	○	○	○	○	△	
			2	1	Development of a system like VMS for small ships (GPS has been introduced, so can we do something using GPS)	○	△	○	○	○	○	○	△	
1	It is necessary to visit fishing grounds just for confirmation of the necessity for arrangements of fishing grounds (positions of buoys, etc.).		1	1	Construction of a system that can share the conditions of fishing grounds and catches with the persons concerned	○	○	○	○	○	○	○	○	
2	Trading in the fish market for small-scale fishers is yet to be activated.					△	△	○	△	○	×	○	△	
3	Information regarding the oceanic conditions etc. is not distributed timely.					○	○	○	○	○	○	○	○	
2	The reliability of data is low.	1	1	1	Development of complicated analysis and AI, deep learning, etc. which avoid human arbitrariness.	△	△	△	○	△	△	△	—	
3	Marine culturing is yet to be developed.	1				X								
Tunisia														
1	No fishing cooperative has been established.	1	1	1	The setting of incentives to establish agricultural cooperatives and fishing cooperatives	X								
			2	2	Implementation of online training regarding the management method of agricultural cooperatives and fishing cooperatives	○	△	△	△	○	○	○	△	
			3	3	Formulation of guidelines and manuals for how to establish agricultural cooperatives and fishing cooperatives	X								
1	Information is not shared.	1				△	△	△	△	△	△	○	△	
2	Resources are not managed as a whole.	1				△	△		△	○	○	○	△	
3	Access to subsidiaries and loans is limited.	1				○	△	△	△	○	△	○	○	
2 Export of fishery products is stagnated.						X								
1	Sufficient traceability (demanded by importers) is not secured	1	1	1	Development of a system with which traceability can be confirmed without any other systems	○	○	○	○	△	○	△	○	
			2	2	Creation of a registration list of fishermen (Also usable for cracking down on illegal fishermen)	○	○	○	○	○	○	○	△	

Issue			Solution			Evaluation Criteria							
						1	2	3	4	5	6	7	8
2	Data is not unified because it is managed in Excel files, etc. by each individual.		2	1	Digitization of collection and management of data on seafood	○	△	△	△	△	○	△	△
3	No response to climate change has been made.		1	1	Digitization of collection and management of data on seafood	X							
				2	Implementation of research to simulate the impact of climate change	○	○	△	△	○	○	△	△
1	The atmospheric temperature, water temperature, etc. cannot be predicted.		1	1	Transmission of information on weather, sea conditions, the spread of diseases of agricultural products, etc.	○	△	△	○	○	○	△	○
2	Domestic species are not protected from red tide and foreign species					X							

 Top priority
 Second priority
 ◎Very high ○High △Medium ×Low

8.2.2. Narrowed Applicable Digital Solutions

The applicable digital solutions in the agriculture and fisheries sector which are narrowed down according to the results of evaluation are as follows.

Issue	Digital Solution
Lack of information sharing between agriculture and fisheries extension workers and farmers and fishermen	Development of a system to visualize and share the wealth of experience and knowledge possessed by agricultural and fisheries extension workers.
Delay of sharing information on weather and sea conditions.	Building a platform for timely information sharing.
Unknown fishing activities of small-scale fishermen, who are the majority in fisheries sector	Introduction of a simple digital operation logbook.
	Development of a simple Vessel Management System (VMS) that can be installed even on small fishing vessels.
Inadequate production management (in agriculture and aquaculture).	Build sensors that can collect data on air temperature, water temperature, humidity, soil, etc., and systems that can analyze these data.

With regard to agriculture, while farmers in Egypt and Tunisia are demanding more guidance from agricultural extension workers, it is difficult to assign enough agricultural extension workers throughout the country with limited budgets, so it is necessary to establish a system that can efficiently provide guidance through the utilization of digital technology. In addition, the spread of COVID-19 has disrupted the logistics of agricultural products, and the importance of agricultural extension workers, who serve as a link between the market and farmers, is being reevaluated from the perspective of food security.

In Egypt and Morocco, the necessary monitoring system (e.g., the mandatory installation of VMS systems for large-scale fishermen) has already been established to a certain extent, but the fishing activities of small-scale fishermen, who make up the majority of the fishing sector, have not been well understood. The introduction of digital technology is required. In addition, since the fisheries sector is an important means of earning foreign

currency, the utilization of digital technology is desired to promote more accurate and efficient management and monitoring of aquaculture and to further improve productivity. In Morocco, in particular, JICA has been supporting the fisheries sector for many years and is expected to continue its support for the sector.

In light of the above, we have selected the following promising digital solutions to be recommended.

Digital Solution	Contents
Egypt	
Digital technology that allows farmers to access information	It is necessary to collect and organize everything from input materials to market price information on a single platform and to provide such information through the platform. Other possibilities include the development of an application to manage the receipt and placement of orders by wholesalers who track farmers' inventories and look for places to sell, and the creation of an e-commerce site that directly matches producers and consumers. It is hoped that by opening up information, farmers will be able to improve their income.
Digital technology that allows a few extension agents to advise more farmers	Introduction of a system that will make the wisdom and know-how of agricultural extension workers and experienced farmers available as educational materials is requested. In addition, a system that allows farmers to easily ask questions to agricultural extension agents at any time via chat, SMS, etc., will be implemented to provide guidance to a large number of farmers.
Digital technology that can track aquaculture activities	Develop and implement applications that utilize cameras and drones to manage aquaculture facilities and monitor the status of aquaculture products, even remotely. It would be even better if it could automate feeding.
Morocco	
Digital technology that can track fishing activities (especially of small-scale fishermen)	It is important to develop and implement an application that can manage aquaculture facilities using cameras and monitor the status of aquaculture products even remotely. It would be even better if feeding could be automated. The introduction of such technology is expected to help ensure the safety of aquaculture operators (no need to take the risk of going to check aquaculture farms when the weather is changing) and reduce costs (no need to send out a boat to check). In addition, cameras and digital logbooks will be installed on small-scale fishing vessels (often rowing boats) so that the location of activities and the status of landings can be monitored. The key to introducing this technology is how to obtain cooperation from the target small-scale fishermen, and it is necessary to set up incentives for them.
Digital technology that enables sharing of information on weather, sea conditions, etc. in a timely manner	Since oceanographic information are still collected manually, it is considered to introduce a system that automatically collects data using sensors and buoys, etc., and a platform for analyzing and sharing such data, if it is more convenient and reasonable than the current way of doing so.
Tunisia	
Digital technology that allows farmers to access information	It is necessary to collect and organize everything from input materials to market price information on a single platform and to provide such information through the platform. Other possibilities include the development of an application to manage the receipt and placement of orders by wholesalers who track farmers' inventories and look for places to sell, and the creation of an e-commerce site that directly matches producers and consumers. It is hoped that by opening up information, farmers will be able to improve their income.
Digital technology that allows a few extension agents to advise more farmers	Introduction of a system that will make the wisdom and know-how of agricultural extension workers and experienced farmers available as educational materials is requested. In addition, a system that allows farmers to easily ask questions to agricultural extension agents at any time via chat, SMS, etc., will be implemented to provide guidance to a large number of farmers.

8.3. Industrial Development Sector

8.3.1. Review Results

The following shows the result of the analysis of the industrial development sector.

Issue			Solution		Evaluation Criteria							
					1	2	3	4	5	6	7	8
Tunisia												
1	Reinforcement of international competitiveness (major target industries: sewing, mechanical engineering, food processing, pharmaceuticals, and chemistry)											
	1	Development of human resources	1	The quality of engineers in Tunisia is world-class but it is necessary to develop young engineers.	X							
	2	Improvement in productivity	1	Utilization of IoT technologies.	○	△	○	○	○	○	○	○
			2	Introduction of intelligent systems to automate production lines.	○	○	○	○	○	○	○	○
			3	Promotion of promising foreign investments.	X							
			4	Introduction of global standard technologies.	X							
			5	Improve the administration system so that it will not hinder business (promotion of E-government).	X							
			6	Improve the understanding levels of company managers about IoT.	△	△	○	△	△	△	○	○
	3	Quality improvement	1	Kaizen is an effective approach.	X							
	4	Logistics improvement	1	Logistics support systems using GPS can be used effectively (in both companies and overall logistics networks).	○	○	○	○	△	○	△	△
5	Arrangement of infrastructures	1	It is necessary to arrange digital infrastructures.	X								
2 Improvement in added values												
1	Market trend analysis	1	We can know cutting-edge technologies by participating in international technology events such as industrial fairs	△	○	×	○	△	△	△	△	
2	Business intelligence	1	In Tunisia, some startups are using AI and providing services that improve added value.	○	○	○	○	△	○	△	○	
3 Reinforcement in value chains												
1	Technology transfer	1	Raise the R&D capability for differentiation even in small companies of one or two employees.	△	○	○	△	○	△	○	○	
2	Cultivation of subcontractors and third-party suppliers	1	Provide fund support such as funding for R&D activities for reinforcement of capabilities (quality and productivity) of small vendors and expansion of the use of the credit guarantee system.	X								
		2	Propose digital solutions (production control systems) suitable for small and medium companies.	○	○	○	○	○	○	○	○	
4 Reinforcement of marketing												
	Improve marketing communication using digital technologies.			○	△	△	○	△	△	△	△	
	1	1	It is important to select effective online marketing tools and it is also necessary to solve institutional constraints. The development of E-commerce requires support from persons concerned such as	X								

Issue	Solution		Evaluation Criteria							
			1	2	3	4	5	6	7	8
		the ministries, the central bank, the post office, etc.								
	2	It is also necessary to construct reliable infrastructures.	X							
	3	Introduction of a tracking system of collection and delivery.	○	△	○	○	△	△	△	△
	4	Introduction of ChatBot.	△	△	△	△	△	△	△	○
5 Utilization of byproducts										
1	Technologies to use byproducts	1	X							
2	Waste recycling	1	△	△	○	△	△	○	△	△
6 Optimization of resource costs										
	1	Digital technologies to improve energy efficiency have been developed. The National Energy Management Agency (ANME) has formulated many effective measures. ANME provides funds for surveys and development for the company-level use of sunlight.	○	○	○	○	△	○	△	○
	2	Practical technologies have been introduced for monitoring of utilization of resources (water, fuel, and energy consumption), etc. In Tunisia, this field has only just begun but startups that provide solutions in this field have been founded.	○	○	○	○	△	○	△	
	3	Control system of heating and cooling of factory lines	△	△	○	△	△	○	○	○
7	Efficient business management under the COVID-19 catastrophe	1	○	△	○	○	△	△	△	△

Top Priority
 Second Priority
 ◎Very high ○High △Medium ×Low

8.3.2. Narrowed Applicable Digital Solutions

The applicable digital solutions in the industrial development sector which are narrowed down according to the results of evaluation are as follows.

Issue	Digital Solution
Productivity Improvement	Use of IoT technologies
	Monitoring technology base on IoT can be utilized for the optimization of resource cost.
	Introduction of intelligent systems to automated production lines
	Proposal of digital solutions (e.g., production control system) that are appropriate for SMEs
Added value enhancement	Provision of AI-based digital services to enhance added value
	Provision of digital technologies to innovate marketing activities
	Digital technologies such as online conferencing tools, e-commerce, and digitization of business operations are also possible.
Value chain enhancement	Strengthening R&D capabilities of SMEs for differentiation

In Tunisia, most of manufacturing enterprises are SMEs. While foreign companies are digitizing on their own, the hurdles to digitization are high for SMEs. In light of this, the diffusion of digital technology to SMEs to support their productivity improvement, R&D promotion, and management capacity building should be given a high priority. Based on the above considerations, the following potential digital solutions are selected and recommended.

Digital Solution	Contents	
Tunisia		
IoT-Based Factory Improvement	It is realistic for SMEs to promote IoT of factories step by step in response to on-site issues and link it to <i>kaizen</i> activities.	
Introduction of digital technology to support <i>kaizen</i>	To conduct a time study by importing the video taken at workplace to a computer, and to create visual work manual.	
IoT by embedding sensors	Sensors are embedded in factory machines, and technologies are introduced to monitor such data as work progress, vibration, pressure, etc. The results of the monitoring can be used for <i>kaizen</i> activities. Monitoring of machine operation status using sensor devices can be cited as an example.	
Establishment of collaboration network for rapid prototyping	Significance of supporting SMEs to Improve their product development capabilities The use of digital technology such as 3D programming and simulation, can help SMEs to create prototypes. Providing SMEs with technical guidance for product development including prototyping enables the commercialization of ideas conceived at workplace and rapid product development. It is also expected to promote collaboration among SMEs. Enhancement of R&D support institutions Recently, several fab labs have been established in Tunisia and they provide services using printed circuit board making machines, 3D printers, and other equipment. It has become an option to use fab lab facilities for prototyping. It is highly significant to strengthen cooperation among existing technical support institutions and fab labs to expand technical guidance and services to SMEs.	
Expansion of BPO services	The use of digital services is expected to increase among Tunisian companies including SMEs due to faster communication networks and digitization of work. Outsourcing of accounting and finance, information management, human resources, sales, marketing, and other operations can improve management efficiency.	

8.4. Transport Sector

8.4.1. Review Results

The following shows the result of the analysis of the transport sector.

Issue				Solution				Evaluation Criteria							
								1	2	3	4	5	6	7	8
Egypt															
1 Traffic safety															
	1	Traffic manners of drivers and pedestrians are bad	1	Enhancement of education curriculums and training courses regarding traffic safety	X										

Issue			Solution		Evaluation Criteria								
					1	2	3	4	5	6	7	8	
1			2	Systematize the salary management of drivers and introduce a mechanism or system to grant points to the drivers in coordination with their driving manners	X								
	2	People lack awareness of traffic safety	1	Perform enlightenment activities through media, etc.	X								
	3	Vehicles broken due to poor maintenance are scattered on roads	1										
	4	There are various other complex factors (utilization of data, cracking down, traffic jams in the city, etc.)	1	Arrangement of an accident database and its utilization by the related departments (countermeasures against various accidents, emergency services and fire-fighting, etc.)	○	○	○	○	△	○	×	○	
			2	Improvements in road infrastructures in sectors and points where accidents occur frequently through the utilization of accident data	○	○	○	○	△	○	×	○	
			3	Provision of information about the traffic conditions of the roads to road users through various media including radio and information boards	○	○	○	○	△	○	×	△	
			4	Improvement in traffic signals	○	○	○	○	△	○	×	○	
			5	Introduction of a driving speed inhibition tool using information technologies (smart hump, etc.)	△	△	○	○	△	○	×	△	
	2	Problems related to commercial vehicles											
	1	Commercial vehicles cannot be performed efficiently	1	Streamlining of vehicle management, operation management, and transportation management using RFID and other digital technologies	○	○	△	○	△	○	△	△	
2	Chronic traffic jams occur at tollbooths of expressways due to large vehicles	1	Same as above	○	△	○	○	△	○	△	△		
3	Customs clearance is inefficient and takes time	1	Same as above	○	○	○	○	△	○	△	△		
4	Roads are damaged due to overloaded vehicles. There is also a problem with traffic safety.	1	Fusion solution between RFID (or, if possible, digital token, etc.) and the weight detection system, or other solutions	○	○	○	○	△	○	△	○		
5	Traffic violation by large vehicles (hindrance of traffic and accidents due to illegal entrance of large vehicles and lanes dedicated to ordinary vehicles)	1	Reinforcement of tacking off and cracking down on vehicles violating traffic regulations using RFID and digital technologies	○	○	○	○	△	△	△	○		
3	Problems related to Cairo Metro												

Issue			Solution		Evaluation Criteria								
					1	2	3	4	5	6	7	8	
	1	The vehicles used for Cairo Metro Line 1 and Line 2 are outdated and the manufacturing of their parts has been discontinued, so parts cannot be supplied.	1	It is necessary to replace the current Metro (Line 1 and line 2)	X								
	2	Cairo Metro is not efficiently connected to other transportation networks, so the convenience is low	1	Improve the efficiency and convenience by, for example, the introduction of a unified payment system available for different public transportations	○	○	○	○	○	△	△	△	
	3	Communication among the departments in the metro operator organization is insufficient	1	Promote digitization in the Metro operator organization	X								
	4	Recently, the number of trains of Metro was increased, so operation management and maintenance are not performed appropriately	1		△	△	△	△	○	○	△	△	
4	Traffic jam												
	1	Various complex factors cause serious traffic jams in the urban area of Cairo	1	'- Improve the service quality (convenience, comfort, and reliability) of public transportation to shift the road traffic demands to public transportation - Introduction and promotion of clean energy mobility such as EV vehicles	△	△	○		△	△	△	○	
	2	Serious traffic jams cause air pollution and time loss	1		○	○	○	○	△	△	×	○	
5	Utilization of traffic data												
	1	Traffic data is not utilized appropriately	1	Take traffic measures using data such as the digitization of traffic management, arrangement of a database of accident information, and utilization of data for accident countermeasures	○	○	○	○	○	○	○	○	○
	2	Information and data are not shared appropriately among related institutions	1		X								
Tunisia													
1	Improvements in traffic safety												
	1	The awareness of the traffic safety and traffic manners of citizens is low	1	Perform enlightenment campaigns for traffic safety	X								
	2	Traffic manners are poor	1	Implement and enhance traffic safety education using information technologies and applications	△								
	3	Efficient traffic safety is not secured	1	Take appropriate traffic safety measures making effective use of data (arrangement and utilization of accident databases, etc.)	○	○	○	○	△	○	×	○	
2			Reinforce cracking down using digital technologies (excess of the speed using cameras and radars, dangerous driving, detection of drunken driving, etc.)	○	○	○	○	△	○	×	○		

Issue			Solution		Evaluation Criteria							
					1	2	3	4	5	6	7	8
			3	Prevent traffic violations using digital technologies (3D hump, etc.)	△	△	○	○	△	○	×	△
2 Road infrastructure maintenance												
1	Road infrastructure management is not planned and implemented appropriately	1	Correctly manage road infrastructure assets using digital technologies (introduction and utilization of GIS, road databases, etc.)	○	○	○	○	○	○	×	○	
		2	Digitization and utilization of digitized data using road infrastructure detection technologies including AI, high-definition camera, OCR technologies, infrared, etc.	○	○	○	○	○	○	×	○	
		3	Appropriately inspect and diagnose road infrastructures using digital technologies	○	○	○	○	○	○	×	○	
3 Traffic management and traffic jam countermeasures												
1	Information about traffic is insufficient for users	1	Provision of traffic information using digital technologies (traffic jam conditions, required time, traffic event conditions such as accidents, etc.)	○	○	○	○	○	○	×	△	
	Efficient traffic measures are not implemented	1	Utilization of traffic big data (grasping of traffic conditions, application to traffic measures, etc.)	○	○	○	○	○	○	×	○	
		2	Correctly grasp the traffic conditions (traffic volume measurement by vehicle type using AI technologies and image processing, etc.)	○	○	○	○	○	○	×	○	
3	Traffic management is not implemented appropriately	1	Enhance traffic lights and facilitate the traffic flow	○	○	○	○	○	○	×	○	
4 Countermeasures against parking in the city												
1	Parking space in the city is insufficient	1		X								
	Cars are parked on the road here and there in the city	1	Reinforce the detection of and cracking down on illegally parked vehicles	×								
	There is no IT system for users	1	Provide information using IT technologies (parking availability information, parking space location information, etc.)	△	△	△	△	△	-	×		
5 Countermeasures against overloaded vehicles												
1	No effective countermeasure for overloaded vehicles is taken	1	Reinforce cracking down on overloaded vehicles (vehicle weight measurement system, running vehicle weight measurement system, etc.)	○	○	○	○	○	○	×	○	
6 Appropriate operation and management of expressways												
1	Expressways are not operated appropriately	1	Appropriate traffic management with the traffic control system	○	○	○	○	○	○	×	○	
2	Toll collection on expressways is inefficient	2	Streamlining of toll collection with the toll collection system	○	○	○	○	○	○	×	○	
7 Public transportation												
1	Lack of funds of public transportation operators	1		X								

Issue		Solution		Evaluation Criteria							
				1	2	3	4	5	6	7	8
2	Information for a user is scarce	1	Provision of information for public transportation using information technologies	△	△	○	△	○	△	×	△
3	Public transportation is not convenient enough	1	Digitization of payments of public transportation fares	○	△	○	○	○	△	×	△

Top priority
 Second priority
 ◎Very high ○High △Medium ×Low

8.4.2. Narrowed Applicable Digital Solutions

The applicable digital solutions which are narrowed down according to the results of evaluation are as follows.

Issue	Digital Solution
Planning, implementation and evaluation of appropriate transportation measures	To appropriately and objectively plan, implement, and evaluate transportation measures by utilizing various traffic data
Appropriate management and control of traffic in the city	To develop signal control and pedestrian signals according to traffic demand to properly control traffic and separate pedestrians
Improvement of traffic safety	
Improving and maintaining highway service levels	To develop highway traffic control and toll collection equipment and realize appropriate highway operations
Overloaded vehicle management and enforcement	To introduce equipment for enforcement and management of overloaded vehicles
Proper maintenance of road infrastructure	To manage appropriately road infrastructure by digitalization of information on the road and associated equipment

The following potential digital solutions are identified based on the studies so far.

Digital Solution	Contents
Egypt	
Digital technology to grasp the actual traffic situations, i.e., movement of people and vehicles, traffic events, etc.	Probe data which is collected from GPS devices on vehicles or smart phone, mobile phone base station data which is usually owned by communication carriers, which enables to grasp movement of people and vehicle. SNS analysis technology which enables to grasp traffic event. Advanced utilization of CCTV using AI technology to measure traffic situation, e.g., traffic volume, abnormal traffic event, etc.
Digital technology to support traffic management and traffic control in the city	Traffic signal control and pedestrian signal control technology according to traffic demand, technologies for traffic control and management, and traffic demand management e.g., traffic information provision
Digital technology to support highway operations and services	Equipment and technology traffic management on the highway including for data collection, data processing and information provision. Equipment and technology for toll collection and overloaded vehicle management
Other digital technologies	Equipment and technology for efficient maintenance of road infrastructure and associated facilities Equipment and technology for efficient operation and management of public transport and electronic payment
Tunisia	
Digital technology to grasp the actual traffic situations, i.e., movement of people and vehicles, traffic events, etc.	Probe data which is collected from GPS devices on vehicles or smart phone, mobile phone base station data which is usually owned by communication carriers, which enables to grasp movement of people and vehicle. SNS analysis technology which enables to grasp traffic event.

Digital Solution	Contents
	Advanced utilization of CCTV using AI technology to measure traffic situation, e.g., traffic volume, abnormal traffic event, etc.
Digital technology to support traffic management and traffic control in the city	Traffic signal control and pedestrian signal control technology according to traffic demand, technologies for traffic control and management, and traffic demand management e.g., traffic information provision
Digital technology to support highway operations and services	Equipment and technology traffic management on the highway including for data collection, data processing and information provision. Equipment and technology for toll collection and overloaded vehicle management
Other digital technologies	Equipment and technology for efficient maintenance of road infrastructure and associated facilities Equipment and technology for efficient operation and management of public transport and electronic payment

8.5. Education Sector

8.5.1. Review Results

The following shows the result of the analysis of the education sector.

Issue		Solution		Evaluation Criteria							
				1	2	3	4	5	6	7	8
Egypt											
1	The education system of Egypt is very rigid (All pupils and schoolers are evaluated by a one-size-fits-all approach and the contents of the education are not arranged to improve the capabilities and good points of each pupil and schooler based on their interests).		1	Incorporate the concept of “Object-based Learning” (providing independent education materials for each chapter and making students pick up the necessary ones for them instead of collectively creating and packaging education materials for each course).	X						
2	1	The policies on “remote education” are not unified among persons concerned	1		X						
	2	The measure for the shift from remote learning (e-learning) to remote education (e-education) is unclear.	1		X						
3	The education curriculum for remote education is yet to be standardized		1	Standardize the contents of remote education. Clarify course titles, achievement targets, and test and evaluation methods, etc.	X						
			1	Standardize the education curriculum in accordance with remote education through cooperation between the government and private companies.	X						
			2	For the development of remote education curriculums, keep a good balance among the three elements: 1. lecture time, 2. office hours (when schoolers can ask questions to teachers, etc.), and 3. practical hours. Get advice from experts in the development of remote education curriculums.	X						

Issue		Solution		Evaluation Criteria							
				1	2	3	4	5	6	7	8
		1	Introduce AR (augmented reality) technologies.	○	△	△	○	△	○	△	○
		2	Introduce design simulators.	○	△	△	○	△	○	△	○
		3	Identify the measures to motivate pupils and schoolers to prevent them from dropping in the middle of the remote education course. For example, a system to grant a point every time a pupil or schooler access the remote education platform.	X							
		4	Develop curriculums that meet the needs of the labor markets.	X							
		1	Include an "E-marketing" course to learn marketing methods on the Internet in the curriculums of vocational schools.	○	○	○	○	○	○	○	△
3	In some regions, the Internet is not available										
1	In many schools, the Internet is not available; some schools have no classroom with PCs, etc.	1	Arrange the infrastructures of schools including Internet connection, etc.	○	△	○	○	○	○	△	○
4	Persons concerned feel anxiety about the rapid changes in the circumstances of education such as the propagation of remote education caused by COVID-19			X							
1	Some schoolers and guardians are resistant to remote education	1	Enlighten guardians of pupils and schoolers about remote education using digital technologies.	X							
		1	Provide training to not only pupils and schoolers who will get remote education but also the households including guardians. Hold online meetings.	○	△	×	○	△	△	△	△
		2	Teach the ethical rules regarding the use of the Internet.	X							
		2	Develop digital tools (apps) with which guardians can follow the achievement levels of learning of their children to incorporate guardians into the flow of remote education.	○	△	△	○	△	△	△	○
		3	Introduce gamification (application of game design elements and game principles to education) to enable pupils and schoolers to learn from education materials like enjoying a game.	○	△	△	○	△	△	△	○
5	Most households do not have the devices necessary for participation in remote education	1	Set up a computer laboratory (computer room) in schools to enable pupils and schoolers to access remote education content.	○	○	○	○	○	○	△	○
6	Teachers have not gotten sufficient training for the methods of instruction using digital technologies	1	Provide training to teachers to encourage them to use digital technologies in their classes in order to improve their capabilities.	○	○	○	○	○	○	△	△
		2	Allocate Information Technology Officers to schools.	X							
		3	Hold workshops for teachers to sweep away the concerns about the propagation of remote education (including mental, social, and technical ones).	X							

Issue		Solution		Evaluation Criteria							
				1	2	3	4	5	6	7	8
7	The utilization of digital tools is insufficient for job training			○	○	○	△	○	○	△	△
8	The curriculum in higher education (university) do not match the needs of the labor market	1	Hold competitions for university students to encourage them to found startups that will develop education-related solutions using digital technologies.	○	△	○	○	○	△	△	△
		2	Provide appropriate career guidance to schoolers.	○	△	△	○	△	△	△	△
		3	Digital contents for new technologies and target technologies are insufficient	○	○	○	○	○	○	○	△
Morocco											
1	There is a gap in terms of access to education	1	Propagation of remote education	X							
		1	Enhancement of the functions of the online platform and contents	○	○	○	○	○	○	△	△
2	The female literacy rate is low	1	Propagation of remote education	X							
3	School equipment necessary for experiments in science and mathematics is insufficient	1	Propagation of remote education	X							
		1	Use virtual simulation using digital education materials as an alternative to enable schoolers to experience experiments in science and mathematics.	○	△	△	○	△	○	△	○
4	The Internet is not available (or the connection is unstable) in some regions	1	Construct a high-speed Internet access network all over Morocco.	○	△	○	○	○	○	△	○
		2	Construct an Internet connection environment in all schools.	○	△	○	○	○	○	△	○
5	Some households and schoolers have no digital equipment which can connect to the Internet for remote education	1	Develop a remote education system accessible from mobile terminals such as smartphones (not only PC).	○	△	△	○	○	○	△	△
6	New activities using digital technologies such as remote education are difficult to be accepted by teachers and schoolers	1	Perform enlightenment activities to not only teachers and pupils/schoolers but also guardians and ordinary citizens to understand the utilization of digital technologies for education.	X							
		2	Teachers, pupils, and schoolers not accustomed to information communication technologies and operations of digital terminals provide support so that they can be timely accustomed to the fast propagation of remote education (provision of training opportunities for digital technologies, etc.)	○	△	○	○	○	○	△	△
		3	Introduce gamification (application of game design elements and game principles to education) to enable pupils and schoolers to learn from education content with interests and affinity.	○	△	△	○	△	△	△	○
7	The teaching capabilities of teachers are insufficient	1	Construct an online platform where on-site practical workers such as teachers realize the functions to get technical advice from experts on the platform in addition to sharing of good (bad) practices and introduction of useful instruction methods (case database).	○	△	△	○	△	○	△	○

Issue		Solution		Evaluation Criteria							
				1	2	3	4	5	6	7	8
		2	Introduce the education support system using AI. Efficiently perform simulations of experiments in the education of science and mathematics, feedback to wrong answers and difficult points of pupils and schoolers, etc. using AI.	○	△	△	○	△	○	△	○
1	Opportunities of training of teachers are insufficient	1	Enhance the training opportunities for teachers and improve especially the skills for the utilization of digital technologies necessary for the execution of remote education.	○	○	○	○	○	○	△	△
8	The burdens of teachers related to the management of schools are big	1	Introduce a school affairs support system for efficient management of schools.	○	○	△	○	○	○	○	○
9	The quality of remote education is low (not standardized)	1	Develop curriculums and education contents to support remote education (reconsider curriculums and education contents suitable for remote education instead of making online the current ones which assume face-to-face classes as they are).	○	○	○	○	○	○	○	○
	1 The curriculum and education contents do not match the needs of the labor market	1	Actively proceed with the utilization of digital technologies in education sites for the development of human resources which meet the needs of the labor market.	X							
10	Even for graduates from higher education, it is not easy to find employment	1	Make practical instructions about digital technologies.	○	○	○	○	○	○	○	△
11	No appropriate career guidance is not performed in secondary and higher education	1	Construct a career consultation system for schoolers by a chatbot, etc. using AI. *Provide Japanese education content using digital technologies	○	△	△	○	△	○	△	○
12	(Other proposed solutions)	1	Formulate comprehensive strategies for the way of post-coronavirus education in Morocco.	X							
13	(Other proposed solutions)	1	Construct an online forum for schoolers to exchange opinions as well as diffuse education using technologies through the forum.	○	△	×	○	△	△	△	○
14	(Other proposed solutions)	1	Support entrepreneurs and startups as well as construct cooperative relationships with them to seek a new way of education. Provide incentives setting up awards for entrepreneurs and startups. In addition to it, also consider awards for teachers using remote education effectively.	X							
15	(Other proposed solutions)	1	Construct an online platform that gathers issues related to education and solutions using digital technologies at one point. Enable matching among persons concerned, startups, etc. of the education sector through the same platform.	○	△	△	○	△	△	△	○

Top Priority
 Support for the construction of the base necessary to arrange the environment for the utilization of digital technologies (software & hardware)
 ◎Very high ○High △Medium ×Low

8.5.2. Narrowed Applicable Digital Solutions

The applicable digital solutions in the transport sector which are narrowed down according to the results of evaluation are as follows.

Issue	Digital Solution
Continuation of educational activities under the Covid-19 situation	Using distance education technology to deliver educational content online.
Closing the access gap to education	
Reduction of teachers' workload	Introducing a Learning Management System (LMS) in schools.
Improvement of the efficiency of school administration	
Capacity building of teachers	Supporting capacity building of teachers through online platforms that enable information sharing and exchange of ideas among teachers across schools.
Improvement of vocational school curriculum to ensure employability	Using learning support systems utilizing AR/VR technology in vocational training schools to provide practical vocational training that leads to employment.

Though both Egypt and Morocco had been developing online educational platforms before the outbreak of the COVID-19, as the COVID-19 is not expected to be contained, measures are required for the widespread dissemination of distance education, which could help to close the access gap to education. In both countries, youth unemployment is a major social issue, and there are high expectations for the use of digital technology to improve the quality of vocational training. Potential digital solutions to be recommended from the above perspectives are identified as follows.

Digital Solution	Contents
Egypt	
Deliver learning contents online	Introducing a web application with the functions to deliver lectures, assignments and quizzes online to school education. Through the web application, teachers and parents can not only check the learning progress and test results of pupils / students, but also analyze areas of weakness based on the results of assignments and quizzes to provide customized meticulous educational activities that take into account the individual circumstances of the pupils / students.
Support school management	Introducing a Learning Management System (LMS) in schools, which visually displays information necessary for school management and enables information to be shared among teachers regardless of their location. The LMS will also record and manage information on individual students, such as examination results, grades and attendance, in an integrated manner from enrolment to graduation.
Support capacity improvement of teachers	Supporting teachers to improve their skills by using an online platform that enables them to share information and exchange opinions with other teachers beyond the boundaries of their school. The online platform enables the sharing of teaching materials and the exchange of teaching tips, opinions and concerns among teachers.
Support the learning of vocation school students using AR / VR	Providing practical vocational training that leads to employment, using learning support systems that utilize AR/VR technology in vocational schools. Although the fields of application need to be further considered, the use of AR/VR technology in vocational training can be considered as an example, as follows. [Building construction training] 3D models of blueprints are superimposed on the real-life background captured by the cameras of smartphones and tablets, utilizing location AR technology.

Digital Solution	Contents
	[Welding skills training] Virtual simulators for welding skills training: embodying realistic images and operations as if the student were actually welding, tailored to their skills.
Morocco	
Deliver learning contents online	Introducing a web application with the functions to deliver lectures, assignments and quizzes online to school education. Through the web application, teachers and parents can not only check the learning progress and test results of pupils / students, but also analyze areas of weakness based on the results of assignments and quizzes to provide customized meticulous educational activities that take into account the individual circumstances of the pupils / students.
Support school management	Introducing a Learning Management System (LMS) in schools, which visually displays information necessary for school management and enables information to be shared among teachers regardless of their location. The LMS will also record and manage information on individual students, such as examination results, grades and attendance, in an integrated manner from enrolment to graduation.
Support capacity improvement of teachers	Supporting teachers to improve their skills by using an online platform that enables them to share information and exchange opinions with other teachers beyond the boundaries of their school. The online platform enables the sharing of teaching materials and the exchange of teaching tips, opinions and concerns among teachers.
Support the learning of vocation school students using AR / VR	Providing practical vocational training that leads to employment, using learning support systems that utilize AR/VR technology in vocational schools. Although the fields of application need to be further considered, the use of AR/VR technology in vocational training can be considered as an example, as follows. [Building construction training] 3D models of blueprints are superimposed on the real-life background captured by the cameras of smartphones and tablets, utilizing location AR technology. [Welding skills training] Virtual simulators for welding skills training: embodying realistic images and operations as if the student were actually welding, tailored to their skills.

8.6. Health Sector

8.6.1. Review Results

The following shows the result of the analysis of the health sector.

Issue		Solution		Evaluation Criteria								
				1	2	3	4	5	6	7	8	
Egypt												
1 Some areas have a gap from urban areas in terms of healthcare												
1	The number of doctors working in medical facilities is insufficient in some prefectures	1	1	Utilize technologies of remote diagnosis (telemedicine). By using such technologies, hospitals in prefectures where doctors are lacking can get the support of specialized physicians, professors, and consultants of large hospitals in other prefectures. Doctors of such hospitals can also experience patient treatment	○	△	○	○	○	○	○	○
2	In some prefectures, the expertise of doctors working in medical	2	1	Utilize technologies of telediagnosis (telemedicine).	○	△	○	○	○	△	○	△

Issue		Solution		Evaluation Criteria											
				1	2	3	4	5	6	7	8				
		facilities is insufficient (some medical staff is not skilled enough).			Obligate all doctors to get fellowship training after graduation (completed). Also, provide fellowship training through online lectures.										
3		In some areas, experts of occupational health and safety in hospitals are insufficient	3	1	Strengthen the enforcement system for occupational health and safety.	△	△	△	△	△	△	△	△	△	
4		Some areas lack universities qualified to teach doctors and nurses	4	1	Train physicians and nurses using distance learning.	△	○	○	△	△	○	○	△	△	
5		Medical facilities in some areas lack drugs	5	1	Check inventory of medicines and utilize an effective drug distribution system through the introduction of HMS.	○	△	△	○	△	△	△	△	△	
2 Internet network of medical facilities															
1		The infrastructures such as the internet networks of public (governmental) medical facilities are inefficient	1	1	Improve communication infrastructures from the viewpoint of streamlining. Especially construct Internet networks with remote areas.	○	△	△	○	△	○	○	△	△	
3 Universal health insurance system and family doctors															
1		The core of the universal health insurance system is assumed to be family doctors, but the number of family doctors is limited	1	1	Recruit and train doctors with attractive salaries. Also, provide other incentives to attract doctors. Use online education and training to train doctors.	△	○	○	△	○	△	○	○	○	
			2	1	Use online education and training to train doctors.	△	○	△	△	○	△	○	△	△	
			3	1	Increase the interests of universities in the home doctor field.	x									
			4	1	Perform orientation for people about the importance of home doctors.	x									
4 Provision of information of drugs															
1		Sufficient information regarding drugs is not provided to doctors (e.g., information such as comparison with other drugs, adverse effects, and characteristics of drugs)	1	1	Provision of a database for medicine	○	△	○	○	△	△	△	△	△	
5 Problem regarding unified medical file															
1		There is no unified medical file (Electronic Medical Record) unified for patients. This is inconvenient for diagnosis and causes misdiagnosis.	1	1	Create a data system for patient information (treatment records) using IT.	○	○	○	○	○	○	○	○	○	
			2		Develop a display system in terminals of medical institutions.	○	○	△	○	○	○	○	○	○	
			3		Construct a data warehouse	○	○	○	○	○	○	○	○	○	○
6 Problem of the quality of doctors															
1		Doctors are not trained about the cutting-edge medical equipment available in medical facilities	1	1	Provide training for medical staff online. Especially, provide training to support medical staff who could not get training during the COVID-19 period. Also, provide remote diagnosis services.	○	○	○	○	○	△	△	△	△	

Issue				Evaluation Criteria							
				Solution							
1	2	3	4	5	6	7	8	9	10	11	12
	2	In some cases, doctors do not provide complete information of diagnosis results to patients	2	1							
	3	It has become difficult to perform group training of medical staff due to COVID-19	3	1	Provide online training for medical staff using video conference, telemedicine (remote diagnosis), etc.	○	○	△	○	△	△
7 Collection and use of health information											
	1	Information received by the Ministry of Health and Population (information of medical facilities, etc.) is insufficient and not reliable in some cases	1	1	Introduction of HMS to collect and manage information of medical facilities	○	○	△	○	○	○
8 Management issues of the projects of the Ministry of Health and Population											
	1	Cooperation with the persons concerned is insufficient in the projects of the health field conducted by the Ministry of Health and Population	1	1	The Ministry of Health and Population will set a total strategy for coordination among all information technology projects of the health sector.	X					
				2	The information center of the Ministry of Health and Population makes adjustments with the related institutions.	X					
				3	Create programs and applications to connect ministries.	△	○	△	△	○	△
	2	Medical staff do not understand the whole picture of development projects of the Ministry of Health and Population in the medical field sufficiently	2	1	Perform orientation (awareness-raising campaign) for the programs of the Ministry of Health and Population to medical staff using digital technologies.	△	△	△	△	△	△
	3	There is no expert of technical support in the development project of the Ministry of Health and Population	3	1	Employ qualified technical support staff.	X					
	4	Lack of IT companies that can provide technical solutions in the project of the Ministry of Health and Population	4	1	Reinforce the cooperative relationships between the Ministry of Health and Population and IT companies to develop systems that provide all kinds of medical services.	△	△	△	△	○	△
	5	The progress of the development projects of the Ministry of Health and Population is delayed because of the difficulty to procure the necessary resources due to COVID-19	5	1	The Ministry of Health and Population discussed the way to proceed with its projects using video conferences during the period of COVID-19.	X					
9 Other											
	1	High medical costs	1	1	Reduce healthcare costs through the use of digital technology.	△					
	2	Medical costs such as clinical inspections,	2	1	Apply and promote the health insurance system.	X					△

Issue			Solution		Evaluation Criteria							
					1	2	3	4	5	6	7	8
		scanning, and X-ray are high										
	3	The tuitions of faculties of medicine are high	3	1	-	X						

Top Priority
 Second Priority
 ◎Very high ○High △Medium ×Low

8.6.2. Narrowed Applicable Digital Solutions

The applicable digital solutions in the health sector which are narrowed down according to the results of evaluation are as follows.

Issue	Digital Solution
Insufficiency of doctors working in medical facilities in some prefectures	Use of remote diagnosis (telemedicine)
Insufficiency of doctors working in medical facilities in some prefectures	Establishment of collaboration network among medical institutions in regions and promotion of data sharing of patient information (medical records) by terminals of medical institutions
No unified electronic medical record (EMR) system	
Information coming to the Ministry of Health and Population (e.g., information on medical institutions) is sometimes inadequate and unreliable.	Establishment of health management system to collect and manage information on medical institutions
Quality issues of medical staff an insufficient education and training institutions of physician and nurses	Use of online education and training

Egypt is in the process of introducing the universal health insurance system with the support of development partners. The following promising digital technologies were selected for recommendation in consideration of the above.

Digital Solution	Contents
Egypt	
Health Management Information System (HMIS)	Health and medical information system (HMIS) collects and standardizes information on diseases, hospitals, etc. for policy making, problem solving, and effective resource allocation.
Remote Medical Services and Medical Information Cooperation Network	Introduction of telemedicine services and a system of information sharing among hospitals to solve the issues of regional disparities and shortage of medical specialists Nationwide network for pathology testing: Establishment of a system for remote pathology testing to solve the issues of the increasing number of tests and the shortage of pathologists in rural areas. Remote diagnosis for primary health care: Promotion of remote diagnosis systems to compensate for the shortage of family doctors. It is possible to collaborate with remote diagnosis units promoted by the government.
Telemedicine Services	Health guidance using wearable devices Business development of health management applications using wearable devices (disease prevention, care prevention, health promotion, etc.)

Digital Solution	Contents	
Universal Health Insurance System	Provision of support to system development for the universal health insurance system.	

Chapter 9 Evaluation of Effectiveness and Validity of Digital Technologies for Resolution of Development Issues through Local Workshops

9.1. How to Evaluate Effectiveness and Validity of Digital Technologies for Resolution of Development Issues

Local workshops were held online in Egypt, Morocco and Tunisia. The purposes of the workshops were to share the ideas for digital solutions to be applied to resolve development issues in targeted sectors, and to obtain the feedback from local stakeholders regarding the feasibility and priority of the solution. The table below shows the outline of the workshops.

Table 9-1 Outline of the Workshops

Country	Date	Number of the Attendees
Egypt	28 th December 2021 (Tue) Local time:13:00~15:50	24
Morocco	21 st December 2021 (Tue) Local time: 9:00~11:30	22
Tunisia	23 rd December 2021 (Thu) Local time: 9:00~11:40	25



Figure 9-1 Scene of the Workshop with the Local Persons Concerned in Egypt (28th December 2021)



Figure 9-2 Scene of the Workshop with the Local Persons Concerned in Morocco (21st December 2021)

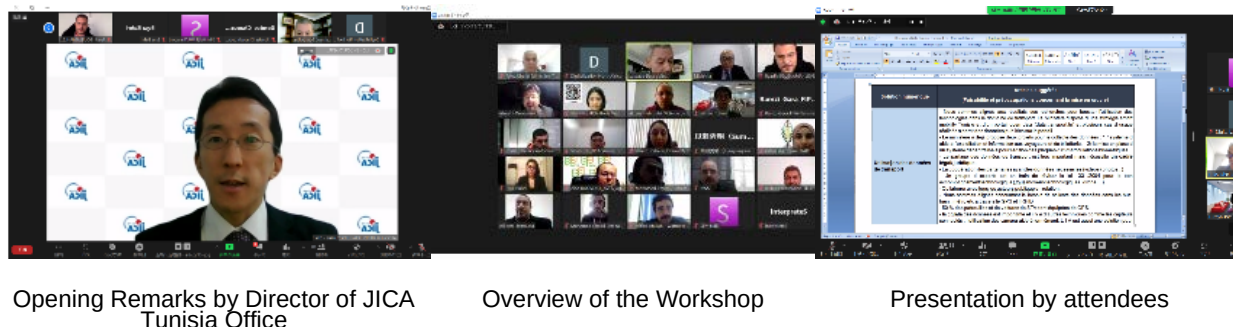


Figure 9-3 Scene of the Workshop with the Local Persons Concerned in Tunisia (23rd December 2021)

9.2. Egypt

9.2.1. Agriculture and Fisheries Sector

(1) Comments on the Proposed Digital Solutions

The major comments from the relevant stakeholders of Egypt on the digital solutions proposed for the agriculture and fisheries sector were as follows.

Table 9-2 Major Comments on the Digital Solutions Proposed for the Agriculture and Fisheries Sector in Egypt

#	Digital Solution	Major Comments
1	To enable farmers to access information (use of platform and “Agmiru”, etc.)	✓ It is one of the most important technologies which Egypt needs. Ministry of Agriculture wants to work in coordination and cooperation with agricultural research institutes, private companies and other ministries. ✓ It is necessary to maintain a database in the ministry that is easy-to-use and has reliable data. ✓ For the implementation, specific operational structure is required. ✓ Ministry of Agriculture can provide necessary fund for the implementation. ✓ JICA is expected to transfer knowledge and technical skills. ✓ It would be nice if the services, such as TABI CHOKU and NIMARU, could be rolled out in Egypt. More detailed information is required.
2	To assist capacity building of extension workers (Online learning materials, remote guidance, VR, etc.)	In Egypt, the number of agricultural extension workers is small. Farmers are complaining about the lack of guidance from agricultural extension workers. Therefore, it is important to efficiently carry out training by utilizing such digital technology.
3	To collect information on conditions of fishing farms (A buoy with an ICT sensor, application for operation diary, etc.)	✓ Many mistakes occur with the current manual work. Automatic data collection can enable grasping the situation more easily and accurately. ✓ Ministry of Agriculture wants to utilize this technology. It is necessary to cooperate with many related government agencies, including Ministry of ICT.
4	To monitor fishing areas remotely (drone, AI, underwater camera, etc.)	✓ It is essential technology for Egypt. More detailed information is required. ✓ When using a mobile phone to report the Catch, the following points should be considered. 1. Install of GPS on all fishing vessels to know their location and fishing grounds: The government of Egypt has already begun development of the system. The law was recently issued that requires all fishing vessels to have GPS. However, some fishermen who are fishing far away from the territorial waters have voiced opposition to the installation of GPS. 2. Post all necessary information and data for the fishermen’s association on the Web: The information is currently collected on paper. 3. From a security point of view, each fishing unit should install a surveillance camera system on the fishing vessel so that it can be confirmed by the government and related organizations. ✓ For the implementation, the Ministry of Agriculture needs to cooperate with the Ministry of ICT and many other related agencies. ✓ Introduction of simple and inexpensive digital technology, such as distribution of tablets and/or maintenance of networks, enables accumulation of the Catch data of each fishing vessels at the headquarters of the fishing center. This will facilitate the submission of statistical data on the Catch require by the EU, in export-related operations.

(2) Feasibility and Priority of Digital Solutions

Based on the feedback from the relevant stakeholders of Egypt, each digital solution in the agriculture and fisheries sector was rated on a three-point scale (☆☆☆☆: high, ☆☆☆: medium, ☆☆: low) as follows.

Table 9-3 Result of Analysis of Digital Solutions in the Agriculture and Fisheries Sector in Egypt

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
1	To enable farmers to access information (use of platform and "Agmiru", etc.)	☆☆☆ It is expected to improve farmers' income.	☆☆☆ - The Ministry of Agriculture intends to proceed as a C/P in coordination with agriculture-related research institutes, etc. - Similar services have already been realized in Japan, and technical cooperation from JICA is expected.	☆☆☆ Workshop participants commented that resolving this issue is a high priority.	- Need to confirm if solutions used in Japan are applicable in Egypt. - A system that can successfully collect and organize data held by multiple ministries and agencies is needed.
2	To assist capacity building of extension workers (Online learning materials, remote guidance, VR, etc.)	☆☆☆ The number of extension agents themselves is small and scattered throughout the country, so there is a need to utilize digital technology to provide efficient guidance.	☆☆ - The Ministry of Agriculture is willing to proceed in collaboration with the Ministry of ICT. - In the education sector, the Egyptian government has already developed and operated an online education platform and can consider utilizing the technology there.	☆☆☆ Farmers have commented that more guidance from agricultural extension workers is needed. Thus, this is a high priority.	It is necessary to confirm whether infrastructure, digital devices, etc. are in place in the rural areas.
3	To collect information on conditions of fishing farms (A buoy with an ICT sensor, application for operation diary, etc.)	☆☆ By collecting data, a more accurate understanding of the current situation can be obtained, based on which countermeasures and other	☆☆ The Ministry of Agriculture (department in charge of fisheries) indicated its intention to proceed the project. It is necessary to confirm whether the data collected across	☆☆ If it can be used for resource management in the future, it will be given higher priority.	- The Ministry of Agriculture, along with government agencies related to fisheries, needs to coordinate with other agencies and take a cross-sectional approach. If digital technology is to be used, the Ministry of

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
		measures can be formulated.	multiple ministries can be successfully linked.		ICT must also be involved. - A variety of data will be needed, and it is important to build a system that can integrate these data.
4	To monitor fishing areas remotely (drone, AI, underwater camera, etc.)	☆☆☆ The data is not well utilized because it is collected on paper, but there is already a system in place to collect this information. The opinion was expressed that the effects of digitization could easily be shown.	☆☆ In Egypt, a law was recently passed to ensure that all fishing boats are equipped with GPS. The Egyptian government plans to implement the law, but will start by recording the amount of landings, etc. at each fishing port.	☆☆ The digital technology required is itself basic, and it is efficient to proceed at this time in conjunction with the movement to install GPS.	- Some fishermen are against the installation of GPS. - Infrastructure development (especially internet environment at sea) needs to be considered.

9.2.2. Transport Sector

(1) Comments on the Proposed Digital Solutions

The major comments from the relevant stakeholders of Egypt on the digital solutions proposed for the transport sector were as follows.

Table 9-4 Major Comments on the Digital Solutions Proposed for the Transport Sector in Egypt

#	Digital Solution	Major Comments
1	To support transport data utilization (prove data, mobile base station data, AI, RFID, etc.)	✓ RFID systems are currently applied to almost all of Egypt. RFID tags attached to vehicles can identify all vehicles on the road. ✓ All vehicles in Egypt are required by law to install RFID tags. Drivers who do not obey must pay a fine. ✓ The cooperation between related ministries (Ministry of Transport, Ministry of ICT, Ministry of Planning) is required for the following matters. 1. Improvement of road network using collected data 2. Enhancement of traffic safety and security 3. Centralization of traffic signal
2	To support traffic management and security support (signal coordination, signal violation enforcement, emergency vehicle priority system, etc.)	This digital technology is effective in the following points. ✓ It sends warning messages to drivers about weather and traffic issues to reduce the risk of accidents. In the event of an accident, it communicates with the nearest ambulance unit, enabling quick response to save lives.

#	Digital Solution	Major Comments
		✓ It controls accidents when passersby cross a congested road. The following suggestions were made. ✓ Enforcement of law on heavy vehicles and strict measures ✓ Utilization of message function to notify driver of traffic violations and fines ✓ Utilization of point system to punish traffic rule violators ✓ Severe punishment for traffic offenders
3	To support highway management and overload control (Traffic counter, meteorological sensor, weight measurement system, traffic control center, electrical message signboard, etc.)	This digital technology is effective in the following points. ✓ Monitoring the number of overloaded vehicles ✓ Accumulation and utilization of overloaded vehicles ✓ Development of robust road network of highway The following suggestions were made. ✓ Point system for overloaded vehicle control on highway ✓ Remote monitoring of highway for congestion ✓ Digital road map for all vehicles

(2) Feasibility and Priority of Digital Solutions

Based on the feedback from the relevant stakeholders of Egypt, each digital solution in the transport sector was rated on a three-point scale (☆☆☆: high, ☆☆☆: medium, ☆☆: low) as follows.

Table 9-5 Result of Analysis of Digital Solutions in the Transport Sector in Egypt

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
1	To support transport data utilization (prove data, mobile base station data, AI, RFID, etc.)	☆☆☆ As the number of private mobility services increases in Egypt, the potential for utilizing various transportation big data is increasing. It was commented that the content was very useful in the situation where there was no utilization mechanism.	☆ - RFID technology is one of the candidates for traffic data sources. As it was confirmed in the Workshop, RFID tags have become mandatory on vehicles in Egypt. Therefore, it has an advantage in terms of an environmental basis for data utilization. - But on the other hand, since the management of traffic data related to the movement of people is related to the Ministry of Home Affairs, there are some doubts about the feasibility of the project. -	☆☆☆ It is judged to be a high priority in terms of strengthening the ability to formulate traffic measures based on objective traffic data.	- The data obtained from the GPS device installed in the vehicle will be utilized to grasp the movement of the vehicle. - It is necessary to take measures such as investing GPS in publicly owned vehicles in order to implement it as a public project.
2	To support traffic management and	☆☆☆	☆	☆☆☆	Various measures other than

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
	security support (signal coordination, signal violation enforcement, emergency vehicle priority system, etc.)	It was confirmed that it is effective in solving the main problems in the transportation field of Japan in terms of alleviating traffic congestion and supporting the improvement of traffic safety.	The feasibility of the project is judged to be low because the traffic management in the city is under the jurisdiction of the Egyptian Ministry of Interior.	As described in "Effectivity for the Issue" on the left, the priority is high considering the seriousness of traffic problems.	technology are required, such as insufficient enforcement, etc.
3	To support highway management and overload control (Traffic counter, meteorological sensor, weight measurement system, traffic control center, electrical message signboard, etc.)	☆☆☆ The highway network is already in place in Egypt. But Egyptian authorities do not have sufficient experience in efficient highway operation and maintenance utilizing data and equipment. In this sense, it was confirmed in the Workshop that this proposal was effective.	☆ The feasibility of the project is judged to be low because the jurisdiction of the highway is under the Ministry of Defense of Egypt.	☆☆☆ As described in "Effectivity for the Issue" on the left, the priority is high considering the current situation.	

9.2.3. Education Sector

(1) Comments on the Proposed Digital Solutions

The major comments from the relevant stakeholders of Egypt on the digital solutions proposed for the education sector were as follows.

Table 9-6 Major Comments on the Digital Solutions Proposed for the Education Sector in Egypt

#	Digital Solution	Major Comments
1	Deliver learning contents online	✓ Online education is crucial and unavoidable. ✓ The followings are requirements for success. 1. The establishment of an education platform and the integration of this platform into the education system. The provision of services on the platform free of charge or for a small fee. 2. Identification of dedicated personnel with necessary knowledge and skills. 3. Training for teachers in the delivery of e-learning contents. 4. Training for students in the use of digital technologies and platforms. 5. Establishment of a feedback system between students and teachers.
2	Support school management	✓ It is very important and reduces the burden on teachers with many tasks. It may facilitate communication between students and schools.

#	Digital Solution	Major Comments
		✓ The followings are requirements for success. 1. Focusing on improving the human skills of school administrators, e.g., leadership. 2. Improving ICT literacy of school administrators. 3. Involvement of Parents Councils. 4. Involvement of local administrators with jurisdiction over schools in the region. 5. Centralizing school management. 6. Raising necessary funds.
3	Support capacity improvement of teachers	✓ It is very important. If used in conjunction with school management systems, it can stimulate communication between the parties involved and enable sharing of experiences among teachers. ✓ The followings are requirements for success. 1. Providing teachers with training opportunities using e-learning, as training for teachers in the use of digital technology is currently inadequate 2. As the capacity of trainers to give feedback on the level of teachers and their weaknesses and to conduct training is insufficient, a mechanism needs to be created to enable teachers to exchange ideas with each other.
4	Support the learning of vocation school students using AR / VR	✓ This is an important technology that contributes to improving students' technical skills. ✓ The following challenges exist. 1. Preparing the infrastructure; VR/AR materials are also essential. 2. Coordination between government agencies, the private sector and educational institutions is necessary. 3. Students need precise guidance in order to use the technology appropriately. 4. Training in VR/AR technology for teachers and students is essential.

(2) Feasibility and Priority of Digital Solutions

Based on the feedback from the relevant stakeholders of Egypt, each digital solution in the education sector was rated on a three-point scale (☆☆☆: high, ☆☆☆: medium, ☆☆: low) as follows.

Table 9-7 Result of Analysis of Digital Solutions in the Education Sector in Egypt

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
1	Deliver learning contents online	☆☆☆ - Workshop participants were positive about the need for online education particularly in the COVID-19 situation. - It is expected to be a means of closing the education gap for rural children and girls.	☆☆☆ - As the Government of Egypt has already developed and operated an online education platform, it is highly feasible. - Expenses may be required to develop internet infrastructure and deploy devices in schools. - There is a need to assign a person in charge of operating the system in schools	☆☆☆ - Improving online education under COVID-19 situation is a high priority.	- Linking with online education platforms developed and operated by the Government of Egypt should be considered. - The ICT skills of teachers and pupils need to be taken into account and the necessary training systems need to be put in place. - Attention needs to be paid to the development of internet infrastructure and deployment of devices.

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
			separately from the teachers.		- The cost burden for the use of systems and content needs to be considered.
2	Support school management	☆☆☆ - There was a high level of interest from workshop participants as a way of reducing the burden on teachers.	☆☆ - Internet infrastructure and device deployment in schools may be costly. - Consideration should be given to the introduction of ICT skills of school teaching staff.	☆☆ - Efforts in conjunction with the spread of online education, such as data capture, may be effective.	- Training needs to be considered if necessary. - It would be more convenient if the data could be referenced, including by education offices.
3	Support capacity improvement of teachers	☆☆☆ - Improving teacher capacity is an essential prerequisite for promoting online education.	☆☆☆ - There is a strong need to strengthen the capacity of teachers to promote online education.	☆☆☆ - In promoting online education, teachers are required to improve their ICT skills and acquire teaching methods adapted to online education.	- The deployment of digital equipment in schools is required. - The development of an education curriculum in line with online education needs to be developed at the same time.
4	Support the learning of vocation school students using AR / VR	☆ - The use of digital technology is only a means to an end, and whether the use of AR/VR technology is effective in vocational training needs to be fully considered.	☆ - In some cases, AR/VR technology could reduce the economic burden on schools, for example by eliminating the need to purchase consumable materials that were previously necessary. - On the other hand, the introduction of AR/VR equipment may require significant costs, and cost-effectiveness needs to be carefully examined.	☆ - Not a priority	- The use of AR/VR technology in any of the vocational training curricula needs to be investigated and studied separately. - Cooperation with the government and the private sector is necessary for the use of AR/VR technology.

9.2.4. Health Sector

(1) Comments on the Proposed Digital Solutions

The major comments from the relevant stakeholders of Egypt on the digital solutions proposed for the health sector were as follows.

Table 9-8 Major Comments on the Digital Solutions Proposed for the Health Sector in Egypt

#	Digital Solution	Major Comments
1	Medical Information Collaboration Network (Sharing of electronic medical records and other medical information among medical institutions)	✓ This technology is effective for improving medical services. ✓ The information system currently underway for the universal health insurance system requires access to a medical information network and could be implemented as part of the same system.
2	Health Management Information System (HMIS) (Health information system that provides real-time information on the status of health and medical care)	✓ The Ministry of Health and Population, in cooperation with the JICA Egypt Office, provides a Health Management Information System (HMIS) for the universal health insurance system. The system registers all beneficiaries who wish to apply for the universal health insurance. Beneficiaries and medical personnel such as pharmacies and radiology centers can access the information registered on the system as appropriate. ✓ Payment processes need to be improved.
3	Telemedicine Services (Health guidance using a wearable device)	✓ Before telemedicine services can be utilized, users must first be made aware of the importance and benefits of telemedicine services through publicity such as television programs and other media and through campaigns utilizing health units. Telemedicine services are not well known and have few users. Efforts should be made to change people's mindset in order to promote their use. ✓ It is indispensable to own the device on the user side and improve the internet environment. ✓ There are currently 150 telemedicine service units established throughout Egypt. The immediate goal is to add 150 more units to bring the total to 300. ✓ Involving all stakeholders, including users, physicians, medical consultants, and government officials, is essential for the spread of medical services. ✓ Already established telemedicine service units do not have an adequate number of physicians who can provide the service. It is also necessary to provide financial incentives to physicians to provide telemedicine services as an additional service at public hospitals.
4	Universal Health Insurance System (Systems that support the universal health insurance system)	✓ The Egyptian Ministry of Health and Population is currently working on establishing the national health insurance system, which started in 2018 and is expected to complete by 2031 or 2032. ✓ To make this a reality, infrastructure improvements, such as the renovation of medical units, will be essential and require a large amount of funding.
5	Utilizing Digital Solutions for the Health Sector (Support to startups providing health-related services)	✓ The general public is not interested in new medical services unless they perceive a benefit to them. It is essential for the government to actively promote new digital solutions through TV, radio and other media. It would also be effective to conduct training and workshops in each region through medical service units. ✓ The government is outsourcing medical equipment, software, and networks to the private sector for telemedicine services that have already been deployed. ✓ An application called "Egypt Health" provides health information, patient history, immunization status, etc. ✓ The government is also actively supporting startups by providing funding. ✓ The JICA office is supporting two startups that diagnose breast cancer and new coronas, respectively. Both are expected to improve the quality of radiology

#	Digital Solution	Major Comments
		services by compensating for the shortage of radiologists, reducing diagnosis time, and improving the accuracy of diagnosis.

(2) Feasibility and Priority of Digital Solutions

Based on the feedback from the relevant stakeholders of Egypt, each digital solution in the health sector was rated on a three-point scale (☆☆☆☆: high, ☆☆☆: medium, ☆☆: low) as follows.

Table 9-9 Result of Analysis of Digital Solutions Proposed for the Health Sector in Egypt

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
1	Medical Information Collaboration Network (Sharing of electronic medical records and other medical information among medical institutions)	☆☆ - Participants agreed that the sharing of medical data, including electronic medical records, would lead to improved medical services. - Support for the establishment of a system not only for information sharing but also for cooperation among regional medical institutions (patient referrals, cooperation in providing medical services, efforts to improve the quality of regional medical services, etc.) would be a more effective solution.	☆ - The information system currently underway for the universal health insurance system is expected to cover medical data sharing as well. - However, it will take time for the universal health insurance system to cover the entire country. - It would be appropriate to select specific regions and work on them as pilots.	☆ - Demarcation with the universal health insurance system is necessary. - The development of medical systems in remote areas is considered to be a higher priority.	
2	Health Management Information System (HMIS) (Health information system that provides real-time information on the status of health and medical care)	☆☆ It was suggested that the collection of medical information is effective in optimizing health care services.	☆ - It is expected that the information system currently underway for the universal health insurance system will also serve as the HMIS. - However, it will take time for the universal health insurance system to cover the entire country. - In view of this situation, it would be appropriate to introduce a simplified system to collect important information necessary for	☆ A demarcation with the universal health insurance system is needed.	The status of collection and utilization of health and medical information by the Ministry of Health and Population and its challenges need to be identified.

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
			formulating, implementing, and monitoring healthcare policies from healthcare-related institutions on a regular basis.		
3	Telemedicine Services (Health guidance using a wearable device)	☆☆☆ Telemedicine is one of the priorities. It was agreed that it would be effective in resolving the problems of regional disparities and lack of physician capacity.	☆☆ - The Ministry of Health and Population is expanding the establishment of telemedicine service units. - Costs vary widely depending on the type of telemedicine. - The need is great but narrowing down of the scope of telemedicine is needed in order to formulate a project. For example, a supporting or complementary role to the telemedicine service unit. - In addition, pathology requires expensive equipment and specialists. Telediagnosis can expand the pathology system with relatively little cost.	☆☆ - The expansion of telemedicine is a high priority for improving health services in Egypt. - It is necessary to demarcate with the telemedicine service units that are being established by the Ministry of Health and Population.	- It is necessary to confirm the services, effectiveness, and challenges of the telemedicine service units being established by the Ministry of Health and Population. - It is also necessary to examine priority areas, such as regional areas of insufficient medical services, and cost-effective tele diagnostic technologies.
4	Universal health insurance System (Systems that support the universal health insurance system)	☆☆☆ - The implementation of the universal health insurance system is being promoted as a government priority. - Participants highly appreciate the effectiveness of the universal health insurance system.	☆☆ - Significant costs are required for equipment upgrades. Development partners support the cost. - Support for system implementation requires significant costs. - Technical assistance for the establishment and operation of the universal health insurance system is considered possible in terms of budget and technical adequacy.	☆ Demarcation with the Ministry of Health and Population and other development partners is needed while others development partners are actively supporting the project.	It is necessary to examine the progress of the universal health insurance system promoted by the Ministry of Health and Population as well as additional support needs.
5	Utilizing Digital Solutions for the Health Sector (Support to startups providing)	☆☆ - Startups providing health-related services have already been created in Egypt.	☆☆ - Since most of the start-ups are private companies, support will be provided	☆ - Support led by the private sector is appropriate.	- The challenges faced by existing health-related start-

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
	health-related services)	- These startups are recognized as contributing to solving issues in the health sector. However, they are basically private services. - There are contacts between the public and private sectors in terms of government procurement for the implementation of government health policies and the establishment of health system.	- from the perspective of fostering the private sector. - Support for startups providing health-related services could be provided as part of startup support. - Support for the introduction of various standards and systems related to technical standards and safety for private sector services in the health service sector is also possible. - Support for the development of start-ups that propose advanced diagnostic and treatment services (university-launched ventures, etc. are envisaged) would contribute to raising the level of medical technology in Egypt.	- Support for the development of institutions and policies related to health-related start-ups can be considered.	- ups need to be identified. - The needs for advanced medical technology in Egypt need to be identified and the possibility of introducing technology through resources such as universities and foreign technology needs to be examined.

9.3. Morocco

9.3.1. Fisheries Sector

(1) Comments on the Proposed Digital Solutions

The major comments from the relevant stakeholders of Morocco on the digital solutions proposed for the fisheries sector were as follows.

Table 9-10 Major Comments on the Digital Solutions Proposed for the Fisheries Sector in Morocco

#	Digital Solution	Major Comments
1	To collect information on sea and fishing conditions (CTD, Application, etc.)	✓ Oceanographic data is collected through oceanographic campaigns, satellites and/or sound data. Oceanographic data is laid out in the form of parameter measurement distribution maps. ✓ More detailed information on the technologies and the procedures of data collection in the proposed solutions is required.
2	To visualize the sea conditions (A buoy with an ICT sensor, An inspection boat with a measuring instrument, etc.)	✓ More detailed information on the technology for visualizing the sea conditions in order to improve the existing system is required.
3	To monitor aquaculture remotely (drone, AI, underwater camera, etc.)	✓ A solution is needed that allows the situation to be constantly monitored in a timely manner. For example, the use of cameras mounted on buoys will enable uninterrupted, continuous, permanent, and constant monitoring.

#	Digital Solution	Major Comments
		✓ Cameras on buoys may be more convenient as drones need many authorizations that are not easily granted. ✓ The camera can help reduce accidents. For example, it can signal when a boat gets too close to the fishing grounds.
4	To visualize the Location of small boats (Application, etc.)	✓ It may be better to attach devices and gadgets to fishing vessels than to install apps on individual fishermen's smartphones. ✓ Situations related to small fishing vessels are currently being monitored, but solutions for locating fishing vessels are necessary. Large vessels are equipped with a VMS system and the technologies to visualize the location is not required.

(2) Feasibility and Priority of Digital Solutions

Based on the feedback from the relevant stakeholders, each digital solution in the fisheries sector was rated on a three-point scale (☆☆☆☆: high, ☆☆☆: medium, ☆☆: low) as follows.

Table 9-11 Result of Analysis of Digital Solutions in the Fisheries Sector in Morocco

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
1	To collect information on sea and fishing conditions (CTD, Application, etc.)	☆☆ In order to calculate long-term sustainable resource management, it is necessary to accurately assess current sea conditions and collect data.	☆☆ The Moroccan government is already collecting some data.	☆ Oceanographic information is currently being collected, but it would be great to take advantage of any useful and reasonable technology that is available.	Need to confirm that the proposed solution can be used in Morocco.
2	To visualize the sea conditions (A buoy with an ICT sensor, An inspection boat with a measuring instrument, etc.)	Same as above	Same as above	Same as above	Same as above
3	To monitor aquaculture remotely (drone, AI, underwater camera, etc.)	☆☆ It is expected to help ensure the safety of aquaculture operators (no need to risk going to check on the farms when the weather is changing) and reduce costs (no need to send out	☆☆ There is also a great deal of government interest in promoting aquaculture, where production can be managed.	☆☆ Since exports of fish are a valuable means of earning foreign currency in the country, it is essential to promote aquaculture.	Various legal regulations regarding the use of drones need to be identified.

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
		boats to check on the farms).			
4	To visualize the Location of small boats (Application, etc.)	☆☆☆ Digital technology can be used to effectively monitor fishing activities, especially on a small-scale fisherman.	☆☆ The key is how to obtain cooperation from the targeted small-scale fishermen. Also, incentives for them need to be set up well.	☆☆☆ It is important to monitor the activities of small-scale fishermen, who constitute the majority of the fisheries sector.	Infrastructure environment needs to be confirmed (especially at sea) before implementing the solution.

9.3.2. Education sector

(1) Comments on the Proposed Digital Solutions

The major comments from the relevant stakeholders of Morocco on the digital solutions proposed for the education sector were as follows.

Table 9-12 Major Comments on the Digital Solutions Proposed for the Education Sector in Morocco

#	Digital Solution	Major Comments
1	Deliver learning contents online	✓ The MASSAR information system¹⁶⁰ is used in Moroccan schools. ✓ Online delivery of learning content is effective in improving student understanding. However, teaching methods using digital technology need to be standardized. ✓ To make e-learning more effective, the establishment of a feedback system for learning is an urgent issue. ✓ It is difficult to ascertain the level of student learning attainment. By utilizing online education, it is possible to comprehensively identify where students are stumbling and help them improve their understanding. ✓ The JICA project 'PEEQ (Project for Promoting Education with Equity and Quality)' has been particularly successful. It should be expanded to the whole country, as the project was targeted at only a few regions. This would also address the issue of the difficulty in assessing students' learning attainment.
2	Support school management	✓ It is important that school management systems are actively implemented to collect information. ✓ In 2006, the ICT utilization promotion programme (generalization of information and communication technologies in education: GENIE) was initiated and multimedia rooms, digital devices and other simple digital equipment has been deployed in schools, but the number is still not enough. ✓ Student management and assessment should be integrated into the MASSAR system.
3	Support capacity improvement of teachers	✓ The NAFIDA Programme, which ran from 2010 to 2015, aimed to build the capacity of teachers in ICT literacy; the programme is being implemented again in 2021. ✓ The Ministry of Education provides digital content to teachers.

¹⁶⁰ A school management platform introduced by the Ministry of Education in 2014. The aims of the introduction are (1) to improve the quality of education by integrating ICT into the education system, (2) to improve school administration, (3) to eliminate inequalities between students, (4) to visualise learning progress for parents, and (5) to improve communication with public authorities. The system allows teachers, students and parents to access necessary information such as student information and grades.

#	Digital Solution	Major Comments
		✓ The government has invested USD 100 million in schools since 2005 and has also increased the education budget allocated to local areas from 2020 onwards to equip schools with digital equipment. ✓ At present, it has not gone as far as supporting teachers to use digital content. ✓ Digital-based pedagogy is not included in the curriculum and teachers themselves are not aware that they have to use digital content. Digital equipment in schools is also inadequate.
4	Support the learning of vocation school students using AR / VR	✓ AR/VR is not yet widespread. ✓ Training has only been conducted for a few teachers at universities. ✓ The significance and priority of utilizing AR/VR in Morocco is questionable. ✓ Morocco's first priority is to first deploy basic digital equipment.

(2) Feasibility and Priority of Digital Solutions

Based on the feedback from the relevant stakeholders of Morocco, each digital solution in the education sector was rated on a three-point scale (☆☆☆☆: high, ☆☆☆: medium, ☆☆: low) as follows.

Table 9-13 Result of Analysis of Digital Solutions in the Education Sector in Morocco

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
1	Deliver learning contents online	☆☆☆ - There were many positive comments from participants who attended the workshop, particularly regarding the need for online education in the COVID-19 situation. - It is expected to be a means of closing the education gap for rural children and girls.	☆☆☆ - As the Government of Morocco has already developed and operated an online education platform, it is highly feasible. - Expenses may be required to develop internet infrastructure and deploy devices in schools.	☆☆☆ - Improving online education in the COVID-19 situation is a high priority.	- Linking with online education platforms developed and operated by the Government of Morocco should be considered. - The ICT skills of teachers and pupils need to be taken into account and the necessary training systems need to be put in place. - Attention needs to be paid to the development of internet infrastructure and deployment of devices. - The cost burden for the use of systems and content needs to be organized and considered.
2	Support school management	☆☆☆ - There was high level of interest from workshop participants as a way of reducing the burden on teachers.	☆☆☆ - Expenses may be required for developing internet infrastructure and deploying devices in schools.	☆☆☆ - Efforts in conjunction with the spread of online education, such as data capture, may be effective.	- Linking with online education platforms developed and operated by the Moroccan Government should be considered.

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
3	Support capacity improvement of teachers	☆☆☆ - Improving teacher capacity is an essential prerequisite for promoting online education	☆☆☆ - The Ministry of Education already provides digital content for teachers, and interest in strengthening teacher capacity to promote online education is likely to be high.	☆☆☆ - In promoting online education, teachers are required to improve their ICT skills and learn teaching methods adapted to online education.	- Digital equipment needs to be deployed in schools. - Curricula for online education need to be developed at the same time.
4	Support the learning of vocational school students using AR / VR	☆ - Workshop participants raised questions about the effectiveness of the use of AR/VR technology in vocational training.	☆ - The introduction of AR/VR equipment may involve significant costs and cost-effectiveness needs to be scrutinized.	☆ - Not a high priority. Workshop participants expressed the opinion that the maintenance of basic facilities and equipment rather than advanced technologies such as AR/VR is a high priority.	- Another research and study are needed on the use of AR/VR technology in which vocational training curricula.

9.4. Tunisia

9.4.1. Agriculture and Fisheries Sector

(1) Comments on the Proposed Digital Solutions

The major comments from the relevant stakeholders of Tunisia on the digital solutions proposed for the agriculture and fisheries sector were as follows.

Table 9-14 Major Comments on the Digital Solutions Proposed for the Agriculture and Fisheries Sector in Tunisia

#	Digital Solution	Major Comments
1	To assist capacity building of extension workers: (Online learning materials, Platform for remote guidance and information sharing, VR, etc.)	✓ Online learning materials and platform for remote guidance and information sharing are important and can contribute to capacity building of extension workers. ✓ Building a platform with data collection functions is beneficial for farmers and fishermen. However, it is necessary to find ways to reduce costs. ✓ The technology can be utilized in collaboration with training centers that support farmers and fishermen in Tunisia.
2	To enable extension workers to access information (IoT, drone,	✓ Extension workers have to access to the information and data they need. This technology would make it possible.

#	Digital Solution	Major Comments
	etc.)	✓ AVFA has a platform that organizes information such as professional training, useful documents, videos and radio. It is necessary to improve in a way that is useful for extension workers.
3	To manage farm activities (digital work with PC, tablets and smartphones)	There are no specific comments on this.
4	To share information on sea conditions: (Platform, API connection, etc.)	✓ Information sharing between stakeholders through online learning content and platforms is useful for improving resource management in Tunisia and Mediterranean.
5	To collect information on fishing activities: (A buoy with an ICT sensor, Application, etc.)	✓ Building a platform with data collection functions is beneficial for farmers and fishermen. However, it is necessary to find ways to reduce costs. ✓ The technology can be utilized in collaboration with training centers that support farmers and fishermen in Tunisia.

(2) Feasibility and Priority of Digital Solutions

Based on the feedback from the relevant stakeholders of Tunisia, each digital solution in the agriculture and fisheries sector was rated on a three-point scale (☆☆☆: high, ☆☆☆: medium, ☆☆: low) as follows.

Table 9-15 Result of Analysis of Digital Solutions in the Agriculture and Fisheries Sector in Tunisia

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
1	To assist capacity building of extension workers: (Online learning materials, Platform for remote guidance and information sharing, VR, etc.)	☆☆☆ The workshop agreed that support for agricultural and fisheries extension workers, who serve as a link between markets and farmers, would be effective.	☆☆☆ AVFA is preparing its own proposal and looking for a supporting organization.	☆☆☆ With limited budgets for agricultural and fisheries extension workers, there is a need for an efficient mechanism to strengthen their capacity.	- The possibility of collaboration with private companies that provide digital tools should be considered. - In addition, cost sharing, including system maintenance and management, should be considered.
2	To enable extension workers to access information (IoT, drone, etc.)	☆☆☆ It is expected that the guidance to farmers and fishermen will be improved if agricultural and fishery extension	☆☆☆ There is already a platform within AVFA that organizes various educational materials, etc. This can be handled in the form of	☆☆☆ Since an information platform already exists, it is expected that providing up-to-date information will effectively improve the guidance of agricultural	Cross-cutting coordination is necessary due to the wide variety of institutions collecting various types of data.

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
		workers gain access to the latest production technology and market information.	updating/improving existing ones.	and fisheries extension workers in a short period of time.	
3	To manage farm activities (digital work with PC, tablets and smartphones)	☆ There are already startups in Tunisia that do business related to agricultural and fisheries business management.	☆ It is expected to be introduced by the private companies, not by the government.	☆ The government believes that large-scale farmers can introduce the technologies on their own. For small-scale farmers, the government is considering providing guidance through agricultural extension agents.	
4	To share information on sea conditions: (Platform, API connection, etc.)	☆☆ In considering long-term resource management, it is necessary to accurately assess the current situation.	☆☆ Need to consider linking existing applications with applications under development.	☆☆ With an eye toward future resource management, it is first necessary to properly understand the current situation.	The data collection and management system need to be coordinated.
5	To collect information on fishing activities: (A buoy with an ICT sensor, Application, etc.)	☆☆ Digital technology can be used to conduct effective monitoring of fishing activities, especially on a small scale.	☆ The key is how to obtain cooperation from the small-scale fishermen who will be the target of the project, but this is expected to be difficult.	☆☆ It is also important to monitor the activities of small-scale fishermen, who constitute the majority of the fisheries sector.	Infrastructure environment needs to be confirmed (especially at sea)

9.4.2. Transport Sector

(1) Comments on the Proposed Digital Solutions

The major comments from the relevant stakeholders of Tunisia on the digital solutions proposed for the transport sector were as follows.

Table 9-16 Major Comments on the Digital Solutions Proposed for Transport Sector in Tunisia

#	Digital Solution	Major Comments
1	To support transport data utilization (prove data, mobile base station data, AI, RFID, etc.)	✓ The Ministry of Transport is planning the following two projects. 1) Operating assistance system and passenger and ticketing data. 2) The establishment of a decentralized system for the edition of biometric registration plates.

#	Digital Solution	Major Comments
		✓ Sharing traffic data is very important, but it requires a legal framework. ✓ It is essential to collaborate with private companies that have big traffic data to effectively utilize traffic data. ✓ The amendment of the law to regulate the use of technologies such as drones is underway. ✓ Collecting information on buses, trains, and subways via GPS and RFID is essential. ✓ There is also a data collection method that utilizes sensors and cameras. AI is also useful for traffic management associated with air pollution and congestion.
2	To support traffic management and security support (signal coordination, signal violation enforcement, emergency vehicle priority system, etc.)	✓ Improving traffic safety is very important. In particular, the measures against overloaded vehicles on expressways and early detection and countermeasures for accident-prone areas shall be strengthened. ✓ Highway safety management is very important, and Japan's experience is very valuable. The technology introduced is considered to be effective in solving the problems discussed in the first workshop. ✓ It is also effective to introduce technologies such as drone monitoring to improve traffic safety.
3	To support highway management and overload control (traffic counter, meteorological sensor, weight measurement system, traffic control center, electrical message signboard, etc.)	✓ Overloaded vehicles are one of the most serious problems in Tunisia. It is required to install an overload control system to solve this. ✓ It is necessary to standardize tolls on expressways.

(2) Feasibility and Priority of Digital Solutions

Based on the feedback from the relevant stakeholders of Tunisia, each digital solution in the transport sector was rated on a three-point scale (☆☆☆: high, ☆☆☆: medium, ☆☆: low) as follows.

Table 9-17 Result of Analysis of Digital Solutions in the Transport Sector in Tunisia

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
1	To support transport data utilization (prove data, mobile base station data, AI, RFID, etc.)	☆☆☆ In the recent trend where the possibility of utilizing various transportation big data is increasing, it was commented that the content was very useful in the situation that there is no utilization mechanism in the country.	☆☆☆ A traffic data platform is under development in Tunisia. However, the function is limited. Thus, it was confirmed that it is useful in terms of upgrade of the function to make it more intelligent. The cost is limited, compared to construction of infrastructure, because it does not require a large facility.	☆☆☆ The priority is high in terms of the fact that a similar initiative has already been taken, meaning to supplement it further, and support for transport planning based on quantitative traffic data.	

#	Digital Solution	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
2	To support traffic management and security support (signal coordination, signal violation enforcement, emergency vehicle priority system, etc.)	☆☆ The proposal was to alleviate traffic congestion and solve problems related to traffic safety. But the workshop clearly showed the need for improving traffic safety. Thus, it may be a good idea to focus more on the content that supports the improvement of traffic safety.	☆☆ - Traffic police is the major counterpart for support for traffic management for general road, and STA for highway. In this sense, the counterpart agencies and their needs, i.e., importance of traffic safety and proper traffic management for general road and highways, were clearly confirmed in the workshop. - Although large-scale equipment is not required, some civil engineering work may be required.	☆☆☆ As described on the left, if the focus is placed more on traffic safety, it could be judged to have a high priority.	
3	To support highway management and overload control (traffic counter, meteorological sensor, weight measurement system, traffic control center, electrical message signboard, etc.)	☆☆☆ It was confirmed that the proposed contents were useful because there is not enough experience in operation and maintenance for expressway utilizing traffic data under the situation that the expressway constructions are increasingly under way. In particular, it is considered to be effective in solving the problems that are becoming increasingly serious due to overloaded vehicles along with development of the expressway.	☆☆ It was confirmed that the counterpart is STA and their needs. It is highly likely that institutional measures related to the introduction of equipment at a certain level and the enforcement of overloaded vehicles will be required. The feasibility was set to level 2 in terms of budget and necessary measures.	☆☆☆ As described on the left, it can be judged that the priority is high in terms of necessity of measures against overloaded vehicles and efficient operation and maintenance of expressways.	

9.4.3. Industrial Development Sector

(1) Comments on the Proposed Digital Solutions

The major comments from the relevant stakeholders of Tunisia on the digital solutions proposed for the industrial development sector were as follows.

Table 9-18 Major Comments on the Digital Solutions Proposed for the Industrial Development Sector in Tunisia

#	Digital Solutions	Major Comments
1	Digital Solutions to Support Kaizen Activities in Factories	✓ <i>Kaizen</i> is an effective method for improving factory productivity. ✓ The concept of <i>kaizen</i> is important, but it takes a reasonable amount of time to take hold. It is important to start <i>kaizen</i> with our own resources. ✓ Digital technology is essential for <i>kaizen</i>. Digitalization of factories and <i>kaizen</i> must be promoted at the same time.
2	Digital technology to monitor operations with sensors embedded in factory machinery	✓ Digital technology supports factory production activities. Particularly for SMEs, it is important to provide support that encourages them to adopt digital solutions. ✓ Currently in Tunisia, machines are mainly used in stand-alone mode, which is to the detriment of factory digitalization. ✓ It would be good to introduce IoT, followed by <i>kaizen</i> and digitalization. ✓ Tunisia has a digital strategy to encourage private companies that want to use IoT, and currently about 30 companies are using IoT. ✓ The country is also promoting 5G. It has also held public hearings on 5G, although concrete opinions have not yet been gathered. ✓ As part of the "Tunisian Development Plan," the country is also promoting the digitalization of public administration. Strengthening investment attraction is another important policy. ✓ The MIEM, with the support of the GIZ, has established support centers for the promotion of Industry 4.0 and is assisting companies in their digitalization. However, there are two barriers to the spread of Industry 4.0. The first is that for many companies, the barriers to digitization are high and technical guidance is necessary. The second is the huge amount of money required to implement industry 4.0. ✓ Supporting startups that can provide digital solutions to factories would be effective.
3	Establishment of a support network for rapid prototyping (3D-CAD, CAE, 3D printers, etc.)	✓ There are quite a few FabLabs in Tunisia (15 FabLabs are listed on the website of Tunisian Fablabs: https://fablabs.tn). There are also institutions that provide technical assistance. However, the strengthening of FabLabs and education on rapid prototyping are essential. ✓ There are engineering high schools and universities that offer high-quality prototyping-related training. ✓ Strengthening FabLab networking is an interesting idea.
4	Support for startups developing digital services (e.g., startups developing BPO services)	✓ It is important to support and encourage SMEs to practice digital solutions. ✓ Some factories are highly automated, while others operate on a stand-alone basis. Digitalization is more advanced at foreign-invested companies. ✓ Although there are startups developing digital services for factories, the country's ecosystem is immature and not conducive to fostering startups. ✓ Startups are growing slowly, and human resource development needs to be strengthened. Many startups lack sufficient experience in manufacturing. Training and educational opportunities in manufacturing are also limited.

#	Digital Solutions	Major Comments
		✓ Many startups have ideas but struggle to raise funds, so some kind of support is needed.

(2) Feasibility and Priority of Digital Solutions

Based on the feedback from the relevant stakeholders of Tunisia, each digital solution in the industrial development sector was rated on a three-point scale (☆☆☆☆: high, ☆☆☆: medium, ☆☆: low) as follows.

Table 9-19 Result of Analysis of Digital Solutions Proposed for the Industrial Development Sector in Tunisia

#	Digital Solutions	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
1	Digital Solutions to Support Kaizen Activities in Factories	☆☆☆ - The participants agreed that <i>kaizen</i> is an effective method for improving productivity. - Workshop participants agreed that effective results can be achieved through the use of digital technology when implementing <i>kaizen</i> .	☆☆ - The MIEM is currently implementing a project to improve quality and productivity of SMEs through <i>kaizen</i> . - The services to be provided by the MIEM will focus on software introduction and guidance to factories that are implementing <i>kaizen</i> . The level of technical difficulty required is not high.	☆☆ - It is an effective tool for companies that are conducting Kaizen activities. - Many private companies that are implementing <i>kaizen</i> can introduce digital tools on their own. - Private sector-led implementation is also an option.	- Possibilities for collaboration with private companies that provide digital tools should be considered. - Consideration should also be given to developing a digital tool for the Tunisian government to implement <i>kaizen</i> . - The possibility of including technical guidance on the use of digital tools as part of the quality and productivity project for SMEs being implemented by the MIEM should be considered.
2	Digital technology to monitor operations with sensors embedded in factory machinery	☆☆☆ - Participants agreed that parallel promotion of IoT and <i>kaizen</i> is effective for improving factory productivity. - Monitoring machine operating	☆☆ - Monitoring machine operating conditions using sensors is a technology that is the first step in introducing IoT to factories. The technology is not difficult to implement. - The MIEM has started the activity of the Industry 4.0 Support Center with the	☆☆☆ - This is of high priority as the first step of factory IoT. - A system to provide guidance to SMEs on factory automation and smart factories is needed. - Private sector-led implementation is also an option. - If implemented by the public sector, activities	- The capability of leading IoT of government agencies (CETIME, Technopark, Industry 4.0 Centers, etc.) should be considered. - The collaboration with the GIZ project to support Industry 4.0 centers needs to be considered.

#	Digital Solutions	Effectiveness as Solution to Issues	Feasibility (Existence and intention of C/P, size of budget, appropriateness of technology, etc.)	Priority	Remarks
		conditions using sensors will lead to improved production management and personnel efficiency.	support of GIZ. Cooperation with this activity is important. - Enlightenment and technical guidance on the introduction of IoT to SMEs are required.	will focus on strengthening the functions of existing technical guidance institutions and training instructors.	- Consideration should also be given to including in activities educational activities to promote IoT for the industry as a whole.
3	Establishment of a support network for rapid prototyping (3D-CAD, CAE, 3D printers, etc.)	☆ - FabLabs and technical guidance institutions already exist in Tunisia. - Some product design is also taught in universities and high schools. - Networking of these institutions was evaluated as meaningful.	☆☆ - Facilitation and guidance to private companies to strengthen collaboration among existing FabLabs and technical support organizations will be the main focus. - The project can be implemented mainly by existing institutions.	☆ - The networking of existing Fab Labs is expected to lead to the expansion of Fab Lab services. - It is difficult to make this a stand-alone project by itself, as the private sector can take the lead in strengthening networking among the FabLabs. - Improvement of education related to design, programming and functional evaluation, which are necessary for product development, can also be considered as support.	- It is necessary to identify the facilities and services of existing Fab Labs and technical support organizations. - It is necessary to confirm the content of teaching on rapid prototyping at universities and high schools.
4	Support for startups developing digital services (e.g., startups developing BPO services)	☆ - It was agreed that start-up support is effective. However, the biggest challenge for startups is funding.	☆ - Private-sector-led support will be the main focus, including matching startups with investors and potential partners for overseas expansion. - Conventional SME loan programs are not suitable for high-risk startups.	☆☆☆ - Startup support is an important policy issue for the Tunisian government. - Private-sector-led start-up support is appropriate. - Support to promote the use of BPO services for the industrial sector and support for the introduction of investment promotion measures can be considered.	- It is appropriate to consider support within the framework of strengthening the start-up ecosystem promoted by the Tunisian government and the private sector.

Chapter 10 Proposal of Candidate Projects

10.1. Criterion of Selection of Draft Project Plans and Draft Project Concepts

Based on the results of the evaluation and narrowing-down of potential digital solutions that are considered effective in solving development issues faced by each sector of each country (explained in Chapter 8) and the results of the evaluation of the effectiveness, feasibility and priority of potential digital solutions (explained in Chapter 9), potential projects utilizing digital technologies were selected for each target sector of each target country.

Of these potential project candidates, “draft project plans” are formulated for candidates which are with high local needs and high potential to be implemented under JICA schemes, such as yen loans, technical cooperation projects, and private-partnership projects. On the other hand, “draft project concepts” are prepared for candidates that are difficult to be implemented under JICA's scheme at this time but may indirectly contribute to JICA's projects.

The reasons for the selection of the Draft Project Plans and Draft Project Concepts are explained below for each target sector of each target country followed by the explanations of Draft Project Plans and Draft Project Concepts.

10.2. Egypt

10.2.1. Digital Technology Innovation (Reinforcement of the Digital Innovation Ecosystem, ICT Policy Implementation System and Innovation Promotion System)

(1) Selection of Candidate Projects

In order to effectively use digital technologies for development, it is necessary to formulate and implement appropriate policies to promote the innovation and use of digital technologies. It is also necessary to set up an appropriate organization with human resources and budget to enable implementation of such policies. According to the results of the hearing with stakeholders and desk survey conducted in this project survey, Egypt already boasts core institutions to support the ICT sector in this regard. However, the research team still believe that the needs are vast and there is still room for support to strengthen the capacities of such organizations.

As the usefulness of innovative solutions are increasing been recognized to solve various social challenges, solutions provided by startups and participatory open innovation processes are increasing in Egypt. Many competitions and hackathons using open innovation methods have been held amidst the COVID-19 pandemic to seek innovative solutions from startups as countermeasures against the pandemic induced challenges. The methodology of utilizing startups as means for solving socio-economic challenges is getting recognition, however, there is growing needs for strengthening institutions which incubate startups. Examples of institutions which may need such support include incubation facilities, techno parks, and smart cities. It is also possible to support various Proof of Concept (POC) initiatives by startups at these facilities to ensure their solutions would meets the needs of the society.

Support in this domain has already been implemented by JICA through “Rwanda ICT innovation ecosystem strengthening project,” and “Project NINJA” in Ethiopia. This type of support by the donors is also increasing in Egypt as many development partners have realized the power startups to solve socio-economic challenges.

Considering these circumstances, it may be possible to consider interventions in the area of strengthening the institutional (governance) capacities of the Government of Egypt to better utilize digital technologies (reinforcement of the ICT policy implementation capabilities) and supporting initiatives to strengthen the capacity of innovation promotion instructions/facilities.

In order to consider potential support projects in this area, it is necessary to make considerations for the possible integration with Project NINJA which JICA is promoting. In the same token, it is also important to consider seeking synergy with similar projects which are supported by other development partners. This is important as it ensures avoiding duplication of efforts by development partners, as well as creating “cooperation-competition (coopetition)” which ensure healthy development of the sector.

Since the strengthening of the governance system and the digital innovation ecosystem was not one of the target sectors of the research initiative, it is necessary to conduct additional stakeholder consultations to confirm the needs and challenges in the area to move forward with the potential support initiatives.

The draft candidate projects in the area of digital ecosystem support based on currently available JICA scheme (except the one which is based on private sector investment/partnership) are the following:

Table 10-1 Draft Candidate Projects for Digital Technology Innovation in Egypt

Theme	Overview	Support form
Strengthening the Government's implementation and governance capacity to promote digital innovation	Strengthening the governance and ICT policy implementation capacities of the Government institutions and associated sector development/promotion institutions to utilize digital technologies to solve a wide range of social issues. Other development partners also provide similar support in this domain, so it is necessary to consider synergy and division of support.	- Information collection and confirmation survey - Expert dispatch - Training in Japan - Third-country training - Technical cooperation projects
Digital innovation ecosystem Strengthening Project	Support project for startups and small and medium enterprises at startup incubation facilities (incubators), techno parks, smart cities, etc., which form the basis of the digital innovation ecosystem. Support focusing on startups and small and medium-sized companies are possible even within the framework of Project NINJA of JICA. It is also possible to provide equipment (FabLab, hacker space (manufacturer space), etc.) in incubators, techno parks, etc. It may also be possible to support seed funding scheme in cooperation with other development partners through providing development loans to the existing financing mechanism and/or through supporting two-step loans scheme to the established banking systems which support small and medium-sized companies.	- Information collection and confirmation survey - Expert dispatch - Training in Japan - Third-country training - Technical cooperation projects - Developmental Loans
Japan and Egypt Startup collaboration support	Many startups in North Africa recognize Japan as a potential technology partner. Some Japanese startups, venture capitals, trading companies, etc. are also seeking opportunities to collaborate with and invest in startups in emerging countries. By supporting networking of these companies, the project seeks to create partnerships between Japanese and Egyptian private companies in the digital technology area.	- Public-private partnerships

Source: JICA Study Team

The results of classifying the above candidate projects into draft project plans and draft project concepts from the perspective of local needs and the possibility of project implementation under JICA's scheme (except for private sector investment/partnership project) are as follows.

Table 1-2 Evaluation of Draft Candidate Projects for Digital Technology Innovation of Egypt

Candidate Project	Result of Classification	Reason
Strengthening the Government's implementation and governance capacity to promote digital innovation	Draft Project Concept	It is imperative to determine if Japanese Digital Technologies could be utilized to contribute to this area. It is also important to determine if JICA's support could be complementary to the other development partners. As such, the priority for this initiative is low.
Digital innovation ecosystem Strengthening Project	Draft Project Concept	It is imperative to determine if Japanese Digital Technologies could be utilized to contribute to this area. It is also important to determine if JICA's support could be complementary to the other development partners. As such, the priority for this initiative is low.

Source: JICA Study Team

(2) Draft Project Plan

There are no candidate projects evaluated appropriate for Draft Project Plan for the digital technology innovation in Egypt.

(3) Draft Project Concept

The following shows the details of Draft Project Concepts.

Candidate Project 1 Draft Project Concept for Digital Technology Innovation in Egypt:
Strengthening the Government's Implementation Capacity to Promote Digital Innovation

Project name	Strengthening the Government's implementation capacity to promote digital innovation
Current conditions and development issues of the target sectors	The Egyptian Government is actively promoting digital technologies as tools to solve socio-economic challenges. As part of the process, the Government is actively encouraging startups to provide innovative solutions. Political and institutional frameworks implementing such policies are relatively well established as compared to the other two countries targeted for the research. Many development partners also support Egypt with great expectations for expanded utilization of digital technologies and innovative development solutions. However, there may exist some gap in terms of the policy implementation capabilities and/or governance systems of the Government and innovation support institutions to effectively foster innovation ecosystem. The proposed project aims to support creating effective organizational structures to accelerate implementation of innovation promotion policies.
Assistance scheme to be applied	Information collection and confirmation survey, expert dispatch, Japan training, third-country training, technical cooperation projects, etc.
The objective of the project	Strengthening the policy implementation capabilities of the institutions to promote digital innovations
Effect of the project	Effective digital innovations to solve socio-economic challenges promoted in Egypt

Overview of the project	Different support schema can be considered depending on the scope of the project: 1) Information collection and confirmation survey Assessment of the Government and parastatal institutions and other innovation promotion institutions (private sector & civil societies). Conduct survey to identify potential gaps in the area of policy implementations and other challenges and formulate support measures to fill the gap. 2) Expert dispatch Dispatching experts to relevant Government institutions to strengthen the capacities of ICT related Government institutions through providing implementation support of innovation promotion policies. Combination of OJT style training as well as utilizing e-learning tools will be used to strengthen human capacity building. 3) Training in Japan Improve the capacities of officers of Egyptian Government to implement innovation promotion policies through learning best practices in the area of digital innovation promotion. In addition, the training occasion would allow visiting innovation ecosystems in Japan. This training course could be combined with additional online training/follow up initiatives as needed. 4) Third-country training Improve the capacities of officers of Egyptian Government to implement innovation promotion policies through learning best practices in the area of digital innovation promotion at third country (country with best example). This training course could be combined with additional online training/follow up initiatives as needed. 5) Technical cooperation project Comprehensive technical cooperation to strengthen the capacities of the Government and innovation support organizations for innovation policy implementation in Egypt. The technical cooperation project could be combined with such digital tools as e-learning systems, enterprise resource planning systems (ERP), etc.
Typical Process of Incubation (Bold typeface denotes potential support area)	Strengthening the capacity of Government agencies to formulate and implement innovation policies (Policy, Market Access, Government Procurement, Funding, Venues, Tax, Regulations, Incentive Mechanisms) Private Sector Support (Incubation, VC, Angel Funding, Mentorship, Market connection, etc.) 
Core digital and digital services Technologies	The proposed support is mainly aimed at improving the general environment for fostering innovation (strengthening the ecosystem) in Egypt through strengthening the government's policymaking and enforcement capabilities (strengthening the governance system). As such, there could be little direct use of digital technologies to support the initiative. Nevertheless, such digital technologies as Enterprise Resource Planning system (ERP), e-learning system, Customer Resource Management system (CRM), etc. can be used to strengthen the governance system of targeted Government agencies. In addition, it is also conceivable to utilize policy decision support system (policy formulation in line with startup development) that utilizes various data.
Theme	Capacity Building of Innovation support organizations (public and private)

Acquired Data (Inputs)	Data pertaining to Innovation Ecosystem (data pertaining to Startups, private sector development, etc.)
Technology for the data acquisition	Databases, ERP, CRM, etc.
Technology for the data analysis	Databases, ERP, CRM, etc.
Intended Output	An environment for effective startup development established
Data Administrator (Holder)	Startups Incubating Institutions
Provided Values	Value for the Government: - Increase entrepreneurship and employment generation through strengthening the entrepreneurs support system - Creation of innovative solutions to solve social issues Value for Entrepreneurs: - Simplification of various procedures/regulations for new and existing businesses through strengthening the entrepreneurial support system
Examples of digital technologies that may be used within the initiative	Potential digital technologies: e-learning systems, enterprise resource planning systems (ERP), etc.
Approximate project cost (human resources, training, materials and equipment, etc.)	1) Japanese side: 50 million Yen 2) Japan side: 100 million Yen 3) Japan side: 10 to 30 million Yen 4) Japan side: 10 to 30 million Yen 5) Japan side: 300 to 500 million Yen Recipient country: XX million Yen
Schedule	1) 0.5 to 1 year 2) 2 years 3) 0.5 years 4) 0.5 years 5) 3 years
Implementation organization	Partner institutions: ICT Ministry, ITIDA Associated institutions: Ministry of Development, Investment and International Cooperation
Risks and countermeasures	• Multiple donors provide digital innovation strengthening support in Egypt. As such, it is necessary to clarify the division of labor with other development partners and the possible advantages of providing cooperation from Japan. • The promotion of digital innovation and startups by the Egyptian Government is holistic, but in a proof-of-concept stage, so it is necessary to consider flexible and effective approaches for the implementation of projects.
JICA projects with which collaboration is expected	• N/A

Source: JICA Study Team

Candidate Project 2 Draft Project Concept for Digital Technology Innovation in Egypt:
Digital Innovation Ecosystem Strengthening Project

Project name	Digital innovation ecosystem strengthening project
Current conditions and development issues of the target sectors	The Egyptian Government is strengthening its digital innovation ecosystem through providing conducive environment to promote growth of private sectors, encouraging creation of innovative solutions for socio-economic challenges, and developing highly skilled human resources. One of such measures taken by the Egyptian Government is the startup (small and medium-sized company) development support which are being conducted at startup development facilities (incubators), techno parks, smart cities, etc. Though major development partners also provide such support in Egypt, synergy and division of labor are deemed possible due to the fact that the needs of the targeted sector are large.

	The proposed support may also be able to use the framework of “Project NINJA,” a signature JICA regional support for startups and small and medium-sized enterprises in Africa. Furthermore, there may be several different supports may be possible such as provision of digital fabrication equipment to incubators, techno parks, and Maker spaces (FabLab and hacker space) to spur hardware-based innovations. Considering the current situation in which startups’ access to finance is still challenging, it may also be possible to provide startups financing mechanism with other development partners. The scheme may be able to provide co-financing support to existing seed funds and also providing access to facilitated loans through “two-step loans” scheme.
Assistance scheme to be applied	Information collection and confirmation survey, expert dispatch, Japan training, third-country training, technical cooperation projects, Grant Aid, Two Step Loan scheme, etc.
The objective of the project	Strengthen digital innovation ecosystem in Egypt which would contribute to the growth of startups
Effect of the project	Effective solutions to solve socio-economic challenges in Egypt created through development of startups.
Overview of the project	Different support schema can be considered depending on the scope of the project: 1) Information collection and confirmation survey Assess the local incubation facilities and innovation promotion institutions, survey the necessary resources, the current gaps, and other factors, and formulate support measures to fill the gap. 2) Expert dispatch Dispatch experts to development-related institutions for management and technical capability reinforcement activities for incubation facilities and organizations. 3) Training in Japan Improve the capabilities of the managers of incubation facilities/institutions in Egypt by sharing knowledge of Japanese incubation facilities and institutions. Provision of remote support are provided as needed. 4) Third-country training Improve the capabilities of the Egypt incubation facilities/institutions by learning the best examples of incubation systems in third countries where the startup ecosystem is well established. Provision of remote support are provided as needed. 5) Technical cooperation project Provide holistic support to the incubation support facilities and institutions to effectively strengthening the digital incubator ecosystem in Egypt. The support may include establishment of POC mechanism, support for the partnerships with Japanese incubators, venture capitals, etc. 6) Technical cooperation project (Project NINJA) Startup development support through the framework of Project NINJA (supporting startup development facilities and institutions). 7) Technical cooperation project (Regional) Startup ecosystem strengthening through sharing of lessons-learned between three targeted countries and invoking “co-competition” among the countries. 8) Grants aid Provision of digital fabrication equipment to the incubation facilities, techno parks, smart cities and other startups incubation facilities. 9) Development loans through existing banking system (co-financing, two-step loan, etc.) Loans to local finance mechanism (including VC and two-step loans of

	commercial banks) in cooperation with other development partners (World Bank, AFD, etc.)
Typical Process of Incubation (Bold typeface denotes potential support area)	Digital Innovation Strengthening Project Government support (Policy, Market Access, Government Procurement, Funding, Venues, Tax, Regulations, Incentive Mechanisms) Private Sector Support (Incubation, VC, Angel Funding, Mentorship, Market connection, etc.) 
Core digital and digital services Technologies	The proposed support is mainly aimed at improving the general environment for fostering innovation (strengthening the ecosystem) in Egypt. As such, there could be little direct use of digital technologies to support the initiative. Nevertheless, such digital technologies as e-learning system, Startups Database (Portal), Digital Fabrication tools, etc. can be used to strengthen the innovation ecosystem.
Theme	Capacity Building of Innovation support organizations (private focus)
Acquired Data (Inputs)	Data pertaining to the innovation ecosystem (information about startups, entrepreneurship development, etc.)
Technology for the data acquisition	Databases, e-learning system
Technology for the data analysis	Databases (including analytic capabilities)
Intended Output	Effective Startups development
Data Administrator (Holder)	Startups support organizations (incubators)
Provided Values	Value for the Government: - Increase entrepreneurship and employment generation through strengthening the startups support system - Creation of innovative solutions to solve social issues Value for Entrepreneurs: - Simplification of various procedures/regulations for new and existing businesses through strengthening the entrepreneurial support system
Examples of usable digital technologies	Potential digital technologies: Digital fabrication equipment
Approximate project cost (human resources, training, materials and equipment, etc.)	1) Japan: 50 million yen 2) Japan: 100 million yen 3) Japan: 30 million yen 4) Japan: 30 million yen 5) Japan: 300 million yen 6) Japan: 100 million yen (depending on the number of target startups) 7) Japan: 100 to 300 million yen 8) Japan 300~500 million yen 9) Japan: 5 billion yen or more Recipient country: XX million yen
Schedule	1) 0.5 to 1 year 2) 2 years 3) 0.5 years 4) 0.5 years 5) 3 years 6) 2 years 7) 3 years 8) 1 year 9) 5 years
Implementation organization	Partner institutions: MSMED, Startup development institutions (incubators, etc.), ICT Ministry, ITIDA, etc. (In the case of Regional Program, relevant institutions of the targeted countries).

	Associated institutions : Ministry of Development, Investment and International Cooperation, financial institutions, etc.
Risks and countermeasures	• Multiple donors support the startup support of Egypt, and it is necessary to clarify the comparative advantages, division of roles, and the possibility of cooperation with development partners. • The digital innovation promotion and startup policies promoted by the Egyptian Government are comprehensive, but there are many institutions involved in this field, including investment from the private sector and support from donors. It is necessary to consider flexible and effective approaches for the implementation of projects.
JICA projects with which collaboration is expected	N/A

Source: JICA Study Team

10.2.2. Agriculture and Fishery

(1) Selection of Candidate Projects

The area along the Nile River in Egypt is an agricultural area that is excellent as long as water is available because it has a dry climate, abundant sunshine, and fertile ground accumulated by a flood. However, since the Nile River is the only source of water, it is the biggest issue how to use the limited water resources efficiently. Due to recent climate change, conventional agriculture depending on experiences does not work properly, so farming based on scientific information is more important than ever.

As for the fishing industry, the demand for aquatic products as a source of protein is increasing globally along with the growth of population and the economic growth of developing countries, but recently the catch has been decreasing with the decrease in the amount of fishery resources, so it is necessary to arrange the system to manage the catch and develop the aquaculture industry to make up for the decrease in the catch.

As a result of the evaluation of projects of the utilization of digital technologies according to the evaluation criteria, the following shows the candidate projects (draft) for agricultural and fishery industry sectors.

Table 1-3 Draft Candidate projects for Agricultural and Fishery Sectors in Egypt

Theme	Overview	Support form
Information gathering and confirmation study on the utilization of digital technology for efficient water resources management	Consider the possibility of identifying specific digital technologies which enable appropriate water allocation in the whole of the irrigation system from the core waterways to terminal waterways and fields and applying the digital technologies to the currently prepared yen loan project.	Addition of operations to additional projects and information collection and confirmation survey in collaboration with the existing project
Inland aquaculture improvement and dissemination project	Develop training programs for inland water aquaculture technologies as well as provide support to enable stable and domestic production of breeders, using digital technologies.	Technical cooperation project
Provision of information to improve income generation of small-scale farmers	Small-scale farmers, who comprise the majority of those engaged in the agricultural sector, will be able to improve agricultural productivity by operating their farms appropriately based on market information, and in addition, they will be able to sell their harvested crops at appropriate prices, which will contribute to improving farmers' profitability.	Technical cooperation project

Source: JICA Study Team

The above candidate projects were classified into Draft Project Plan and Draft Project Concept from the viewpoint of local needs and the possibility of project implementation under JICA's scheme.

Table 10-4 Evaluation of Draft Candidate Projects for Agriculture and Fisheries sector of Egypt

Candidate Project	Result of Classification	Reason
Information gathering and confirmation study on the utilization of digital technology for efficient water resources management	Draft Project Concept	In Egypt, where water resources are limited, it is highly significant that digital technology can be used to efficiently implement water resource management. On the other hand, a "Detailed Design Survey on Irrigated Water Resources Improvement" is currently being dispatched to the country, and some supports may be proposed in the course of the activity; therefore, this is categorized as the draft project concept in this study.
Inland aquaculture improvement and dissemination project	Draft Project Plan	As climate change and other factors make fishing catches unstable and make it difficult to increase landings in terms of resource management, there is a need to promote more stable aquaculture and increase productivity. In addition, marine products are a valuable way to earn foreign currency, and in recent years, more detailed traceability has begun to be demanded, especially in Europe, which is a major export destination from Egypt.
Provision of information to improve income generation of small-scale farmers	Draft Project Plan	Losses are occurring in the transition from one process to the next because the value chain is not well connected throughout agriculture. Successful integration and provision of information from inputs to market prices is likely to improve the profitability of small-scale farmers. Since JICA decided to implement a SHEP project, part of this draft project could be incorporated into the SHEP project.

(2) Draft Project Plan

The details of the Draft Project Plans are shown below.

Candidate Project-3 Draft Project Plan for Fisheries sector of Egypt:
Inland Water Aquaculture Improvement and Propagation Project

Project name	Inland water aquaculture improvement and propagation project
Current conditions and development issues of the target sectors	Egypt is ranked first in the African continent and sixth in the world in terms of the aquaculture production volume and a massive number of farmed fish is available in the market, so its potential for the aquaculture industry is high. However, compared with inland water culture, inland water aquaculture is a priority development field of the government but not promoted sufficiently: for example, natural breeders or imported breeders have to be used because of the lack of aquaculture technologies and shortage of artificial breeder dealers.
Applicable scheme of JICA	Technical cooperation project
The objective of the project	The objective is to develop training and education for the propagation of inland water aquaculture technologies and contribute to the development of inland water aquaculture.
Effect of the project	• Development of training programs for inland water aquaculture technologies. • Domestic and stable production of breeders.
Overview of the project	Perform the following activities in this project to achieve the above-mentioned objective.

	1. Breeder production • Review the breeder production process and system to clarify the current situation and issues of breeder production. • Formulate the methods to improve the breeder production process and the management of hatcheries using digital technologies. • Select, demonstrate, and evaluate the pilot area. 2. Aquaculture technology • Clarify the current situation and issues of inland water aquaculture. • Select the priority issues and pilot region. • Review the existing training and propagation programs and make the necessary revisions. • Create or revise training materials according to the revised program. • Provide and evaluate training in the pilot region. Examples of usable digital technologies: • Collection and utilization of fishing ground environment data using ICT buoys • Development of the information provision system which can predict red tide and handle the decrease of farmed fish due to a high-water temperature, etc. • Selection of juvenile fish using AI	
Prerequisites	• Pilot areas, facilities, seedlings, etc. should be secured by the Egyptian government to enable pilot aquaculture. • A system (mechanism/organization) for coordination among the stakeholders (e.g., inland aquaculture companies, government agencies, etc.) should be in place. • The system (mechanism/organization) must be in place to promote the use of the collected data and its application. • There must be aquaculture experts who can judge the collected data (e.g., what temperature is appropriate for water temperature, what size is appropriate, etc.).	
Digital technologies, element technologies for digital services	①Secure a place for aquaculture → ②Set up equipment ②Set up equipment ↓ ③Get young shellfish and fish ③Get young shellfish and fish ↓ ④Raising them ④Raising them ↙ ⑤Land fish	
Sub-theme	Selection of aquaculture sites	Aquaculture technologies
Collected data (inputs)	• Condition of potential fishing grounds (soil, water depth, bottom sediment, etc.) • Fishing ground environment (water temperature, salinity, oxygen, etc.)	• Fishing ground environment (water temperature, salinity, oxygen, etc.) • Growth status of aquaculture products (size, color, etc.) • Operation management records (feeding, cleaning, shipping, etc.) • Aquaculture management status (weather, feeding, water quality, etc.)
Technologies to be utilized in data collection	• Observation by ICT buoys, etc. (IoT) • Drone (flying and underwater) photography of aquaculture farms	• Observation by ICT buoys, etc. (IoT) • Drone (flying or underwater) photography of aquaculture farms • Satellite-based weather data collection
Technologies to be utilized in data processing	• Numerical and image analysis	• Numerical and image analysis by machine learning
Outputs	• Selection of suitable areas for inland water aquaculture	• Establishment of a data-based aquaculture production management system
Data management	Government	Fisheries cooperatives

Value proposition	Value to the Government <u>Diversification of industry</u> In addition to the expected development of the processing industry through stable production, there is also potential for the development of the small-scale industries surrounding aquaculture (seedlings, feed, equipment, etc.). <u>Stable food supply</u> Stable production of farmed fish will increase domestic food self-sufficiency.	Value for aquaculturists <u>Improved income</u> The use of ICT technology can improve the efficiency of production, thereby increasing income. <u>Acquisition of new technologies</u> The acquisition of aquaculture techniques using ICT technology.
Examples of usable digital technologies	See the following parts in the table in 5.1.2 Fisheries sector of Chapter 5: 2. Production (aquaculture) (1) Farm management technologies, (2) Growth management technologies	
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 400 million yen Accepting country: XX million yen	
Schedule	3 years	
Implementation organization	Partner institution of the other party: Ministry of Agriculture and Land Reclamation Related institutions of the other party: Institutions and organizations related to aquaculture technologies and breeders including the agricultural research institute (central experimental laboratory of aquaculture research)	
Assumed concerns and countermeasures against them	• If there is no breeder production facility for the purpose of the production, supply, etc. of juvenile fish for aquaculture, it will be necessary to set up such facilities (by grants). • Inland water aquaculture is regarded as a business rather than development, so they are likely to demand investments and entry into the specific business by Japanese companies with technologies instead of ODA. • In some areas and locations (especially at sea) where telecommunication infrastructure is not in place and Internet access is not available, we will consider solutions that do not require constant Internet access, as well as communication methods that do not depend on the Internet, such as satellites and LPWA (Low Power Wide Area). Consideration is required. • New digital tools (especially drones) may be legally prohibited or require permits (approval from the military or ICT ministries). In addition, surveys using satellite data require prior security clearance and may have considerable time.	
JICA projects with which collaboration is expected	• There is a possibility of interaction with the technology project to be implemented in 2022/2023FY (aquaculture and fishery distribution project for economic development). However, note that this is inland water culture.	

Source: JICA Study Team

Candidate Project-4 Draft Project Plan for the Agricultural sector of Egypt:

Arrangement of an Information Provision System to Improve the Income Generation of Small-scale Farmers

Project name	Arrangement of an information provision system to improve the income generation of small-scale farmers
Current conditions and development issues of the target sectors	Food loss is occurring as it moves from one process to the next because information from inputs to market prices is not integrated and the value chain is not well connected throughout agriculture. In addition, there are high expectations for weather observation data analysis to improve agricultural productivity, and although the importance of agricultural weather and other types of data to further improve productivity and efficiency is recognized, measures for each agricultural product (in each region) are lagging behind.
Applicable scheme of JICA	Technical cooperation project

The objective of the project	The objective is to improve the income of small-scale farmers by providing farmers with information on everything from inputs to market prices, so that they can use the information to conduct appropriate farming activities.		
Effect of the project	• Periodic collection and organization of information on the prices from inputs to market • Provision of organized information to farmers. • Appropriate farming depending on the situation		
Overview of the project	Perform the following activities in this project to achieve the above-mentioned objective. • Confirm the current accuracy and management system of different information and identify issues in the process. • Construct an implementation system considering the methods to collect accurate information and provide it to farmers. • Propose and demonstrate the information collection and management system using digital technologies. • Review the implementation system from information collection to provision based on the demonstration result.		
Prerequisites	• A system (mechanism/organization) for coordination among the stakeholders (farmers, government agencies, etc.) should be in place. • The data collected and the implementation system (mechanism/organization) to promote the use of the data must be in place. • Agricultural experts must be available to judge/understand the collected data.		
Digital technologies, element technologies for digital services	The project will contribute to improving farmers' income by linking the value chain where information has been diffused separately.		
	Sub-theme	Understanding the current situation assessment	Instruction on farming
	Collected data (inputs)	• Air temperature, humidity, CO2 concentration, soil temperature and moisture content, solar radiation, rainfall, etc.	• Data collected in the "Current Situation Assessment" section - Input goods prices and market price data
	Technologies to be utilized in data collection	• Sensor-based observation (IoT) - Drone photography of farmland - Collecting weather data using satellites	• Computers capable of computing analysis, simulation, etc.
	Technologies to be utilized in data processing	Database system that can be organized in a form that facilitates analysis Integration technology for data from multiple sensors	• Numerical and image analysis by machine learning
	Outputs	Building a database that facilitates evaluation and analysis	• Purchasing affordable, higher quality inputs • Check work schedule and history • Pesticide and fertilizer use plans • Prepare other reports • Profitable sales outlets for farmers
	Data management	Agricultural cooperatives	Agricultural cooperatives/Farmers
Value proposition	Value to the Government		Value to farmers - The farmers will be able to see the intuition and experience of their farmland, making it easier to accumulate and pass

	- The number of farmers is expected to increase by lowering the hurdles for newcomers to agriculture. - Stable agricultural production will improve food self-sufficiency in the country.	on their agricultural know-how to the next generation. - The farmers will be able to know where they can sell their harvests at higher prices, which will increase their income. - The farmers will be able to learn agricultural techniques using ICT technology.
Examples of usable digital technologies	See the following parts in the table in 5.1.1 Agricultural sector of Chapter 5: 1. Production (1) Business management technology, (2) Production management technology	
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 300 million yen Accepting country: XX million yen	
Schedule	3 years	
Implementation organization	Partner institutions of the other party: Ministry of Agriculture and Land Reclamation, the agricultural research institute (central research institute of agricultural meteorology), and Meteorological Agency Related institutions of the other party: Organizations and institutions engaged in agricultural meteorology including the Ministry of Information (a memorandum for two years was concluded with the Ministry of Agriculture for promotion of digital solutions in the agricultural field)	
Assumed concerns and countermeasures against them	• It may be necessary to consider responses to the low digital literacy of farmers. • New digital tools (especially drones) may be legally prohibited or require permits (approval from the military or ICT ministries). In addition, surveys using satellite data require prior security clearance and may have considerable time.	
JICA projects with which collaboration is expected	• There is a possibility of collaboration for securing a place for demonstration because a succeeding project (2022 to 2026) is in preparation for the market-oriented agriculture improvement project for small-scale farmers (2014 to 2019). • Communities managed by JICA (JICA Platform for Food and Agriculture (JiPFA)), Japan Intellectual Support Network in Agricultural Sciences (JISNAS), and Africa Field Innovation Center for Agricultural Technology (AFICAT) (planned)).	

Source: JICA Study Team

(3) Draft Project Concept

The details of the Draft Project Concepts are shown below.

Candidate Project-5 Draft Project Concept for the Agricultural Sector of Egypt: Information Collection and Confirmation Survey for the Utilization of Digital Technologies for Efficient Water Resource Management

Project name	Information collection and confirmation survey for the utilization of digital technologies for efficient water resource management (Or consider the following as additional operations for the existing projects)
Current conditions and development issues of the target sectors	The Egyptian government positioned the agricultural sector as a pillar of economic development and clarified a plan of rehabilitation aiming at efficient and sustainable use of water resources in the long-term development strategy "Egypt Vision 2030" formulated in 2015. In addition, the "national water resource plan" (1997 to 2017) set the target to efficient use of water resources in irrigation as a pillar; the "sustainable agricultural development strategy 2030" formulated in 2009 set the target to an improvement in the productivity of agriculture per unit of water used for poverty

	reduction. Considering these policies, the important measures in the “national water resource plan” (2017 to 2037) include the introduction of modern irrigation in terminal fields (water-saving irrigation facilities such as drip irrigation and sprinklers including pumping-up pumps from terminal waterways), so the government is conducting the preparation survey of the yen loan project.
Applicable scheme of JICA	Addition of operations to additional projects and information collection and confirmation survey in collaboration with the following existing project
The objective of the project	More efficient water resource management using (Japanese) digital technologies in the yen loan project.
Effect of the project	• Identification of specific digital technologies which enable appropriate water allocation in the terminal waterways and fields where modern irrigation system is introduced. • Consider the possibility of applying the specified digital technologies to the currently prepared yen loan project.
Overview of the project	Perform the following activities in this survey to achieve the above-mentioned objective. • Extract the activities which seem to receive benefits from digital technologies from the business plans under consideration in the preparation survey of the irrigation water resource management improvement business. • Identify digital technologies usable for efficient water resource management. • Confirm the necessary implementation system and costs (initial investment, maintenance and management cost, etc.) for using the identified technologies. • Consider the possibility of application to the yen loan project.
Examples of usable digital technologies	See the following parts in the table in 5.1.1 Agricultural sector of Chapter 5: 1. Production (1) Business management technology, (3) Water management technology
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 50 million yen Accepting country: XX million yen
Schedule	0.5 to 1 year
Implementation organization	Partner institutions of the other party: Ministry of Agriculture and Land Reclamation Related institutions of the other party: Institutions and organizations related to water resource management
Assumed concerns and countermeasures against them	• There may be skeptical opinions about the possibility of operating and implementing digital technologies. • The Egyptian government (especially the Ministry of Water Resources and Irrigation) is very sensitive with digital data. • No proposal for digitization (visualization) will be accepted which may leak the conditions of the water resources of Egypt to any other country.
JICA projects with which collaboration is expected	• Efficient water resource management policy advisor of Egypt • Operations of the pump maintenance and management advisor of Egypt (May 2020 to February 2022) • Preparation survey of the irrigation water resource management improvement project of Egypt (February 2020 to April 2022) • New Dairut Weir Construction Project (yen loan project: April 2022 - March 2026): There is a possibility of collaboration between the construction of the central control room and the telemetry system.

Source: JICA Study Team

10.2.3. Transport

(1) Selection of Candidate Projects

From the viewpoint of transport issues, the support to establish (or prepare) framework to realize effective utilization of transport data is the basis for various measures, so its priority is considered to be high. In addition,

it is recommended to prioritize support related to urban transport because the problem with transport in the city is serious. On the other hand, from the viewpoint of project formation, the major counterpart will be the Ministry of Interior, so it is considered that the project formation may be difficult and support for the reinforcement of the management capabilities of expressways, etc. could be more easily acceptable.

As a result of the evaluation of projects of the utilization of digital technologies according to the evaluation criteria, the following shows the candidate projects (draft) for the transport sector.

Table 10-5 Draft Candidate Projects for the Transport Sector in Egypt

Theme	Overview	Support form
Consideration of measures and support for the establishment of frameworks for the utilization of traffic data and digital technologies	To handle various urban transport issues, support the establishment of frameworks including rules, systems, and organizations to enable effective utilization of data and digital technologies in the transport field.	Information collection survey and development study
Support for the introduction of a smart traffic management system	Introduce a traffic signal system using digital technologies for countermeasures against traffic jams in the capital area.	Grants and loans
Support for the reinforcement of the traffic management capabilities	Support the reinforcement of the operation and maintenance capabilities of the introduced system mentioned above and the urban traffic management capabilities using digital technologies.	Technical cooperation project
Support for the reinforcement of the operation and maintenance capabilities of toll roads	In Tunisia, it is planned to introduce systems and equipment for the operation and management of toll roads and high-standard highways throughout the country, so support the reinforcement of the operation and maintenance capabilities using the effective utilization of data.	Technical cooperation project
Support for the reinforcement of the traffic safety capabilities using digital technologies	Support for the reinforcement of the traffic management capabilities and promotion of the propagation of traffic safety actions and culture using digital technologies such as an improvement in the reliability of traffic accident data and analysis of and formulation of countermeasures against traffic accidents.	Technical cooperation project

Source: JICA Study Team

The above draft candidate projects were classified into draft project plans and draft project concepts from the viewpoints of local needs and the possibility of implementation as a JICA's scheme.

Table 10-6 Evaluation of Draft Candidate Projects for Transport Sector of Egypt

Candidate Project	Result of Classification	Reason
Consideration of measures and support for the establishment of frameworks for the utilization of traffic data and digital technologies	Draft Project Plan	As various traffic data are becoming available, it is highly necessary to formulate, implement, and evaluate objective and quantitative traffic policies based on traffic data in order to respond to urban traffic issues.
Support for the introduction of a smart traffic management system	Draft Project Concept	The executing agency and the regulatory agency will be the Ministry of Defense and the Ministry of Home Affairs. Therefore, it is judged that it is appropriate to classify these candidates into Draft Project Concept.
Support for the reinforcement of the traffic management capabilities	Draft Project Concept	

Candidate Project	Result of Classification	Reason
Support for the reinforcement of the operation and maintenance capabilities of toll roads	Draft Project Concept	
Support for the reinforcement of the traffic safety capabilities using digital technologies	Draft Project Concept	

Source: JICA Project Team

(2) Draft Project Plan

The following shows the details of Draft Project Plans.

Candidate Project-6 Draft Project Plan for the Transport Sector of Egypt: Information Collection Survey for the Utilization of Traffic Data and Digital Technologies to Solve Transport Issues

Project name	Information collection survey for the utilization of traffic data and digital technologies to solve transport issues (or consideration of the following matters as additional activities for the existing survey)
Current conditions and development issues of the target sectors	Recently, the population of Egypt has been increasing and concentrating on the capital area of Cairo. Especially, recently, high-standard highways such as inter-city roads connecting to rural areas and ring roads connecting to the suburbs of the capital area have been constructed. But the population in the capital area of Cairo exceeds 20 million, which has led to serious traffic jams, so there are various traffic issues. In Egypt, "Misr National Transport Study (MINTS)," etc. were formulated in the past and are about to be renewed. It is desirable to effectively use traffic data and digital technologies to solve traffic issues under the situation that the information technologies are rapidly advancing nowadays. Thus, in this regard, it is necessary to take measures upon appropriate incorporation of the necessary frameworks to enable such utilization in the transport plan in this country. Under these circumstances, currently, JICA is planned to perform an "information collection survey for the transport development plan." On the other hand, there is a wide range of possibilities of applying traffic data and digital technologies to solve traffic issues by the advancement of digital technologies. For example, the data related to the behavior histories of people and vehicles is accumulated through private ride-sharing services and smartphones, etc. owned by citizens. Using these in public sectors enables the formulation, implementation, evaluation, etc. of various traffic measures based on quantitative demand analysis, but the efficient utilization of data of private sector requires rules and systems. Cracking down on vehicles with traffic violations using digital technologies requires linking the vehicle information and traffic data. However, it is necessary to take measures in such areas as automobile inspection system, the vehicle tax, etc. and collaborate with them to ensure it.
Applicable scheme of JICA	Additional activities for the "information collection survey for the transport development plan" or new information collection survey
The objective of the project	To support the formulation of the necessary frameworks and measures for the utilization of traffic data and digital technologies to solve traffic issues.
Effect of the project	Appropriate utilization of traffic data and digital technologies to solve traffic issues Planning and implementation of measures for city and traffic problems based on the utilization of traffic data.

Overview of the project	The frameworks, systems, and necessary measures to enable the utilization of data in the traffic field in Egypt and handle various urban traffic issues will be studied. The effective utilization of digital technologies and traffic data for the necessary traffic measures requires the related measures and frameworks. Based on these, the following matters will be studied in this project: • Identification of technologies usable for the resolution of urban traffic issues of Egypt • Consideration of frameworks to enable the utilization of data related to these technologies • Consideration of the implementation system for the efficient collection, accumulation, and utilization of data • Consideration of cooperation with local private companies • Review of the existing traffic plans such as “Misr National Transport Study (MINTS)” and consideration of the reflection of the above-mentioned measures in these plans		
Digital technologies, element technologies for digital services	Introducing technologies that can be used to solve urban traffic issues, incorporating the data collected from them into the traffic data platform considering sophistication.		
Input Data	- Movement of people and vehicles		
Technologies for obtaining data	- Probe data collection: Latitude / longitude information based on GPS from smartphones and in-vehicle devices - Mobile phone base station data collection of telecommunications carriers - Movement information obtained from RFID - Image analysis utilizing AI technology - Transport electronic payment		
Technologies for data processing	- Statistical processing (probe, base station data, RFID, image analysis, electronic payment for transport) - Map matching (probe, base station data) - Analysis by machine learning (image analysis), etc.		
Output	- Movement speed analysis result, movement route analysis result, OD analysis result, demography, traffic volume statistics result by vehicle type, sudden event tendency analysis result, secular change of these, etc. - Utilizing for various road traffic measures based on these (traffic information provision, road network development plan, public transport network development plan, etc.)		
Data administrator/owner	Traffic administrator, Public transport operator, Road administrator, Communication carries		
Provided Value	For Government: - Saving in economic loss due to improvement of road and traffic management and traffic congestion	For transport Operators - Increase in revenue due to improvement of transport service and traffic congestion	For General Citizen - Enhancement of convenience and reliance of travel due to improvement of transport service and traffic congestion
Examples of usable digital technologies	See the following parts Table 5-1 in 5.3 Transport sector of Chapter 5: 1. Technologies using traffic big data (1) Utilization of probe data, (2) Utilization of mobile phone base station data, (3) Utilization of image analysis and AI technologies 2. Traffic control and traffic management (2) Utilization of the RFID technology		
Approximate project cost	Japan: 100 million yen Accepting country: XX million yen		

(human resources, training, materials and equipment, etc.)	
Schedule	1 year
Implementation organization	Implemented by: Ministry of Transport Support: Other related institutions (including local private companies)
Assumed concerns and countermeasures against them	Currently, JICA plans to perform an “information collection survey for the transport development plan” and a project similar to this one may be proposed as the output, but the smart and digital technologies in the traffic field may not be necessarily highlighted as a survey item, so arrangements with the relevant survey are required.
JICA projects with which collaboration is expected	Information collection survey for the transport development plan of Egypt (currently selecting a consultant)

Source: JICA Study Team

(3) Draft Project Concept

The following shows the details of Draft Project Concepts.

Candidate Project-7 Draft Project Concept for the Transport Sector of Egypt:
Project for the Establishment of Smart Traffic Management System in the Cairo Metropolitan Area

Project name	Project for the establishment of smart traffic management system in the Cairo metropolitan area
Current conditions and development issues of the target sectors	Recently, the population of Egypt has been increasing and concentrating on the capital area of Cairo. Especially, recently, high-standard highways such as inter-city roads connecting to rural areas and ring roads connecting to the suburbs of the capital area have been constructed. But the population in the capital area of Cairo exceeds 20 million, which has led to serious traffic jams. One of the main causes of traffic jams in urban areas is the inadequacy of traffic lights. In the urban area of Cairo, traffic lights are yet to be sufficiently in place considering the city scale and road density, which is the main cause of traffic jams in Cairo and problems with traffic safety.
Applicable scheme of JICA	Grant aid project
The objective of the project	Introduction of a traffic light system using digital technologies in the urban area of Cairo
Effect of the project	Improvement in the urban traffic flow, which mitigates traffic jams. Improvement in traffic safety by smoothened traffic flow.
Overview of the project	The project includes the following items: - Introduction of Japanese traffic light equipment for the main intersections in the city (up to about 30 locations). - Introduction of a center system in addition to roadside traffic light accidents. - Installation of vehicle traffic light and passenger traffic light equipment for separation of pedestrians and vehicles in the city (temporal and spatial separation between pedestrians and vehicles) in order to smoothen the traffic flow and improve traffic safety. - Improvement of the intersections where traffic light equipment is to be installed. - Study of the necessity for the replacement of the existing traffic light equipment. The examples of the utilization of digital technologies are: - Mitigation of traffic jams by grasping, analyzing, and predicting the real-time traffic volume with sensors
Digital technologies, element technologies for digital services	Aiming to alleviate traffic congestion by grasping, analyzing, and predicting real-time traffic volume with sensors

Input Data	Traffic Volume at intersection		
Technologies for obtaining data	Traffic counter, CCTV, probe, etc.		
Technologies for data processing	Statistic processing for traffic volume, image analysis, generation of traffic signal control parameters based on input data, etc.		
Output	Traffic signal control (area control, corridor control, etc.)		
Data administrator/owner	Traffic administrator		
Provided Value	For Government: - Saving in economic loss due to improvement of road and traffic management and traffic congestion	For Traffic Administrator - Increase in efficiency of traffic management	For General Citizen - Enhancement of convenience and reliance of travel due to improvement traffic congestion
Examples of usable digital technologies	See the following parts Table 5-1 in 5.3 Transport sector of Chapter 5: 2. Traffic control and traffic management (1) Signal control and related technologies (2) Utilization of RFID technologies		
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 500 to 800 million yen Accepting country: XX million yen		
Schedule	3 years		
Implementation organization	Supervised by: Ministry of Interior Implemented by Cairo traffic police Supported by: Government of Cairo and other related institutions		
Assumed concerns and countermeasures against them	- It is important whether the agreement and approval of the Ministry of Interior and the traffic police can be obtained. - Since this project adopts grants, the presence of a Japanese traffic light manufacturer who is willing to enter the market of the target country and make a bid for this project. - It is necessary to reinforce the sustainable operation and maintenance capabilities of the managers (traffic police and related institutions) for the traffic light equipment introduced in this project. Therefore, it is recommended to implement a technical cooperation project in parallel to this project.		
JICA projects with which collaboration is expected	- Information collection survey for the transport development plan of Egypt - Support project for the reinforcement of the traffic management capabilities in the urban area of Cairo (Project proposed in this survey: Support for the reinforcement of the operation capabilities of traffic lights) - Loan project (next stage): This grant project introduces traffic light equipment in the center of the city limiting the target area, but it is recommended to expand the target area by a loan project to proceed with stepwise arrangements.		

Source: JICA Study Team

Candidate Project-8 Draft Project Concept for the Transport Sector of Egypt:
Project for Capacity Development of Traffic Management in the Cairo Metropolitan Area

Project name	Project for capacity development of traffic management in the Cairo metropolitan area
Current conditions and development issues of the target sectors	Recently, the population of Egypt has been increasing and concentrating on the capital area of Cairo. Especially, recently, high-standard highways such as inter-city roads connecting to rural areas and ring roads connecting to the suburbs of the capital area have been constructed. But the population in the capital area of Cairo exceeds 20 million, which has led to serious traffic jams. One of the main causes of traffic jams in urban areas is the inadequacy of traffic lights. In the urban area of Cairo, traffic lights are yet to be sufficiently in place considering the city scale and road density, which is the main cause of traffic jams in Cairo and problems with traffic safety.

	Along with this, it is important to reinforce the capabilities to manage traffic in the city.		
Applicable scheme of JICA	Technical cooperation project		
The objective of the project	Reinforce the capabilities for traffic management using digital technologies in the urban area of Cairo		
Effect of the project	Reinforcement of the road traffic management system and capabilities Mitigation of traffic jams in the city thanks to the reinforcement, which improves the traffic safety		
Overview of the project	“Support project for the introduction of the smart traffic management system for the urban area of Cairo in Egypt (grants)” proposed in this survey introduces traffic light equipment using digital technologies in the center area of the city as the target area. It is also recommended to expand the target area through a loan project as the succeeding project. Aiming at synergy with these projects, this project supports the reinforcement of the operation and maintenance capabilities for the traffic light system to be introduced for the Cairo traffic police, the government of Cairo, etc., which are traffic administrators, and the capabilities for traffic management in the city. The following capabilities will be mainly reinforced: - Operation and maintenance capabilities of the traffic light system; - Reinforcement of the road traffic management system in the city; - Capabilities to collect and analyze road traffic information/data; - Capabilities to formulate and implement road traffic regulation measures; - Capabilities to carry out intersection improvement		
Digital technologies, element technologies for digital services	Introducing signal equipment that utilizes digital technology to support the enhancement of operational and maintenance capabilities related to signal systems and the capacity related to traffic management in the city.		
Input Data	Traffic Volume at intersection		
Technologies for obtaining data	Traffic counter, CCTV, probe, etc.		
Technologies for data processing	Statistic processing for traffic volume, image analysis, generation of traffic signal control parameters based on input data, etc.		
Output	Traffic signal control (area control, corridor control, etc.)		
Data administrator/owner	Traffic administrator		
Provided Value	For Government: - Saving in economic loss due to improvement of road and traffic management and traffic congestion	For Traffic Administrator - Increase in efficiency of traffic management	For General Citizen - Enhancement of convenience and reliance of travel due to improvement traffic congestion
Examples of usable digital technologies	See the following parts Table 5-1 in 5.3 Transport sector of Chapter 5: 2. Traffic control and traffic management (1) Signal control and related technologies (2) Utilization of RFID technologies		
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 300 million yen Accepting country: XX million yen		
Schedule	3 years		
Implementation organization	Supervised by: Ministry of Interior Implemented by Cairo traffic police, the government of Cairo Supported by: Other related institutions		
Assumed concerns and countermeasures against them	- It is important whether the agreement and approval of the Ministry of Interior and the Cairo traffic police can be obtained.		
JICA projects with which collaboration is expected	- Information collection survey for the transport development plan of Egypt - Support project for the introduction of traffic lights in the urban area of Cairo (Grants: Proposed above)		

Source: JICA Study Team

Candidate Project-9 Draft Project Concept for the Transport Sector of Egypt:
Project for Capacity Development of Toll Road Management Utilizing Digital Technology

Project name	Project for capacity development of toll road management utilizing digital technology	
Current conditions and development issues of the target sectors	Especially recently, in Egypt, high-standard tolled roads connecting to the urban area of Cairo, its surrounding area, and local cities have been constructed at a rapid rate. The major ones include the diversion around the capital area of Cairo, connection to the surrounding regions, and the ring road, the outer ring road, and radial road network in the capital area connecting the capital area with the major local cities. The equipment for operation and maintenance of these tolled roads are currently under construction and the introduction project of equipment using digital technologies for a total length of about 1,000km is in progress. However, Egypt has no experience in the operation and maintenance of tolled roads and such equipment and systems, so efficient and sustainable operation and maintenance capabilities are required.	
Applicable scheme of JICA	Technical cooperation project	
The objective of the project	To reinforce the tolled road management capabilities using digital technologies	
Effect of the project	Improvement in the operation and maintenance capabilities for traffic control on tolled roads Improvement in the operation and maintenance capabilities for toll collection on tolled roads	
Overview of the project	The operation of tolled roads is roughly divided into traffic control and toll collection operations. The objective of traffic control is to improve and maintain the safety and service quality of expressway space where vehicles move at a high speed; the main objective of toll collection is to secure funds for sustainable management of tolled roads. In this project, the operation and maintenance capabilities will be reinforced. The following items to be reinforced are also included in the project; - The institutional and organizational structure for the sustainable operation and maintenance of tolled roads, - Capabilities for procurement, project management and monitoring in the stages of the construction of roads and the introduction of equipment and systems. - Capabilities of the efficient utilization of IT systems and data through these activities.	
Digital technologies, element technologies for digital services	Through systems using IT technology and efficient use of data, it supports the strengthening of operation and maintenance capabilities for the sustainable operation of toll roads.	
Theme	Traffic Management	Toll Collection
Input Data	Traffic volume, traffic flow, traffic event information (accidents, falling objects, traffic violations, etc.), weather information, and other related information (construction schedule information, etc.)	Information for determination of fare based on driving history (vehicle type, entrance / exit information, etc.)
Technologies for obtaining data	Traffic counters, CCTV, weather sensors, axle load measurement, etc.	RFID, DSRC, GNSS
Technologies for data processing	Traffic statistics processing, image analysis, traffic event management, etc.	(Processing based on the above and system on the central side)
Output	Traffic information, various highway traffic management, emergency response	Highway / toll road toll collection
Data administrator/owner	Highway operator	Highway operator

Provided Value	For Government: - Reduction of economic loss due to congestion alleviation on highways and entrances and exits	For Highway Operator - Improvement of business feasibility due to efficiency of toll collection	For Road Users - Enhancement of convenience of mobility due to alleviation of congestion and improvement of traffic safety on highway
Examples of usable digital technologies	See the following parts Table 5-1 in 5.3 Transport sector of Chapter 5: 3. Management of expressways (1) Traffic control system (2) Toll collection system (3) Application of the overloading detection system and probe technologies		
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 300 million yen Accepting country: XX million yen		
Schedule	3 years		
Implementation organization	Supervised by: Ministry of Defense Implemented by: National Road Public Corporation Supported by: Other related institutions		
Assumed concerns and countermeasures against them	- It is important whether the agreement and approval of the Ministry of Defense and the national road public corporation can be obtained.		
JICA projects with which collaboration is expected	Information collection survey for the transport development plan of Egypt		

Source: JICA Study Team

**Candidate Project-10 Draft Project Concept for the Transport Sector of Egypt:
Project for Capacity Development of Traffic Safety in Cairo Using Digital Technology**

Project name	Project for capacity development of traffic safety in Cairo using digital technology
Current conditions and development issues of the target sectors	The capital area of Cairo in Egypt is the largest city in Egypt with a population of 20 million or more. Recently, the population of Egypt has been increasing with economic growth and concentrating on the urban area. As the number of cars has been increasing with economic growth and population increases, traffic jams have been getting more and more serious in the capital area of Cairo. Under these circumstances, the lack of traffic manners causes traffic accidents, which also leads to the further deterioration of traffic jams. Under such circumstances, it is demanded to improve the traffic manners of road users and reinforce the traffic safety capabilities of the authorities.
Applicable scheme of JICA	Technical cooperation project
The objective of the project	To reinforce the capabilities for traffic safety
Effect of the project	Improvement in the traffic manner of road users Reinforcement of the traffic safety management capabilities of the authorities Improvement in traffic jams and promotion of traffic safety through such improvement and reinforcement
Overview of the project	To improve the reliability of traffic accident data, reinforce the capabilities to analyze and formulate countermeasures against traffic accidents, and promote the propagation of traffic safety actions and culture in the capital area of Cairo in Egypt. In addition, it aims to decrease traffic accidents by improving the organizational capabilities and implementation capabilities for the road traffic safety of the Cairo traffic police and the traffic environment of Egypt, mainly the capital area. The activities also include the formulation of a traffic safety education curriculum, the public relations for traffic safety, analysis of and countermeasures against traffic accidents, the arrangement and utilization of data for traffic, accidents, etc. and arrangement of the surrounding environment/preparation of the mechanism for them, the formulation,

	implementation, and evaluation of plans for traffic regulations and enforcement, and support for the reinforcement of the capabilities for cracking down on traffic violations, etc.		
Digital technologies, element technologies for digital services	Utilizing digital technology, it aims to improve the reliability of traffic accident data, strengthen the ability to analyze traffic accidents and formulate countermeasures, and promote traffic safety behavior and culture.		
Input Data	Traffic volume, accident information, traffic event information, various information about road accessories, etc.		
Technologies for obtaining data	Traffic counter, CCTV, probe information collection, speed gun, RFID, ANPR (automatic number plate recognition), etc.		
Technologies for data processing	Accident database construction, image analysis, vehicle-specific traffic statistics, traffic event statistics, OD analysis, etc.		
Output	Accident database, various statistics and analysis results above, crackdown → Strengthening traffic safety capabilities using these		
Data administrator/owner	Traffic administrator, Road administrator		
Provided Value	For Government: - Reduction of economic loss due to improved traffic safety	For Traffic Administrator - Improvement of traffic safety measures and response capabilities	For General Citizen - Enhancement of convenience and reliance of travel due to improvement traffic safety
Examples of usable digital technologies	See the following parts Table 5-1 in 5.3 Transport sector of Chapter 5: 1. Technologies using traffic big data (3) Utilization of image analysis and AI technologies 2. Traffic control and traffic management (1) Traffic light control and related technologies (2) Utilization of the RFID technology In addition to these, accident database, accident information management system, etc.		
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 300 million yen Accepting country: XX million yen		
Schedule	3 years		
Implementation organization	Supervised by: Ministry of Interior Implemented by: Cairo traffic police Supported by: Other related institutions		
Assumed concerns and countermeasures against them	- It is important whether the agreement and approval of the Ministry of Interior and the Cairo traffic police can be obtained.		
JICA projects with which collaboration is expected	Information collection survey for the transport development plan of Egypt		

Source: JICA Study Team

10.2.4. Education

(1) Selection of Candidate Projects

Online education is about to propagate rapidly as a result of public and private activities for the promotion of online education through nationwide school closure measures due to COVID-19. On the other hand, the propagation of online education without sufficient preparation has caused confusion in the field of education in schools, so there are many issues such as how to incorporate conventional education with face-to-face methods by teachers as the basis in online education.

In addition, in Egypt, the unemployment rate of young people has been extremely high. As a cause, a mismatch between the contents of higher education and job training and the needs of the industry was pointed out, and it

is demanded to perform activities to fill this gap such as the incorporation of the instructions on digital technologies recently utilized in the industry in the curriculum.

As a result of the evaluation of projects of the utilization of digital technologies according to the evaluation criteria, the following shows the candidate projects (draft) considered to be effective for the resolution of the issues of the education sector.

Table 10-7 Candidate Projects for the Education Sector in Egypt (Draft)

Theme	Overview	Support form
Project to strengthen teachers' ICT skills for blended learning practices in primary education	Effective education methods (mixed learning models) combining face-to-face education and remote education are identified. In addition, the quality of primary education is improved by the practice of mixed education by teachers who have received online training for the utilization of ICT and Japanese-style education.	Technical cooperation
Project to improve the quality of vocational training by using digital technology to meet the needs of industry	Provide support for the revision of the curriculum, teacher training, and the procurement of the necessary equipment to practice job training and education using digital technologies which match the needs of industry in vocational training schools.	Technical cooperation

Source: JICA Study Team

The results of classifying the above candidate projects into draft project plans and draft project concepts from the perspective of local needs and the possibility of project implementation under JICA's scheme are as follows.

Table 10-8 Evaluation of Candidate Project for the Education Sector in Egypt

Candidate Project	Result of Classification	Reason
Project to strengthen teachers' ICT skills for blended learning practices in primary education	Draft Project Concept	The Ministry of Education has developed an online platform to support self-learning for primary and secondary school pupils called the Egyptian Knowledge Bank (EKB), and expectations are high for the spread of online education in the context of an uncertain outlook for the end of the COVID-19. Effective teaching methods that effectively combine online and face-to-face learning (blended learning models) need to be identified, as well as improving teachers' ICT utilization skills. Consider incorporating it as part of the activities of the "Project for Enhancement and Dissemination of Tokkatsu Models"
Project to improve the quality of technical education and vocational training by using digital technology to meet the needs of industry	Draft Project Concept	The effectiveness of the use of AR/VR technology in enhancing technical education and vocational training that leads to employment needs to be fully scrutinized. The introduction of AR/VR technology is not necessarily a high priority under the current situation that even basic facilities and maintenance are not fully in place.

Source: JICA Study Team

(2) Draft Project Plan

There are no candidate projects evaluated appropriate for Draft Project Plan for the education sector in Egypt.

(3) Draft Project Concept

The following shows the details of the Draft Project Concepts.

Candidate Project-11 Draft Project Concept for the Education Sector of Egypt:
Project to Strengthen Teachers' ICT Skills for Blended Learning Practices in Primary Education

Project name	Project to strengthen teachers' ICT skills for blended learning practices in primary education (Consider incorporating it as part of the activities of the "Project for Enhancement and Dissemination of Tokkatsu Models")
Current conditions and development issues of the target sectors	The Ministry of Education deploys the online platform to support the self-learning of pupils and schoolers of primary and secondary education called the Egyptian Knowledge Bank (EKB). Due to the coronavirus catastrophe, the promotion of online education is an urgent issue and the further utilization of EKB is expected, but there remain some issues: the presence of access to online platforms and education materials, knowledge and skill levels for ICT, and learning gaps caused by differences in learning levels of practice in classes using online education materials of teachers. Though it is difficult to predict the situation of the coronavirus catastrophe, the conversion of the education sector to ICT has been considered since before the coronavirus catastrophe, and it is desirable to accelerate the propagation and acceleration of the utilization of the e-learning and learning management systems because of the coronavirus catastrophe. On the other hand, there is a concern about the impact of the propagation of remote education on the cultivation of the sociality of pupils due to a lack of direct face-to-face communication.
Applicable scheme of JICA	• Technical cooperation project (Consider incorporating it as part of the activities of the "Project for Enhancement and Dissemination of Tokkatsu Models") • Public-private partnerships
The objective of the project	• To improve the quality of education by the identification of effective education methods (mixed learning models) in primary education, the practice of classes combining face-to-face classes and e-learning by teachers who have received training for the utilization of ICT, and the enhancement of the holistic education activities which contribute to the cultivation of the sociality of pupils using ICT effectively.
Effect of the project	• Identification of effective education methods (mixed learning models) using ICT. • The practice of effective and efficient school education and school management using e-learning and learning management systems by teachers who have received training. • Enhancement of holistic education activities by teachers who have received training using ICT effectively contribute to the cultivation of the sociality of pupils
Overview of the project	• Organize the issues in the practice of mixed learning models in the schools selected as pilot schools and identify the knowledge and skills which teachers should learn. • Organize the existing education services using digital technologies considered to be effective. • Based on these, plan and practice online training for the teachers at the pilot schools for effective mixed education and school affairs management using ICT and the practice of holistic education activities and support their promotion and establishment together with the teachers who have received the training. • Create and apply nationwide the guidelines for schools and teachers which describe measures, etc. to practice effective mixed education and school affairs management using ICT and holistic education activities based on the experience of the introduction of education services using digital technologies in the pilot schools and the lessons learned from them.
Prerequisites	• Internet-capable devices (PCs and tablets) are deployed in schools. • Stable internet connection with a certain level of transfer speed, data volume and access are established in schools.
Elemental digital technology for digital services	• Learning content distribution system • Use of an integrated school management system

	• Support system for sharing lesson videos and feedback among teachers
Acquired data (input)	[Learning content distribution system] • Learning progress of pupils and students • Grades, etc. [Use of integrated school management system] • Various information related to school management and operation • Personal information of students and pupils, etc. [Support system for sharing lesson videos and feedback among teachers] • Lesson videos • Feedback from users, etc.
Technologies that can be used in the data acquisition part	[Learning content distribution system] • Data acquisition is based on input from users (students, teachers and parents) [Use of an integrated school management system] • Data acquisition is based on input from users (school administrators and teachers) [Support system for sharing lesson videos and feedback among teachers] • Data acquisition is based on user input
Technologies that can be used in the data processing part	[Learning content distribution system] • AI/machine learning of weak areas in learning • Delivery of optimal learning materials and learning advice based on the above • Visualization of learning history, grades, etc. [Integrated school management system] • Integrated management of various school information through database to achieve the following - Visualization and comparative analysis of various management information - Management of pupil and student information (grades, attendance, health information, etc.) - Sharing of information among school staff (teachers, administrators, etc.) [Support system for sharing lesson videos and feedback among teachers] • Lesson video distribution
Output	[Learning content distribution system] • Establishment of a detailed learning guidance system tailored to each individual student [Integrated school management system] • Reduce the workload of school staff • Improvement of the quality of school management and administration through the multifaceted use of information through the centralization of information [Support system for sharing lesson videos and feedback among teachers] • Improve the quality of teaching by sharing information and learning from each other
Data administrator	(Since it is assumed that the existing services is used, the main data is managed by the service provider. The following is the assumption of the data management as a user.) [Learning contents distribution system] • Schools (teachers), parents, children and students [Integrated school management system] • Schools [Support system for sharing lesson videos and feedback among teachers] • System users (teachers)
Value offered	[Learning content distribution system] Value to the government • Improving the quality of education Value for pupils and students • Individually optimized learning experience Value for teachers • Reduced workload

	• Optimized teaching and learning Value for parents • Detailed information sharing and feedback on grades and academic guidance [Integrated school management system] Value to the government • Improvement of the working environment for teachers • Reduction of labor and other costs by improving operational efficiency Value for schools and teachers • Improvement in the quality of school management and administration through the multifaceted use of information through the centralization of information • Reduction in the workload of school staff • Effective child and student guidance through the accumulation and sharing of student and teacher information [Support system for sharing lesson videos and feedback among teachers] Value to the government • Improvement of the overall quality of education Value for teachers • Improvement in the quality of teaching • Reduced workload
Examples of usable digital technologies	• Utilization of the learning contents delivery system • Utilization of the integrated school affairs management system • Sharing of class videos among teachers, utilization of the feedback support system, etc. • (For the usable digital technologies mentioned above and their specific use cases, see Chapter 5 "Table 5-1 Use cases of digital technologies to the education sector")
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 500 million yen Accepting country: XX million yen
Schedule	5 years
Implementation organization	Supervised and adjusted by: Ministry of Education and Technical Education Implemented by: Departments of education of prefectures/Primary education schools
Assumed concerns and countermeasures against them	Confirm the Internet connection conditions of schools in the selection of the pilot schools and the device ownership conditions of teachers and pupils because some cases are assumed that the Internet environment of the pilot schools is insufficient or Internet-enabled devices available for teachers or pupils are insufficient. In some cases, also consider supporting the arrangement of the internet connection environment and the acquisition of devices. Also, consider the possibility of applying software and applications not assuming the internet connection in schools without the Internet connection environment. In addition, since it is assumed that there may be significant differences in the ICT skills of teachers, pupils and parents, sufficient consideration should be given to providing training opportunities, including basic PC skills operation, if necessary. It is desirable to identify effective technologies and solutions possessed by the private sector, including those in cooperation with EKB and local ones, and to consider including a mechanism for their sustainable use.
JICA projects with which collaboration is expected	Project for Enhancement and Dissemination of Tokkatsu Models

Source: JICA Study Team

Candidate Project-12 Draft Project Concept for the Education Sector of Egypt:
Project to Improve the Quality of Technical Education and Vocational Training by Using Digital Technology to
Meet the Needs of Industry

Project name	Project to improve the quality of technical education and vocational training by using digital technology to meet the needs of industry
Current conditions and development issues of the target sectors	In Egypt, the high unemployment rate of young people is a big social problem. It is pointed out that the cause is a mismatch between the curriculums in vocational schools and higher education and the needs in the labor market. Especially in the labor market of Egypt, the learning of practical capabilities demanded by the demand side, that is companies, is not sufficiently supplied by the supply side, that is education and training in technical and vocational education and training (TVET) institutions and higher education, so labor shortage is also a big issue of the business investment environment from the viewpoint of industry. In the field of vocational training, it is desired to improve the quality of technical education and vocational training to achieve employment based on the recent conditions of the utilization of digital technologies. Because practice equipment is insufficient or aged in many cases, they can contribute to the mitigation of cost burdens for the purchase of equipment and the improvement in the quality of practice by, for example, the development of systems for practice using VR and AR technologies and the joint use of such systems among education institutions.
Applicable scheme of JICA	• Technical cooperation project • Public-private partnerships
The objective of the project	To realize the practice of technical education and vocational education using digital technologies which can meet the needs of industry in technology-related high schools.
Effect of the project	• Identification of digital technology elements including VR, AR, etc. usable in curriculums of vocational training schools by investigating the needs of industry (The targets are assumed to be departments assumed to match the needs for human resources in the industry such as departments of automobiles, machines, electricity, electronics, industrial electricity, and construction. The needs are to be surveyed assuming especially collaboration with Japanese companies which run business in Egypt (employment of graduates)) • Revisions of curriculums and education materials including digital technology elements. • Procurement of the necessary equipment, planning and development of contents, and practical vocational education which meets the needs of industry. • Reinforcement of the capabilities of instructors through TOT. • Construction of a cooperative organization with industry and revisions of curriculums and educational materials based on periodic surveys of human resource needs.
Overview of the project	• Survey the needs of industry including Japanese companies which have entered the market in Egypt and identify the target vocational training course (Also consider performing an information collection confirmation survey, etc. before the technology project). • Grasp the gap between the current curriculums of technology-related high schools and the human resources demanded in the industry. Identify the issues which are bottlenecks in the implementation of the current curriculums, and identify the measures to streamline technical acquisition (time, cost, etc.) • Based on the survey result, support the revisions of curriculums and education materials to practice vocational training activities including digital technology elements in the technology-related high schools selected as the pilot schools. • Support the procurement of the necessary equipment and the planning and development of contents.

	• Provide training for teachers. • Company internship and employment support for students are performed in cooperation with the industry.
Prerequisites	• Internet-capable devices (PCs and tablets) are deployed of in schools. • Stable internet connection with a certain level of transfer speed, data volume and access are established in schools.
Elemental digital technology for digital services	• Vocational and technical training (The specific vocational training courses to be covered need to be identified through information gathering and confirmation surveys. As examples, the following describes the “Educational material for building construction practice using AR technology” and the “AR welding skills training system” developed by the Polytechnic University (PTU) of Japan.
Acquired data (input)	[Educational material for building construction practice using AR technology] • 2D drawings [AR welding skills training system] • Hands-on practice with equipment connected to the system.
Technologies that can be used in the data acquisition part	[Educational material for building construction practice using AR technology] • Tablets and smartphones • Capture images of 2D drawings using the built-in camera • 3D models in the cloud [AR welding skill training system] • Welding mask (camera), welding gloves connected to the system, etc. • AR technology
Technologies that can be used in the data processing part	• Analysis and skill assessment system
Output	[Educational material for building construction practice using AR technology] • Efficient skills acquisition [AR welding skills training system] • Efficient skill acquisition
Data administrator	(Since it is assumed that the existing services is used, the main data is managed by the service provider. The following is the assumption of the data management as a user) [Educational material for building construction practice using AR technology] • Vocational training schools [AR welding skill training system] • Vocational training school
Value offered	[Educational material for building construction practice using AR technology] • Efficient acquisition of skills • Improvement of the quality of technical training (accurate and objective evaluation of skills) • Reduction of costs for technical training (equipment and material costs, etc.) [AR welding skills training system] • Efficient acquisition of skills • Improvement of the quality of technical training (accurate and objective assessment of skills) • Reduction in the cost of technical training (equipment, materials, etc.)
Examples of usable digital technologies	Utilization of VR and AR technologies, etc. (For specific use cases, see Chapter 5 “Table 5-2 Use cases of digital technologies in the vocational training field”)
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 500 million yen Accepting country: XX million yen
Schedule	5 years
Implementation organization	Supervised and adjusted by: Ministry of Education and Technical Education, Ministry of Trade and Industry Implemented by: Technology-related high schools

Assumed concerns and countermeasures against them	• For the procurement of the necessary digital equipment, identify the necessary materials and equipment in the project and support procurement. • For the revision of curriculums and training for teachers, also consider support from Egypt-Japan University of Science and Technology (E-JUST). • Careful attention should be paid to the acquisition of skills by teachers who operate VR/AR technology-based equipment and provide instruction to students.
JICA projects with which collaboration is expected	• The Project for Procurement of Education and Research Equipment for Egypt-Japan University of Science and Technology (E-JUST) • Technology education improvement project

Source: JICA Study Team

10.2.5. Health

(1) Selection of Candidate Projects

Only in Egypt is the health sector a target sector. The Egyptian government is proceeding with health sector reform aiming at an improvement in the quality of medical services, securing of public access, the establishment of a sustainable health finance system, etc., and arranging the universal health insurance system.

In February 2016, the “Japan-Egypt Healthcare Cooperation Agreement” between Japan and Egypt. In this agreement, the governments of these countries agreed to support each other in the healthcare field for the enhancement of the health care system of Egypt. The fields of cooperation are (1) reinforcement of the healthcare system, (2) development of human resources, (3) maternal and child health, (4) cooperation with private companies for medical technologies, medical equipment, development of human resources, etc., and (5) cooperation for Africa. The JICA country-specific analysis paper for Egypt (March 2016) shows a plan to support the achievement of UHC of the Egyptian government including the reinforcement of the healthcare services, etc. in the “support program for basic social services.” JICA started the “project for improving hospital quality” planned to continue for five years from May 2019. The objective of this project is to arrange the management and supervision system of the Ministry of Health and Population and the implementation management system of the supervised hospitals to improve the quality of the services of the supervised hospitals. The Egyptian government requested Japan to provide technical cooperation for the introduction of the new universal health insurance system, so JICA is planned to perform the “survey for the formulation of the basic plan of the UHC policy implementation capability reinforcement project” in February 2021.

Considering these circumstances, it is meaningful to consider projects which contribute to the improvement in the quality of the medical services of Egypt using digital technologies effectively. For consideration of the project, it is necessary to consider synergy with the existing “project for improving hospital quality” or the universal health insurance system promoted by the Egyptian government.

As a result of the evaluation of projects of the utilization of digital technologies according to the evaluation criteria, the following shows the candidate projects (draft) for the health sector.

Table 10-9 Draft Candidate Projects for the Health Sector in Egypt (Draft)

Theme	Overview	Support form
Data collection survey for the support for the universal health insurance system (or implementation as an	Confirm the need for support for the universal health insurance system and consider the contents of the support. The possible support contents include the support for the development of the ICT system of the	Data collection survey

Theme	Overview	Support form
additional activity for the existing survey)	health insurance (UHI), the provision of systems and equipment, and technology transfer.	
Support for the establishment of the health management information system (HMIS)	The aim of the Health and Management Information System (HMIS) is to collect and standardize information about diseases, hospitals, etc. and make use of them for the formulation of policies, resolution of problems, and effective resource allocation. Arrange HMIS which grasps the conditions of healthcare in real-time and enables appropriate policy implementation.	Technical cooperation project, loans, and grants
Establishment of the nationwide network of pathologic examination	Construct an organization for remote pathologic examinations using images to make up for the lack of pathologists in rural areas. Also, arrange the laboratory to be the core as needed.	Technical cooperation project, loans, and grants
Expansion of remote diagnosis for primary healthcare	Support the propagation of the remote diagnosis system to make up for the lack of family doctors. It is expected to complement the UHI system.	Technical cooperation projects and public-private partnerships
Support for the health guidance project using wearable devices	Deployment of projects of health management applications using wearable devices (disease prevention, care prevention, health promotion, etc.)	Public-private partnerships

Source: JICA Study Team

The above draft candidate projects were classified into draft project plans and draft project concepts from the viewpoints of local needs and the possibility of implementation as a JICA's scheme.

Table 10-10 Evaluation of Draft Candidate Projects for Health Sector of Egypt

Candidate Project	Result of Classification	Reason
Data collection survey for the support for the universal health insurance system (or implementation as an additional activity for the existing survey)	Draft Project Concept	The universal health insurance is one of the high priority projects of the Egyptian government. WB, AFD, and the Foreign, Commonwealth and Development Affairs of the United Kingdom support the universal health insurance system. Japan is supporting system construction through the UHC Development Policy Loan (DPL). Some support may be proposed depending on the progress of the ongoing JICA project for Strengthening of Universal Health Care Policy Implementation Capacity in Egypt.
Support for the establishment of the health management information system (HMIS)	Draft Project Concept	The urgency and importance of establishing a separate HMIS must be confirmed as the system is scheduled to be established as part of the universal health insurance system that is being developed. Therefore, for the same reasons as above, this is classified as Draft Project Concept.
Establishment of the nationwide network of pathologic examination	Draft Project Concept	There is a high need for support for remote diagnosis. However, JICA is implementing many projects, and the priority for the formation of a project specializing in medical technology is judged to be low. The JICA's project, Hospital Quality Improvement Technical Project, with the Ministry of Health and Population as a counterpart, has little medical technology intervention component and focuses on operational improvement. Therefore, it is difficult to place telemedicine and its system development within the existing technical projects. It is possible that some support will be proposed depending on the progress of the ongoing JICA Project for Strengthening UHC Policy Implementation Capacity. However, it is necessary to

Candidate Project	Result of Classification	Reason
		coordinate with other donors' technical assistance and provision of equipment.
Expansion of remote diagnosis for primary healthcare	Draft Project Concept	Ditto. However, it has a higher priority than the above-mentioned establishment of a national network for pathological examination.
Support for the health guidance project using wearable devices	Implementation by the private sector	The project is deemed suitable for implementation and dissemination led by private companies (start-ups). There are several start-ups that actually provide remote diagnosis services.

Source: JICA Project Team

(2) Draft Project Plan

There are no candidate projects evaluated appropriate for Draft Project Plan for the health sector in Egypt.

(3) Draft Project Concept

The following shows the details of Draft Project Concepts.

Candidate Project-13 Draft Project Concept for the Health Sector of Egypt: Data Collection Survey for the Support for the Universal Health Insurance System

Project name	Data collection survey for the support for the universal health insurance system (or implementation as an additional activity for the existing survey)
Current conditions and development issues of the target sectors	The Egyptian government is proceeding with the arrangement of the universal health insurance (UHI) system. UHI is proceeding with the introduction through six periods with 2032 as the target year of completion. As the project of the first period, it was introduced in Port Said and the introduction procedure is in progress in Luxor and Ismailia. It is also planned to develop systems to support UHI such as a medicine inventory information system, laboratory information system, radiation information system/PACS, billing system, reservation and schedule management system, and electronic medical records (EMR). In 2019, Vodafone received an order for the development of the UHI system of 100 million pounds and is planned to develop the system based on the national health service (NHS) used in Britain. The World Bank and the African Development Bank support the UHI of Egypt. In 2020, the World Bank decided to bear 400 million dollars in the total cost of 2.84 billion dollars. Under these circumstances, Japan also started technical cooperation project on UHIS. Donors will hold regular meetings to effectively share and collaborate on information. The construction of the universal health insurance system is the core of the medical system of Egypt and a big project to cover the medical institutions across the country. It is meaningful to perform a survey to consider the possibility of support from the viewpoint of donor cooperation.
Assistance scheme to be applied	Data collection survey
The objective of the project	To survey the UHI introduction plan, the support conditions of the other donors, and the possibility of support for UHI.
Effect of the project	Proposal of a support policy and project design for the construction of the ICT system necessary for efficient implementation of UHI in Egypt.
Overview of the project	In this project, consider the following in order to confirm a way of support for the construction of the ICT system for the UHI system of Egypt. ICT system arrangement plan for UHI, which is being introduced by Egypt, and its progress

	• Support conditions of the other donors for the UHI ICT system arrangement plan • Narrowing down of technologies required for the UHI ICT system • Clarification of the needs for support for the establishment of the UHI ICT system • Proposal of support measures for the arrangement of the UHI ICT system As for the construction of the UHI ICT system, perform surveys considering the possibility of the following support. - Provide technical cooperation to support the health insurance system of Egypt. Propose the basic design and the introduction plan of the systems necessary for the management of the health insurance system in this project (technology project). - Create the requirement definition document including the system conceptual diagram and the design of the operation flow necessary for the development of all or some of the health insurance systems of Egypt. In addition, develop, operate, and maintain the relevant system (grants/loans). - Introduce facilities and equipment for the operation of the health insurance systems in medical institutions. It consists of applications, servers, terminal equipment, communication equipment, etc. (grants/loans).
Examples of usable digital technologies	See the case of "(4) Health insurance system" in 5.2.2. Use case of digital technologies in the health sector of 5,2 Health sector of Chapter 5.
Elemental digital technology for digital services	This project will develop an information system for the smooth implementation of the universal health insurance system. The main components of the information system are: (1) Subscriber information system A system that certifies insured qualifications, insured ledger data, online qualification confirmation when claiming insurance premiums, and saves insured treatment records. (2) Insurance premium payment information system Storage of payment information sent from financial institutions (3) Medical billing system A system that connects insurance medical institutions, insurance pharmacies, and examination / payment institutions via a network line, and delivers billing data such as medical fees online. (4) Drug database A database of medicines covered by medical insurance. (5) Medical information sharing system A system for sharing patient medical information between medical institutions and within medical institutions.
Acquired data (input)	(1) Subscriber information system Input of insured information (2) Insurance premium payment information system Input of insurance premium payment information (3) Medical billing system Ingest billing data sent online (4) Drug database Creating a database of drug information approved for medical insurance coverage (5) Medical information sharing system Creating a database of medical information of medical institutions
Technologies that can be used in the data acquisition part	(1) Subscriber information system Receiving documents or data online (2) Insurance premium payment information system Receiving online payment information (3) Medical billing system Receiving billing data online

		(4) Drug database Receiving documents or data online (5) Medical information sharing system Receiving and exchanging data online
	Technologies that can be used in the data processing part	(1) Subscriber information system Database technology, (2) Insurance premium payment information system Online payment system, database technology (3) Medical billing system Computer processing system that checks invoices, sends them to payment institutions, and keeps records (4) Drug database Database technology (5) Medical information sharing system Database technology
	Output	(1) Subscriber information system Providing insured information (2) Insurance premium payment information system Provision of insurance premium payment information, provision of insurance premium delinquency information (3) Medical billing system Sending billing data to the payment institution (4) Drug database Providing approved drug information (5) Medical information sharing system Providing medical information for insured persons
	Data administrator	General Authority of Healthcare (GAHC)/Ministry of Health and Population, UPA (Unified Medical Procurement Authority) for medical database
	Value offered	Value for the government: The procedure of the universal health insurance system can be smoothly operated by utilizing the information communication system. Value for medical institutions and pharmacies: Billing data can be created and sent on a PC, and this greatly simplifies paperwork. In addition, it will be possible to easily search medical and insurance claim records. Value for patients: The administrative burden related to insurance premium payments and health benefits is reduced.
	Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 50 million yen Accepting country: XX million yen
	Schedule	1 year
	Implementation organization	Partner institutions of the other party: General Authority of Health care (GAHC) /Ministry of Health and Population, UPA(Unified Medical Procurement Authority) for medical database Related institution of the other party: Health department of the prefecture
	Assumed concerns and countermeasures against them	- Multiple donors support the universal health insurance system of Egypt, so it is necessary to clarify the division of roles of Japan. - The universal health insurance system proceeded with by the Egyptian government is a big plan, so it is necessary to consider realistic and effective approaches such as stepwise arrangement and distribution. - It is necessary to formulate a plan with sufficient consideration of the capabilities of local ICT vendors for the system development in Egypt.
	JICA projects with which collaboration is expected	- Project for improving hospital quality - Project for reinforcing the UHC policy implementation capabilities

Source: JICA Study Team

Candidate Project-14 Draft Project Concept for the Health Sector of Egypt:
Support for the Establishment of the Health Management Information System (HMIS)

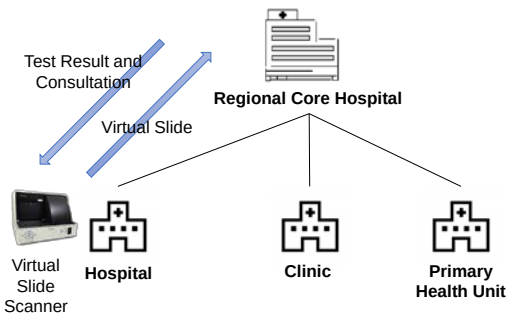
Project name	Support for the establishment of the health management information system (HMIS)
Current conditions and development issues of the target sectors	HMIS is an information system to collect and manage the necessary information for the implementation of the health policy and to sustainably manage the medical services. HMIS includes the health statistics indicators such as infectious disease information and disease statistics, as well as hospital information (number of doctors, equipment, medicine inventory, etc.) and financial indicators (medical equipment, labor cost, prices of drugs, and medical income). Egypt has a massive amount of healthcare-related data, and the problem is that it is difficult to process and use such data for the decision-making of healthcare administration. It is demanded to construct a data warehouse of healthcare information and use such data for decision-making of healthcare administration by arranging HMIS.
Assistance scheme to be applied	Technical cooperation project
The objective of the project	Improve HMIS which collects and analyzes data from medical institutions.
Effect of the project	Realization of strategic and effective implementation of healthcare administration by using the healthcare information system.
Overview of the project	This project will include the following activities in order to improve the HMIS of Egypt. - Analyze the current conditions of the existing HMIS and extract the points to be improved. Also, survey the condition of the pilot project in Port Said. - Construct a new HMIS model. - Propose the information collection and management system using cutting-edge digital technologies. - Introduce HMIS applications in each medical institution to construct the information collection system. - Provide training of HMIS to the related parties. - Construct a system to timely analyze and use the data of the data warehouse and develop and use tools to support healthcare administration and measures.
Examples of usable digital technologies	See the case of "(2) Health and Management Information System (HMIS)" in 5.2.2. Use case of digital technologies in the health sector of 5.2 Health sector of Chapter 5.
Elemental digital technology for digital services	Collect health care related information in HMIS and build a reporting system to the upper organization.
Acquired data (input)	- Public health information - Medical institution information (priority information) - Health care information (priority information) - Health and medical financial information - Human resources information in the field of health care - Epidemiological survey information
Technologies that can be used in the data acquisition part	Input from terminals (PCs, tablets, mobile phones, etc.) and database operation on the Internet and cloud
Technologies that can be used in the data processing part	Database technology, data analysis technology (for example, business intelligence technology), communication technology in networks
Output	Aggregated health-related information and data analysis results
Data administrator	Ministry of Health and Population
Value offered	Value for the government: Information related to health care can be quickly aggregated and used for policy making of health administration. Value for medical institutions:

	The procedure for reporting health-related information will be simplified and the administrative burden will be reduced. Value for citizens: Providing appropriate health services will provide benefits such as reduced morbidity and improved quality of medical services.
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 500 million yen Accepting country: XX million yen
Schedule	3 years
Implementation organization	Partner institutions of the other party: Medical Information: General Authority of Healthcare (GAHC), Public Health and Finance Information: Ministry of Health and Population Related institution of the other party: Health department of the prefecture
Assumed concerns and countermeasures against them	• It is necessary to clarify demarcation with the information system proceeded with in the arrangement of the UHI system. • To collect information from many primary and secondary medical institutions without omission, it is necessary to use digital technologies systematically. • For the new HMIS, introduce the middleware technology and enable an exchange of information among databases, as well as consider the possibility of reinforcing security, • It is also a possibility not only to use such information for the macro-level health administration but also to consider using on-site utilization of information such as the utilization of the data obtained from infant health examinations for maternal and child health activities. • It is also considered to use the analysis result of healthcare data to epidemic control such as Covid-19.
JICA projects with which collaboration is expected	• Project for improving hospital quality • Project for reinforcing the UHC policy implementation capabilities

Source: JICA Study Team

Candidate Project-15 Draft Project Concept for the Health Sector of Egypt:
Establishment of the Nationwide Network of Pathologic Examination

Project name	Establishment of the nationwide network of pathologic examination
Current conditions and development issues of the target sectors	In recent remote pathological diagnosis, it is possible to scan samples, send data as virtual slides (whole image slide: WSI), and display high-accuracy pathological tissue images on a monitor. Such progress of digital technologies expands the range of utilization of remote diagnosis to daily diagnosis, etc. though remote diagnosis had been just used to complement facilities with a shortage of pathologists. In addition, the activities to use image analysis by AI have started thanks to an accumulation of digital image data of pathological tissue samples. The first remote pathological diagnosis in Egypt was performed by connecting the Umberto I Hospital in Cairo with the Civico Hospital in Italy in 2003. In 2004, the Cairo University Hospital started remote pathological diagnosis jointly with hospitals in Britain, Italy, and the U.S. Currently, the above-mentioned WSI is also used. As of 2018, WSI is used by three hospitals in Egypt: Faculty of Medicine of the Cairo University, Egypt Childhood Cancer Hospital, and Military International Medical Center. It is planned to construct a remote pathological diagnosis network connecting domestic cancer hospitals. In hospitals in Egypt, especially secondary hospitals, there remain issues such as the resolution of the lack of pathologists, an improvement in the accuracy of pathological diagnosis, and an improvement in the diagnosis skills of pathologists, and the enhancement of remote pathological diagnosis is considered to meet such needs.
Assistance scheme to be applied	Different schemes can be considered for this support. (1) Grants

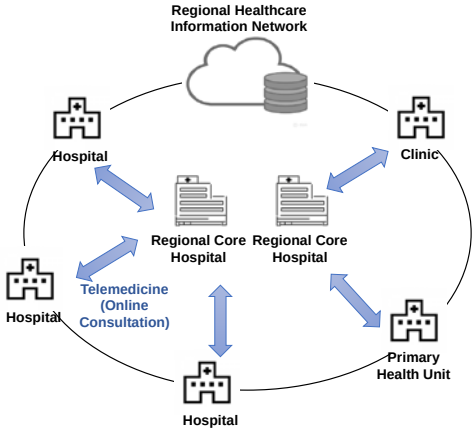
	(2) Technology project
The objective of the project	(1) Introduce equipment necessary for remote pathological diagnosis in local base hospitals in order to construct a remote pathological diagnosis network of Egypt. (2) Construct a remote pathological diagnosis network of Egypt to enhance the pathological diagnosis service.
Effect of the project	(1) The pathological diagnosis services of local base hospitals are enhanced. (2) It is possible to enhance pathological diagnosis and improve the accuracy by making the core hospitals and laboratories providing high-accuracy pathological diagnosis and supporting hospitals with a shortage of pathologists.
Overview of the project	Aiming at the synergy with the above-mentioned grants, this project supports the reinforcement of the pathological diagnosis capabilities of the core hospitals of remote pathological diagnosis, the management capabilities of the remote pathological diagnosis network, and the remote pathological diagnosis technologies of local base hospitals. Specifically, reinforce mainly the following capabilities: • Reinforcement of the remote diagnosis consultation capabilities of the core hospitals • Reinforcement of the remote diagnosis technologies of the local base hospitals • Implementation of online education regarding remote pathological diagnosis • Provision of pathological inspection services to local primary health care units connected to remote medicine (Use simple pathological inspection kits).
Examples of usable digital technologies	See the case of “(1) Medical information coordination network” and “(3) Telemedicine” in 5.2.2. Use case of digital technologies in the health sector of 5.2 Health sector of Chapter 5.
Elemental digital technology for digital services	The purpose of this project is to build a remote pathological diagnosis network. 
Acquired data (input)	Pathological specimen
Technologies that can be used in the data acquisition part	The virtual slide system scans the created pathological specimens at high speed and converts them into high-resolution digital data.
Technologies that can be used in the data processing part	The pathological specimen data taken by the scanner becomes digital data, and various image processing techniques for improving the observation system can be utilized.
Output	Image data of pathological specimens
Data administrator	Participating medical institutions
Value offered	Value for medical institutions: The hospital that prepares the pathological specimen can obtain the diagnosis and consultation of the core hospital having a high degree of pathological diagnosis ability, and can improve the accuracy of the pathological diagnosis. Value for patients: It is possible to receive advanced pathological diagnosis without going to a remote core hospital, and it is also possible to receive appropriate medical services.
Approximate project cost	Japan:

(human resources, training, materials and equipment, etc.)	(1) 0.5 to 1 billion yen (2) 0.5 billion yen Accepting country: XX million yen
Schedule	(1) 1 year (2) 3 years
Implementation organization	Partner institutions of the other party: General Authority of Health Care (GAHC) /Ministry of Health and Population and public hospital (Cairo University) Partner institutions of the other party: Secondary public hospitals
Assumed concerns and countermeasures against them	• In this project, it is also possible to perform the following “Propagation of remote diagnosis for primary healthcare” as a component. • WSI is a newly developed technology, so its applicability has to be evaluated. • It is necessary to confirm the type of demand for pathological diagnosis, necessary equipment in rural areas, etc. • It is necessary to consider the possibility of connecting to the image analysis system by AI using collected image data.
JICA projects with which collaboration is expected	• Project for improving hospital quality

Source: JICA Study Team

Candidate Project-16 Draft Project Concept for the Health Sector of Egypt:
Expansion of Remote Diagnosis for Primary Healthcare

Project name	Expansion of remote diagnosis for primary healthcare
Current conditions and development issues of the target sectors	It is family doctors assigned to primary health units that take the central role in primary medicine in the universal health insurance system of Egypt. However, citizens tend to select medical specialists from the start and access a public secondary medicine institution or private hospital instead of a family doctor. In addition, doctors do not choose a career as family doctors. It is a big issue to increase family doctors in the implementation of the universal health insurance system. On the other hand, currently, citizens increasingly use online diagnosis services and get an introduction letter to a secondary medical institution. In most of the other prefectures than the capital city, not only the number of the medical staff of hospitals is insufficient but also some of them are less skilled, so patients seek another hospital in a nearby prefecture or visit a hospital in Cairo. As a result, the treatment is delayed, and the symptoms become severe in some cases. It is meaningful to enhance medical services in regions with a shortage of medical staff by the propagation of high-quality remote diagnosis services. The Ministry of Health and Population has started a remote diagnosis service in Port Said, in which the universal health insurance system has been introduced. UNDP also supports medical services by remote diagnosis in remote areas. It is planned to reinforce the telemedicine implementation system of 100 core hospitals.
Assistance scheme to be applied	Technical cooperation project
The objective of the project	To enhance primary healthcare using online diagnosis and consultation.
Effect of the project	Enhancement of the primary healthcare service, which is primary medicine.
Overview of the project	This project reinforces the diagnosis systems of the primary and secondary medical institutions by complementing the existing remote diagnosis services and improve the medical services for citizens by online remote diagnosis. It is possible to select and support model hospitals subject to the pilot from the core hospitals of telemedicine proceeded with the Egyptian government. Specifically, perform the following activities focusing on rural areas. • Development of the platforms and applications (PC and mobile) of online diagnosis services • Introduction of online diagnosis and consultation services for primary medical institutions

	• Introduction of an online referral system in secondary medical institutions • Introduction of online diagnosis and consultation services for secondary medical institutions
Examples of usable digital technologies	See the case of “(1) Medical information coordination network” and “(3) Telemedicine” in 5.2.2. Use case of digital technologies in the health sector of 5,2 Health sector of Chapter 5.
Elemental digital technology for digital services	This project will form a regional medical institution cooperation network centered on secondary medical institutions. In addition, the secondary medical institution provides a remote diagnostic service to the primary medical institution. 
Acquired data (input)	Remote diagnosis: Patient medical record information, patient interviews, diagnostic data
Technologies that can be used in the data acquisition part	Remote diagnosis: Online interview, electronic data transmission
Technologies that can be used in the data processing part	Remote diagnosis: Electronic medical record system, remote diagnostic imaging support system
Output	Remote diagnosis: Patient's diagnosis result and treatment policy
Data administrator	Participating medical institutions
Value offered	Value for medical institutions: The remote diagnosis enables the primary medical institution to provide a more accurate diagnosis to the patient with the support of the secondary medical institution. Sharing of medical information (specialty of medical staff, acceptable patient status, etc.) among medical institutions will be promoted. By promptly obtaining acceptable information of medical institutions, patient referrals between medical institutions can be performed smoothly. Effective utilization of medical diagnostic equipment is promoted. Value for patients: It is possible to receive a diagnosis by a doctor with a higher level of knowledge, and a more accurate diagnosis can be received. In addition, by introducing patients between medical institutions, they can receive treatment at hospitals where they can receive more advanced treatment.
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 300 million yen Accepting country: XX million yen
Schedule	3 years
Implementation organization	Partner institutions of the other party: General Authority of Health care (GAHC) /Ministry of Health and Population Related institution of the other party: Health department of the prefecture
Assumed concerns and countermeasures against them	• It is necessary to avoid overlaps with PHC reinforcement measures or PHI systems by the Ministry of Education and Population.

	• It assumes an adjustment with the arrangement plan of telemedicine proceeded with the Egyptian government. It is also assumed to consider support focusing on online diagnosis and consultation. • Also, consider introducing it in emergency medicine. • It is also a possibility to include "Arrangement of the nationwide network of pathologic examination" mentioned above in the scope. • Services to match patients with doctors online for remote diagnosis are increasing. It is necessary to clarify the division of roles with such private services. • There is a concern that the workload of doctors and technicians at core hospitals that actually carry out remote diagnosis will be excessive. It is necessary to consider the construction of a system and procedures that can handle medical examinations systematically, and it is also necessary to consider increasing the number of human resources to meet the increase in workload.
JICA projects with which collaboration is expected	• Project for improving hospital quality

Source: JICA Study Team

10.3. Morocco

10.3.1. Digital technology innovation (reinforcement of the digital innovation ecosystem, ICT policy implementation system, and innovation promotion system)

(1) Selection of Candidate Projects

Morocco, as with other two targeted countries within this survey, is actively utilizing digital technologies to mitigate socio-economic challenges and to help achieve its national development. Morocco has the advantage of having strong connection with the European markets (especially with France and Spain, which have a deep historical and geographical relationship) under the economic agreement with the EU. Morocco is maximizing this arrangement and has steadily developed service industries using digital technologies such as service outsourcings and call centers. In addition, Morocco is also vigorously promoting the development of startups to foster domestic ICT industry and to increase employment. Regarding the development of startups, Morocco is not only supporting entrepreneurs in its own country but also inviting promising entrepreneurs from other countries to establish startups in Morocco and provide incubation support to them as well. These measures are taken as a step to establish Morocco as a regional innovation hub, much like its neighbor Tunisia.

On the other hand, the survey has learned that the Government's policy implementation/enforcement capacity could be improved to accelerate Morocco's development and, as such, there could be an opportunity to strengthen the Government's policy implementation capacities and associated governance system. This could be facilitated through supporting introduction and adaption of appropriate digital technologies. In this domain, several development partners have been supporting Morocco's Government capabilities through using digital technology. AFD (Agence Française de Développement), for example, is supporting local startups to help solve government challenges, and the World Bank is also supporting Government reform using digital technologies. When considering capacity building support for the Government agencies, it may be more effective to support an agency which promotes digital innovation (e.g., Ministry of ICT). Through providing targeted support, the targeted agency/ministry not only establish itself as a benchmark for other ministries but the efficient and effective implementation of digital policies by the agency/ministry could accelerate the Morocco's efforts to strengthen the digital innovation ecosystem.

As for other possibilities of support, it may also be possible to strengthen the capacity and system of incubation facilities and institutions in Morocco. As in the case of Egypt, this kind of support may be provided to strengthen the digital innovation ecosystem in Morocco. While these supports are promising, as these supports was not in the scope of the initial survey, it is necessary to verify the needs and potential support with the counterparts for additional information. Potential draft candidate projects are as follow:

Table 10-11 Draft Candidate Projects for Digital Technology Innovation in Morocco

Theme	Overview	Support Form
Strengthening the government's policy implementation capacity using digital technologies	Strengthening the Government institutions' policy implementation capacities to utilize digital technologies to solve myriad of socio-economic challenges in Morocco. Other development partners also provide similar support in this domain, so it is necessary to consider synergy and division of support.	- Information collection and confirmation survey - Expert dispatch - Training in Japan - Third-country training - Technical cooperation projects
Strengthening the government's implementation and governance capacity to promote digital innovation	Strengthening the governance and ICT policy implementation capacities of the Government institutions and associated sector development/promotion institutions to utilize digital technologies to solve a wide range of social issues. Other development partners also provide similar support in this domain, so it is necessary to consider synergy and division of support.	- Information collection and confirmation survey - Expert dispatch - Training in Japan - Third-country training - Technical cooperation projects
Digital innovation ecosystem strengthening project	Support project for startups and small and medium enterprises at startup incubation facilities (incubators), techno parks, smart cities, etc., which form the basis of the digital innovation ecosystem. Support focusing on startups and small and medium-sized companies are possible even within the framework of Project NINJA of JICA. It is also possible to provide equipment (FabLab, hacker space (manufacturer space), etc.) in incubators, techno parks, etc. It may also be possible to support seed funding scheme in cooperation with other development partners (e.g., WB and AFD) through supporting development loans to the existing financing mechanism and/or through providing two-step loans scheme to the established banking systems which support small and medium-sized companies.	- Information collection and confirmation survey - Expert dispatch - Training in Japan - Third-country training - Technical cooperation projects - Developmental Loans
Japan and Morocco Startup collaboration support	Many startups in North Africa recognize Japan as a potential technology partner. Some Japanese startups, venture capitals, trading companies, etc. are also seeking opportunities to collaborate with and invest in startups in emerging countries. By supporting networking of these companies, the project seeks to create partnerships between Japanese and Moroccan private companies in the digital technology area.	- Public-private partnerships

Source: JICA Study Team

The results of classifying the above candidate projects into draft project plans and draft project concepts from the perspective of local needs and the possibility of project implementation under JICA's scheme (except for private sector investment/partnership project) are as follows.

Table 10-12 Evaluation of Draft Candidate Projects for Digital Innovation Technology of Morocco

Candidate Project	Result of Classification	Reason
Strengthening the government's policy implementation capacity using digital technologies	Draft Project Concept	It is imperative to determine if JICA's support could be complementary to the other development partners. Moreover, domestic resources for support are as such, the priority for this initiative is low.
Strengthening the government's implementation and governance capacity to promote digital innovation	Draft Project Concept	It is imperative to determine if Japanese Digital Technologies could be utilized to contribute to this area. It is also important to determine if JICA's support could be complementary to the other development partners. As such, the priority for this initiative is low
Digital innovation ecosystem strengthening project	Draft Project Concept	It is imperative to determine if Japanese Digital Technologies could be utilized to contribute to this area. It is also important to determine if JICA's support could be complementary to the other development partners. As such, the priority for this initiative is low

(2) Draft Project Plan

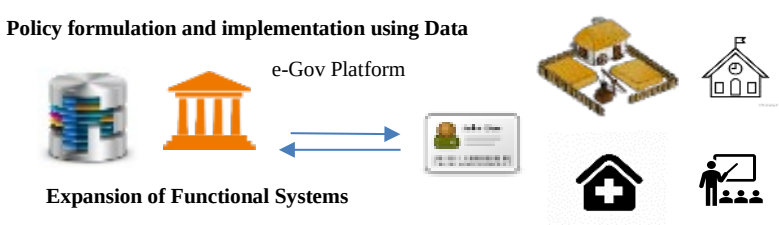
There are no candidate projects classified as Draft Project Plan in digital technology innovation in Morocco.

(3) Draft Project Concept

The following list describes the details of the Draft Project Concepts.

Candidate Project-17 Draft Project Concept for Digital Technology Innovation in Morocco:
Strengthening the Government's Policy Implementation Capacity Using Digital Technologies

Project name	Strengthening the government's policy implementation capacity using digital technologies
Current conditions and development issues of the target sectors	Morocco is embarking on a challenge of transforming various Government agencies to be transparent, efficient, and effective institutions. In order to expand public services, it is important to enhance these Government agencies' capacities, especially in the area of policy formulation and implementation. Utilization of appropriate digital technologies could facilitate the process. In particular, by enacting and implementing policies using data, improving the efficiency of Government organizations through using digital technology, and expanding delivery of public services to citizens and the private sector using digital technology, it is envisioned that the people's trust in the Government will be increased and to use national resources more effectively. When considering the support in this area, it is necessary to conduct further investigation about the current state of digitization of the Moroccan government, support given by the development partners, and select the target ministries and agencies.
Assistance scheme to be applied	Information collection and confirmation survey, expert dispatch, Japan training, third-country training, technical cooperation projects, etc.
The objective of the project	Strengthening the policy implementation capabilities of the institutions to promote digital innovations
Effect of the project	Effective digital innovations to solve socio-economic challenges promoted in Morocco
Overview of the project	Different support schema can be considered depending on the scope of the project: 1) Information collection and confirmation survey

	Assessment of the Government and parastatal institutions and other innovation promotion institutions (private sector & civil societies). Conduct survey to identify potential gap in the area of policy implementations and other challenges, and formulate support measures to fill the gap. 2) Expert dispatch Dispatching experts to relevant Government institutions to strengthen the capacities of ICT related Government institutions through providing policy formulation and implementation support. Combination of OJT style training as well as utilizing e-learning tools will be used to strengthen human capacity building. 3) Japan training Improve the capacities of officers of Moroccan Government to implement innovation promotion policies through learning best practices in the area of e-Government and Public service digitization of relevant public institutions. This training course could be combined with additional online training/follow up initiatives as needed. 4) Third-country training Improve the capacities of officers of Moroccan Government to implement innovation promotion policies through learning best practices in the area of public service digitization at the third country (country with best example). This training course could be combined with additional online training/follow up initiatives as needed. 5) Technical cooperation project Comprehensive technical cooperation to strengthen the capacities of the Government for policy formulation and implementation in Morocco. The technical cooperation project could be combined with such digital tools as e-learning systems, enterprise resource planning systems (ERP), policy support system, e-Government applications (functional services), etc.
Typical Process of e-Government (Bold typeface denotes potential support area)	Policy formulation and implementation using Data  Expansion of Functional Systems
Core digital and digital services Technologies	(Some of these initiatives may already be under implementation under the e-Gov Morocco Initiative) • services, possessed data, and possessed systems of each ministry and agency (including related laws) • Development of interoperability framework between ministries and agencies (including related bills and system integration) • Providing services using an appropriate electronic platform • Expansion of services and tailor-made by utilizing collected transaction data
Theme	Leverage digital technology to improve government services.
Acquired Data (Inputs)	Foundation System Data (National ID, Civil Registry, Birth Certificates) Functional Service Data (Obtained through transactions of various different services)
Technology for the data acquisition	Strengthening Foundation and Functional systems Interoperability framework (e.g.; Estonian X-Road) Open Data Enterprise Architecture

	Expanded use of API to access various different data
Technology for the data analysis	Interoperability framework (e.g.; Estonian X-Road) with associated analytics Open Data and associated analytics Deep-Learning
Intended Output	Improved provision of efficient services through digitization Improved transparency and efficiency of public service provision process.
Data Administrator (Holder)	Government Ministries and agencies
Provided Values	Value for the Government: - Provision of streamlined citizen services - Improvement of tax revenue - Streamlining of Government procedures and resource usage Value for citizens - Provision of transparent and efficient citizen services - Reduction of corruption, etc.
Examples of digital technologies that may be used within the initiative	Potential digital technologies: e-learning systems, enterprise resource planning systems (ERP), policy decision support systems, Interoperability framework (integrated middleware that enables data exchange between ministries and agencies), etc.
Approximate project cost (human resources, training, materials and equipment, etc.)	1) Japan: 50 millions yen 2) Japan: 10~30 millions yen 3) Japan: 10~30 million yen 4) Japan: 300~500 million yen (excluding procurement of middleware) Recipient country: XX million yen
Schedule	1) 0.5 to 1 year 2) 2 years 3) 0.5 years 4) 3 years
Implementation organization	Partner Institutions: Ministry of ICT, ADD Associated institutions: relevant ministries/agencies
Risks and countermeasures	• Multiple development partners are supporting the ministries and agencies using digital technologies in Morocco. It is necessary to clarify Japan's comparative advantage, division of roles, and possibility of cooperation with other development partners in the area.
JICA projects with which collaboration is expected	• N/A

Source: JICA Study Team

**Candidate Project-18 Draft Project Concept for Digital Technology Innovation in Morocco:
Strengthening the Government's Implementation and Governance Capacity to Promote Digital Innovation**

Project name	Strengthening the government's implementation and governance capacity to promote digital innovation
Current conditions and development issues of the target sectors	The Moroccan Government is actively promoting digital technologies as tools to solve socio-economic challenges. As part of the process, the Government is actively encouraging startups to provide innovative solutions. Political and institutional frameworks implementing such policies are relatively well established as compared to the other two countries targeted for the research. Many development partners also support Morocco with great expectations for expanded utilization of digital technologies and innovative development solutions. However, there may exist some gap in terms of the policy implementation capabilities and/or governance systems of the Government and innovation support institutions to effectively foster innovation ecosystem. The proposed project aims to support creating effective organizational structures to accelerate implementation of innovation promotion policies.

Assistance scheme to be applied	Information collection and confirmation survey, expert dispatch, Japan training, third-country training, technical cooperation projects, etc.
The objective of the project	Strengthening the policy implementation capabilities of the institutions to promote digital innovations
Effect of the project	Effective digital innovations to solve socio-economic challenges promoted in Morocco
Overview of the project	Different support schema can be considered depending on the scope of the project: 1) Information collection and confirmation survey Assessment of the Government and parastatal institutions and other innovation promotion institutions (private sector & civil societies). Conduct survey to identify potential gap in the area of policy implementations and other challenges and formulate support measures to fill the gap. 2) Expert dispatch Dispatching experts to relevant Government institutions to strengthen the capacities of ICT related Government institutions through providing implementation support of innovation promotion policies. Combination of OJT style training as well as e-learning tools will be used to strengthen institutional capacity building. 3) Japan training Improve the capacities of officers of Moroccan Government to implement innovation promotion policies through learning best practices in the area of digital innovation promotion. In addition, the training occasion would allow visiting innovation ecosystems in Japan. This training course could be combined with additional online training/follow up initiatives as needed. 4) Third-country training Improve the capacities of officers of Moroccan Government to implement innovation promotion policies through learning best practices in the area of digital innovation promotion at third country (country with best example). This training course could be combined with additional online training/follow up initiatives as needed. 5) Technical cooperation project Comprehensive technical cooperation to strengthen the capacities of the Government and innovation support organizations for innovation policy implementation in Morocco. The technical cooperation project could be combined with such digital tools as e-learning systems, enterprise resource planning systems (ERP), etc.
Typical Process of Incubation (Bold typeface denotes potential support area)	<u>Strengthening the capacity of Government agencies to implement innovation policies</u> Government support (Policy, Market Access, Government Procurement, Funding, Venues, Tax, Regulations, Incentive Mechanisms) Private Sector Support (Incubation, VC, Angel Funding, Mentorship, Market connection, etc.) 
Core digital and digital services Technologies	The proposed support is mainly aimed at improving the general environment for fostering innovation (strengthening the ecosystem) in Morocco through strengthening the government's policymaking and enforcement capabilities (strengthening the governance system). As such, there could be little direct use of digital technologies to support the initiative. Nevertheless, such digital technologies as Enterprise Resource Planning system (ERP), e-learning system, Customer Resource Management system (CRM), etc. can be used to strengthen the governance system of targeted Government agencies. In addition, it is also conceivable to utilize policy decision support system (policy formulation in line with startup development) that utilizes various data.

Theme	Capacity Building of Innovation support organizations (public and private)
Acquired Data (Inputs)	Data pertaining to Innovation Ecosystem (data pertaining to Startups, private sector development, etc.)
Technology for the data acquisition	Databases, ERP, CRM, etc.
Technology for the data analysis	Databases, ERP, CRM, etc.
Intended Output	An environment for effective startup development established
Data Administrator (Holder)	Startups Incubating Institutions
Provided Values	Value for the Government: - Increase entrepreneurship and employment generation through strengthening the entrepreneurs support system - Creation of innovative solutions to solve social issues Value for Entrepreneurs: - Simplification of various procedures/regulations for new and existing businesses through strengthening the entrepreneurial support system
Examples of digital technologies that may be used within the initiative	Potential digital technologies: e-learning systems, enterprise resource planning systems (ERP), etc.
Approximate project cost (human resources, training, materials and equipment, etc.)	1) Japanese side: 50 million Yen 2) Japan side: 100 million Yen 3) Japan side: 10 to 30 million Yen 4) Japan side: 10 to 30 million Yen 5) Japan side: 300 to 500 million Yen Recipient country: XX million Yen
Schedule	1) 0.5 to 1 year 2) 2 years 3) 0.5 years 4) 0.5 years 5) 3 years
Implementation organization	Partner institutions: Ministry of ICT, ADD (Digital Development Agency) Associated institutions: AMDIE (Moroccan Investment and Export Development Agency)
Risks and countermeasures	• Multiple donors provide digital innovation strengthening support in Morocco. As such, it is necessary to clarify the division of labor with other development partners and specifying possible advantages of providing cooperation from Japan. • The promotion of digital innovation and startups by the Moroccan Government holistic but in a proof-of-concept stage, so it is necessary to consider flexible and effective approaches for the implementation of projects.
JICA projects with which collaboration is expected	• N/A

Source: JICA Study Team

Candidate Project-19 Draft Project Concept for Digital Technology Innovation in Morocco:
Digital Innovation Ecosystem Strengthening Project

Project name	Digital innovation ecosystem strengthening Project
Current conditions and development issues of the target sectors	The Moroccan Government is strengthening its digital innovation ecosystem through creating conducive environment to promote growth of private sectors, supporting creation of innovative solutions, and develop highly skilled human. One of such measures which is focused by the Moroccan Government is the startups (small and medium-sized company) development support which are being conducted at startup development facilities (incubators), techno parks,

	smart cities, etc. Though major development partners (e.g., the World Bank) also provide such support in Morocco, synergy and division of labor are deemed possible due to the fact that the needs of creating strong ecosystem are vast. The proposed support may also be able to use the framework of “Project NINJA,” a signature JICA regional support for startups and small and medium-sized enterprises in Africa. Furthermore, there may be several different supports may be possible such as provision of digital fabrication equipment to incubators, techno parks, and Maker spaces (FabLab and hacker space) to spur hardware-based innovations. Considering that Morocco has established “ANAVA Fund” and has seen emergence of other startups financing mechanisms, it may also be possible to support such startups financing mechanisms with other development partners. The financing support may include co-financing support to existing seed funds and/or access to facilitated loans through “two-step loans” scheme.
Assistance scheme to be applied	Information collection and confirmation survey, expert dispatch, Japan training, third-country training, technical cooperation projects, Grant Aid, Two Step Loan scheme, etc.
The objective of the project	Strengthen digital innovation ecosystem in Morocco which would contribute to the growth of startups
Effect of the project	Effective solutions to solve socio-economic challenges in Morocco created through development of startups.
Overview of the project	Different support schema can be considered depending on the scope of the project: 1) Information collection and confirmation survey Assess the local incubation facilities and innovation promotion institutions, survey the necessary resources, the current gaps, and other factors, and formulate support measures to fill the gap. 2) Expert dispatch Dispatch experts to development-related institutions for management and technical capability reinforcement activities for incubation facilities and organizations. 3) Japan Training Improve the capabilities of the managers of incubation facilities/institutions in Morocco by sharing knowledge of Japanese incubation facilities and institutions. Provision of remote support are provided as needed. 4) Third-country training Improve the capabilities of the Moroccan incubation facilities/institutions by learning the best examples of incubation systems in third countries where the startup ecosystem is well established. Provision of remote support are provided as needed. 5) Technical cooperation project Provide holistic support to the incubation support facilities and institutions to effectively strengthening the digital incubator ecosystem in Morocco. The support may include establishment of POC mechanism, support for the partnerships with Japanese incubators, venture capitals, etc. 6) Technical cooperation project (Project NINJA) Startup development support through the framework of Project NINJA (supporting startup development facilities and institutions). 7) Technical cooperation project (Regional) Startup ecosystem strengthening through sharing of lessons-learned between three targeted countries and invoking “co-competition” among the countries. 8) Grants aid Provision of digital fabrication equipment to the incubation facilities, techno parks, smart cities and other startups incubation facilities.

	9) Development loans through existing banking system (co-financing, two-step loan, etc.) Loans to local finance mechanism (including VC and two-step loans of commercial banks) in cooperation with other development partners (World Bank, AFD, etc.)
Typical Process of Incubation (Bold typeface denotes potential support area)	Digital Innovation Strengthening Project Government support (Policy, Market Access, Government Procurement, Funding, Venues, Tax, Regulations, Incentive Mechanisms) Private Sector Support (Incubation, VC, Angel Funding, Mentorship, Market connection, etc.) 
Core digital and digital services Technologies	The proposed support is mainly aimed at improving the general environment for fostering innovation (strengthening the ecosystem) in Morocco. As such, there could be little direct use of digital technologies to support the initiative. Nevertheless, such digital technologies as e-learning system, Startups Database (Portal), Digital Fabrication tools, etc. can be used to strengthen the innovation ecosystem.
Theme	Capacity Building of Innovation support organizations (private focus)
Acquired Data (Inputs)	Data pertaining to the innovation ecosystem (information about startups, entrepreneurship development, etc.)
Technology for the data acquisition	Databases, e-learning system
Technology for the data analysis	Databases (including analytic capabilities)
Intended Output	Effective Startups development
Data Administrator (Holder)	Startups support organizations (incubators)
Provided Values	Value for the Government: - Increase entrepreneurship and employment generation through strengthening the startups support system - Creation of innovative solutions to solve social issues Value for Entrepreneurs: - Simplification of various procedures/regulations for new and existing businesses through strengthening the entrepreneurial support system
Examples of digital technologies that may be used within the initiative	Potential digital technologies: Digital fabrication equipment
Approximate project cost (human resources, training, materials and equipment, etc.)	1) Japan: 50 million yen 2) Japan: 100 million yen 3) Japan: 30 million yen 4) Japan: 30 million yen 5) Japan: 300 million yen 6) Japan: 100 million yen (depending on the number of target startups) 7) Japan: 100 to 300 million yen 8) Japan: 5 billion yen or more Recipient country: XX million yen
Schedule	1) 0.5 to 1 year 2) 2 years 3) 0.5 years 4) 0.5 years 5) 3 years 6) 2 years

	7) 1 year 8) 5 years
Implementation organization	Partner institutions: Startup development institutions (incubators, etc.), ICT Ministry, etc. Associated institutions: AMEDIE, APABI (ICT offshore association), Ministry of Finance, Financial Institutions, etc.
Risks and countermeasures	- Multiple donors support the startup support of Morocco, and it is necessary to clarify the comparative advantages, division of labor, and the possibility of cooperation with other development partners. - The digital innovation promotion and startup policies promoted by the Moroccan Government are comprehensive and complex, so it is necessary to consider flexible and effective approaches for the implementation of projects.
JICA projects with which collaboration is expected	N/A

Source: JICA Study Team

10.3.2. Fishery

(1) Selection of Candidate Projects

As for the fishery industry, the global demand for marine products as a source of protein is increasing due to population growth and the economic growth of developing countries, while fish catches have been declining in recent years due to the decline in fishery resources. Thus, the improvement of marine resource management and the development of aquaculture, which could substitute the decline, is needed. In addition to migratory fish such as sardines, Morocco has an abundance of white fish, octopus, squid, and crustaceans due to the abundant plankton from the cold currents flowing along the Atlantic coast. The amount of fish production in Morocco ranks first in the African continent and the sixteenth in the world, which makes the fisheries sector an important source of foreign currency.

Morocco's fisheries strategy (Plan Halieutis) calls for the establishment of a sustainable fishing quota system based on scientific evidence, the development of a resource management system, and the promotion of support for small-scale fishermen, who make up the majority in the fisheries sector. JICA has been supporting INRH, a national research institute, on how to maintain ships and equipment for resource surveys, how to collect and analyze data to manage resources through "Small Floating Fish Resource Survey Capacity Enhancement Project (2010-2015)" among other projects. However, it is still difficult to grasp the current situation of small-scale fishermen, who make up the majority in the fisheries sector, and there is a need to diversify their sources of income and build a fishery resource management system that involves them.

As a result of the evaluation using the criteria to select projects utilizing digital technology, the following are the possible candidate projects for the agriculture and fisheries sector. Although agriculture is also a key industry in Morocco, the government of Morocco has high expectations for Japan's support to the fisheries sector, and in fact, Japan has not provided much support to the agricultural sector in the past, only candidate projects for the fisheries sector are selected in this study.

Table 10-13 Draft Candidate Projects for Fisheries Sectors in Morocco

Theme	Overview	Support form
Strengthening the organization of fishery associations to realize a	A system and structure will be put in place to efficiently implement a collaborative fisheries management approach between small-scale fishermen and the government using digital technology.	Technical cooperation and/or SATREPS

Theme	Overview	Support form
sustainable local fishery industry		
Project to promote sea surface aquaculture to small-scale fishermen	Training and education for dissemination of marine aquaculture technology to small-scale fishermen will be developed, and the conversion of small-scale fishermen to aquaculture will be promoted to support diversification of their income sources.	Technical cooperation

Source: JICA Study Team

The above candidate projects were classified into Draft Project Plan and Draft Project Concepts from the viewpoint of local needs and the possibility of project implementation under JICA's scheme.

Table 10-14 Evaluation of Candidate Projects for the Fisheries Sector in Morocco

Candidate Project	Selection	Reason
Strengthening the organization of fishery associations to realize a sustainable local fishery industry	Draft Project Concept	Currently, the lack of understanding the current situation regarding small-scale fishermen, who make up the majority of the sector, is an urgent issue, and the introduction of a management system utilized with fishery cooperatives is required to promote the management of fishery resources by the government. On the other hand, it was decided to keep this as a project concept, as it is important to set incentives for fishery cooperatives and to obtain their cooperation before introducing digital technology.
Project to promote sea surface aquaculture to small-scale fishermen	Draft Project Plan	This is because it is expected to help ensure the safety of aquaculture farmers (no need to risk going to check on the farms when the weather is changing) and reduce costs (no need to send out a boat to check).

Resource: JICA Study Team

(2) Draft Project Plan

The details of the Draft Project Plans are shown below.

Candidate Project-20 Draft Project Plan for Fisheries sector of Morocco:
Marine Aquaculture Improvement for Small Scale Fishermen Project

Project name	Marine aquaculture improvement for small scale fishermen project
Current conditions and development issues of the target sectors	The fisheries industry plays an important role in the national economy and as a source of animal protein for the people. However, due to climate change and other factors, the amount of fish caught by small-scale fishermen are decreasing, and there is a need for diversification of income sources. On the other hand, the technology for marine aquaculture (especially aquaculture in waters facing the open sea) is not widespread enough. Although the sector is considered a priority area for the development of the country by the government, there is still room to be improved.
Applicable scheme of JICA	Technical cooperation
The objective of the project	Training and education for the dissemination of marine aquaculture technology to small-scale fishermen will be developed, and the conversion of small-scale fishermen to aquaculture will be promoted.
Effect of the project	• Training programs for sea surface aquaculture technology will be developed. • The conversion of small-scale fishermen to aquaculture will be promoted.
Overview of the project	In order to achieve the above objectives, the following activities will be carried out in this project. • To identify the current status and issues of small-scale fishermen • To identify the current status and issues of marine aquaculture

	To review existing training and dissemination programs for marine aquaculture. Select pilot areas for small-scale aquaculture and participants in the pilot aquaculture Revise the training and extension program while conducting the pilot activity with small-scale fishermen participating in the pilot. Organize the lessons learned from the pilot activity and further improve the revised program. Conduct and evaluate the training in the pilot area.	
Overview of fishery management (bold indicates the activity related to this project)	<pre> graph TD 1[① Secure a place for aquaculture] --> 2[② Set up equipment] 2 --> 3[③ Get young shellfish and fish] 3 --> 4[④ Raising them] 4 --> 5[⑤ Land fish] </pre>	
Assumption	The Moroccan government will secure pilot areas, equipment and seedlings to enable small-scale fishermen to conduct aquaculture as a pilot. A system (mechanism/organization) to explain the necessity of aquaculture to small-scale fishermen, and to coordinate with government agencies. There should be aquaculture experts who can make judgments about the data collected (what temperature is good for the water, what size is appropriate, etc.).	
Digital technologies, element technologies for digital services	•Guidance on the selection of marine areas and the introduction of digital technology that can be used in the implementation of aquaculture.	
Input Data	Selection of aquaculture area	Aquaculture technology
Technologies for obtaining data	•Sea conditions of fishing areas (depth, bottom quality, tide, waves, etc.) •Fishery environment (water temperature, salinity, acidity, etc.)	•Fishing environment (water temperature, salinity, oxygen, etc.) - Growth status of aquaculture products (size, color, etc.) - Records of operation management (feeding, cleaning, shipping, etc.) - Status of aquaculture management (weather, feeding, water quality, etc.)
Technologies for data processing	Observation using ICT buoys, etc. (IoT) •Photography of aquaculture farms using drones (flying type and underwater type) Collection of weather data using satellites	Observation using ICT buoys, etc. (IoT) •Photography of aquaculture farms using drones (flying type and underwater type) Collection of weather data using satellites
Output	Numerical and image analysis	Numerical and image analysis using machine learning
Data administrator/owner	Selection of suitable areas for sea surface farming	Development of aquaculture production management system based on data
Input Data	Government	Fishery cooperative
Provided Value	For government Diversification of industries In addition to the expected development of processing industries due to stable production, there is the potential for the development of a wide range of industries surrounding	For small scale fishermen Stabilization of income Stabilize income by being able to control the catch to some extent. Acquisition of new technologies In addition to vessel operation and fishing techniques, acquisition of aquaculture technology (and by extension, ICT technology used therein).

	aquaculture (seedlings, feed, equipment, etc.). Stable supply of food Stable production of farm-raised fish will help improve the domestic food self-sufficiency rate.	Reduction of fishing vessel operating costs Reduction of fuel and vessel maintenance costs for fishing (but trade-off with maintenance of aquaculture facilities and feed costs)
Examples of usable digital technologies	See the table in Chapter 5 5.1.2 Fisheries sector 1. production (aquaculture) (1) farm management technology, (2) growth management technology. In addition to the above, please refer to (3) Feeding management technology and (4) Production management technology.	
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 50 million yen Accepting country: XX million yen	
Schedule	5 years	
Implementation organization	Partner institutions of the other party: DPM, ISPM Related institutions of the other party: ANDA, INRH and other institutions related to marine aquaculture	
Assumed concerns and countermeasures against them	Since digitization leads to openness of information, it is difficult to obtain cooperation from vested interests that have been enclosing information. In addition, it is important to be able to show what incentives are available to promote to share the location of small-scale fishing vessels, which would make their (secret) fishing grounds known. Therefore, along with the introduction of digitalization, careful explanations are required to gain the understanding and cooperation of all stakeholders, including measures for information openness and setting incentives.	
JICA projects with which collaboration is expected	• Aquaculture promotion in Morocco (2019-2020): Methods for developing aquaculture technology will be tested for shellfish (mussels and oysters). The project is expected to be completed in 2019. • Blue Growth Aquaculture Development Project (2022-2025): The objective of this project is to develop and promote small-scale aquaculture of shellfish and algae from the perspective of promoting sustainable fisheries and improving the livelihood of small-scale fishermen. • In the field of aquaculture, a new project for the promotion of small-scale aquaculture for small-scale fishermen will be launched this fiscal year.	

Source: JICA Study Team

(3) Draft Project Concept

The details of the Draft Project Concepts are shown below.

Candidate Project-21 Draft Project Concept for Fisheries Sector of Morocco: Strengthening Fisheries Association to Realize a Sustainable Fisheries sector

Project name	Strengthening fisheries association to realize a sustainable fisheries sector
Current conditions and development issues of the target sectors	Morocco has set the correction of regional income disparities and the conservation of fishery resources as important policy issues and has placed emphasis on strengthening support for small-scale fishermen in the fisheries sector. In response to this, JICA implemented a technical cooperation project, "Small-scale Fishery Extension System Development Project," from 2001 to 2006. However, the project was limited to the development of an extension worker system in the fisheries sector and did not introduce fisheries resource management using fishery cooperatives. At present, it is an urgent issue that the current situation of small-scale fishermen, who make up the majority of the

	fishery industry, cannot be grasped, and the introduction of a management system using fishery cooperatives is required in order to promote the management of fishery resources by the government.	
Applicable scheme of JICA	Technical cooperation and/or SATREPS	
The objective of the project	Systems and structures will be put in place to efficiently implement a co-management approach between small-scale fishermen and the government.	
Effect of the project	An information collection system for efficient fisheries management using digital technology will be established. A system for fisheries management involving small-scale fishermen will be established.	
Overview of the project	In this project, the following activities will be carried out in order to achieve the above objectives. 1. To select a pilot district and implement pilot activities as follows - Identify the current situation and issues of small-scale fishermen and the management status of fishery cooperatives. - To establish an implementation structure and a system to collect, organize, and regularly update fishery information necessary for co-management by small-scale fishermen and the government. - A mechanism for consensus building and compliance with rules and regulations regarding the implementation structure and system will be established. - Implement and evaluate fishery management system. 2. The results of the pilot activities will be systematized and shared. - Consider how to utilize the data collected by the system.	
Overview of fishery management (bold indicates the activity related to this project)	<pre> graph TD 1[①Understand the current situation] --> 2[②Evaluation and analysis] 2 --> 3[③Create policies and regulations] 3 --> 4[④Implementation & Monitoring] 4 --> 1 </pre>	
Assumption	• There should be an implementation system (structure and organization) to collect and utilize the data.	
Digital technologies, element technologies for digital services	• In order to evaluate and analyze fishery resources in the future, it is first necessary to correctly understand the current situation. In order to do so, the project aims to introduce technology to collect and create a database of objective data that shows the current situation more precisely and efficiently.	
Input Data	• Catch and landing information (amount, measurement of fish, etc.) • Oceanographic observations (water temperature, salinity, ocean currents, etc.) • Operation and fishing environment (location and timing of operation, fish response, etc.)	
Technologies for obtaining data	• Observation using ICT buoys, etc. (IoT) • Photography of aquaculture farms using drones (flying and underwater types) • Collecting weather data using satellites • Finding fish schools using detectors	
Technologies for data processing	A database system that can be organized into a form that is easy to evaluate and analyze. Integration technology for data entered by multiple parties	
Output	Building a database for easy evaluation and analysis	
Data administrator/owner	Fishermen/Public organization/Research institute	
Provided Value	For government -The current status of marine resources can be grasped more precisely. -The visualization of fishery resources makes it possible to set feasible resource targets.	For fishermen • It will be easier to accumulate and pass on fishing know-how as fishermen will be able to see their intuition and experience about the waters they operate in.

	-More detailed data analysis is possible, including time series and fish species.	• It will improve the welfare of smallholder fishermen and their families (e.g. CNSS Cotisation (social security) deductions based on smallholder fishermen's catches are being made through IT technology).
Examples of usable digital technologies	See the table in Chapter 5 5.1.2 Fisheries Sector 1. production (small-scale fisheries) (1) information collection technology, (2) information sharing technology, (3) technology to predict fishing grounds and catches	
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 30~50 million yen Accepting country: XX million yen	
Schedule	3~5 years	
Implementation organization	Partner institutions of the other party: INRH and FCPM Related institutions of the other party: DPM and other institutions related to marine resource management	
Assumed concerns and countermeasures against them	- The digitalization leads to openness of information, which makes it difficult to obtain cooperation from vested interests that have been enclosing information until now. In addition, it is important to be able to show what incentives can be shown to promote to share the location of small-scale fishing vessels, which would make their (secret) fishing grounds known. Therefore, along with the introduction of digitalization, careful explanation is required to gain the understanding and cooperation of stakeholders, including measures for information openness and the establishment of incentives. - Since there are areas and locations (especially at sea) where Internet access is not available due to the lack of telecommunication infrastructure, it will be necessary to consider solutions that do not require constant Internet access, as well as communication methods that do not depend on the Internet, such as satellites and LPWA (Low Power Wide Area). - New digital tools (especially drones) may be legally prohibited or require permits.	
JICA projects with which collaboration is expected	• The project can be implemented as a technical cooperation project for the yen loan to build a marine and fishery research vessel in Morocco (2017-2021). • "The Project for Improvement of the New Generation Fishery Port of Souiria K'dima" (grant aid) can consider incorporating a mechanism to collect the above information when expanding and developing wholesale and retail markets. • The method of building a fishery management system with the involvement of fishery cooperatives is currently being implemented in the SATREPS "Indonesia Mariculture Big Data Generation and Analysis for Sustainable Production and Stable Supply of Fisheries Resources (2017-2022)". Researchers for the project have also expressed interest in implementing it in Morocco.	

Source: JICA Study Team

10.3.3. Education

(1) Selection of Candidate Projects

Morocco has been working on the digitalization of the education sector even before the outbreak of COVID-19, but as a result of the closure of schools due to the outbreak of COVID-19, the country was forced to move to

online education. On the other hand, the widespread use of online education without adequate preparation has caused confusion in schools, and there are many challenges, including how to incorporate the online education to face-to-face education and integrate them.

In Morocco, unemployment, especially among young people, remains extremely high. It has been pointed out that this is due to the fact that the content of education in higher education and vocational training is focused only on acquiring knowledge and not on developing practical skills, and therefore the skills of graduates of universities and vocational training schools do not match the needs of industry. Efforts should be made to fill this gap by including digital technology, which is now being used in industry in the curriculum of higher education and vocational training.

Based on the evaluation of the ideas for the use of digital technologies according to the evaluation criteria, the following candidate projects were identified as being effective in addressing the issues in the education sector. It is important to avoid duplication with the PAIFE projects being conducted by EU in order to create synergies.

Table 10-15 Draft Candidate Project for the Education Sector in Morocco

Theme	Overview	Support from
Project to strengthen teachers' ICT skills for blended learning practices in primary education	Effective education methods (mixed learning models) combining face-to-face education and remote education are identified. In addition, the quality of primary education is improved by the practice of mixed education by teachers who have received online training for the utilization of ICT and Japanese-style education.	Technical cooperation
Project to improve the quality of vocational training by using digital technology to meet the needs of industry	Provide support for the revision of the curriculum, teacher training, and the procurement of the necessary equipment to practice job training and education using digital technologies which match the needs of industry in vocational training schools.	Technical cooperation

Source: JICA Study Team

The results of classifying the above candidate projects into draft project plans and draft project concepts from the perspective of local needs and the possibility of project implementation under JICA's scheme are as follows.

Table 10-16 Evaluation of Candidate Project for the Education Sector in Morocco

Candidate Project	Result of Classification	Reason
Project to strengthen teachers' ICT skills for blended learning practices in primary education	Draft Project Plan	The Ministry of Education has rolled out an online education platform called Telmidice, and expectations are high for the spread of online education in the context of an uncertain outlook for the end of the COVID-19. Effective teaching methods that effectively combine online and face-to-face learning (blended learning models) need to be identified, as well as improving teachers' ICT utilization skills.
Project to improve the quality of vocational training by using digital technology to meet the needs of industry	Draft Project Concept	The effectiveness of the use of AR/VR technology in enhancing vocational training that leads to employment needs to be fully scrutinized. The priority for introducing AR/VR technology is not necessarily under the current situation that even basic facilities and maintenance are not fully in place.

Source: JICA Study Team

(2) Draft Project Plan

The following shows the details of the Draft Project Plan.

Candidate Project-22 Draft Project Plan for the Education Sector of Morocco: Project to Strengthen Teachers' ICT Skills for Blended Learning Practices in Primary Education

Project name	Project to strengthen teachers' ICT skills for blended learning practices in primary education (Consideration as an activity in the "Project for Promoting Education with Equity and Quality (PEEQ)")
Current conditions and development issues of the target sectors	As a result of the widespread of COVID-19, the Ministry of Education has launched distance education through an online education platform called "Telmidice". However, there are many challenges, including the fact that many teachers are not familiar with using a PC and there are no uniform guidelines on how to teach effectively while using distance education. Teachers have been forced to deal with distance learning without having had the opportunity to receive adequate training, and there are concerns that the quality of education will deteriorate. Although it is difficult to foresee the consequences of the COVID-19, the adoption of ICT in the education sector has been under consideration even before the widespread of COVID-19, and it is hoped that the COVID-19 will accelerate the spread and expansion of the use of e-learning and learning management systems. On the other hand, the widespread use of distance learning may have an impact on the social development of children due to the lack of direct face-to-face communication.
Applicable scheme of JICA	• Technical cooperation project (Consideration as an activity in the "Project for Promoting Education with Equity and Quality (PEEQ)") • Public-private partnerships
The objective of the project	• To improve the quality of education by the identification of effective education methods (mixed learning models) in primary education, the practice of classes combining face-to-face classes and e-learning by teachers who have received training for the utilization of ICT, and the enhancement of the holistic education activities which contribute to the cultivation of the sociality of pupils using ICT effectively. This also improves children's quality of learning.
Effect of the project	• Identification of effective education methods (mixed learning models) using ICT. • The practice of effective and efficient school education and school management using e-learning and learning management systems by teachers who have received training. • Enhancement of holistic education activities by teachers who have received training using ICT effectively contribute to the cultivation of the sociality of pupils.
Overview of the project	• Organize the issues in the practice of mixed learning models in the schools selected as pilot schools and identify the knowledge and skills which teachers should learn. • Organize the existing education services using digital technologies considered to be effective. • Based on these, plan and practice online training for the teachers at the pilot schools for effective mixed education and school affairs management using ICT and the practice of holistic education activities and support their promotion and establishment together with the teachers who have received the training. • Académies Régionales de l'Education et de la Formation (AREF), Prefectural Education Office are involved in the implementation and planning of the training, so that the personnel of these organization will be able to implement the training by themselves after the project has been completed.

	• Create and apply nationwide the guidelines for schools and teachers which describe measures, etc. to practice effective mixed education and school affairs management using ICT and holistic education activities based on the experience of the introduction of education services using digital technologies in the pilot schools and the lessons learned from them. • Verification of the developed guidelines will be conducted to ensure that they are firmly in place in schools. • Efforts to improve children's learning through individually optimised learning through the effective use of ICT will continue.
Prerequisites	• Internet-capable devices (PCs and tablets) are deployed of in schools and distributed to teachers. • Stable internet connection with a certain level of transfer speed, data volume and access are established in schools.
Elemental digital technology for digital services	• Learning content delivery system • Use of an integrated school management system • Support system for sharing lesson videos and feedback among teachers
Acquired data (input)	[Learning content distribution system] • Learning progress of pupils and students • Grades, etc. [Use of integrated school management system] • Various information related to school management and operation • Personal information of students and pupils, etc. [Support system for sharing lesson videos and feedback among teachers] • Lesson videos • Feedback from users, etc.
Technologies that can be used in the data acquisition part	[Learning content distribution system] • Data acquisition is based on input from users (students, teachers and parents) [Use of an integrated school management system] • Data acquisition is based on input from users (school administrators and teachers) [Support system for sharing lesson videos and feedback among teachers] • Data acquisition is based on user input
Technologies that can be used in the data processing part	[Learning content distribution system] • AI/machine learning of weak areas in learning • Delivery of optimal learning materials and learning advice based on the above • Visualization of learning history, grades, etc. [Integrated school management system] • Integrated management of various school information through database to achieve the following - Visualization and comparative analysis of various management information - Management of pupil and student information (grades, attendance, health information, etc.) - Sharing of information among school staff (teachers, administrators, etc.) [Support system for sharing lesson videos and feedback among teachers] • Lesson video distribution
Output	[Learning content distribution system] • Establishment of a detailed learning guidance system tailored to each individual student. [Integrated school management system] • Reduce the workload of school staff • Improvement of the quality of school management and administration through the multifaceted use of information through the centralization of information [Support system for sharing lesson videos and feedback among teachers] • Improve the quality of teaching by sharing information and learning from each other.

Data administrator	(Since it is assumed that the existing services is used, the main data is managed by the service provider. The following is the assumption of the data management as a user.) [Learning contents distribution system] • Schools (teachers), parents, children and students [Integrated school management system] • Schools [Support system for sharing lesson videos and feedback among teachers] • System users (teachers)
Value offered	[Learning content distribution system] Value to the government • Improving the quality of education Value for pupils and students • Individually optimized learning experience Value for teachers • Reduced workload • Optimized teaching and learning Value for parents • Detailed information sharing and feedback on grades and academic guidance [Integrated school management system] Value to the government • Improvement of the working environment for teachers • Reduction of labor and other costs by improving operational efficiency Value for schools and teachers • Improvement in the quality of school management and administration through the multifaceted use of information through the centralization of information • Reduction in the workload of school staff • Effective child and student guidance through the accumulation and sharing of student and teacher information [Support system for sharing lesson videos and feedback among teachers] Value to the government • Improvement of the overall quality of education Value for teachers • Improvement in the quality of teaching • Reduced workload
Examples of usable digital technologies	• Utilization of the learning contents delivery system • Utilization of the integrated school affairs management system • Sharing of class videos among teachers, utilization of the feedback support system, etc. (For the usable digital technologies mentioned above and their specific use cases, see Chapter 5 "Table 5-1 Use cases of digital technologies to the education sector")
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 500 million yen Accepting country: XX million yen
Schedule	5 years
Implementation organization	Supervised and adjusted by: Ministère de l'Éducation nationale, du Préscolaire et des Sports Implemented by: Académies Régionales de l'Éducation et de la Formation (AREF), Prefectural Education Office
Assumed concerns and countermeasures against them	Confirm the Internet connection conditions of schools in the selection of the pilot schools and the device ownership conditions of teachers and pupils because some cases are assumed that the Internet environment of the pilot schools is insufficient or Internet-enabled devices available for teachers or pupils are insufficient. In some cases, also consider supporting the arrangement of the Internet connection environment and the acquisition of devices. Also, consider

	the possibility of applying software and applications not assuming the Internet connection in schools without the Internet connection environment. Since it is assumed that there may be significant differences in the ICT skills of teachers, pupils and parents, sufficient consideration should be given to providing training opportunities, including basic PC skills operation if necessary. It is desirable to identify effective technologies and solutions possessed by the private sector, including those in cooperation with EKB and local ones, and to consider including a mechanism for their sustainable use.
JICA projects with which collaboration is expected	Consider as an activity in the "Project for Promoting Education with Equity and Quality (PEEQ)"

Source: JICA Study Team

(3) Draft Project Concept

The following shows the details of the Draft Project Concept.

Candidate Project-23 Draft Project Concept for the Education Sector of Morocco: Project to Improve the Quality of Vocational Training by using Digital Technology to Meet the Needs of Industry

Project name	Project to improve the quality of vocational training by using digital technology to meet the needs of industry
Current conditions and development issues of the target sectors	The high rate of youth unemployment is a major social problem in Morocco. One of the reasons for this is that the curricula of vocational training schools and higher education do not meet the needs of the labor market. The shortage of human resources is a major challenge for the business investment environment, especially in the Moroccan labor market, where education and training at TVET institutions and higher education on the "supply side" are insufficient to meet the practical skills required by companies on the "demand side". In the field of vocational training, there is a need to improve the quality of vocational training to make it more employable in the light of the current use of digital technology. As there are many cases where equipment for practical training is insufficient or outdated, it is suggested developing a system for practical training using VR and AR technology, which can be used jointly to reduce the cost burden of purchasing equipment and improve the quality of training.
Applicable scheme of JICA	• Technical cooperation project • Public-private partnerships
The objective of the project	To realize the practice of vocational education using digital technologies which can meet the needs of industry in technology-related high schools.
Effect of the project	• Identification of digital technology elements including VR, AR, etc. usable in curriculums of vocational training schools by investigating the needs of industry (The targets are assumed to be departments assumed to match the needs for human resources in the industry such as departments of automobiles, machines, electricity, electronics, industrial electricity, and construction. The needs are to be surveyed assuming especially collaboration with Japanese companies which run business in Egypt (employment of graduates)) • Revisions of curriculums and education materials including digital technology elements. • Procurement of the necessary equipment, planning and development of contents, and practical vocational education which meets the needs of industry. • Reinforcement of the capabilities of instructors through TOT. • Construction of a cooperative organization with industry and revisions of curriculums and educational materials based on periodic surveys of human resource needs.
Overview of the project	• Survey the needs of industry including Japanese companies which have entered the market in Morocco and identify the target vocational training course

	(Also consider performing an information collection confirmation survey, etc. before the technology project). • Grasp the gap between the current curriculums of technology-related high schools and the human resources demanded in the industry. Identify the issues which are bottlenecks in the implementation of the current curriculums, and identify the measures to streamline technical acquisition (time, cost, etc.) • Based on the survey result, support the revisions of curriculums and education materials to practice vocational training activities including digital technology elements in the technology-related high schools selected as the pilot schools. • Support the procurement of the necessary equipment and the planning and development of contents. • Provide training for teachers. • Company internship and employment support for students are performed in cooperation with the industry. • Even after the Project is completed, the needs of the industry is surveyed regularly and the curriculum is revised accordingly.
Prerequisites	• Internet-capable devices (PCs and tablets) are deployed of in vocational schools. • Stable internet connection with a certain level of transfer speed, data volume and access are established in vocational schools.
Elemental digital technology for digital services	• Vocational and technical training (The specific vocational training courses to be covered need to be identified through information gathering and confirmation surveys. As examples, the following describes the "AR technology-based building construction training materials" and the "AR welding skills training system" developed by the Polytechnic University (PTU) of Japan.
Acquired data (input)	[Educational material for building construction practice using AR technology] • 2D drawings [AR welding skills training system] • Hands-on practice with equipment connected to the system.
Technologies that can be used in the data acquisition part	[Educational material for building construction practice using AR technology] • Tablets and smartphones • Capture images of 2D drawings using the built-in camera • 3D models in the cloud [AR welding skill training system] • Welding mask (camera), welding gloves connected to the system, etc. • AR technology
Technologies that can be used in the data processing part	• Analysis and skill assessment system
Output	[Educational material for building construction practice using AR technology] • Efficient skills acquisition [AR welding skills training system] • Efficient skill acquisition
Data administrator	(Since it is assumed that the existing services is used, the main data is managed by the service provider. The following is the assumption of the data management as a user) [Educational material for building construction practice using AR technology] • Vocational training schools [AR welding skill training system] • Vocational training school
Value offered	[Educational material for building construction practice using AR technology] • Efficient acquisition of skills • Improvement of the quality of technical training (accurate and objective evaluation of skills) • Reduction of costs for technical training (equipment and material costs, etc.)

	[AR welding skills training system] • Efficient acquisition of skills • Improvement of the quality of technical training (accurate and objective assessment of skills) • Reduction in the cost of technical training (equipment, materials, etc.)
Examples of usable digital technologies	Utilization of VR and AR technologies, etc. (For specific use cases, see Chapter 5 "Table 5-2 Use cases of digital technologies in the vocational training field")
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 500 million yen Accepting country: XX million yen
Schedule	5 years
Implementation organization	Supervised and adjusted by: Ministère de l'Éducation nationale, du Préscolaire et des Sports Implemented by: Office de la Formation Professionnelle et de la Promotion du Travail (OFPPT)
Assumed concerns and countermeasures against them	• For the procurement of the necessary digital equipment, identify the necessary materials and equipment in the project and support procurement. • Careful attention should be paid to the acquisition of skills by teachers who operate VR/AR technology-based equipment and provide instruction to students.
JICA projects with which collaboration is expected	-

Source: JICA Study Team

10.4. Tunisia

10.4.1. Digital Technology Innovation (Reinforcement of the Digital Innovation Ecosystem, ICT Policy Implementation System and Innovation Promotion System)

(1) Selection of Candidate Projects

Tunisia has been an early adapter of using ICT and digital technologies for socio-economic development and for more than 20 years it has identified ICT/digital technologies as a pillar of national development. In recent years, Tunisia has put special emphasis on startup development and is positioning to become a benchmark for startup development in Africa. As part of the strategic initiative, Tunisia enacted "Startup Act," an act which is renowned for its forward-looking provisions and is currently working to implement the Act. This move has also been recognized by the "Smart Africa Alliance," a regional organization that promotes ICT and development in Africa. While Tunisia enacted strong strategies and associated acts, the challenges of their implementation are monumental. Tunisia's current e-strategy, the "Digital Tunisia 2020" ICT strategy," for example, has more than half of its projects, which were aimed to be achieved by 2020, were not implemented. Delay in implementing other policies/acts is also noticeable. One of the biggest reasons for the implementation difficulties is budget constraint of the Tunisian government, however, it has been pointed out that it is also due to the weak implementation capacity of the Government agencies. When conducting interviews for the survey, many Tunisia stakeholders expressed that "the old-fashioned bureaucracy" is putting a brake on various innovative initiatives in Tunisia. Supporting the reform of the Government ministries/agencies and strengthening the capacity of the institutions and their governance system, thus, are indispensable for advancing the development of Tunisia. This challenge is present at all sectors, but it appears as particularly acute issue in the ICT/digital sector. One of the examples of this challenge is delayed operations of "Anava fund," highly anticipated "fund of fund" to help

solve financing challenges of the startups. The operationalization of the fund has been delayed due to the process delays within the Government. This and other delays in implementing the Startups Act are great concerns for the Tunisian startups and their support institution such as the TunisiaStartups.

Recognizing the great needs, many development partners, including the World Bank and the African Development Bank, are providing support for reforming the Government institutions and strengthening the capacity of Government agencies. Among these types of support, there are many projects in which the utilization of digital technology is widely planned. However, since these needs are monumental, it is possible to provide support from JICA as well.

In addition to possibility of supporting the capacity development of Government institutions, it may also be possible to support the startups support facilities and institutions, as these institutions play a major role in realizing the digital innovation ecosystem.

Possibility of capacity development support for the Government institutions and strengthening of the digital innovation ecosystem, however, has not been widely consulted with the stakeholders as it was not the initial target of the survey and the information extracted from the stakeholders was quite limited. It is necessary to conduct further consultation exercise with the counterparts to reconfirm actual support needs in the area, however, the draft candidate projects are as follow.

Table 10-17 Draft Candidate Projects for Digital Technology Innovation in Tunisia

Theme	Overview	Support Form
Strengthening government implementation capacity through using digital technology (Human Capacity Building)	Strengthening the Government institutions' policy implementation capacities to utilize digital technologies to solve myriad of socio-economic challenges in Tunisia. As other development partners (e.g., WB, AfDB, GiZ, KfW) also provide similar support in this domain, it is necessary to consider potential synergy and division of support (suggest concentrating support in the area of human capacity development).	- Information collection and confirmation survey - Expert dispatch - Training in Japan - Third-country training - Technical cooperation projects
Strengthening governance capacity to promote digital innovation	Strengthening the governance and ICT policy implementation capacities of the Government institutions and associated sector development/promotion institutions to utilize digital technologies to solve a wide range of social issues. Other development partners also provide similar support in this domain, so it is necessary to consider synergy and division of support.	- Information collection and confirmation survey - Expert dispatch - Training in Japan - Third-country training - Technical cooperation projects
Strengthening the digital innovation ecosystem	Support project for startups and small and medium enterprises at startup incubation facilities (incubators), techno parks, smart cities, etc., which form the basis of the digital innovation ecosystem. Support focusing on startups and small and medium-sized companies are possible even within the framework of Project NINJA of JICA. It is also possible to provide equipment (FabLab, hacker space (manufacturer space), etc.) in incubators, techno parks, etc. It may also be possible to support seed funding scheme in cooperation with other development partners through supporting development loans to the existing financing mechanism (e.g., ANAVA Fund, other VCs) and/or through providing two-step loans scheme to the established banking systems which support small and medium-sized companies.	- Information collection and confirmation survey - Expert dispatch - Training in Japan - Third-country training - Technical cooperation projects - Developmental Loans

Theme	Overview	Support Form
Japan and Tunisia Startup collaboration support	Many startups in North Africa recognize Japan as a potential technology partner. Some Japanese startups, venture capitals, trading companies, etc. are also seeking opportunities to collaborate with and invest in startups in emerging countries. By supporting networking of these companies, the project seeks to create partnerships between Japanese and Tunisian private companies in the digital technology area.	- Public-private partnerships

Source: JICA Study Team

The above draft candidate projects were classified into draft project plans and draft project concepts from the viewpoints of local needs and the possibility of implementation as a JICA's scheme (except for private sector investment/partnership) are as follows.

Table 10-18 Evaluation of Draft Candidate Projects for Digital Innovation Technology of Tunisia

Candidate Project	Result of Classification	Reason
Strengthening government implementation capacity through using digital technology (Human Capacity Building)	Draft Project Concept	While the needs are great, it is difficult to determine how to differentiate Japanese support under the condition of limited resources. As such, the priority is low.
Strengthening governance capacity to promote digital innovation	Draft Project Concept	While the needs are great, it is difficult to determine how to differentiate Japanese support under the condition of limited resources. As such, the priority is low.
Strengthening the digital innovation ecosystem	Draft Project Concept	While the needs are great, it is difficult to determine how to differentiate Japanese support under the condition of limited resources. As such, the priority is low.

Source: JICA Study Team

(2) Draft Project Plan

There are no candidate projects classified as Draft Project Plans in Digital Innovation Technology in Tunisia.

(3) Draft Project Concept

The following list describes the details of Draft Project Concepts.

Candidate Project-24 Draft Project Concept for Digital Technology Innovation in Tunisia:
Strengthening Government Implementation Capacity through Using Digital Technology

Project name	Strengthening the government's implementation capacity through using digital technology (Human Capacity Development)
Current conditions and development issues of the target sectors	Tunisia is embarking on a challenge of transforming the Government institutions, which is marred by archaic bureaucratic procedures, to be transparent, efficient, and effective institutions. In order to expand enhanced public services, it is important to enhance these Government agencies' capacities, especially in the area of policy formulation and implementation along with accelerated utilization of appropriate digital technologies could facilitate the process. In particular, by enacting and implementing policies using data, improving the efficiency of Government organizations through using digital technology, and expanding delivery of public services to citizens and the private sector using digital technology, it is envisioned that the people's trust in the Government will be increased and to use national resources more effectively.

	When considering the support in this area, it is necessary to conduct further investigation about the current state of digitization of the Tunisian Government, support given by the development partners, and select the target ministries and agencies. It is, thus, envisioned that the support should be concentrated on human capacity building of Government officers to facilitate the e-Government implementation in Tunisia.
Assistance scheme to be applied	Information collection and confirmation survey, expert dispatch, Japan training, third-country training, technical cooperation projects, etc.
The objective of the project	Strengthening the policy implementation capabilities of the institutions which promote digital transformation. Increasing public services through digital technologies.
Effect of the project	Increased capacity in the Government agencies result to streamlined and efficient Government agencies, streamlined use of public resources, and enhanced public services.
Overview of the project	Different support schema can be considered depending on the scope of the project: 1) Information collection and confirmation survey Assessment of the Government and parastatal institutions. Conduct assessment to identify potential skill gaps in the area of e-Government implementations and business process related challenges and formulate support measures to fill the gap. 2) Expert dispatch Dispatching experts to relevant Government institutions to strengthen the capacities of ICT related Government institutions through providing human capacity building in the area of policy formulation and implementation support. Combination of OJT style training as well as e-learning tools will be used to conduct the human capacity building initiatives. 3) Training in Japan Improve the capacities of officers of Tunisian Government to implement innovation promotion policies through learning best practices in the area of e-Government and Public service digitization of relevant public institutions. This training course could be combined with additional online training/follow up initiatives as needed. 4) Third-country training Improve the capacities of officers of Tunisian Government to implement innovation promotion policies through learning best practices in the area of public service digitization at the third country (country with best example). This training course could be combined with additional online training/follow up initiatives as needed. 5) Technical cooperation project Comprehensive technical cooperation to strengthen the human capacities of the Tunisian Government ministries/agencies for the e-Government related policy formulation and implementation. The technical cooperation project could be combined with such digital tools as e-learning systems.
Typical Process of e-Government (Bold typeface denotes potential support area)	Policy formulation and implementation using Data Foundation and Functional Systems Capacity Building for e-Gov implementation e-Gov Platform Service delivery
Core digital and digital services Technologies	Human Resource Development for e-Government implementation.
Theme	Leverage digital technology to improve government services.

Acquired Data (Inputs)	* The support is intended for strengthening human resource capacity building. As such, the initiative will not any dataset on e-Government services. Maybe able to acquire data on the implementation of e-Learning.
Technology for the data acquisition	e-Learning tools
Technology for the data analysis	CRM module for e-Learning tools
Intended Output	Improved provision of efficient services through digitization Improved transparency and efficiency of public service provision process.
Data Administrator (Holder)	Government Ministries and agencies
Provided Values	Value for the Government: - Provision of streamlined citizen services - Improvement of tax revenue - Streamlining of Government procedures and resource usage Value for citizens - Provision of transparent and efficient citizen services - Reduction of corruption, etc.
Examples of digital technologies that may be used within the initiative	Potential digital technologies: e-learning systems and others
Approximate project cost (human resources, training, materials and equipment, etc.)	1) Japan: 50 million yen 2) Japan: 10~30 million yen 3) Japan: 10~30 million yen 4) Japan: 300~500 million yen (excluding procurement of middleware) Recipient country: XX million yen
Schedule	1) 0.5 to 1 year 2) 0.5 years 3) 0.5 years 4) 3 years
Implementation organization	Partner Institutions: Ministry of Communication Technologies Associated institutions: relevant ministries/agencies
Risks and countermeasures	• Multiple development partners are supporting the ministries and agencies using digital technologies in Tunisia. It is necessary to clarify Japan's comparative advantage, division of roles, and possibility of cooperation in the area.
JICA projects with which collaboration is expected	• N/A

Source: JICA Study Team

Candidate Project-25 Draft Project Concept for Digital Technology Innovation in Tunisia:
Strengthening Governance Capacity to Promote Digital Innovation

Project name	Strengthening governance capacity to promote digital innovation
Current conditions and development issues of the target sectors	The Tunisian Government is actively promoting digital technologies as tools to solve socio-economic challenges for the past 20 years. Tunisia has formulated many advanced ICT strategies and related policies, however, implementation of these strategies/policies often lagged behind. Many development partners are also supporting the strengthening of the digital innovation ecosystem in Tunisia with an expectation that it will bring about much needed transformation in Tunisia. While there are many supporters in this area, establishment of a sustainable digital innovation ecosystem will not be achievable if the policy implementation capacities and governance system of the Government agencies and innovation promotion organizations are not strengthened. The Project, therefore, aims to support creating effective organizational structures to accelerate implementation of innovation promotion policies.

Assistance scheme to be applied	Information collection and confirmation survey, expert dispatch, Japan training, third-country training, technical cooperation projects, etc.
The objective of the project	Strengthening the policy implementation capabilities of the institutions to promote digital innovations
Effect of the project	Effective digital innovations to solve socio-economic challenges promoted in Tunisia
Overview of the project	Different support schema can be considered depending on the scope of the project: 1) Information collection and confirmation survey Assessment of the Government and parastatal institutions and other innovation promotion institutions (private sector & civil societies). Conduct survey to identify potential gap in the area of policy implementations and other challenges and formulate support measures to fill the gap. 2) Expert dispatch Dispatching experts to relevant Government institutions to strengthen the capacities of ICT related Government institutions through providing implementation support of innovation promotion policies. Combination of OJT style training as well as e-learning tools will be used to strengthen institutional capacity building. 3) Japan training Improve the capacities of officers of Tunisian Government to implement innovation promotion policies through learning best practices in the area of digital innovation promotion. In addition, the training occasion would allow visiting innovation ecosystems in Japan. This training course could be combined with additional online training/follow up initiatives as needed. 4) Third-country training Improve the capacities of officers of Tunisian Government to implement innovation promotion policies through learning best practices in the area of digital innovation promotion at third country (country with best example). This training course could be combined with additional online training/follow up initiatives as needed. 5) Technical cooperation Project Comprehensive technical cooperation to strengthen the capacities of the Government and innovation support organizations for innovation policy implementation in Tunisia. The technical cooperation project could be combined with such digital tools as e-learning systems, enterprise resource planning systems (ERP), CRM, etc.
Typical Process of Incubation (Bold typeface denotes potential support area)	Strengthening the capacity of Government agencies to implement innovation policies Government support (Policy, Market Access, Government Procurement, Funding, Venues, Tax, Regulations, Incentive Mechanisms) 
Core digital and digital services Technologies	The proposed support is mainly aimed at improving the general environment for fostering innovation (strengthening the ecosystem) in Tunisia through strengthening the government's policymaking and enforcement capabilities (strengthening the governance system). As such, there could be little direct use of digital technologies to support the initiative. Nevertheless, such digital technologies as Enterprise Resource Planning system (ERP), e-learning system, Customer Resource Management system (CRM), etc. can be used to strengthen the governance system of targeted Government agencies. In addition, it is also conceivable to utilize policy decision support system (policy formulation in line with startup development) that utilizes various data.
Theme	Capacity Building of Innovation support organizations (public and private)

Acquired Data (Inputs)	Data pertaining to Innovation Ecosystem (data pertaining to Startups, private sector development, etc.)
Technology for the data acquisition	Databases, ERP, CRM, etc.
Technology for the data analysis	Databases, ERP, CRM, etc.
Intended Output	An environment for effective startup development established
Data Administrator (Holder)	Startups Incubating Institutions and relevant Government organizations
Provided Values	Value for the Government: - Increase entrepreneurship and employment generation through strengthening the entrepreneurs support system - Creation of innovative solutions to solve social issues Value for Entrepreneurs: - Simplification of various procedures/regulations for new and existing businesses through strengthening the entrepreneurial support system
Examples of digital technologies that may be used within the initiative	Potential digital technologies: e-learning systems, enterprise resource planning systems (ERP), etc.
Approximate project cost (human resources, training, materials and equipment, etc.)	1) Japanese side: 50 million Yen 2) Japan side: 100 million Yen 3) Japan side: 10 to 30 million Yen 4) Japan side: 10 to 30 million Yen 5) Japan side: 300 to 500 million Yen Recipient country: XX million Yen
Schedule	1) 0.5 to 1 year 2) 2 years 3) 0.5 years 4) 0.5 years 5) 3 years
Implementation organization	Partner institutions: Ministry of Communication and Technologies Associated institutions: Tunisian Startups (Umbrella organization for Startups)
Risks and countermeasures	• Multiple donors provide digital innovation strengthening support in Tunisia. As such, it is necessary to clarify the division of labor with other development partners and specifying clear advantages of providing support from Japan. • The promotion of digital innovation and startups by the Tunisian Government holistic but in a proof-of-concept stage, so it is necessary to consider flexible and effective approaches for the implementation of projects.
JICA projects with which collaboration is expected	• N/A

Source: JICA Study Team

Candidate Project-26 Draft Project Concept for Digital Technology Innovation in Tunisia:
Strengthening the Digital Innovation Ecosystem

Project name	Strengthening the digital innovation ecosystem
Current conditions and development issues of the target sectors	The Tunisian Government is strengthening its digital innovation ecosystem through creating conducive environment to promote growth of private sectors, supporting creation of innovative solutions for its challenges, and developing high-skilled human resources. One of such measures which is focused by the Tunisian Government is the startup (small and medium-sized company) development support which are being incubated at startup development facilities (incubators), techno parks, smart cities, etc. Though major development partners (e.g., the World Bank) also provide similar support in Tunisia, synergy and

	division of labor are deemed possible due to the fact that the needs of creating strong digital ecosystem are vast. The proposed support may also be able to use the framework of “Project NINJA,” a signature JICA regional support for startups and small and medium-sized enterprises in Africa. Furthermore, there may be several different supports may be possible such as provision of digital fabrication equipment to incubators, techno parks, and Maker spaces (FabLab and hacker space) to spur hardware-based innovations. Considering that Morocco has established “ANAVA Fund” (fund of fund) and has seen emergence of other startups financing mechanisms, it may also be possible to support such startups financing mechanisms with other development partners. The financing support may include co-financing support to existing seed funds and/or access to facilitated loans through “two-step loans” scheme.
Assistance scheme to be applied	Information collection and confirmation survey, expert dispatch, Japan training, third-country training, technical cooperation projects, Grant Aid, Two Step Loan scheme, etc.
The objective of the project	Strengthen digital innovation ecosystem in Tunisia which would contribute to the growth of startups
Effect of the project	Effective solutions to solve socio-economic challenges in Tunisia created through development of startups.
Overview of the project	Different support schema can be considered depending on the scope of the project: 1) Information collection and confirmation survey Assess the local incubation facilities and innovation promotion institutions, survey the necessary resources, the current gaps, and other factors, and formulate support measures to fill the gap. 2) Expert dispatch Dispatch experts to development-related institutions for management and technical capability reinforcement activities for incubation facilities and organizations. 3) Japan Training Improve the capabilities of the managers of incubation facilities/institutions in Tunisia by sharing knowledge of Japanese incubation facilities and institutions. Provision of remote support are provided as needed. 4) Third-country training Improve the capabilities of the Tunisian incubation facilities/institutions by learning the best examples of incubation systems in third countries where the startup ecosystem is well established. Provision of remote support are provided as needed. 5) Technical cooperation project Provide holistic support to the incubation support facilities and institutions to effectively strengthening the digital incubator ecosystem in Tunisia. The support may include establishment of POC mechanism, support for the partnerships with Japanese incubators, venture capitals, etc. 6) Grants aid Provision of digital fabrication equipment to the incubation facilities, techno parks, smart cities and other startups incubation facilities. 7) Development loans through existing banking system (co-financing, two-step loan, etc.) Loans to local finance mechanism (including VC and two-step loans of commercial banks) in cooperation with other development partners (World Bank, AFD, etc.)

Typical Process of Incubation (Bold typeface denotes potential support area)	<u>Digital Innovation Strengthening Project</u> Government support (Policy, Market Access, Government Procurement, Funding, Venues, Tax, Regulations, Incentive Mechanisms) Private Sector Support (Incubation, VC, Angel Funding, Mentorship, Market connection, etc.) 
Core digital and digital services Technologies	The proposed support is mainly aimed at improving the general environment for fostering innovation (strengthening the ecosystem) in Tunisia. As such, there could be little direct use of digital technologies to support the initiative. Nevertheless, such digital technologies as e-learning system, supporting enhancement of Startups Portal, Digital Fabrication tools, etc. can be used to strengthen the innovation ecosystem.
Theme	Capacity Building of Innovation support organizations (private focus)
Acquired Data (Inputs)	Data pertaining to the innovation ecosystem (information about startups, entrepreneurship development, etc.)
Technology for the data acquisition	Databases, e-learning system
Technology for the data analysis	Databases (including analytic capabilities)
Intended Output	Effective Startups development
Data Administrator (Holder)	Startups support organizations (incubators)
Provided Values	Value for the Government: - Increase entrepreneurship and employment generation through strengthening the startups support system - Creation of innovative solutions to solve social issues Value for Entrepreneurs: - Simplification of various procedures/regulations for new and existing businesses through strengthening the entrepreneurial support system
Examples of digital technologies that may be used within the initiative	Potential digital technologies: Digital fabrication equipment
Approximate project cost (human resources, training, materials and equipment, etc.)	1) Japan: 50 million yen 2) Japan: 100 million yen 3) Japan: 30 million yen 4) Japan: 30 million yen 5) Japan: 300 million yen 6) Japan: 100 million yen (depending on the number of target startups) 7) Japan: 100 to 300 million yen 8) Japan: 5 billion yen or more Recipient country: XX million yen
Schedule	1) 0.5 to 1 year 2) 2 years 3) 0.5 years 4) 0.5 years 5) 3 years 6) 2 years 7) 1 year 8) 5 years
Implementation organization	Partner institutions: Startup development institutions (incubators, etc.), Ministry of Communication and Technologies, etc.

	Associated institutions : Tunisian Startups, Ministry of Finance, Financial Institutions (Smart Capital), etc.
Risks and countermeasures	Multiple donors support the startup support of Tunisia, and it is necessary to clarify the comparative advantages, division of labor, and the possibility of cooperation with other development partners.
JICA projects with which collaboration is expected	N/A

Source: JICA Study Team

10.4.2. Agriculture and Fishery

(1) Selection of Candidate Projects

Agriculture accounts for about 10% of Tunisia's GDP, and agricultural exports account for 6% of total exports. The fisheries industry also plays an important role as a source of food security, animal protein, and foreign currency. However, the working population engaged in agriculture is aging and the number of extension workers is decreasing due to budget cuts, so there is a need to increase the number of new workers. As for the fisheries sector, the recent development of the fishing technology has led to excessive landings and illegal operations, which is threatening to reduce fishery resources. It is necessary to establish an appropriate fishery management system.

As a result of the evaluation of other digital technology utilization proposals according to the evaluation criteria, the following are the possible candidate projects for the agriculture and fisheries sectors. Among the proposed candidate projects, the revision of the training curriculum for agricultural and fishery workers has received a particularly strong request for support from AVFA, and a draft proposal has been submitted after the implementation of the workshop.

Table 10-19 Draft Candidate Projects for Agriculture and Fisheries sectors in Tunisia

Theme	Overview	Support form
Training for existing and new agricultural and fishery workers	The project will support the implementation of training programs that introduce new technologies, including digital technologies, as well as the introduction of equipment and materials necessary for these programs, in order to improve the teaching skills of teachers in training schools and to improve the curriculum, thereby contributing to the improvement of the level of agricultural and fishery education in Tunisia.	Technical Cooperation
Strengthen the fishery cooperatives	Support will be provided to ensure that systems and structures are in place to efficiently implement a co-management approach between fishermen and government using digital technology, and to encourage the utilization of the data collected.	Technical Cooperation
Assessment of fishery resources	Support for the establishment of an assessment system for fishery resources to enable sustainable production and stable supply of fishery products through the development of fishery statistical data.	SATREPS and/or Technical Cooperation

Source: JICA Study Team

The above candidate projects were classified into Draft Project Plans and Draft Project Concepts from the viewpoint of local needs and the possibility of project implementation under JICA's scheme.

Table 10-20 Evaluation of Candidate Projects for the Agriculture and Fisheries sector in Tunisia

Candidate projects	Categorization	Reason
Training for existing and new agricultural and fishery workers	Draft Project Plan	With limited budgets for agricultural and fisheries extension workers, there is a need for a mechanism to efficiently strengthen their capacity. In addition, there is a platform that already organizes various information etc. within AVFA, a potential counterpart institution. This can be addressed in the form of updating/improving existing ones.
Strengthening fisheries cooperatives	Draft Project Concept	Currently, the current status of small-scale fishermen, who make up the majority of the fishing industry, is not being understood, and the introduction of a management system utilizing the support from fishery cooperatives is required to promote the management of fishery resources by the government. On the other hand, it was decided to keep this as a concept proposal because it is important to set incentives for fishery associations and to obtain their cooperation before introducing digital technology.
Assessment of Fisheries Resources	Draft Project Concept	Improving the quality of marine and fisheries research for sustainable and appropriate management of marine resources is a challenge. On the other hand, since it is essential to obtain the agreement of all stakeholders before introducing digital technology, it was decided to keep this as a concept proposal first.

Source: JICA Study Team

(2) Draft Project Plan

The details of the Draft Project Plans are shown below.

Candidate Project-27 Draft Project Plan for the Agriculture and Fisheries sector of Tunisia: Project for Curriculum Development Support for Training Schools for Agricultural and Fishery Workers

Project name	Curriculum development support for training schools for agricultural and fishery workers
Current conditions and development issues of the target sectors	In Tunisia, there are 31 agricultural training centers, 8 fisheries training centers, and 1 ToT center under the AVFA. These centers contribute to the promotion of the agricultural and fisheries sector in Tunisia by training agricultural and fishery workers and providing training to extension agents. However, the centers are struggling to attract new workers, especially young people, because 1) they have to study at remote centers for several months or years, and 2) the training does not correspond to the current technology of smart farming and fishing.
Applicable scheme of JICA	Technical cooperation
The objective of the project	The purpose of this project is to improve the teaching skills of the teachers in the training schools, to improve the curriculum, and to contribute to the improvement of the level of agricultural and fishery education in Tunisia by introducing new technologies, including digital technologies, and the necessary equipment and materials.
Effect of the project	• Training curricula for smart agriculture and fisheries will be developed. • New training methods, such as distance learning for theory and field training for implementation, will be developed. • Capacity of instructors will be strengthened so that they can conduct training according to the revised curriculum. • Procurement of equipment needed to conduct the training.
Overview of the project	In order to achieve the above objectives, the following activities will be carried out in this project.

	- To evaluate the current training curriculum and identify areas for improvement. - Examine the required training contents, methods, and functions. - To develop the improved training curriculum and establish the implementation system. (In this process, it is possible to learn about the training situation in other countries through training in Japan and training in third countries) - Implement and evaluate the improved training curriculum.		
Prerequisites	Internet-enabled devices (PCs and tablets) should be deployed in schools (and in some cases, students). The school should have an Internet environment that is stable and can be used with a certain level of transmission speed, data volume, and number of accesses, and students should be able to access it. Equipment and devices used in smart agriculture and fishery should be installed in schools.		
Elemental digital technology for digital services	In order to increase the number of the next generation engaged in the primary industry and to improve productivity, this project will provide guidance on how to introduce the necessary technologies to promote smart agriculture and fisheries.		
Theme	Design of educational materials for smart agriculture and fishery	Learning contents distribution system	
Acquired data (input)	- Examples - How to use the equipment	- Online materials and exam - Student progress - Grades, etc.	
Technologies that can be used in the data acquisition part	- Internet search - Online interviews with equipment manufacturers	Manipulation of the question (difficulty level) according to the correctness or incorrectness of the answer.	
Technologies that can be used in the data processing part	- Word, Excel, Power Point, etc. - Video editing - Creating teaching materials using XR	- Analysis of areas of weakness through machine learning - Visualization of learning history, grades, etc.	
Output	Educational materials for practicing smart farming and fishing	Establishing a system of meticulous learning guidance tailored to each individual.	
Data administrator	School	School (partially participants)	
Value offered	Value to the government Increase in the number of newcomers to agriculture and fisheries	Value to the school - Reduction of location costs - Reduction of workload such as grading and evaluation - Increase in added value by providing new technologies	Value to participants - Take classes regardless of time or location. - Repeat what you don't understand. - Learn the latest technology.
Examples of usable digital technologies	See the following sections in the table of Chapter 5, 5.1.1 Agricultural Sector. 3. Others (1) Skills transfer technology Refer to the following sections in the table of Chapter 5, 5.1.2 Fisheries Sector and Chapter 5, 5.1.2 Fisheries Sector. 1.Other (3) Technology for training new fishery workers		
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 0.3 billion yen C/P: xx yen		
Schedule	3 years		
Implementation organization	Counterpart: AVFA		

	Other stakeholders: National Pedagogical Institute and continuous Agricultural Training (INPFCA), other organizations involved in the capacity development of people in agriculture and fisheries sector.
Assumed concerns and countermeasures against them	There are areas and locations where telecommunication infrastructure is not in place and internet access is not available. In addition, not all farmers and fishermen necessarily have smartphones (basic ICT literacy may be low). Therefore, it is necessary to consider solutions that do not require constant Internet access, and to consider communication methods that do not depend on the Internet, such as satellites and LPWA (Low Power Wide Area). In addition, detailed follow-up with users is desirable upon implementation.
Possible collaboration with JICA project	There is a strong desire from AVFA. As a priority partner country in the JICA/IFAD partnership MoU, strengthening cooperation in the field of SHEP/IFNA is being considered.

Source: JICA Study Team

(3) Draft Project Concept

The details of the Draft Project Concepts are shown below.

Candidate Project-28 Draft Project Concept for the Agriculture and Fisheries sector of Tunisia:
Project for Strengthening the Organization of Fishery Cooperatives for the Realization of Sustainable Local
Fishery

Project name	Strengthening the organization of fishery cooperatives for the realization of sustainable local fishery
Current conditions and development issues of the target sectors	JICA supported the development of a coastal fisheries resource management plan based on information on fisheries resources/ecosystems, fisheries operations, and socioeconomics, as well as the sustainable use and management of fisheries resources in the region as a whole, through "Project on Co-management of Coastal Fisheries in the Gulf of Gabes". In addition, it supported the sustainable use and management of fishery resources in the entire region by strengthening cooperation between fishermen and Tunisian administrative agencies. However, there were some constraints due to the lack of manpower to collect information, especially the small number of extension agents who provided technical support in the fishing communities compared to the size of the target area, and the lack of transport for the agents.
Applicable scheme of JICA	Technical cooperation
The objective of the project	Systems and structures will be put in place to efficiently implement a co-management approach between fishermen and government.
Effect of the project	• An efficient information collection system using digital technology will be established. • The activities of extension agents will be carried out using digital technology. • Utilization of the collected data will be promoted
Overview of the project	In this project, the following activities will be carried out in order to achieve the above objectives. 1. Pilot areas will be selected, and the following will be demonstrated. • To establish an implementation system and system to collect, organize, and regularly update fishery information necessary for co-management by fishermen and government. • A mechanism for consensus building and compliance with rules and regulations regarding the implementation structure and system will be established. • Implement and evaluate fishery management using the system. 2. The results of the demonstration will be systematized and shared. • Examine methods of data utilization.

Overview of management of marine resources (underlined section is covered in this project)	<pre> graph TD 1[① Understand the current situation] --> 2[② Evaluation and analysis] 2 --> 3[③ Create policies and regulations] 3 --> 4[④ Implementation & Monitoring] 4 --> 1 </pre>	
Prerequisites	There should be an implementation system (structure and organization) to promote the collected data and its utilization.	
Elemental digital technology for digital services	In order to evaluate and analyze fishery resources in the future, it is first necessary to correctly understand the current situation. In order to do so, the project aims to introduce technology to collect and create a database of objective data that shows the current situation more precisely and efficiently.	
Acquired data (input)	• Catch and landing information (catch, measurement of catch, etc.) • Oceanographic observations (water temperature, salinity, ocean currents, etc.) • Operation and fishing ground environment (location and timing of establishment, fish population response, etc.)	
Technologies that can be used in the data acquisition part	• Observation using ICT buoys, etc. (IoT) • Photographing of aquaculture farms using drones (flying and underwater types) • Collecting weather data using satellites • Collecting weather data using satellites • Detecting fish schools using detectors	
Technologies that can be used in the data processing part	A database system that can be organized into a form that is easy to evaluate and analyze Integration technology for data entered by multiple parties	
Output	Building a database for easy evaluation and analysis	
Data administrator	Fishermen, Government, Research Institutes	
Value offered	Value to Government • The current status of fishery resources can be grasped more precisely. The visualization of fishery resources makes it possible to set feasible resource targets.	Value to Fishermen • It will be easier to accumulate and pass on fishing know-how by visualizing the intuition and experience about the waters where operation is done.
Examples of usable digital technologies	See the following sections in the table of Chapter 5 5.1.2 Fisheries Sector 1. production (small-scale fisheries) (1) information collection technology, (2) information sharing technology, (3) technology to predict fishing grounds and catches	
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 0.3 billion yen Counterpart: xx yen	
Schedule	3 years	
Implementation organization	Counterpart: DGPA Stakeholders: INSTM, fishery cooperatives, other institutions related to the management of marine resource	
Assumed concerns and countermeasures against them	Since digitization leads to openness of information, it is difficult to obtain cooperation from vested interests that have been enclosing information. In particular, it will be important for fishermen to be able to show what incentives they have to promote to share the location of small-scale fishing vessels, which would make their (secret) fishing grounds known. In addition, it is necessary to consider how to create a mechanism to collect data without changing the usual behavior/habits of the people. Therefore, along with the introduction of digitalization, careful explanation is required to gain the understanding and cooperation of the stakeholders, including measures for information openness and the establishment of incentives.	

Value offered	Counterpart requested to utilize the system established in “Project on Co-management of Coastal Fisheries in the Gulf of Gabes (2012-2016)”
---------------	---

Source: JICA Study Team

Candidate Project-29 Draft Project Concept for the Agriculture and Fisheries sector of Tunisia:
Project for Support for Strengthening the Assessment System for Fishery Resources

Project name	Support for strengthening the assessment system for fishery resources		
Current conditions and development issues of the target sectors	Ecosystems, including fishery resources, have been greatly affected by climate change and marine pollution, and annual fluctuations in fish catches have been increasing. The quality of marine and fishery research for sustainable and appropriate management of fishery resources has become an urgent issue.		
Applicable scheme of JICA	SATREPS and/or Technical Cooperation		
The objective of the project	The purpose of this project is to establish a system for collecting fishery statistics necessary for sustainable and appropriate management of fishery resources and to implement water resources management.		
Effect of the project	Fisheries statistical data will be developed. Assessment of fishery resources for sustainable production and stable supply. To be able to provide scientific evidence for sustainable fisheries management.		
Overview of the project	In order to achieve the above objectives, the following activities will be conducted in this project. - To establish a system for collecting fishery statistics after confirming the current data collection and collection methods. - To collect, organize, and periodically update necessary data using digital technology. - In the case of a fishery, the fishery should be managed in a manner that is consistent with the data.		
Overview of management of marine resources (underlined section is covered in this project)	<pre> graph TD 1[① Understand the current situation] --> 2[② Evaluation and analysis] 2 --> 3[③ Create policies and regulations] 3 --> 4[④ Implementation & Monitoring] 4 --> 1 </pre>		
Prerequisites	- Rules (laws, regulations, ordinances, etc.) for the management of fishery resources should be established. - Data on the current status of fishery resources must be collected. - A system (mechanism and organization) to promote the use of the collected data.		
Elemental digital technology for digital services	This is an introduction to the methods of assessing and analyzing fishery resources using digital technology and a database collected to understand the current situation.		
Acquired data (input)	• Data collected in "Understanding the current situation".		
Technologies that can be used in the data acquisition part	• Computers capable of computing resource assessment, simulation, etc.		
Technologies that can be used in the data processing part	• Numerical and image analysis using machine learning		
Output	- Resource assessment results - Necessary data for setting resource management targets, etc.		
Data administrator	Research Institutes		
Value offered	Value to the government Stemming the decline in fishery production	Value to the research institutes Conducting more sophisticated resource assessment analysis	Value to fishermen Consideration of management system according to the current situation

	Establish a resource management system based on the results of analysis using data closer to the current situation.		
Examples of usable digital technologies	See the following sections in the table of Chapter 5 5.1.2 Fisheries Sector 1. production (small-scale fisheries) (1) information collection technology, (2) information sharing technology, (3) technology to predict fishing grounds and catches		
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 0.5 billion yen C/P: xx yen		
Schedule	5 years		
Implementation organization	Counterpart: Director General of fisheries, Ministry of Agriculture		
Assumed concerns and countermeasures against them			
Value offered	• “The Project for Optimizing Mariculture based on Big Data with Decision Support System in Indonesia (2017-2022)” • “Project for Improvement of Fisheries Resource Management Equipment (2019-2020)”		

Source: JICA Study Team

10.4.3. Industrial Development

(1) Selection of Candidate Projects

In Tunisia, foreign companies account for 32% of the total employment though they just account for 5% of the total number of private companies of 84,283 in the manufacturing field (2018). The industries in which foreign companies account for 70% of the total number of companies include fiber, electricity/machine, metal products, foods/beverage, leather/shoes, etc. Most of them are labor-intensive export companies and the main market is the EU. Domestic companies account for 95% of the total number of companies but most of them are small and medium-sized companies.

In Tunisia, the domestic industries and small and medium-sized companies have to secure and reinforce international competitiveness because the abolition of tariff barriers has been proceeding with the conclusion of the partnership agreement with the EU. Among them, improvements in the technology level and productivity and industrial multilateralization are issues. Leading foreign export companies are independently promoting the necessary digitization of factories. On the other hand, factory digitization of small and medium companies is said to be delayed.

The Tunisian government is implementing policies to actively develop digital industries to become an innovation base in the African continent. For example, the “Startup Act,” which supports startups” was enacted in 2018, and incentives such as corporate tax exemption have been introduced. In Tunisia, startups using digital technologies are actively established because the university entrance ratio is high and there are many graduates from faculties of engineering. There are also some startups that support automation such as IoT of factories.

Under such circumstances, JICA implemented the “Project for the Establishment of the Vocational Training Center for the Electric and Electronics Industry” (February 2001 to January 2006) to support private sectors. This project supported electrical and electronic technology vocational training centers in order to improve the

quality of engineers in the electricity and electronics fields in Tunisia. After that, the quality/productivity improvement master plan survey (2006 to 2008) was implemented. Then, based on it, “Project on Quality/Productivity Improvement” was implemented for the purpose of the development of human resources that would propagate quality and productivity improvement activities. This project was implemented in two periods: phase 1 (October 2009 to May 2013) and phase 2 (January 2016 to December 2019).

Considering these, it is likely that this project will promote the utilization of digital technologies to support productivity, R&D, management, etc. with small and medium companies as the main targets. It is also important to involve local startups in such utilization of digital technologies.

As a result of the evaluation according to the evaluation criteria, the following shows the candidate projects (draft) for industrial development.

Table 10-21 Draft Candidate Projects for Industrial Development Sector in Tunisia

Theme	Overview	Support form
Factory improvement program using IoT (including enlightenment of managers and factory automation instructions)	IoT of factories represented by the monitoring of the machine operation status using sensors and devices supports kaizen activities by visualization of the on-site operations. Instruct the on-site introduction of IoT for small and medium-sized companies. Also make instructions about the enlightenment of IoT to managers, the automation of production lines, the reduction of energy consumption, etc.	Technical cooperation project
R&D support through the R&D support center business (including the establishment of a network of local fabrication laboratories)	Support the establishment of an R&D support center to be a model and reinforce the capabilities to instruct prototyping and incubation of small and medium-sized companies. In addition, raise the technology level of local fabrication laboratories with the R&D center as the core.	Technical cooperation project
Two-step loan for supporting digitization investments	Promote loans for digitization investments by small and medium-sized companies by two-step loans using yen loans.	Loans
Promotion of investments in the BPO business	Tunisia's potential of attracting investments in the business process outsourcing (BPO) business is considered to be high. Attract BPO business investments in Tunisia by foreign companies including Japanese companies.	Dispatch of JICA expert (investment advisor) /JETRO investment promotion service
Supporting of foreign direct investment through Japan's business support services	Support the entry of business support services using Japanese digital technologies into Tunisia by JICA's program for partnership with private sector. Support investments including the possibility of involvement of local startups.	Partnership with private sector

Source: JICA Study Team

The above draft candidate projects were classified into draft project plans and draft project concepts from the viewpoints of local needs and the possibility of implementation as a JICA's scheme.

Table 10-22 Evaluation of Draft Candidate Projects for Industrial Development of Tunisia

Candidate Project	Result of Classification	Reason
Factory improvement program using IoT (including	Draft Project Concept	In Tunisia, it is not able to initiate new technical cooperation projects. The incorporation of this candidate was considered as a

Candidate Project	Result of Classification	Reason
enlightenment of managers and factory automation instructions)		component in the project for industrial promotion through cluster development which is currently under preparation by JICA. The project is expected to focus on BDS, however, there is the possibility of incorporating the candidate project, IoT-based factory improvement, as a component. As the need for factory productivity improvement through the introduction of IoT was confirmed, the possibility of future project formation remains.
R&D support through the R&D support center business (including the establishment of a network of local fabrication laboratories)	Draft Project Concept	Ditto
Two-step loan for supporting digitization investments	Draft Project Concept	SMEs will need to raise investment capital to invest in digitalization. However, considering the current situation of SMEs, the need for digital technology is considered to be limited among their whole needs for capital investment. It is considered appropriate to consider a project of two-step loans for capital investment by SMEs and to include investment in digital technology as one of uses of loan.
Promotion of investments in the BPO business	Implementation by the private sector	The development of an investment environment (ecosystem) that encourages new investment by the private sector is considered a priority issue for promoting investment. Support for private-sector investment is possible, but it is considered difficult to formulate a project.

Source: JICA Study Team

(2) Draft Project Plans

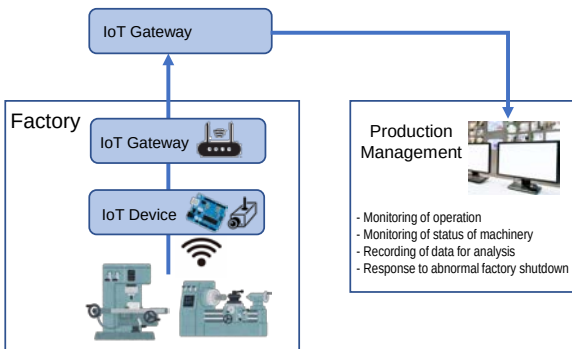
There are no candidate projects evaluated appropriate for Draft Project Plan for the industrial development in Tunisia.

(3) Draft Project Concepts

The following shows the details of Draft Project Concepts.

Candidate Project-30 Draft Project Concept for Industrial Development Sector in Tunisia: IoT-Based Factory Improvement Program

Project name	IoT-based factory improvement program
Current conditions and development issues of the target sectors	With the progress of the shift to IoT of factories represented by the Fourth Industrial Revolution, the manufacturing industry is forced to invest in digitization. There is a trend to promote the Fourth Industrial Revolution in Tunisia as well. Leading companies are independently promoting the necessary digitization of factories. On the other hand, factory digitization of small and medium enterprises is said to be delayed. It is unrealistic for small and medium-sized companies to introduce a large-scale IoT system and shift to smart factories at once. It is realistic for small and medium-sized companies to promote IoT of factories step by step in response to the on-site issues and link it to kaizen activities. The monitoring of the machine operation status by sensors and devices is an example. In addition, the monitoring of the use of energy and water can reduce costs.

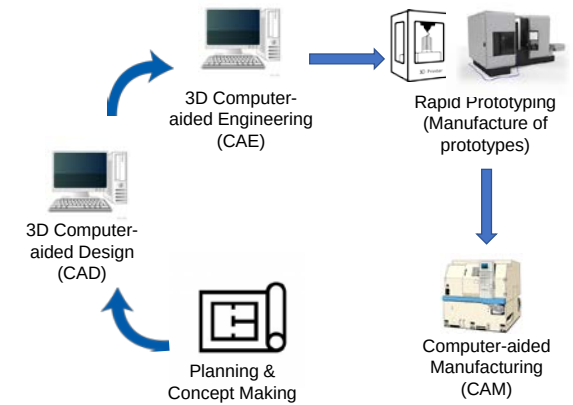
	In many cases, small and medium-sized companies lack technology information on the utilization of AI and diagnostic imaging technologies and factory automation using automation machines and robots and knowledge on the desirable procedure. Especially, there is a problem with the understanding of the top management. Support for activities for IoT by small and medium-sized companies in Tunisia is expected to contribute to an improvement in the productivity of factories of small and medium-sized companies.
Assistance scheme to be applied	Technical cooperation project
The objective of the project	To improve productivity by the promotion of the introduction of IoT in factories of small and medium-sized companies and the utilization of digital equipment.
Effect of the project	Productivity improvement by the introduction of IoT in factories of small and medium-sized companies and the automation of production lines. Efficiency improvement of the use of energy and water is also expected.
Overview of the project	This project performed the following activities in order to promote IoT of factories of small and medium-sized companies. • Set up a unit that instructs IoT to companies in the Ministry of Industry, Energy, and Mines (MIEM). • Creation of an instruction curriculum (creation of IoT devices to digitize and send the on-site environment to the Internet, construction of a system that receives data sent from IoT devices on a cloud, utilization of data for kaizen activities, etc.) • Provide education and training to small and medium-sized companies. Make engineers of companies be able to introduce IoT independently by hands-on training. Also, make instructions about the automation of production lines. • Make on-site instructions for the introduction of IoT in small and medium-sized companies. • Perform enlightenment activities for on-site IoT and automation
Digital technologies and element technologies of digital services	This project makes instructions for the introduction of IoT technologies by companies.  <pre> graph TD subgraph Factory IG1[IoT Gateway] ID[IoT Device] IG1 --- ID end IG1 --- IG2[IoT Gateway] IG2 --- PM[Production Management] PM --- M[Monitoring of operation] PM --- MS[Monitoring of status of machinery] PM --- R[Recording of data for analysis] PM --- RS[Response to abnormal factory shutdown] </pre>
Data acquisition (input)	Remote monitoring (machine operation status, operating status of heat-treating furnaces, heat treatment temperature, and product manufacturing status by sensors)
Technologies related to data acquisition	IoT devices (which consists of sensors, actuators, communication modules, MCU, etc.; sensors including optical sensors, temperature sensors, distance sensors, acceleration sensors, gradient sensors, sound sensors, etc.), CCD camera IoT gateway, IoT server, etc.
Technologies usable for the data processing part	Display and recording of monitoring data obtained by sensors, monitoring data analysis using AI, and image analysis using AI
	Abnormality detection of equipment, monitoring of the operation status of equipment, monitoring of the product manufacturing status, remote operations of machines, defective product check by image analysis, energy-saving of factory management, etc., based on the monitoring result displayed on PC.
Data administrator	Companies that will introduce IoT technologies

Provided values	Values which companies can obtain: This project enables to realize IoT with extremely small costs making use of knowledge obtained from on-site operations in small and medium-sized manufactures through technical instructions to companies. The following effects are expected: for example, the introduction of a system in old production facilities, acquisition of data necessary for kaizen activities, sharing of production information among departments, and high accessibility of production information for on-site workers.
Examples of usable digital technologies	See the case of “(3) Embedding in sensor machines” in 5.2.3. Use cases of digital technologies which contribute to Industrial Development in 5.2 Industrial Development sector of Chapter 5. It is also a possibility to combine with the case of “(2) Introduction of digital technologies to support kaizen” as support for kaizen activities. It is also a possibility to provide workshop-style training by introducing IoT in factories of small and medium-sized companies. For the training curriculum, the case of four-day training of Factory Scientist below can be used as a reference. Day 1: Basics of the local system (development of IoT devices using Arduino (hands-on training) and creation of parts using a 3D printer (hands-on training)) Day 2: Basics of the server system (construction of the data reception system using Microsoft Azure (hands-on training) and knowledge on a database) Day 3: Data processing and visualization (basics of statistics necessary for the utilization of data and visualization extracting data and using BI tools (hands-on training)) Day 4: Visualization and further pursuit of visualization (application of visualization to business and methods for acquisition of more data (hands-on training))
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 500 million yen Accepting country: XX million yen
Schedule	3 years
Implementation organization	Partner institution of the other party: Ministère de l'Industrie, de l'Energie et des Mines (MIEM) Related institutions of the other party:
Assumed concerns and countermeasures against them	• It is important to cooperate with the departments which instruct kaizen of MIEM to make use of the experiences of the project on quality/productivity improvement. • GIZ supports Industry 4.0 of Tunisia and the digital solutions of Tunisian companies in the Industry 4.0 Center in Sousse and Sfax. The instructions combining IoT, and kaizen methods implemented in this project will be able to be demarcated and combined with the support of GIZ. • It is necessary to consider the current state of production lines of small and medium-sized enterprises and the proposal of digital technology considering the optimum digitization. • It is also a possibility that in the IoT-based factory improvement is includes in association with BDS support in the industrial development project through cluster development currently under consideration.
JICA projects with which collaboration is expected	• Industrial development project through cluster development

Source: JICA Study Team

**Candidate Project 31 Draft Project Concept for Industrial Sectors in Tunisia:
R&D Support by Strengthening Function of the R&D Support Center**

Project name	R&D support by strengthening function of the R&D support center
Current conditions and development issues of the target sectors	Prototyping for the development of new products by companies requires machines such as injection molding machines of resin, metal cutters, print board fabrication machines. Recently, 3D printers have come to be used for prototyping. Companies fabricate prototypes with in-house facilities or outsource prototyping to external specialized companies. In Tunisia, outsources were very limited due to the delayed development of the supporting industry. Recently, several fabrication laboratories have been established in Tunisia, which provides users with equipment for prototyping such as print board fabrication machines and 3D printers. Such fabrication laboratory facilities can be used for prototyping. Prototyping using digital technologies by small and medium-sized companies requires technologies of 3D programming and simulation. It is meaningful to reinforce the R&D activities of small and medium-sized companies by the implementation of technical instructions to improve the R&D capabilities such as prototyping of small and medium-sized companies.
Assistance schemed to be applied	Technical cooperation project
The objective of the project	To support prototyping by providing technical instructions on R&D and prototyping equipment to small and medium-sized companies including startups by setting up the R&D support centers. The target products are assumed to be electric and electronic equipment (including digital equipment).
Effect of the project	Reinforcement of the R&D capabilities of small and medium-sized companies including startups to enable smooth and quick prototyping and activate the development of new products.
Overview of the project	This project performed the following activities in order to support the R&D activities of small and medium-sized companies. • Set up R&D support centers using existing facilities (existing theme parks, fabrication laboratories, universities, etc.). • Prepare the necessary materials and equipment as the base of digital fabrication. • Create curriculums for R&D instructions and digital fabrication and provide education and training. • Instruct and support prototyping of companies. • Promote business-academia R&D and open innovation. • Establish a network of domestic fabrication laboratories and support the improvement in technical capabilities. Also, reinforce collaboration and complements relationships.
Digital technologies and element technologies of digital services	This project supports the product development process by companies by using development tools based on digital technologies. The main technologies to be used are as follows. - 3D Computer-Aided Design (CAD): Handle 3D shapes and design using computers. - 3D Computer-Aided Engineering (CAE): Analyze the 3D design data (logical simulation, structural analysis, etc.) using computers. - Rapid Prototyping: Create prototypes in short term with 3D printers, machining centers, etc. using 3D CAD data. - Computer-Aided Manufacturing (CAM): Create manufacturing data in the form of numerical control (NC) data and deliver it to the manufacturing line.

 This project does not apply to projects manufactured in cyber-physical system environments adopted in large companies but aims to support on-side product development in small and medium-sized companies.	
Data acquisition (input)	Before design: Product development concept and design review result which summarize the objective of product development, the product concept, the final specifications of the product, the required functions of products, etc. After design: 3D design data After computer analysis: Structure analysis results and test results by computers After prototyping: Prototype and prototype evaluation result, bill of materials, and NC data
Technologies related to data acquisition	Design: 3D CAD system Computer analysis: 3D CAE system Prototyping: 3D printer and machining center Production: CAM system and CNC machine
Technologies usable for the data processing part	Design: 3D CAD system Computer analysis: 3D CAE system Prototyping: 3D printer and machining center Production: CAM system and CNC machine
Output	Quick prototyping using 3D printers, etc. and NC data to be applied to the production line
Data administrator	Companies that develop products and, in some cases, universities, fabrication laboratories, CETIME, etc. which provide instructions and support
Provided values	Values which companies can obtain: - Deepening of understanding of small and medium-sized companies including startups (hereinafter the same) by training for product development using digital technologies. - Acquisition of the CAD/CAE/CAM operation skills by small and medium-sized companies through training of CAD/CAE/CAM. - Support the product development of small and medium companies by lending CAD/CAE/CAM computers in facilities.

	- Support the product development of small and medium companies by lending 3D printers and machining centers in facilities. - Support the product development of small and medium-sized companies by providing various advice regarding product development to small and medium-sized companies. This project enables the commercialization of ideas of on-site workers and accelerates the product development process in small and medium-sized manufacturers by providing the following technical instructions regarding product development to small and medium-sized companies. The promotion of collaborations among small and medium-sized companies is also expected. In the prototyping of parts, there are many manual processes and sufficient accuracy cannot be obtained in many cases. Direct cutting work using 3D data can shorten the prototyping time. It also enables prototyping independent from the skills of experienced workers.
Examples of usable digital technologies	See the case of "(1) Prototype design and fabrication using digital technologies" in 5.2.3. Use cases of digital technologies which contribute to Industrial Development in 5.2 Industrial Development sector of Chapter 5. Support the prototyping and commercialization processes with 3D printers and CNC machines from a design by 3D CAD/CAM.
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 500 million yen Accepting country: XX million yen
Schedule	3 years
Implementation organization	Partner institution of the other party: Ministère de l'Industrie, de l'Energie et des Mines Related institutions of the other party:
Assumed concerns and countermeasures against them	• The candidates for R&D support centers include Centre Technique des Industries Mécaniques et Electriques (CETIME), techno parks, universities, etc. For the determination, it is necessary to evaluate their owned facilities, human resources, locations, etc. as well. • It also includes the provision of the necessary equipment as needed. • It is important to establish a network of the existing fabrication laboratory and construct a complement relationship.
JICA projects with which collaboration is expected	• Industrial development project through cluster development

Source: JICA Study Team

Candidate Project 32 Draft Project Concept for Industrial Development Sector in Tunisia: Two-step Loan for Supporting Digitization Investments

Project name	Two-step loan for supporting digitization investments (This project envisages the provision of medium- to long-term two-step loans (TSL) to small and medium-sized enterprises (SMEs), of which digitalization investment is one of targets. The following project description focuses on the financing of digitization investments.)
Current conditions and development issues of the target sectors	With the progress of the shift to IoT of factories represented by the Fourth Industrial Revolution, the manufacturing industry is forced to invest in digitization. There is a trend to promote the Fourth Industrial Revolution in Tunisia as well. In Tunisia, the development of the medium and long-term financial market is delayed, so financing is an issue in investments in digitization of factories by small and medium-sized companies. There exists demand for funds for not only the arrangement of digital production infrastructures but also the foundation of new companies. Under these circumstances, the provision of medium and long-term finance to small and medium companies is much-needed support. JICA has provided a

	two-step loan of 6.28 billion yen through a private investment support project by yen loans (2007 to 2011) in order to promote a foundation of new small and medium-sized companies and the expansion of the scales of the existing companies by providing medium and long-term finance with low interest to small and medium-sized companies. Provide a two-step loan to small and medium-sized companies in response to the digital age based on this lesson learned.
Assistance scheme to be applied	Loans
The objective of the project	To contribute to the reinforcement of the industrial competitiveness, industrial multilateralization, and creation of new employment in Tunisia through the promotion of investments in digitization by small and medium-sized companies and foundation of new companies by supplying medium and long-term finance to small and medium-sized companies.
Effect of the project	Reinforcement of the industrial competitiveness of Tunisia and creation of new employment thanks to increases in digitization investments by small and medium-sized companies and foundation of new companies.
Overview of the project	This project provides medium and long-term two-step loans (TSL) to small and medium-sized companies. • Provide subleasing loans for digital investments to small and medium-sized companies through subleasing from Banque de Financement des Petites et Moyennes Entreprises (BFPME) to intermediary financial institutions (PFI). • The target companies are companies that provide manufacturing and manufacturing support services, and the target purposes of use of funds are the investments funds necessary for digitization investments and the foundation of new companies. • For project formation, the digital technology consultant employed for the project will provide advice on the introduction of digital technologies to the candidate companies and evaluate the validity of the investment plan.
Digital technologies and element technologies of digital services	This project supports funds necessary capital investments for the introduction of digital technologies by companies. The assumed target digital technology investments are as follows: - Investment in smart factories; - Investment in manufacturing line automation; - Robot investment; - Introduction of a CAD/CAE system; - Introduction of CNC machine; - Introduction of 3D printers; - Introduction of a business management system; - Start of new services using digital technologies, etc.
Data acquisition (input)	-
Technologies related to data acquisition	-
Technologies usable for the data processing part	-
Output	-
Data administrator	Companies that invest in digital technologies
Provided values	Values which companies can obtain: Enable the realization of digitization of companies by long-term loans to digital technology investments by companies. Values which the government can obtain: The productivity and competitiveness of the entire industry are improved thanks to the progress of the introduction of digital technologies in the industry of Tunisia.

Examples of usable digital technologies	The assumed loan targets are the projects for the utilization of digital technologies shown 5.2.3. Use cases of digital technologies which contribute to Industrial Development in 5.2 Industrial Development sector of Chapter 5.
Approximate project cost (human resources, materials and equipment, etc.)	Japan: 4 to 8 billion yen (loan funds, TA, etc.) Accepting country: XX million yen
Schedule	5 years
Implementation organization	Partner institutions of the other party: Ministère de l'Industrie, de l'Energie et des Mines, Banque de Financement des Petites et Moyennes Entreprises (FPME) Related institutions of the other party: PFI (intermediary financial institutions)
Assumed concerns and countermeasures against them	• It is necessary to form a project based on the lessons learned from private investment support projects. • It is necessary to confirm the conditions of the financial market, the needs for funds assumed loan target companies, etc. For the confirmation of the needs for funds, the attitudes of companies toward DX and the non-physical aspects such as the availability of human resources who will play a key role in digitization. • There is a possibility that the purposes of the use of funds may not be limited but cover a wide range of capital investments by small and medium-sized companies. • It is necessary to consider demarcation and cooperation with loan schemes for small and medium-sized companies of other donors. • It is also important to find promising loan projects by collaborating with projects such as "factory improvement program using IoT" and "R&D support through the R&D support center project" mentioned above.
JICA projects with which collaboration is expected	• Industrial development project through cluster development

Source: JICA Study Team

10.4.4. Transport

(1) Selection of Candidate Projects

As a result of the evaluation of projects of the utilization of digital technologies according to the evaluation criteria, the following shows the candidate projects (draft) for the transport sector.

From the viewpoint of transport issues, the support to establish (or prepare) framework to realize effective utilization of transport data is the basis for various measures, so its priority is considered to be high. In addition, high-standards roads will be increasingly constructed and the problems such as road surface damage and accidents caused by overloaded vehicles have already become apparent in some toll road sections. For this reason, it is considered that the priority of support for strengthening the operation and maintenance capacity of toll roads using digital technology is high.

Table 10-23 Draft Candidate Projects for the Transport Sector in Tunisia

Theme	Overview	Support Form
Consideration of measures and support for the preparation of frameworks for the utilization of traffic data and digital technologies and data platform	To handle various urban transport issues, support the establishment of frameworks including rules, systems, and organizations to enable effective utilization of data and digital technologies in the transport field.	Data collection survey and development study
Support for the reinforcement of the	In Tunisia, national toll roads and high-standard road networks are in the process of being developed, but the authorities and road operators do not have sufficient experiences of operation	Technical cooperation project

Theme	Overview	Support Form
operation and maintenance capabilities of toll roads	and maintenance of toll roads and facilities. Thus, the reinforcement of the operation and maintenance capabilities using the effective utilization of data will be supported.	
Support for the reinforcement of the traffic safety capabilities using digital technologies	Support for the reinforcement of the traffic management capabilities and promotion of the propagation of traffic safety actions and culture using digital technologies such as an improvement in the reliability of traffic accident data and analysis of and formulation of countermeasures against traffic accidents.	Technical cooperation project
Support for the introduction of a smart traffic management system	Introduce a traffic signal system using digital technologies for countermeasures against traffic jams in the capital area.	Grants and loans
Support for the reinforcement of the traffic management capabilities	Support the reinforcement of the operation and maintenance capabilities of the introduced system mentioned above and the urban traffic management capabilities using digital technologies.	Technical cooperation project

Source: JICA Study Team

The above draft candidate projects were classified into draft project plans and draft project concepts from the viewpoints of local needs and the possibility of implementation as a JICA's scheme.

Table 10-24 Evaluation of Draft Candidate Projects for Transport Sector of Tunisia

Candidate Project	Result of Classification	Reason
Consideration of measures and support for the establishment of frameworks for the utilization of traffic data and digital technologies	Draft Project Plan	As various traffic data are becoming available, it is highly necessary to formulate, implement, and evaluate objective and quantitative traffic policies based on traffic data in order to respond to urban traffic issues.
Support for the reinforcement of the operation and maintenance capabilities of toll roads	Draft Project Concept	The development of expressway is increasingly underway in Tunisia but there is not enough experience of operation and maintenance. It is required to maintain an efficient and uniform highway service level nationwide by utilizing digital technology.
Support for the reinforcement of the traffic safety capabilities using digital technologies	Draft Project Concept	In relation to the above, the major issues are the deterioration of traffic safety due to overloading of large vehicles and the improvement of traffic safety in the city. There is a need to strengthen traffic safety capabilities using digital technology.
Support for the introduction of a smart traffic management system	Draft Project Concept	Although traffic congestion is occurring during peak hours in urban areas, it is a local situation at this stage. So, it can be judged that it is appropriate to place more focus on improvement of ability for controlling traffic and safety.
Support for the reinforcement of the traffic management capabilities	Draft Project Concept	

Source: JICA Project Team

(2) Draft Project Plans

The following shows the details of Draft Project Plans.

Candidate Project-33 Draft Project Plan for the Transport Sector of Tunisia:
Support for Formulating a Framework for Transportation Data Platform and Data Use

Project name	Support for formulating a framework for transportation data platform and data use
Current conditions and development issues of the target sectors	Due to the size of the population and cities in the major cities of Tunisia, the major cities such as Tunis are not suffering from chronic traffic congestion, but the dependence on road traffic for land transport is high. Dependency rate of 90% or more for passengers and 80% or more for cargo and especially in urban areas, there are various transport issues. The main issues are improvement of traffic safety, maintenance of road infrastructure, appropriate management of city traffic, operation of expressways and measures against overloaded vehicles, and improvement of convenience of public transport services. In recent years, the Ministry of Transport has formulated the "Smart Mobility Plan" in Tunisia. The Ministry of Transport has also attempted to develop a transport data platform, but it is still limited to basic ones.
Applicable scheme of JICA	Development Study
Objectives of the project	To support the formulation of the necessary frameworks and data platform for the utilization of traffic data and digital technologies to solve traffic issues.
Effect of the project	Appropriate utilization of traffic data and digital technologies to solve traffic issues Planning and implementation of measures for city and traffic problems based on the utilization of traffic data.
Overview of the project	In order to respond to various urban transport issues, the frameworks and systems that enable the utilization of various data in the transport field in Tunisia, and necessary measures will be studied. The preparation of a traffic data platform that enables efficient data utilization will also be supported. In the transport field as well, with the progress of digital technology, it has become possible to utilize traffic data and information technology to solve various traffic problems. For example, data related to the behavior history of people and vehicles is being accumulated through private ride-sharing services and smartphones owned by citizens. If these can be utilized in the public sector, it will be possible to formulate, implement, and evaluate various transport measures based on quantitative demand analysis. However, rules and systems are needed to efficiently utilize private sector data in the public sector. When cracking down on traffic violation vehicles using information technology, it is necessary to link vehicle information with traffic data. However, in order to secure this, it is necessary to cooperate in terms of vehicle inspection system and vehicle tax. Based on these, the following will be considered in this project. - Reviewing Smart Mobility Plan and related projects - Identifying the technologies that can be used to solve urban transport issues in the country - Consideration of frameworks to enable the utilization of data related to these technologies - Consideration of the implementation system for the efficient collection, accumulation, and utilization of data - Consideration of cooperation with local private companies - Consideration of improvement of traffic data platform which has been under preparation by Ministry of Transport of Tunisia
Digital technologies, element technologies for digital services	Introducing technologies that can be used to solve urban traffic issues, incorporating the data collected from them into the traffic data platform considering sophistication.
Input Data	Movement of people and vehicles
Technologies for obtaining data	Probe data collection: Latitude / longitude information based on GPS from smartphones and in-vehicle devices Mobile phone base station data collection of telecommunications carriers

	Movement information obtained from RFID Image analysis utilizing AI technology Transport electronic payment		
Technologies for data processing	Statistical processing (probe, base station data, RFID, image analysis, electronic payment for transport) Map matching (probe, base station data) Analysis by machine learning (image analysis), etc.		
Output	Movement speed analysis result, movement route analysis result, OD analysis result, demography, traffic volume statistics result by vehicle type, sudden event tendency analysis result, secular change of these, etc. Utilizing for various road traffic measures based on these (traffic information provision, road network development plan, public transport network development plan, etc.)		
Data administrator/owner	Traffic administrator, Public transport operator, Road administrator, Communication carries		
Provided Value	For Government: - Saving in economic loss due to improvement of road and traffic management and traffic congestion	For transport Operators - Increase in revenue due to improvement of transport service and traffic congestion	For General Citizen - Enhancement of convenience and reliance of travel due to improvement of transport service and traffic congestion
Examples of usable digital technologies	See the following parts Table 5-1 in 5.3 Transport sector of Chapter 5: 1. Technologies using traffic big data (1) Utilization of probe data, (2) Utilization of mobile phone base station data, (3) Utilization of image analysis and AI technologies 2. Traffic control and traffic management (2) Utilization of the RFID technology		
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 100 million yen Accepting country: XX million yen		
Schedule	1 year		
Implementation organization	Implemented by: Ministry of Transport (ITS Cell) Support: Other related institutions (including local private companies)		
Assumed concerns and countermeasures against them	In recent years, the Ministry of Transport has formulated the "Smart Mobility Plan" in Tunisia. Thus, it shall be reviewed and additional necessary measures shall be proposed. In addition, the Ministry of Transport is currently working on development of a transportation data platform. It is important to thoroughly check the added new functions of the transportation data platform that is currently being developed at the time of project implementation, and to make necessary and appropriate inputs.		
JICA projects with which collaboration is expected			

Source: JICA Study Team

(3) Draft Project Concepts

The following shows the details of Draft Project Concepts.

Candidate Project-34 Draft Project Concept for the Transport Sector of Tunisia:
Project for Capacity Development of Toll Road Management Utilizing Digital Technology

Project name	Project for capacity development of toll road management utilizing digital technology	
Current conditions and development issues of the target sectors	Road transport in Tunisia is mainly by road (more than 90% for passengers and more than 80% for freight), and the impact of road development on the country's economic activities is great. In addition, the long-term basic strategy of the road sector is stipulated in the "Road Bridge Bureau Strategy 2030", and a medium-term plan is formulated every five years. Above all, highway development is regarded as important, and the current 360km is planned to be expanded to 1,210km by 2030. In this way, in Tunisia, while full-scale development of high-standard roads is underway in the future, most of the equipment for operation and maintenance have not yet been introduced in the serviced sections except for some toll collection systems. In addition, as high-standard roads are being developed, related organizations have pointed out concerns about safety and road pavement management due to overloaded vehicles. Under such circumstances, capacity building for sustainable highway management is required.	
Applicable scheme of JICA	Technical cooperation project	
The objective of the project	To reinforce the tolled road management capabilities using digital technologies	
Effect of the project	Improvement in the operation and maintenance capabilities for traffic control on tolled roads Improvement in the operation and maintenance capabilities for toll collection on tolled roads	
Overview of the project	The operation of tolled roads is roughly divided into traffic control and toll collection operations. The objective of traffic control is to improve and maintain the safety and service quality of expressway space where vehicles move at a high speed; the main objective of toll collection is to secure funds for sustainable management of tolled roads. In this project, the operation and maintenance capabilities will be reinforced. The following items to be reinforced are also included in the project. The institutional and organizational structure for the sustainable operation and maintenance of tolled roads, Capabilities for procurement, project management and monitoring in the stages of the construction of roads and the introduction of equipment and systems. Capabilities of the efficient utilization of IT systems and data through these activities.	
Digital technologies, element technologies for digital services	Through systems using IT technology and efficient use of data, it supports the strengthening of operation and maintenance capabilities for the sustainable operation of toll roads.	
Theme	Traffic Management	Toll Collection
Input Data	Traffic volume, traffic flow, traffic event information (accidents, falling objects, traffic violations, etc.), weather information, and other related information (construction schedule information, etc.)	Information for determination of fare based on driving history (vehicle type, entrance / exit information, etc.)
Technologies for obtaining data	Traffic counters, CCTV, weather sensors, axle load measurement, etc.	RFID, DSRC, GNSS
Technologies for data processing	Traffic statistics processing, image analysis, traffic event management, etc.	(Processing based on the above and system on the central side)
Output	Traffic information, various highway traffic management, emergency response	Highway / toll road toll collection
Data administrator/owner	Highway operator	Highway operator

Provided Value	For Government: Reduction of economic loss due to congestion alleviation on highways and entrances and exits	For Highway Operator Improvement of business feasibility due to efficiency of toll collection	For Road Users Enhancement of convenience of mobility due to alleviation of congestion and improvement of traffic safety on highway
Examples of usable digital technologies	See the following parts Table 5-1 in 5.3 Transport sector of Chapter 5: 3. Management of expressways (1) Traffic control system (2) Toll collection system (3) Application of the overloading detection system and probe technologies		
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 300 million yen Accepting country: XX million yen		
Schedule	3 years		
Implementation organization	Supervised by: Ministry of Public Works, Ministry of Transport Road Bridge Bureau Implemented by: Societe Tunisie Autoroutes: STA Supported by: Other related institutions		
Assumed concerns and countermeasures against them	In Tunisia, the method of automatic toll collection (ETC) has not been standardized at the time of this survey. If it is not standardized at the time of implementation of the proposed project, it is recommended to consider adding scope for support for standardization.		
JICA projects with which collaboration is expected			

Source: JICA Study Team

Candidate Project-35 Draft Project Concept for the Transport Sector of Tunisia:
Support for the Establishment of Smart Traffic Management System in the Tunis Metropolitan Area

Project name	Support for the establishment of smart traffic management system in the Tunis metropolitan area
Current conditions and development issues of the target sectors	In the Tunis metropolitan area, although constant and chronic traffic congestion has not yet become serious due to the size of the city and population, there are some areas where the traffic congestion occurs especially during peak hours in the morning and evening in the city. In such places, improper signal installation locations and undeveloped pedestrian signals are one of the factors that hinder proper traffic flow. In addition, there are concerns about traffic safety due to these factors, and local government agencies have pointed out the need to improve traffic management in the city.
Applicable scheme of JICA	Grant aid project
The objective of the project	Introduction of a traffic light system using digital technologies in the urban area of Tunis
Effect of the project	Improvement in the urban traffic flow, which mitigates traffic jams. Improvement in traffic safety by smoothened traffic flow.
Overview of the project	The project includes the following items - Introduction of Japanese traffic light equipment for the main intersections in the city (up to about 10 to 20 locations). - Introduction of a center system in addition to roadside traffic light accidents. - Installation of vehicle traffic light and passenger traffic light equipment for separation of pedestrians and vehicles in the city (temporal and spatial separation between pedestrians and vehicles) in order to smoothen the traffic flow and improve traffic safety. - Improvement of the intersections where traffic light equipment is to be installed. - Study of the necessity for the replacement of the existing traffic light equipment. The examples of the utilization of digital technologies are:

	- Mitigation of traffic jams by grasping, analyzing, and predicting the real-time traffic volume with sensors		
Digital technologies, element technologies for digital services	Aiming to alleviate traffic congestion by grasping, analyzing, and predicting real-time traffic volume with sensors		
Input Data	Traffic Volume at intersection		
Technologies for obtaining data	Traffic counter, CCTV, probe, etc.		
Technologies for data processing	Statistic processing for traffic volume, image analysis, generation of traffic signal control parameters based on input data, etc.		
Output	Traffic signal control (area control, corridor control, etc.)		
Data administrator/owner	Traffic administrator		
Provided Value	For Government: Saving in economic loss due to improvement of road and traffic management and traffic congestion	For Traffic Administrator Increase in efficiency of traffic management	For General Citizen Enhancement of convenience and reliance of travel due to improvement traffic congestion
Examples of usable digital technologies	See the following parts Table 5-1 in 5.3 Transport sector of Chapter 5: 2. Traffic control and traffic management (1) Signal control and related technologies (2) Utilization of RFID technologies		
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 400 to 700 million yen Accepting country: XX million yen		
Schedule	3 years		
Implementation organization	Implemented by: Tunis traffic police Supported by: Tunis city and other related institutions		
Assumed concerns and countermeasures against them	- It is important whether the agreement and approval of Tunis traffic police can be obtained. - Since this project adopts grants, the presence of a Japanese traffic light manufacturer who is willing to enter the market of the target country and make a bid for this project. - It is necessary to reinforce the sustainable operation and maintenance capabilities of the managers (traffic police and related institutions) for the traffic light equipment introduced in this project. Therefore, it is recommended to implement a technical cooperation project in parallel to this project.		
JICA projects with which collaboration is expected	- Support project for the reinforcement of the traffic management capabilities in the urban area of Tunis (Project proposed in this survey: Support for the reinforcement of the operation capabilities of traffic lights) - Loan project (next stage): This grant project introduces traffic light equipment in the center of the city limiting the target area, but it is recommended to expand the target area by a loan project to proceed with stepwise arrangements.		

Source: JICA Study Team

**Candidate Project-36 Draft Project Concept for the Transport Sector of Tunisia:
Project for the Capacity Building of Traffic Management in the Tunis Metropolitan Area**

Project name	Project for the capacity building of traffic management in the Tunis metropolitan area
Current conditions and development issues of the target sectors	In the Tunis metropolitan area, although constant and chronic traffic congestion has not yet become serious due to the size of the city and population, there are some areas where the traffic congestion occurs especially during peak hours in the morning and evening in the city. In such places, improper signal installation locations and undeveloped pedestrian signals are one of the factors that hinder proper traffic flow. In addition, there are concerns about traffic safety due to

	these factors, and local government agencies have pointed out the need to improve traffic management in the city. In connection with this, it is important to strengthen the operation and maintenance capacity of traffic signals and traffic management in the city.		
Applicable scheme of JICA	Technical cooperation project		
The objective of the project	Reinforce the capabilities for traffic management using digital technologies in the urban area of Tunis		
Effect of the project	Reinforcement of the road traffic management system and capabilities Mitigation of traffic jams in the city thanks to the reinforcement, which improves the traffic safety		
Overview of the project	“Support project for the introduction of the smart traffic management system for the urban area of Tunis in Tunisia (grants)” proposed in this survey introduces traffic light equipment using digital technologies in the center area of the city as the target area. It is also recommended to expand the target area through a loan project as the succeeding project. Aiming at synergy with these projects, this project supports the reinforcement of the operation and maintenance capabilities for the traffic light system to be introduced for the Tunis traffic police, the government of Tunis, etc., which are traffic administrators, and the capabilities for traffic management in the city. The following capabilities will be mainly reinforced: - Operation and maintenance capabilities of the traffic light system; - Reinforcement of the road traffic management system in the city; - Capabilities to collect and analyze road traffic information/data; - Capabilities to formulate and implement road traffic regulation measures; - Capabilities to carry out intersection improvement		
Digital technologies, element technologies for digital services	Introducing signal equipment that utilizes digital technology to support the enhancement of operational and maintenance capabilities related to signal systems and the capacity related to traffic management in the city.		
Input Data	Traffic Volume at intersection		
Technologies for obtaining data	Traffic counter, CCTV, probe, etc.		
Technologies for data processing	Statistic processing for traffic volume, image analysis, generation of traffic signal control parameters based on input data, etc.		
Output	Traffic signal control (area control, corridor control, etc.)		
Data administrator/owner	Traffic administrator		
Provided Value	For Government: Saving in economic loss due to improvement of road and traffic management and traffic congestion	For Traffic Administrator Increase in efficiency of traffic management	For General Citizen Enhancement of convenience and reliance of travel due to improvement traffic congestion
Examples of usable digital technologies	See the following parts Table 5-1 in 5.3 Transport sector of Chapter 5: 2. Traffic control and traffic management (1) Signal control and related technologies (2) Utilization of RFID technologies		
Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 300 million yen Accepting country: XX million yen		
Schedule	3 years		
Implementation organization	Implemented by: Tunis traffic police, Tunis City Supported by: Other related institutions		
Assumed concerns and countermeasures against them	- It is important whether the agreement and approval of Tunis traffic police can be obtained.		
JICA projects with which collaboration is expected	- Project for introduction of the smart traffic management system for the urban area of Tunis in Tunisia (grant project proposed by this survey)		

Source: JICA Study Team

**Candidate Project-37 Draft Project Concept for the Transport Sector of Tunisia:
Project for Capacity Development of Traffic Safety in Tunis Using Digital Technology**

Project name	Project for capacity development of traffic safety in Tunis using digital technology		
Current conditions and development issues of the target sectors	The Tunis metropolitan area of Tunisia is the country's largest city with a population of over 1.7 million. The dependence on road transport for land transport is high (more than 90% for passengers and more than 80% for freight), and there are various transport problems especially in urban areas. Above all, the lack of traffic manners of citizens causes traffic accidents, and these are factors that further worsen traffic congestion. In such a situation, improvement of traffic manners of road users and strengthening of traffic safety management capability on the management authority side are required, and similar points have been pointed out by related organizations in the country.		
Applicable scheme of JICA	Technical cooperation project		
The objective of the project	To reinforce the capabilities for traffic safety		
Effect of the project	Improvement in the traffic manner of road users Reinforcement of the traffic safety management capabilities of the authorities Improvement in traffic jams and promotion of traffic safety through such improvement and reinforcement		
Overview of the project	To improve the reliability of traffic accident data, reinforce the capabilities to analyze and formulate countermeasures against traffic accidents, and promote the propagation of traffic safety actions and culture in the capital area of Tunis in Tunisia. In addition, it aims to decrease traffic accidents by improving the organizational capabilities and implementation capabilities for the road traffic safety of the Tunis traffic police and the traffic environment of Tunis. The activities also include the formulation of a traffic safety education curriculum, the public relations for traffic safety, analysis of and countermeasures against traffic accidents, the arrangement and utilization of data for traffic, accidents, etc. and arrangement of the surrounding environment/preparation of the mechanism for them, the formulation, implementation, and evaluation of plans for traffic regulations and enforcement, and support for the reinforcement of the capabilities for cracking down on traffic violations, etc.		
Digital technologies, element technologies for digital services	Utilizing digital technology, it aims to improve the reliability of traffic accident data, strengthen the ability to analyze traffic accidents and formulate countermeasures, and promote traffic safety behavior and culture.		
Input Data	Traffic volume, accident information, traffic event information, various information about road accessories, etc.		
Technologies for obtaining data	Traffic counter, CCTV, probe information collection, speed gun, RFID, ANPR (automatic number plate recognition), etc.		
Technologies for data processing	Accident database construction, image analysis, vehicle-specific traffic statistics, traffic event statistics, OD analysis, etc.		
Output	Accident database, various statistics and analysis results above, crackdown → Strengthening traffic safety capabilities using these		
Data administrator/owner	Traffic administrator, Road administrator		
Provided Value	For Government: - Reduction of economic loss due to improved traffic safety	For Traffic Administrator - Improvement of traffic safety measures and response capabilities	For General Citizen - Enhancement of convenience and reliance of travel due to improvement traffic safety
Examples of usable digital technologies	See the following parts Table 5-1 in 5.3 Transport sector of Chapter 5: 1. Technologies using traffic big data (3) Utilization of image analysis and AI technologies 2. Traffic control and traffic management (1) Traffic light control and related technologies (2) Utilization of the RFID technology In addition to these, accident database, accident information management system, etc.		

Approximate project cost (human resources, training, materials and equipment, etc.)	Japan: 300 million yen Accepting country: XX million yen
Schedule	3 years
Implementation organization	Implemented by: Tunis traffic police Supported by: Other related institutions
Assumed concerns and countermeasures against them	- It is important whether the agreement and approval of the Tunis traffic police can be obtained.
JICA projects with which collaboration is expected	

Source: JICA Study Team