Data Collection Survey on the Digitalization of the National Identification System in the Republic of Senegal

Final Report

January 2022

Japan International Cooperation Agency (JICA)

International Development Center of Japan

Japan Telecommunications Engineering and Consulting Service

The following exchange rates are used in this report (JICA monthly exchange rate December 2021) :
EUR 1 = JPY 128.135
XOF 1 = JPY 0.19534

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Abbreviation and Acronyms

ADIE	Agence de l'informatique de l'Etat	State IT Agency
AFD	Agence française de développement	French Development Agency
ANACMU	Agence nationale de la couverture maladie universelle	National Agency for Universal Health Coverage
ANPEJ	Agence nationale pour la promotion de l'emploi des jeunes	National Agency for the Promotion of Employment of the youth
ANSD	Agence nationale de la statistique et de la démographique	National Agency of Statistics and demographic
API		Application Programming Interface
ARTP	Autorité de régulation des télécommunications et des postes	Telecommunications Regulatory Authority and and Post Office
AU		African Union
BOS-PSE	Bureau opérationnel de suivi du plan sénégal emergent	Operational office for the follow-up of the Senegalese emergent plan
CCIAD	Chambre de commerce, d'industrie et d'agriculture de Dakar	Dakar Chamber of Commerce and Industry
CDP	Commission de protection des données personnelles	Personal Information Protection Committee
CEC	Centre de l'état civil	Resident Registration Center
CMC	Centres multimédia communautaire	Community Multimedia Centre
CNEC	Centre national d'état civil	Central civil registration center
CNI	Carte nationale d'identité	National identity card
DAF	Direction de l'automatisation des fichiers, MINT	File Automation Branch, MINT
DEC	Direction de l'état civil, MCTDAT	Directorate of Civil Status, MCTDAT
DGAS	La Direction générale de l'Action sociale	The Directorate General for Social Action
DGID	Direction générale des impôts et des douanes	General Directorate of Taxes and Customs
DMZ		DeMimitalized Zone
DGPSN	Délégation Générale à la Protection Sociale et à la Solidarité Nationale	General Delegation for Social Protection and National Solidarity
DSISS	Division du Système d'Information Sanitaire et Sociale	Health and Social Information System Division

DSPRV	Direction de la solde, des pensions, et ventes Viagères, MFB	Directorate of Pay, Pensions and Sales, MFB
ECOWAS		Economic Community of West African States
Enable	Agene belge de développement	Belgian Development Agency
EU		European Union
GDP		Gross Domestic Product
GNI		Gross National Income
GPE	Partenariat Mondial pour l'Education(PME)	Global Partnership for Education
ICT		Information and Communication Technology
ID		Identification (Document)
ID4D		Identification for Development
IDI		ICT Development Index
ILO		International Labouré Organization
ITU		International Telecommunication Union
JICA		Japan International Cooperation Agency
KYC		Know Your Customer
LGWAN		Local Government Wide Area Network
MCTDAT	Ministère des collectivités Territoriales, du développement et et de L'amenagement des Territoires	Ministry of Local Authority, Development and territorial planning
MDGs		Millennium Development Goals
MAER	Ministère de l'agriculture et de l'équipement rural	Ministry of Agriculture and Rural Equipment
MDCEST	Ministère du Développement Communautaire, de l'Equité Sociale et Territoriale	Ministry of Community Development and Social Equality
MEN	Ministère de l'éducation nationale	Ministry of National Education
MENT	Ministère de l'économie numérique et des télécommunications	Ministry of Digital Economy and Telecommunications
MEPC	Ministère de l'économie, du plan et de la coopération	Ministry of Economy, Planning and Cooperation
MFB	Ministère des finances et du budget	Ministry of Finance and Budget

MFP	Ministère de la fonction publique	Ministry of the Civil Service
MINT	Ministère de l'intérieur	Ministry of Interior
MJ	Ministère de la justice	Ministry of Justice
MOSIP		Modular Open Source Identity Platform
MSAS	Ministère de la santé et de l'action sociale	Ministry of Health and Social Action
ODA		Official Development Assistance
PAP	Plan actions prioritaires	Priority action plan
PNBSF	Programme National de Bourse de sécurité familiale	National Family Security Grant Program
PPP	Public-Private Partnership	Public-private partnership
PSE	Plan Sénégal émergent	Emerging Senegal Plan
SDGs		Sustainable Development Goals
SIGICMU	Système d'information de gestion intégré de la couverture maladie universelle	Integrated management information system of the universal health coverage
SIM		Subscriber Identification Module
SIMEN	Système d'information et de management de l'éducation nationale	National Education Information System
UHC		Universal Health Coverage
UNDP		United Nations Development Programme
UNICEF		United Nations Children's Fund
USO		Universal Service Obligation
WBG		World Bank Group
WHO		World Health Organization

注： In the context of this report, the "Resident registration (Enregistrement des faits d'état civil)" includes births, marriages, deaths, etc. The local government of the place of residence (city hall, commune) is in charge of the register. It is equivalent to the Japanese family register, but differs in that it is not a "household" register but an "individual" one (parent-child relationships are recorded, but not sibling relationships). Birth registration is particularly important as it legally guarantees the identity of the child who is born.
In a narrow sense, "digitization" means the conversion of analog signals of continuous data such as text, sound, images, video, etc. into digital signals of 0s and 1s. It can also include the use of ICTs such as computer analysis and networks to drive change, and is referred to as 'digital technology'.

1. Background and Purpose of the Survey

1.1 Background of the Survey

One's identity is the basis for a social life for everyone. However, one billion people in the world do not have valid identification (ID). About half of them are those living in Sub-Saharan Africa. The identification is necessary for fair elections, improved tax payment, various economic activities (opening bank accounts, employment, purchase or rent housing, etc.), infant care including vaccination, basic education, improved security, etc. Providing a national identity is an important infrastructure fundamentally necessary for both the nation and the people to guarantee basic human rights and promote "Human Security".

To deal with this issue, an international initiative called "Identity for Development (ID4D)" was established with the World Bank as the secretariat in 2014. ID4D carries out activities such as information sharing, support for introduction, and advisory regarding national IDs in developing countries. ID4D believes that the introduction of national ID can achieve not only the Target 16.9 of Sustainable Development Goals (SDGs) "By 2030, provide legal identity for all, including birth registration", but also significantly contribute to other Goals of SDGs.

In the past, national IDs were often managed on a paper basis. In the present day, when cloud technology and biometric authentication technology have advanced, it is safer, more accurate, and more convenient to use digital technology to manage national IDs. In particular, under the severe restriction caused by the COVID-19 pandemic, provision, and delivery of public services, including education, health care, social protection, etc. accelerate the reliance on the internet and digital technology. It is highly expected that introducing and widespread digital national IDs and authentication using them will enable the provision and delivery of public and private services to everyone who needs them.

In 2020, JICA conducted the "Data Collection Survey on the Promotion of National Identification System using Digital Technologies" in Senegal to examine the current situation and issues, including the national ID system, roles among organizations concerned, and digital technology, etc. Consequently, civil registration and digital national ID systems incorporated with election cards were identified. Both systems are expected to be fully digitalized and linked soon. Besides, the ID and civil registration systems have not been interoperable with other public services, including health, social protection, education, and private services such as banks. Therefore, it was suggested to introduce a robust and secure "Data Sharing Platform" based on digital ID authentication to improve the interoperability through official development assistance (ODA) of the Government of Japan. In the current study, the Ministry of Digital Economy and Telecommunications (MENT), which plays a central role in promoting digitization in Senegal, expressed apprehension about the current siloed databases of various ministries, and expressed a positive attitude towards the establishment of a cross-cutting platform.

The World Bank has been promoting the digitization of national identity through the West Africa Unique Identification for Regional Integration and Inclusion Program in the Economic Community of West African States (ECOWAS). The program's target countries are countries whose national identification systems have

yet to be sufficiently developed. If national identification systems are developed in various ECOWAS member countries, such as in Senegal where the national identity is already digitalized, it can be assumed that in the next stage there will be a transition to interventions to link data between public services through the development of a data sharing platform. Therefore, Japan's participation in the development of a data sharing platform in Senegal can also be extended to ECOWAS. The World Bank suggests that effective interoperability requires machine-readability of data and the use of APIs provided by the information exchange platform[1].

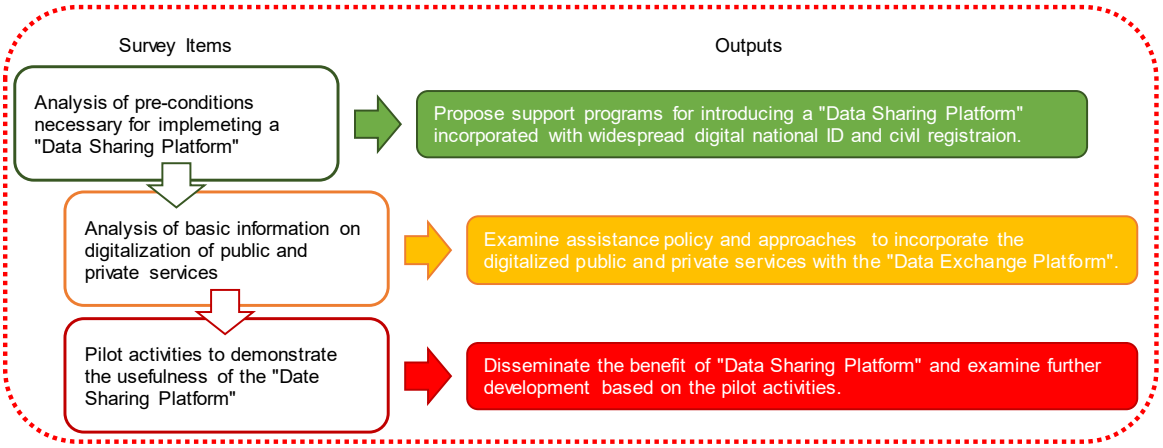
This survey was conducted to collect and analyze basic information on the current status and challenges of digitization in Senegal, detailed information on related organizations, the possibility of collaboration with other donors, and the technical specifications of the data sharing platform, with a view to cooperate in the implementation of a robust and secure data sharing platform based on the proposed integrated resident registration and national ID system.

1.2 Purpose of the Survey

Based on the Background of the Survey described above, the Survey aims at mainly three outputs as follows.

1. To examine pre-conditions necessary for possible support programs for a “Data Sharing Platform” incorporated with widespread digital national ID and digitalized civil registration database in Senegal, assuming a financial assistance project.
2. To examine assistance policy and approaches to incorporate the digitalized public and private services with the introduced “Data Sharing Platform”.
3. To conduct pilot activities for disseminating the usefulness of digital national ID and benefit of the “Data Sharing Platform” after its introduction, and to examine further development in the future based on the lessons learned from the pilot activities.

Figure 1.1 Purpose of the Survey and the Support Program to be Proposed



Source: JICA Study Team

[1] Data for better lives, World Development Report, the World Bank (2021)

2. Status of Digitization in Senegal

2.1 Digital strategy in Senegal

（1） Socioeconomic Conditions

Senegal has maintained a stable civilian government since its independence in 1960 in the West African region, where there are many countries with unstable security and political situations. Senegal is actively involved in the African Union (AU) and the Economic Community of West African States (ECOWAS or CEDEAO in French), and plays an active role as a mediator in ending conflicts in the region, thus occupying an important position in the African region as a whole.

On the other hand, the Senegalese economy had been stagnant since the end of the 1970s, with a budget deficit, balance of payments deficit, and external debt problems due to the stagnation of the country's main product, peanut production, etc. In 1994, the Senegalese government decisively implemented structural reforms, including currency devaluation, privatization of state-owned enterprises, revision of labor laws, and liberalization of import prices. Since 1995, the economy has been on a growth trajectory, generally growing at a rate of more than 5%. In particular, the tertiary sector, which accounts for two-thirds of GDP, has been developing in the commercial, logistics, and communications sectors. In addition, the development of mineral resources such as gold, titanium, and phosphate ore, as well as oil and gas fields offshore Mauritania and Senegal, is expected to grow. Gross National Income (GNI) per capita in 2018 amounted to USD 1,410 (World Bank Atlas Method). On the other hand, challenges remain, such as the widening gap between the rich and the poor and the problem of youth unemployment (8.0% for youth compared to 6.5% overall, according to the International Labor Organization (ILO) in 2018).

The country, which covers 197,000 square kilometers (about half the size of Japan), is divided into 14 Régions, 45 Départements, and 525 Communes. Decentralization has been in effect since January 1997, and the 2013 amendment to the Law on Local Governments established local governments in provinces and municipalities with ordinary elected heads and assemblies, each of which has been delegated the administrative authority stipulated in the law by the national government.

（2） Emerging Senegal Plan (PSE)

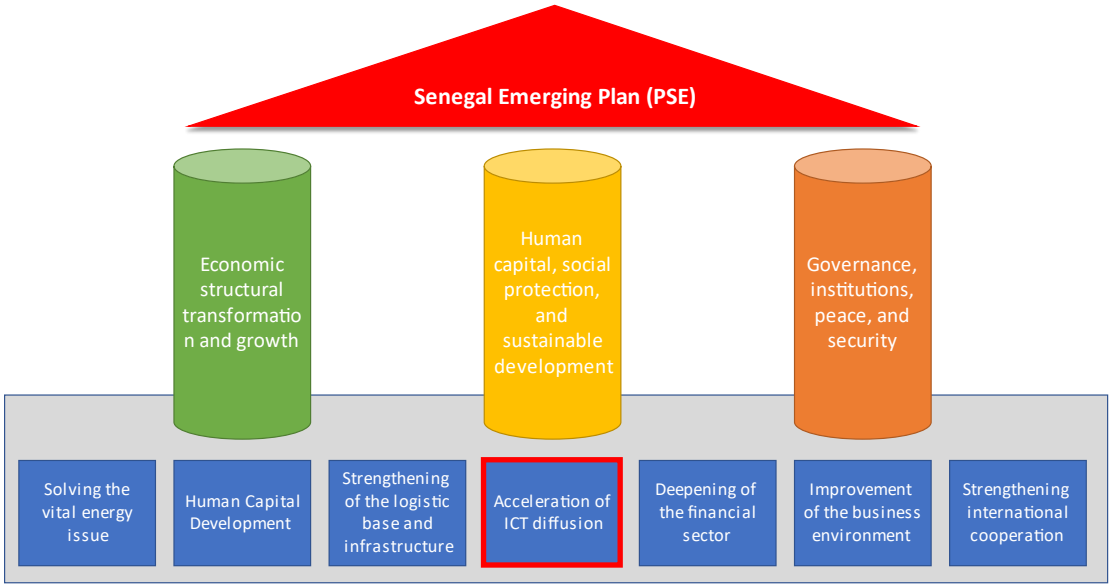
In 2014, the Sall administration formulated the Emerging Senegal Plan (PSE), which sets out a development strategy aimed at making Senegal an emerging country by 2035, raising the GDP growth rate to 7% by 2017. In addition, the country's development strategy for the 10 years to 2023 is based on the following three pillars: 1) economic transformation and growth; 2) human capital, social protection, and sustainable development; and 3) governance, institutions, peace, and security. In addition, the country is working to diversify areas of economic growth and promote the private sector, based on the seven common fundamentals of regional integration and the participation of Senegalese abroad.

Table 2.1 Pillars of the Emerging Senegal Plan (PSE)

Pillar	Sector
1. Economic structural transformation and growth	1. Agriculture, cattle breeding, fishing
	2. Social economy
	3. Social settlements and construction ecosystem
	4. Industrial logistics hub
	5. Multi-service and tourism hub
	6. Mining and Fertilizer
	7. Culture
	8. Sports
2. Human capital, social protection, and sustainable development	1. The public and sustainable human resource development
	2. Education and training
	3. Health and nutrition
	4. Social protection
	5. Water supply and sewerage system
	6. Residence and living environment
	7. Prevention and control of hazards and disasters
	8. Environment and sustainable development
3. Governance, institutions, peace, and security	1. Peacebuilding and Security
	2. Promotion of rule of law, human rights, and justice
	3. Promote equity and gender equality
	4. State reform and strengthening of public administration
	5. Regional planning, regional development, and territorialization
	6. Strategic, economic, and financial governance

Source： The Emerging Senegal Plan (PSE) Summary of the Current State and Issues around the National Identity Card and Civil Status

Figure 2.1 Structure of the Senegal Emerging Plan (PSE)



Source： Prepared by JICA Study Team based on the Senegal Emerging Plan (PSE)

As a key task to realize PSE, the government will promote the digitization of administrative procedures and the establishment of fiscal and legal frameworks to improve the business environment to enhance the competitiveness of industries and promote investment, and will establish monitoring and evaluation

mechanisms for planning and implementation, develop human resource capacity, foster a culture of transparency and accountability, and promote results-based management to achieve social integration and governance by citizens.

（3） Priority Action Plan (PAP)

PSE will be implemented through a five-year "Priority Action Plan" (PAP). PAP (2019-2023) has 21 strategic goals and 56 expected outcomes in line with the three pillars of the PSE, to achieve the SDGs.

Table 2.2 Strategic Goals of Priority Action Plan (2019-2023) and Expected Outputs

Three Pillars	Strategic Goals	Expected Outputs
1. Economic structural transformation and growth	1. Promote growth sectors and exports	1. Growth and employment promoting sectors will be developed 2. Exports will be diversified and quality will be improved 3. Domestic demand dependent on imports will decrease 4. Improve the competitiveness of SMEs
	2. Increase the level and efficiency of investment	1. Improve the efficiency of public investment 2. Private investment will increase
	3. Quality infrastructure development	1. Improved access to economic infrastructure 2. Improve the supply of telecommunications, ICT, and digital services
	4. Improve access to energy and land	1. Quality, sufficient, and affordable energy supply 2. Improve the supply of safe, built-up land
	5. Strengthening the foundation for high productivity	1. Quality of human resources in the manufacturing sector will be improved 2. Increase the level of normalization of the economy 3. Women's participation in productive activities will be strengthened. 4. Innovation in production sites will be enhanced 5. Better regulation of the labor market
	6. Promote sustainable industrialization	1. Industrial structure will become more dense and diversified 2. Industrial sector will be revitalized 3. Sustainable forms of production and consumption will be formed.
2. Human capital, social protection, and sustainable development	1. Improve the health of the people	1. Reduced morbidity and mortality 2. Improve the nutritional status of the people 3. Governance of the health sector will be improved
	2. Promote quality education that meets socioeconomic and cultural needs	1. The number of illiterate people will decrease 2. Access to quality education is guaranteed 3. Technical education and vocational training will be strengthened 4. Access to quality higher education will be enhanced. 5. Training is applied according to socioeconomic needs 6. Improve the efficiency of spending on education and training
	3. Research and innovation in development services	1. Research and innovation will be promoted.
	4. Improve access to quality basic social services	1. Improve energy supply in rural areas 2. Access to water supply and sewage system will be improved in both quality and quantity
	5. Improve access to public housing and decent living conditions	1. Public housing supply will be improved 2. Improve the quality of the living environment
	6. Promote appropriate employment	1. Promote the development of entrepreneurs 2. Supply of both formal and informal employment will

Three Pillars	Strategic Goals	Expected Outputs
		improve 3. Employment of young people and women will be improved.
	7. Acceleration of the rhythm of demographic transition	1. Population growth will be controlled
	8. Promoting Governance in Migration	1. Migrant management system will be improved
	9. Promote social security	1. The welfare of the people will be improved 2. Social inclusion of people with disabilities will be improved 3. Child protection will be improved
	10. Strengthening the resilience of people and ecosystems to climate change	1. Climate change response will be strengthened. 2. Sustainable management of the environment and natural resources will be enhanced.
3. Governance, institutions, peace, and security	1. Improve public services	1. More efficient management of public finances 2. Make the business environment more attractive 3. Transparency in the management of public resources will be enhanced 4. Reduce the incidence of corruption 5. Public administration will become more efficient
	2. Strengthening citizenship and the rule of law	1. Fair justice will be improved 2. Improve resident registration practices
	3. Promote gender equality	1. Women's empowerment will be improved 2. Women's presence in politics and government will be strengthened 3. Women's physical and moral protection will be improved
	4. Strengthen peace and security	1. Improve the safety of the living environment 2. International cooperation will be strengthened
	5. Strengthen governance in all regions	1. Make the land more attractive 2. Improve land management

Note: Shading indicates items that are considered to be related to resident registration or digital national ID
Source： PAP 2019-2023

The PAP (2019-2023) includes improved registration of residents in the PSE Pillar 3: Governance, Institutions, Peace and Security and Strategic Goal 2: Strengthen Citizenship and Rule of Law. In 2017, it was not possible to register births and deaths at hospitals and other facilities, but through digitization and networking, the target is to increase this to 100% by 2023.

In addition, the PSE's Pillar 1: Economic Structural Transformation and Growth and Strategic Goal 3: Quality Infrastructure Development call for improving the supply of telecommunications, ICT, and digital services, with targets to increase the Internet penetration rate from 62.9% in 2017 to 91.7% in 2023 and the Internet user ratio from 28.63% in 2017 to 46.41% in 2023.

Thus, digital national ID is firmly positioned in the national development plan as an improvement of resident registration in the PAP strategic goal "Strengthening Citizenship and Rule of Law" and as an improvement of communication and ICT and digital service supply in "Quality Infrastructure Development".

（4） Digital Strategy 2025 and Action Plan

In 2016, MENT's predecessor, the Ministry of Posts and Telecommunications, developed the Digital Strategy (Stratégie Sénégal Numérique 2016-2025), a national strategy for the ICT sector in line with the

PSE.

The strategy consists of 97 reforms and projects under three prerequisites and four strategic axes, along with the vision the strategy aims to achieve.

Table 2.3 Overall framework of the Digital Strategy 2025

Vision	"In 2025, digital technology for all and for all uses in Senegal with a dynamic and innovative private sector in a high-performance ecosystem".	
Key Objectives by 2025	Three fundamental prerequisites	Cost
1. The contribution of digital to GDP at 10%. 2. An increase in GDP by the digital spillover effect of other key sectors, of CFAF 300 billion. 3. 35,000 direct jobs created. 4. International rankings • for the Network Readiness Index (NRI) of the World Economic Forum (WEF), at least the 70th place in the world, and the 4th in Africa • ITU's ICT Development Index (IDI), at least 90th in the world and 4th in Africa	1. Legal and institutional framework (6 reforms and projects)	2,100
	2. Human capital (7 reforms and projects)	5,650
	3. Digital trust (5 reforms and projects)	4,250
	Four priority areas of intervention	Cost
	1. Open and affordable access to digital networks and services (19 reforms and projects)	1,094,600
	2. Administration connected to the service of citizens and businesses (14 reforms and projects)	27,200
	3. Promotion of an innovative digital industry that creates value (9 reforms and projects)	140,100
	4. Dissemination of digital technology in priority economic sectors (37 reforms and projects)	87,400

Note: million FCFA
Source： The Digital Strategy 2025

The strategy aimed to increase GDP by XOF 300 billion, create 35,000 jobs, and increase the ICT sector's share of GDP from 6.28% in 2014 to 10% in 2025 through its implementation. In addition to the XOF 40 billion (about $7.2 billion) "Digital Technology Park," several other projects have been launched. These include incubation projects to support entrepreneurs, various events at local farm markets, and encouragement of the launch of mobile financial services to promote fintech. In terms of international indices, the Strategy aims at being ranked in the top 70 in the world and in the top 4 in Africa in the World Economic Forum's Network Readiness Index (NRI), while the strategy aims at being ranked within the top 90 in the world and within the top 4 in Africa in ICT Development Index (IDI) of the International Telecommunication Union (ITU).

In 2020, with the support of the United Nations Development Programme (UNDP), MENT prepared a review of the strategy and an action plan for its steady implementation, to align it with the PAP (2019-2023) and the 2030 target SDGs.

The review confirmed that 18 of the 97 reforms and projects in the strategy have been implemented, but since many have not yet been implemented, the action plan prepared includes a list of implementing organizations and priorities. The table below excerpts the major reforms and projects related to the data sharing platform that is the subject of this study.

Table 2.4 Major reforms and projects related to data sharing platform in Digital Strategy 2025

	Reforms and Projects	Source of funds	Priority	Implementing Organization

Directly related				
Axe 2	511 Formulation of e-government strategy	Public	P1	MENT
	514 Interoperability of government information systems	Public	P2	MENT, MT
	515 Support for sectoral ministries	Public	P1	MENT, Sector ministries
	521 dematerialization of priority administrative procedures	PPP	P1	MENT/ADIE, Private sector
Indirectly related				
Prerequisite 3	312 National infrastructure for electronic signature management (public key infrastructure)	Public	P1	CNC, MENT/ADIE
Axe 1	441 Expansion of the Community Multimedia Center	Public	P2	MENT
Axe 2	513 Creating a reliable digital identity	Public	P1	DEC, MENT, DAF, MSAS, MDCEST, and others
	522 Secure electronic payment system	PPP	P1	MENT, DGCPT, MFB
	523 Digitization of resident registration	Public	P2	DEC/ADIE, DAF
	524 Digitization of legal procedures	Public	P2	MJ, MENT/ADIE
	531 Exchange and consultation platform for citizens on policies and public services	Public	P2	DEC, MFB, ARTP, MENT

Source： Prepared by JICA Study Team based on Digital Strategy 2025

Table 2.5 Japanese Government's Policy on Development Cooperation with Senegal

Basic Policy on ODA	"Supporting balanced economic and social development that supports stability and development in the West African region." Based on the Senegal Emerging Plan (PSE), which aims to make Senegal an emerging country by 2035, Senegal will work on social development to reduce inequality and strengthen resilience in parallel with the promotion of economic development to promote sustainable development of Senegal, which is rapidly developing its economy, maintaining an annual growth rate of over 6%. This will promote balanced development between economic and social aspects, and provide support aimed at achieving quality growth and contributing to the SDGs.	
Priority Areas	Infrastructure for industrial development	Support infrastructural development for industrial development, with a focus on urban infrastructure and human resources to boost balanced and sustainable economic growth. 1. Development of high-quality infrastructure that contributes to industrial development： Efforts to decentralize urban functions as well as infrastructure development in urban areas are supported. In addition, the development of infrastructure to facilitate trade and movement within West Africa is being promoted. 2. Development of industrial human resources： Contribute to the development of industrial human resources and the improvement of opportunities for young people to obtain rewarding jobs. Also, new ways are considered to contribute to industrial development by combining industrial human resource development with private-sector collaboration and entrepreneurial support.
	Reducing inequality, strengthening resilience	Strengthen the resilience of the poor and vulnerable by focusing on food production and supply and social services of education and health, which form the basis of social life, and by working to reduce the disparities that can arise from economic development. 1. Strengthen stable food production and supply capacity： To strengthen the rice value chain, support will be provided through productivity improvement, distribution promotion, farm management improvement, and agricultural infrastructure development. Support capacity building of farmers and promotion of sustainable agriculture. The resilience of rural areas vulnerable to the effects of climate change will be strengthened and vulnerable groups with chronic malnutrition problems will be supported. To promote sustainable fisheries, sustainable management of marine resources and strengthening of

		the value chain will be addressed. 2. Improve the quality and accessibility of social services and social security：Support will be provided to strengthen both the capacity to provide health care services and the health security system to achieve universal health coverage (UHC). In addition, Japan will continue to provide support in the areas of maternal and child health and improved governance, which it has cooperated with in the past, and will work to expand such support nationwide. Contribute to the improvement of the quality of elementary math and secondary science and mathematics education as support for basic education. Contribute to the universalization of basic education with quality, taking into account the improvement of access to education.
Important notes	• Further enhance support for "human resource development" with technology transfer, utilizing Japan's knowledge and technology, and ensure effective results by linking hardware (facility development) and software (human resource development). At the same time, Senegal will be positioned as a base for wide-area assistance (South-South cooperation), and projects will be formulated in consideration of the effects of cooperation on other West African countries. • In addition to supporting the development of human resources who will contribute to the socio-economic development of the country through study abroad programs, etc., investment of Japanese companies is supported proactively and the possibility of collaboration through support for BOP business and corporate CSR activities will be explored. • For balanced economic and social development, attention will be paid to strengthening the administrative system and enhancing the capacity of administrative officials in addressing each development issue. • To achieve the priority area of "Reducing Disparities and Strengthening Resilience," attention will be paid to the benefits to local areas, and when selecting local areas (provinces and prefectures) for input, coordination will be made both within the same sector and across sectors to ensure effective implementation of assistance. • Expand cooperation with various media to strengthen publicity about Japan's cooperation.	

Source： Development Cooperation Policy by Country, Ministry of Foreign Affairs (Changed in September 2020)

Although the digitization of national IDs is not explicitly mentioned in the development cooperation policy of the Japanese government, the utilization of digitized national IDs is considered to be in line with the development cooperation policy of the Japanese government, as it will contribute to the development of infrastructure for industrial development and the improvement of basic social services, especially in the fields of education and health.

2.2 Status of Digitalization in Senegal

（1） Organizations responsible for digitization

a） Ministry of Digital Economy and Telecommunications (MENT)

i) Organization

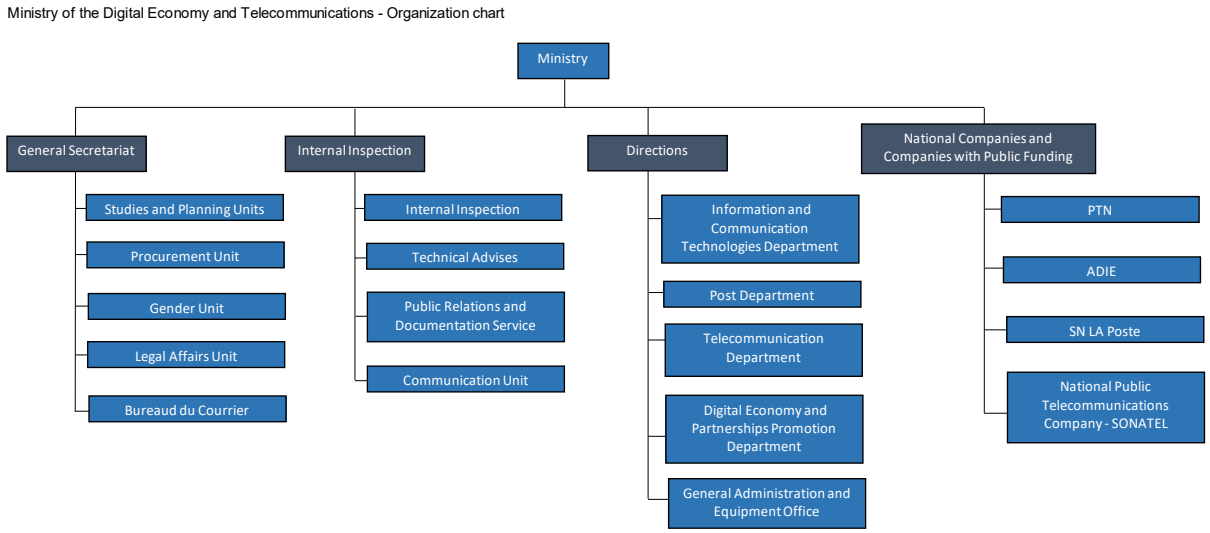
The role of the Ministry of Digital Economy and Telecommunications is set out in Decree No. 2020-2224 Relating to the Assignments of the Minister of the Digital Economy of Telecommunications, published in November 2020. The Decree stipulates that the Minister of the Digital Economy shall be responsible for the development and implementation of policies in the field of the digital economy and telecommunications.

In the area of the digital economy, the decree stipulates to promote sectoral policy making and implementation, law-making and application, implementation of strategies and action plans for digital development, promotion of citizens' access to digital networks, implementation of policies to bridge the digital divide, production, and supply of digital content, diversification of e-commerce, e promoting e-

government, e-health, and e-education.

Concerning the information and communications sector, the decree stipulates to ensure the development and implementation of a communications sector that is widely accessible to all, and for ensuring that the means of communication cover the entire country. It also stipulates that the MENT shall ensure the implementation of policies that support the promotion of information and communication technologies, except the tasks delegated to the Communications Regulatory Authority and ADIE.

Figure 2.2 Organogram of MENT



Source： MENT website

ii) Legal system

Legislation and policies related to MENT include the Senegal Digital Strategy (2016-2025), the Digital strategy 2025 Action Plan, and others, as well as the National Cybersecurity Strategy (SNC 2022), published in 2017.

iii) Staffing and implementation capacity

MENT has about 20 engineers. The capacity to implement MENT can be compared with international indicators for e-government. One international index is the E-Government Development Index (EGDI), which is a weighted average of three indicators: the Telecommunications Infrastructure Index (TII), the Human Capital Index (HCI), and the Online Services Index (OSI).

The three indicators are compiled by the International Telecommunication Union (ITU) for the TII, UNESCO for the HCI, and the United Nations Department of Economic and Social Affairs (UNDESA) for the OSI. 193 UN Member States are covered in 2020 and Senegal is ranked 150th, which is higher than the African average and the West African average, suggesting that Senegal is more advanced in its e-government initiatives than its neighbors.

Table 2.6 E-Government Development Index： EGDI

	2020	2018	2016	2014	2012	2010	2008	2005	2004	2003
Senegal(Rank)	150	150	144	151	163	163	153	153	145	147
Senegal(Value)	0.421000	0.348600	0.325050	0.266570	0.267260	0.224140	0.253100	0.223780	0.232780	0.200640
Region Ave.	0.357400									
Sub Region Ave.	0.391400									

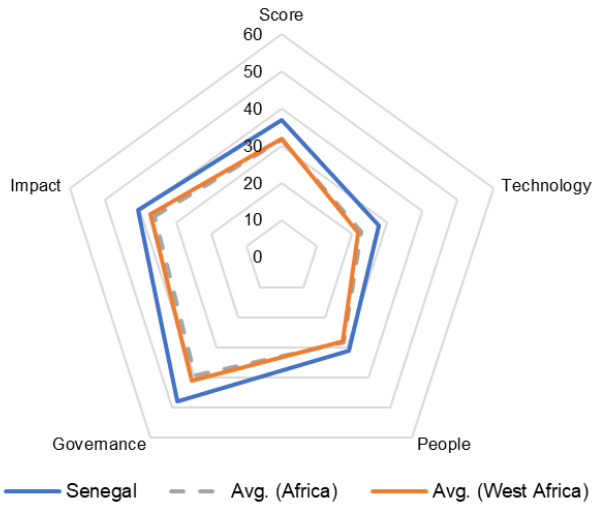
Source: UN E-Government Knowledge Index

Looking at the Network Readiness Index (NRI) for 2020 in terms of the five indicators of technology, human resources, governance, impact, and score, as shown in the figure below, Senegal is above the average for West Africa and Africa as a whole in all indicators. In particular, the difference in the indicators of technology

and governance is large compared to the average for West Africa and Africa as a whole.

The NRI (2020) covers 134 countries, including 35 in Africa (of which 10 are in West Africa). Senegal is ranked 100th, placing it 11th in Africa and 3rd in West Africa. Although Senegal has not reached the targets set in the Digital Strategy, the ranking has improved since the NRI in 2016, when the Digital Strategy was published (Senegal ranked 107th out of 139 countries and 15th in Africa).

Figure 2.3 Senegal's scores of the Network Readiness Index



	Score	Technology	People	Governance	Impact
Senegal	36.90	27.71	31.09	48.05	40.74
Avg. (Africa)	31.65	22.65	28.40	39.57	35.94
Avg. (West Africa)	32.06	21.65	28.14	41.30	37.14

Source： NRI（2020）

iv) Budget

The budget of the MENT for 2020 is 17.7 billion FCFA (about 3.54 billion yen). By item, the digital economy accounts for the majority of the budget (89%), pilot, coordination, and administrative management for 3%, and the postal sector for 8%. In comparison with other countries, in Cameroon, which has a slightly larger economy than Senegal, the budget in 2020 of the Ministère des Poste et Télécommunications is about FCFA 24.9 billion, while in Uganda the budget of the Ministry of ICT & National Guidance in 2019 is about FCFA 4.98 billion. In Uganda, the budget of the Ministry of ICT & National Guidance in 2019 is 280 billion UGX (about 8.7 billion yen). In Zimbabwe, which has a slightly smaller economy than Senegal, the budget of the Ministry of Information Communication Technology, Postal and Courier Services is 2 billion ZWL in 2020, while that of the Ministry of Information, Publicity and Broadcasting Services is about 1.5 billion ZWL, totaling ZWL 3.5 billion ZWL (about 1 billion yen).

Table 2.7 Budget of MENT

Digital Economy	Goods and Services	66,475,000
	Staff Expenditure	175,019,104
	Investment executed by	10,888,000,000
	Current Transfers	2,000,000,000
	Capital Transfers	2,700,000,000
	Goods and Services	194,050,000

Pilot, Coordination, and Administrative Management	Staff Expenditure	237,732,000
	Investment executed by	106,889,223
Postal Sector	Goods and Services	19,200,000
	Staff Expenditure	26,869,000
	Current Transfers	1,300,000,000
MENT		17,714,234,327
Total		3,573,000,000,000

Source： Projet de Loi de Finance de L'année 2020, République du Sénégal

b） External bodies of MENT

i) ADIE

The ADIE (National IT Agency) is an external body of the MENT. ADIE was established by decree No. 2004-1038 of July 23, 2004, establishing and setting the rules of organization and operation of the State IT Agency[2]. The establishment aims to provide public administrations with a coherent system of information technology communication, meeting international standards in terms of quality, security, performance, and availability.

ADIE has 130 staff as of 2020. As shown in Table 2.8, the main roles are online administrative procedures, providing technical support to government agencies on e-government.

Table 2.8 Main role of ADIE

・Dematerialization of administrative procedures ・Rationalization of IT spending in the government sector ・Interconnection of national organizations through the creation of a national network infrastructure ・Provision of a reliable information system for the effective monitoring of government actions ・Establishment and coordination of a legislative and regulatory framework to encourage the development of information and communication technologies ・Reduction of the digital divide and social exclusion by increasing access to ICT 【Participation in e-government strategy】 ・Provision of information systems and decision support tools to the State ・Provision of a decentralized interface for administrative access with citizens and businesses ・Persistence and protection of the national archive by providing electronic memory ・Definition, monitoring, and evaluation of performance indicators of the implemented information systems ・Assessment of the impact of investments made in the field of IT ・Contributing to good governance by promoting remote democracy

Source： ADIE website

Table 2.9 Major projects of ADIE

Project	Main Content
Passant	The installation of fiber optics and the construction of data centers to connect the networks of cities, administrations, and public places.
Smart Sénégal	A program launched with China's support to realize the Priority Action Plan 2019-2023. It consists of five components: Smart Cities, Smart Education, Smart Territories, Submarine Cables, and Smart WiFi.
Projet National Large Bande	The project, launched in January 2016 (currently in its third phase), involves the

[2] https://www.adie.sn/sites/default/files/lois/3-De%CC%81cret%20Portant%20Org%20et%20fonct%20ADIE%20-%20Copie.pdf

	development of the intranet of the public administration and the construction of a data center (Diamniadio).
Digitalization	Digitization of public administration. The aim is to implement dematerialization so that citizens can carry out administrative procedures online and the administration can process them online.
PAMA	The aim is to improve the Senegalese government's email and create a secure platform for government officials to exchange, share, communicate and collaborate.
Plan National Géomatique	In support of Senegal's national plan for geoinformation technology, Canada provided supports starting from 2008, and since the end of 2012, geospatial data such as the national data catalog (Geo-directory) and the preferred geographic database (BaseGeo) have been available. ADIE has set up a data center and other related infrastructure.
TeleDAc (La Télé-Demande d'Autorisation de Construire)	In a project to improve the business environment, business-related procedures were made available online. The time required for a construction permit was reduced from three months to 28 days. The project was funded by ICF.
PHM-Sites Web	Development of ministries' websites
Intranet Administratif	Development of an intranet for administrative bodies. WiMAX was supported by South Korea and the extension of 2,000 km of optical fiber was supported by China (US$50 million).
FUDPE (Le Fichier Unifié des Données du Personnel de l'Etat)	The Unified National Human Resources Data File (FUDPE) aims to contribute to improved transparency and financial management, as well as to the strengthening of good governance. It regularly manages data affecting personnel costs which is one of the largest expenditures in the national budget. EU supports the project and the third phase was commenced in April 2019.
GD3E (La gestion des déchets d'équipements électriques et électroniques)	Management of waste electrical and electronic equipment (WEEE).

Source： ADIE website

Director-General is set under a Supervisory Board. The Director-General is responsible for the coordination and target setting and consists of the Director-General (DG), the Secretary-General (SG), the Programme Manager, and the Project Office Coordinator (PMO). Under the Director General (DG), there is a Secretary-General, a Procurement Unit in charge of procurement operations, and a Procurement Commission in charge of monitoring tender openings and evaluating tenders.

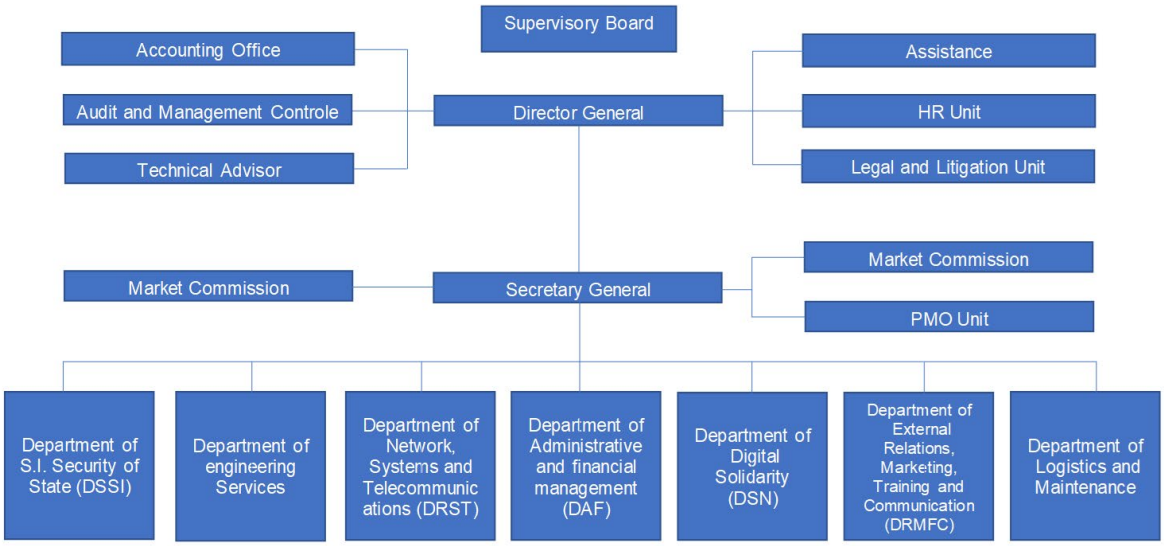
Under the Secretary-General, the following departments have been set up

- Department of Digital Solidarity (DSN) is responsible for tackling the digital divide and social exclusion through ICT integration in schools, the useful and sustainable recycling of computer equipment, and training for vulnerable groups.
- Department of System Information Security of State (DSSI) is responsible for the review and implementation of information systems security policy
- Department of Engineering Services (DSI) is responsible for project management and technical monitoring. It also supports the management structure in the implementation of ICT projects and is responsible for the development, integration, and marketing of applications/products/services.
- Department of Network, Systems, and Telecommunications (DRST) is responsible for the management and maintenance of systems, networks, and telecommunications infrastructure. It is also responsible for the management of the country's IT equipment, user support, and the development and operation of

information systems.

- Department of Administrative and Financial Management (DAF) is responsible for accounting and financial management, and human resources management
- Department of External Relations, Marketing, Training and Communication (DRMFC) is responsible for promoting ADIE's services and products and strengthening them with other governmental organizations.
- Department of Logistics and Maintenance (DLM) is responsible for the maintenance of logistics, IT, information, and communication equipment.

Figure 2.4 Organogram of ADIE



Source : ADIE

ii) ARTP

ARTP (Autorité de régulation des télécommunications et des postes) is an external body of MENT.

The ARTP was established by the President of the Republic as an independent administrative body responsible for the regulation of the telecommunications and postal sectors, with legal personality and financial and managerial autonomy. Law No. 2011-01 of 24 February 2011 on the Telecommunications Code gives the ARTP the following mission, authority, and privileges.

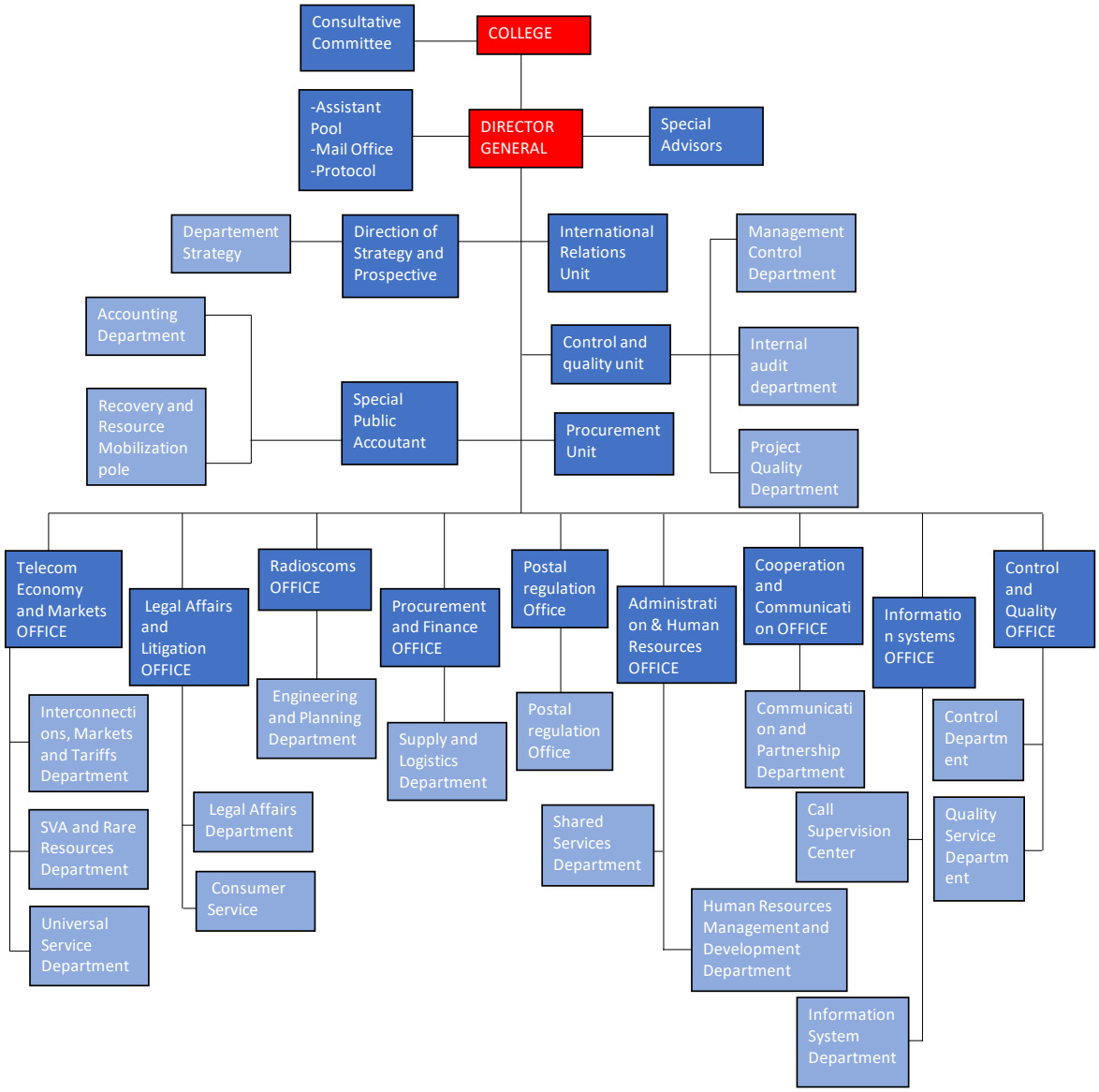
Table 2.10 Main Role of ARTP

・General duties (application of regulations, advice, opinions, and proposals for legislative and regulatory texts to the President of the Republic and the Government). ・Ensuring compliance with the rules of sound and fair competition ・Follow-up of the operator's specifications ・Ensuring fair interconnection between operators ・Thorough management and control of scarce resources (frequency, number) ・Development of regulatory instruments (approval of technical and tariff offers for unbundling, the definition of applicable conditions for the choice of operator, the definition of conditions for number portability and ensuring their implementation). ・Regulate the charges of powerful operators. ・Coordinate the implementation of the universal access/service development policy ・Licensing and enforcement for the regulation, registration, and management of domain names and the

establishment of appropriate control mechanisms
・Represent Senegal at meetings organized by international organizations where issues relevant to the Senegalese mission are discussed

Source： ARTP website

Figure 2.5 Organogram of ARTP



Source： ARTP

2.3 Status and Issues of Digitalization of National ID and Residence Registration

（1） Status and issues

In Senegal, the association of civil status registration, including births, with the national identity card (CNI), continues and the digitization of services is actively encouraged. In the future, data linking based on a single identity is expected in all areas such as health, social protection, and education. The efficiency of intergovernmental operations will improve and the well-being of the population will be greatly enhanced.

The table below examines the current status and challenges of the national identity card which is the basis of

social life and of civil status registration which represents a reliable source of information for the national identity card.

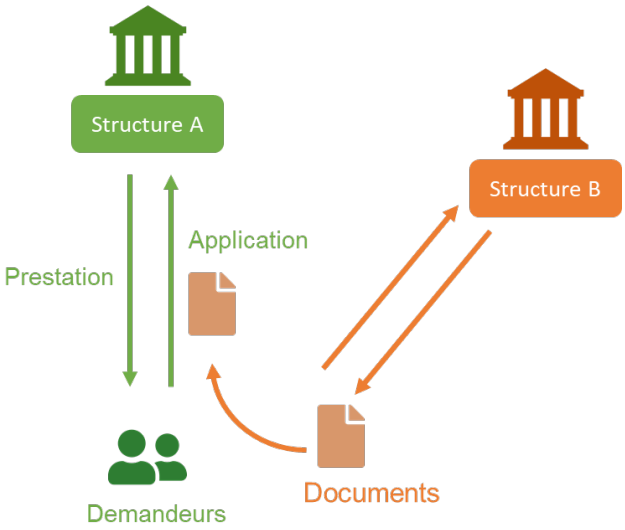
Table 2.11 Current State and Issues of National ID and Civil Registration

Sector	Current State	Issues
National ID	• Able to issue for children 5 years or older, mandatory for children 15 years or older. • Registration and preparation at the enrollment office of the prefectures (submit the necessary documents and biometric information). • As an object of verification of individual identity, it relates to elections and mobile phones.	• Dispersion of required documents (birth certificate, proof of residence, etc.), forgery, fraud, etc. • Need to visit the enrollment office at least twice, registration and receipt. • 2 to 6 weeks are required from registration to obtain. • Correcting or modifying listed items takes time. • The national identity card is used for elections, cell phone registration, and health insurance cards, but is not attached to or used at the level of other public services.
Civil Registration	• Register in the registry at the commune's Resident Registration Center (CEC). • Need to visit also for collecting the documents from the CEC.	• Registration is done face to face and by hand in most CECs. • Better if there is a secondary CEC in the neighborhood (midwife, mosque, etc.). • Beyond one year after birth, the CEC can no longer register the birth; the birth must be certified by the district court. • Need to go to the CEC to obtain a certificate.

Source： JICA Study Team

According to the current situation in Senegal, citizens are often required to get relevant documents and certificates from other agencies and attach them for the application of a specific public service. On the other hand, the agency that accepts the application must confirm the suitability and authenticity of the attached documents and carefully input the information to avoid making a typing mistake. This imposes a great deal of labor, time, and cost on both the citizen who apply and the administration who accepts and processes the application. However, if reliable information processed by an agency can be used directly in another agency, the reliability of information and data will be improved, mistakes due to typographical errors can be neglected, and the quality and efficiency of public services will be significantly improved. In addition, overall administrative costs could be reduced steadily.

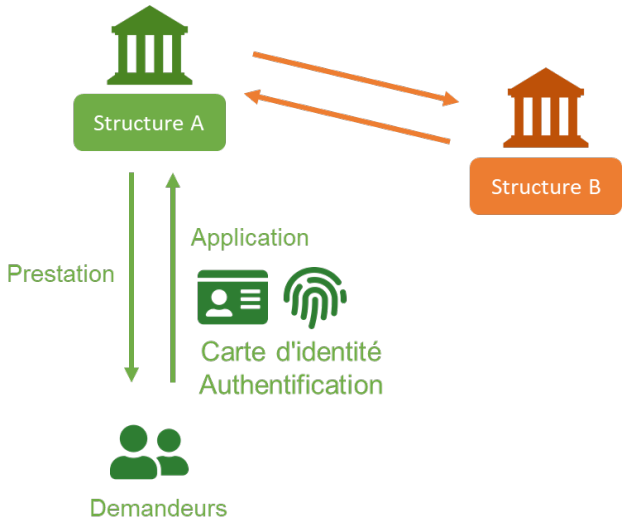
Figure 2.6 Current Situation



Source： JICA Study Team

For applications using national ID and biometric authentication, these issues can be overcome by providing a platform for sharing information on the back end between the agency which received the application for public services and the agency which has the related information.

Figure 2.7 Data and Information Sharing on the Back End



Source： JICA Study Team

（2） Related organizations and division of roles

a） DAF

In Senegal, a project has been launched in 2016 to replace the old national ID card and election registration card with a new smart card with biometrics authentication, which has registered about 83% of the target population.

i) Organization

The organization in charge of the national ID is the DAF (Department of Document Automation, Ministry of Interior), which consists of the Research and Development Department, External Relations Department, New Technology Promotion Department, General Affairs Department, Operations Department, and Archive Department. Applications and registrations for national IDs are conducted at 47 police stations, 11 prefectural offices, and 6 diplomatic official residences abroad. The CNI with biometric data is under the centralized jurisdiction of the Department of Documentation and Automation (DAF) of the Ministry of Interior (MINT), which has 14 civilians, including 5 engineers, 210 police officers, 45 dispatched security guards, and several support staff from Synapsys which is a local partner of IRIS, the Malaysian company that manufactured the CNI. Most of the staff are engaged in simple tasks in the CNI fabrication process, and only a few are involved in planning and studying the technical aspects including the utilization of the CNI. The annual budget is approximately XOF 1 million (about 18 million yen). DAF currently has two offices, the headquarters and an annex in Dakar, but no regional organization. The DAF aims to develop the following prospects for the organization;

1. to transform the CNI Registry into a regional organization of the DAF, staffing all police stations and provincial offices and consulates nationwide

2. to promote networking

3. to set up CNI registries in countries with large numbers of Senegalese living abroad

4. to promote the development of new CNI applications.

5. to improve the capacity of staff engaged in ICT and its utilization.

ii) Operation

The CNI will be issued at the police station of the applicant after the DAF produces the CNI at its headquarters in Dakar. However, 22 of the 45 prefectures do not have police stations, so from January 2020, DAF has started to set up directly managed application offices in 11 of them. Applications are also being accepted at 6 diplomatic official residences abroad.

CNI applications must be accompanied by a birth certificate from the CEC (issued based on the original birth registration) and a certificate of residence from the village or 46 district head of the place of residence. In rare cases, birth certificates that appear to be forged become a problem. The CNI can be obtained at the age of 5 or older, and must be obtained at the age of 15, and is valid for 10 years. The CNI also serves as an electoral card, and in fact, 7.1 million CNIs with voting rights have been issued, compared to 0.25 million without voting rights, which is one-third.

At the time of the survey, a total number of 7.63 million cards had been issued, with approximately 83% of the population aged 15 and above having acquired them. There is no charge to apply for and receive a CNI, but a fee of XOF10,000 (about 1,800 yen) is required to reissue a lost or damaged CNI.

The first 11 digits of the 16-digit CNI number are the resident registration number based on the date of birth

(one digit for gender, two digits for prefecture, and eight digits for date of birth), and the last five digits are a unique number without duplication. The IC chip contains the CNI number, first name, last name, address, height, face photo, fingerprints (two fingers only), iris, etc.

The backside of the CNI is an electoral card, but the DAF intends to develop software and platforms to allow the CNI to be used for online identity verification by government agencies and the private sector. In particular, a system to generate fee income and use it for bank identity verification, and a system to link it with taxpayer-identification numbers at the request of the Ministry of Finance and Budget (MFB) is in the trial stage.

b） DEC

In Senegal, the birth registration rate is almost 80%, which is relatively high compared to other African countries.

i) Organization

DEC (Department of Civil Registration, Ministry of Local Government, Development and Land Development) is responsible for all aspects of civil registration, including birth and death registration. Registration of births, marriages, divorces, deaths, adoptions, etc. is handled by the CECs of 525 communes nationwide. (At the time of the survey, there were 585 CECs nationwide, including CEC branch offices.) Communes are local governments whose heads and councils are elected by universal suffrage, and they are entrusted by the national government with a number of powers related to people's lives. The CEC in Pikin, Dakar, which we visited, had 26 employees, but according to an EU survey, the average number of employees in CECs nationwide is between 4 and 5. In the 585 CECs, 126 use stand-alone PCs for their work, and about three types of software are used for resident registration management. In most of the CECs, the status of management of the resident registration ledgers, buildings, education and skills of the personnel, and labor costs are the main issues.

At the central, the DEC is responsible for providing technical support to the CEC nationwide. However, the DEC is extremely small, with only 15 full-time staff and 3 contract staff, and the organization and capacity of the DEC must be strengthened in order to promote the digitization, biometric data acquisition, and networking of resident registration nationwide, which will be implemented from 2020. The DEC's annual budget is XOF114 million (about 20 million yen).

ii) Operation

Birth registration is the most important, but death registration is also essentially important so that the right to vote does not remain after death. At the time of the survey, it was estimated that 77% of births were registered, 21% of marriages were registered, and 31% of deaths were registered, leaving 23% of births unregistered.

For birth registration, parents apply with a copy of their CNI, along with birth records from the health facility where the birth took place, a midwife or other health care provider, or testimony from someone who witnessed the birth at home. The CEC registrar fills out three registers per registration, handing the first to the applicant, sending the second to the district court, and keeping the third in the CEC. The same procedure is used for

marriage registration and death registration. This decentralized management of registration information allows for recovery in the unlikely event that the applicant loses the original or the CEC destroys the ledger by a fire.

All registration is free of charge, but a fee of about XOF200 (about 36 yen) is required for CNI applications and certificates required by schools and other institutions.

DEC believes that a major reason why not all births are registered is due to lack of access to CEC and lack of understanding of the importance of birth registration. Some of the CEC branches are located in health facilities where births take place, but the DEC hopes to further expand the number of CEC branches by involving religious facilities where weddings and funerals are held in addition to health facilities.

2.4 Status and Issues of Digitalization in Sectors

（1） Health

a） Overviews and Challenges

MSAS (Ministry of Health and Social Action, hereinafter referred to as MSAS) is considering the promotion of digitalization in the health sector in general. In particular, MSAS recognizes the need to promote the sharing of patient information between health facilities and the promotion of telemedicine by encouraging the introduction of electronic medical records throughout the country.

ANA CMU (National Agency for UHC) has an integrated UHC information management system called SIGI CMU. The system was built after the relevant ministries shared the necessary data with us during its development. For example, in collaboration with the DAF, the CNI card can be used as an insurance card. On the other hand, as the CNI can only be held by people over 16 years of age, the insurance card cannot be used by citizens under 15 years of age or by the population that does not hold a CNI basically.

b） Efforts for Digitalization

MSAS developed a vision for the strategy and planning of the digital health sector in 2019 in the Plan Stratégique Santé Digitale 2018-2023. The following year, in 2020, the Ministry discussed and developed the Programme de Digitalisation du Sector de la Santé. The six areas are (1) telemedicine, (2) information systems between medical facilities, (3) geographical health information, (4) management of medicines, (5) dissemination of electronic medical records, and (6) digitalization of information from national health posts (including management of medicine stocks and medical equipment). From 2021, the MSAS is preparing to build a platform called the SIGES project, a health information management system to implement the above six programmes.

SIGI CMU (Integrated Health Information Management System for UHC), owned by ANA CMU, has the following functions: SIBIO (biometric authentication system for health security subscribers), SUNUCMU (crowdfunding system and electronic payment), SAMACMU (mobile app for individual subscribers), GESTAM (health insurance administration system), SITFAC (electronic processing system for medical claims) and Datawarehouse (database).

c） Gaps between Current Situation and Goals

MSAS wants to share patient information between health facilities by promoting the introduction of electronic medical records throughout the country and has linked the patient ID (medical record number) of each facility to the CNI. On the other hand, cooperation between health facilities has not progressed well because each facility (especially advanced hospitals) freely introduces electronic medical records and lacks interoperability. MSAS is therefore promoting interoperability among medical facilities (e.g. through the development of ministerial ordinances), and has the concept of a unified patient ID system that would issue a single patient ID (medical record number) for each health facility.

ANA CMU currently uses the CNI card as its insurance card, but in the future it will be able to exchange two-way, real-time data with the DEC's birth and resident registration data to cover citizens under 15 years of age and those who do not hold a CNI, thus increasing convenience. In the future, ANA CMU will also be responsible for the management and administration of the free health care system, the compulsory unemployment health insurance (IPM), the corporate pension system (IPRES), the health insurance for civil servants and the private health insurance.

（2） Education

a） Overviews and Challenges

Compulsory education consists of six years of primary education and four years of early secondary education. Primary school graduation required the examination of certificate of completion of primary education(certificat de fin d'études élémentaires: CFEE) . Until 2011, CFEE was a necessary condition for entering early secondary education, but the policy was amended in 2011 to allow students to enter without a CFEE[3]. However, the CFEE exam system remains in place. In some situations, such as entering a private school or finding a job, a CFEE certificate may be required as proof that the student has basic skills. In order to register for the exam, the people must have all the official documents below. (1) a birth certificate, (2) school records and attendance certificates, and (3) a registration fee of 250 FCFA[4].

b） Efforts for Digitalization

The Ministry of National Education is proceeding with the construction and introduction of the online education administration management system "Senegal Education Management System (SIMEN)." It issues its own ID to everyone involved in education (managers, faculty, students, etc.). It takes a single sign-on (SSO) mechanism and is designed so that once you log in, you can use all applications and resources with access privileges. It also stores grades and diplomas.

c） Gaps between Current Situation and Goals

SIMEN planned to cover all data under the jurisdiction of the Ministry of National Education, but there was no data linkage with MFPAA, which governs vocational schools, and MESRI, which governs higher

[3] Basic Education Sector Analysis Report: Senegal（JICA 2012.8 Japanese） page.16 https://openjicareport.jica.go.jp/pdf/12083200.pdf

[4] Register for the Primary School Graduation Certificate exam：https://senegalservices.sn/demarches/papiers/examens-concours-et-diplomes/sinscrire-a-lexamen-du-certificat-de-fin-detudes-elementaires-cfee

education. High school graduates are required to submit paper-based certificates when applying to universities. In some cases, the diploma issued by the school is required to be further authenticated by the Ministry of Education. The whole process is paper-based and requires a visit to the competent authorities, which takes a long time[5]. Since the information is not linked to the information in the resident registration, it is difficult to grasp the accurate enrollment rate and to allocate educational resources in a rational manner.

（3） Social Protection

a） Overviews and Challenges

In Senegal, sickness and maternity benefits, occupational accident benefits, and family benefits were introduced before independence in 1960, and the old-age, disability, and survivor laws were enacted after independence. Conditional cash transfers for orphans and vulnerable children were introduced in 2008, and the National Family Benefit Program (PNBSF), a conditional social cash benefit for the poorest and most vulnerable households, was launched in 2013. In 2015, social assistance expenditure was 0.7% of GDP, with an annual social assistance expenditure of US$16.79 per poor person. It is still low compared to Benin's 2.9% of GDP, Cape Verde's 1.2%, and Liberia's 1.2%. One of the challenges is to balance between expanding social assistance spending and maintaining fiscal discipline.

b） Efforts for Digitalization

To efficiently implement social protection programs within a limited budget, DGPSN has established two management information systems: RNU and the PNBSF management information system. RNU is responsible for the upstream of the cash transfer program and has the functions of data registration and targeting of the poor and vulnerable households. The PNBSF management information system takes responsibility for the downstream of the program and has the functions of data registration of beneficiary households, cash transfer statement preparation, payment reconciliation, complaint handling, monitoring, evaluation, and reporting. Interoperability has been established between the two management information systems. In addition, RNU is widely used by other social protection programs as a common platform for identifying the poor and vulnerable households

c） Gaps between Current Situation and Goals

Service delivery in social protection programs is highly fragmented among different ministries and agencies, including DGPSN. Management information systems are also not interoperable among different social protection programs. There are significant steps required towards building one-stop services for social protection programs, like South Africa. Despite the Means Test conducted, the applications for the cash transfer program highly rely on information provided by the applicants, and external checks are very limited. As a result, targeting errors and leakages in the cash transfer programs are high, and the government budget is being wasted. Furthermore, a monitoring and evaluation framework for the cash transfer programs has not been established. To enhance future impact evaluation and evidence-based policy planning, the monitoring

[5] Have a diploma authenticated：https://senegalservices.sn/demarches/papiers/legalisation-authentification-certification-conforme-et-enregistrement/faire-authentifier-un-diplome

and evaluation framework is required as soon as possible.

Table 2.12 Roles of National ID and Civil Registration in Principal Public Service

Sector	Current State	Issues
Education	• Basic education is compulsory. • It is necessary to go to the secretariat of the university or another to obtain a transcript or a graduation certificate.	• Children without birth registration can enter primary school but cannot obtain a school leaving certificate. • The National Education Information System (SIMEN) assigns unique identifiers to teachers, children and students, but these are not linked to the national identity card.
Health	• Antenatal visit for pregnant women and vaccination up to the age of 5 years are recommended. • The universal health insurance system is underway.	• Even if the birth is not registered, maternal and child health remains a humanitarian target but remains difficult to understand effectively and continuously. However, a unique identifier is desirable for effective monitoring and surveillance. • There is a community insurance system, targeting citizens in the informal sector, which uses the national identity card as a health insurance card, but the participation rate is still low.
Social Protection	• The promotion of one-stop shops for social protection services is progressing through digitization. • Cash benefits, including mobile money, are offered as part of anti-COVID-19 measures.	• The various social security institutions use information systems to manage beneficiary data, but the interoperability of the systems remains weak. • A single national register (RNU) has been put in place to manage data from poor and vulnerable households, but it does not cover all households and there is room to improve targeting accuracy.

Source： JICA Study Team

2.5 Activities of other Donors and Possibilities for Collaboration

（1） The World Bank

The World Bank's concept of operations consists of three pillars: i) institutional, legal or regulatory reforms in telecom and digital economy, ii) financing digital connectivity especially in lagging regions, and iii) supporting public administration in its digitalization (efforts include platform).

The World Bank is planning to launch the Senegal Digital Economy Acceleration Project. The cost of the project is US$ 100million and the counterparts are the Ministry of Digital Economy and the Ministry of Finance and Budget (MFB). The digital platforms that the Bank will focus on are Revenue Mobilization, Public Financial Management, and Procurement, and the project will support the Ministry of Finance in building the platforms. The Ministry of Finance has an intention to expand the platform and strengthen the effective management of public expenses and effective management of revenue from tax revenue in areas such as e-Procurement and e-Tax. Since the Senegalese government is also unprepared for a very complex agenda, the Bank is considering not only digital assistance but also technical assistance for cyber security. As digital ID is already supported by other donors, the Bank's support does not include a digital ID component and there will be no capital investment for the digital ID.

Table 2.13 The World Bank financed Senegal Digital Economy Acceleration Project

Name of project	Senegal Digital Economy Acceleration Project
Components	Effective management of public expenses, effective management of revenue from tax revenues
Expenses	US$ 100 million
Implementing organization	MFB, MENT
Implementation period	N/A

Source： The World Bank website and hearing from people concerned

In the area of social security, the RNU and PNBSF information systems were developed with financial support from the World Bank, and both systems were built by local IT vendors. The World Bank provides technical and financial support not only for the development of the RNU and PNBSF information systems but also for their operation and maintenance. The World Bank also provides technical and financial support for cash transfer programs such as the PNBSF. The World Bank is currently preparing the formation of a follow-on safety net project to be completed in 2024.

Table 2.14 The World Bank's Support in Social Security Sector

Program	Overview
Senegal Safety Net Project 2014 to 2024 US$97.5 million loan	・ Objective： Supporting the establishment of social safety net systems and providing cash transfers for the poorest and most vulnerable households. ・ (1) To support the development of social safety net systems. (i) Development of core instruments and procedures as the backbone of the social safety net system、(ii) Support to strengthen the organizational capacity of sectoral actors in the DGPSN and social safety net system ・ (2) Support the expansion and strengthening of the PNBSF for the poorest and most vulnerable households, (i) Cash transfers to PNBSF beneficiary households, (ii) Ancillary actions by DGPSN, sector actors, and local agencies, (iii) Support costs for program management and evaluation.

Source： Prepared by JICA Study Team with reference to the World Bank website.

In the education sector, the World Bank is leading the PAQEEB project to improve the quality and equity of basic education[6]. Within the Ministry of Education, departments such as DEE[7], DEMSG[8], and DPRE[9] are participating. In this project, decentralization of school operations at the regional, departmental, and school levels and close collaboration with the community (e.g., teacher recruitment and training, financial management of resources in schools) are important steps toward improving educational outcomes. Periodic assessment of learning over the past 10 years, initial teacher training, credentialing, review of teaching standards, and the implementation of a 10-year compulsory basic education program are also important initiatives that support the strategy in this area. The strategy was developed to move from an input-driven system of books, classrooms, desks and blackboards to a results-based management system that focuses on improving learning outcomes, school performance, and equity of access for poor children in underserved areas. The budget is US$60 million.

[6] https://projects.worldbank.org/en/projects-operations/project-detail/P133333
[7] Direction de l'Enseignement Élémentaire
[8] Direction de l'Enseignement Moyen et Secondaire Général
[9] Direction de la Planification et de la Réforme de l'Éducation

（2） UNDP

UNDP is supporting the Government of Senegal's Digital Strategy 2025, and in the framework of the Projet d'Appui à la Gouvernance Numérique (PAGNUM), the National ID Project Feasibility Study (Etude de faisabilité du Projet Identité Numérique Nationale (INN)) is being conducted from August 2021 to February 2022.

PAGNUM supports MENT with its government portals, which include the areas of Senegal Service, E-Governance, E-Justice, E-Territory, and National ID. The objectives of the INN are to facilitate administrative procedures and quick access to government information, promote interoperability of national information systems, facilitate data exchange between individuals and businesses, and promote inclusion of all people to achieve the SDGs and create wealth. UNDP commissioned GAINDE 2000 to conduct the INN study, with experts in capacity building, legal systems, and digital resources. INN is considering Rwanda's IREMBO, India's AADHAAR, UAE's UAE PASS, and Estonia's E-Estonia as benchmarks.

JICA study team had a meeting with UNDP in November 2021, and UNDP suggested that both parties may be able to cooperate in information exchange, implementation of a common framework for interoperability of national information systems and promotion of national digital IDs, division of roles (JICA focuses on information interoperability, while UNDP focuses on ID integration and implementation of legal systems and appropriate governance), financial support (support for INN operationalization through PAGNMU), and technical support (implementation of APIs for ID integration). To implement data sharing platform, it is necessary to coordinate among multiple ministries, and UNDP may be able to play a role in this coordination from a neutral standpoint.

（3） WHO

WHO is working in the health sector in Senegal based on a three-pronged plan: first, to support the achievement of UHC; second, to support the response to emergencies such as the current COVID-19; and third, to improve social welfare.

In terms of support for achieving UHC, WHO is working with the ANACMU and coordinating with the Ministry of Economy, Planning, and Cooperation. As the leading agency in the health sector, WHO also coordinates the support of all development partners, including the Chinese and US embassies, to ensure effective implementation without overlap. The main health areas to be coordinated are maternal and child health, promotion of infectious diseases (HIV, tuberculosis, malaria, etc.), non-communicable diseases (diabetes, hypertension, cancer, neglected tropical diseases), immunization (polio, etc.), and strengthening of health systems (human resource development, quality improvement of health services, drug management, health financing, governance, health information systems). The second, emergency response support, is provided for communicable diseases and pandemics (COVID-19, cholera, Ebola, corona hemorrhagic fever, etc.), while the improvement of social welfare includes support for anti-smoking and climate change measures.

（4） UNICEF

In the health sector, UNICEF supports a platform for the collection of information related to birth registration. As the EU takes initiatives in supporting the digitization of birth registration and resident registration, UNICEF would like to collaborate to link medical record information to the DEC birth registration data file. If there is a data sharing platform, it will be possible for mothers to enter the necessary information on the system in advance and register their children's births promptly after delivery at medical facilities. If the data sharing platform is interoperable with DHIS2, which is used in MSAS, there is a possibility that it can be used for resident registration, especially at health posts.

In the health sector, UNICEF also provides technical and financial support to cash transfer programs such as the PNBSF.

Table 2.15 UNICEF's Support in Social Security Sector

Equity, Governance and Social Policy Programme	・ Objective： Strengthen and expand social protection systems that support the well-being of all children in Senegal, especially those who are most at risk of discrimination and exclusion. Support the development and expansion of national social protection systems, such as cash transfers, health insurance, and education subsidies. ・ (1) Administrative, good governance, and financial reforms: Integrate data collection systems on children for efficient and transparent management of public affairs and use them to inform public policy. ・ (2) Social Security Reform： Increase public funding for the social sector, including child social protection, to provide more equitable and sustainable social services. ・ (3) Decentralization Reform： Supporting local governments to facilitate access to basic social services for children.

Source： Prepared by JICA Study Team with reference to the UNICEF website.

（5） GIZ

Digital health support is one of the frameworks of GIZ's Special Initiative on Training and Employment (Investing for Jobs), where health and development are directly linked. For example, economic development creates the necessary means for better nutrition, better housing and sanitation, and better health services, and the health of the population has a clear impact on economic growth.

Especially in 2020, Covid-19 has increased the need for and enhancement of digital capabilities in the healthcare industry. Therefore, GIZ initiated a partnership with four German companies (Hospital Engineering, COGNOS International, Tiani Spirit, and getINNOtized) and started a new project with the participation of all stakeholders, including the Senegalese government, private sector, universities, and civil society in order to turn Senegal into a growing market with a modern health care system by 2035. Specifically, in July 2021, GIZ worked with the Ministry of Health, UNICEF, and cell phone companies to introduce an app (developed by TIANI) on Covid-19, which is already in use in Australia. The app was installed in hospitals and Pasteur laboratories to link Covid-19 test data. At the same time, GIZ has also supported the logistics of trailers and other equipment as mobile inspection stations. The data is managed by MSAS and can be technically linked to DHIS2, but it is not yet connected as it is still under consideration within MSAS. The concept of GIZ is that all the systems provided are open source, so they can be linked with CNI and the existing data of other ministries.

（6） EU

The EU has been assisting the DEC since 2012 in the area of civil registration. In the EU project, which started in June 2020, the Belgian Development Agency (Agence Belge de développement: Enabel: Enabel) will be responsible for i) improving the accessibility (flow and circulation) of resident registration information, ii) recovering existing documents (creating more specialized archives), iii) developing 104 civil registration centers, and iv) training people concerned in the commune on civil registration procedures, while Civipol is responsible for developing the civil registration system and equipment in the registration centers.

Enabel commented that it would be desirable to set up a central data sharing platform instead of directly exchanging data between DEC and DAF and that JICA's participation in the EU project is favorable because DEC does not develop a data sharing platform; therefore, cooperation with the EU is expected.

Table 2.16 Overview of the EU Project to Support the Modernization of Senegal's Resident Registration system

Name of project	Projet d’appui à la modernisation de l’état civil (PAMEC)
Components	1. Improving governance in civil registration 2. Improving information and knowledge about civil registration 3. Preservation of civil registration archives
Expenses	EUR 5,000,000
Implementing organization	Central civil registration center（Centre national d’état civil： CNEC）（Predecessor of DEC））
Implementation period	Five years from September 2012 (extended by one year from the original plan)

Source： Previous survey

Table 2.17 Overview of the EU Program to Support the Strengthening of Senegal’s Civil Registration Information System

Name of project	Programme d’appui au renforcement du système d’information de l’état civil et à la création d’un fichier national d’identité biométrique
Top target	Contribute to respecting the rights of individuals with regard to identification through the establishment of an efficient civil registration information system and civil registration with secure biometric information.
Project objectives	1. Improve Senegal's civil registration information system 2. Create a resident registration document with biometric information
Beneficiaries	・Total Senegalese population (15 million) ・Experts（7 million） ・All communes ・Government organizations in Senegal
Expected results	Objective 1: improve Senegal's civil registration system Output 1-2: Supply and demand for civil registration services strengthened through training and awareness-raising Objective 2: create biometric civil registration documents Output 2-1: civil registration document base with biometric information is connected to each commune
Estimate	EUR 28,000,000
Implementing organization	Senegal：MCTDAT（Objective 1）、MINT（Objective 2） EU： CIVIPOL（Mainly Output1-1 and Output2-1）、Enabel（Mainly output 1-2）
Implementation period	42 months from June 2020

Source： Previous survey

（7） French Development Agency（AFD）

In the field of e-health, AFD funded the NGO, AMREF (Association pour la Médecine et la Recherche en Afrique) from 2015 to 2018 to support an ICT-based study on pregnancy, delivery, and child undernutrition in health centers in Senegal. The project supported research on pregnancy, childbirth, and child undernutrition using ICT in health centers in Senegal.

In the education sector, AFD is implementing the Program for the Development of Education in Senegal (PADES) with a total cost of €72.2 million, co-financed by GPE (€37.2 million donation) and AFD (€35 million, of which €10 million grant and €25 million low-interest loan). This program is to support Senegal's revised education sector policy document, the Program for the Improvement of Quality, Equity and Transparency in the Education and Training Sector (PAQUET-EF) (2018-2030), to be implemented by the Ministry of National Education (MEN). This program will be implemented over a four-year period (2019-2022) and will be completed during 2023. The co-funding is managed and supervised by AFD, a partner agency of GPE. SIMEN, which is currently under development, is also supported by this program.

（8） China

China has been developing an e-government network (intranet) in Senegal, and the completion ceremony was held in February 2009. The Chinese government, through the Export-Import Bank of China, granted a preferential loan of 390 million yuan to the Senegalese government to develop data systems for government agencies, universities, hospitals, and other national entities, an e-government data center platform, and a data center office building. Huawei and China Machinery Engineering Corporation (CMEC) jointly developed the facility. Huawei provided the network equipment, installation, adjustment, and maintenance, and the data center and office building were contracted by a Chinese company.[10]

China is currently implementing and supporting Smart Senegal, which consists of five components, to help Senegal realize its PSE Priority Action Plan (2019-2023).

Table 2.18 Smart Senegal

Name of project	Smart Senegal	
Components	1. Safe City： 2. Safe Education： 3. Smart Territories： 4. Smart Wi-Fi： 5. Submarine cable	Installation of surveillance cameras, traffic monitoring Use of ICT in the field of education Provision of public services through "Citizen's House" Installation of Wi-Fi spots Submarine cable Installation
Expenses	87 billion FCFA	
Implementing organization	ADIE	
Implementation period	2019-2023	

Source： Smart Senegal website

（9） South Korea

The Economic Development Cooperation Fund (EDCF) of South Korea implemented the Government ICT Infrastructure Project in Senegal from 2009 to 2011 to develop a wireless network (WiMAX (WiMAX) in

[10] http://www.e-gov.org.cn/egov/web/article_detail.php?id=98460

Senegal[11]. 655 public institutions in 35 cities were connected by a wireless network to improve the transparency and productivity of public services. On the Senegalese side, the Ministry of Economy and Finance is the borrower and ADIE is the implementing agency. The loan is for approximately US$2,500 million (or less), with an interest rate of 0.5% and a maturity of 30 years (with a grace period of 10 years).

（10） Others

In 2013, the World Bank's Doing Business ranked Senegal as one of the lowest-ranked countries in sub-Saharan Africa for the number of days it takes to obtain a construction permit. In response, the ADIE, in collaboration with other ministries and agencies, began developing TeleDAc, an administrative portal, in 2013 to improve the investment environment. As a result, the procedure can be done online and the number of days to obtain a construction permit has been shortened. The Investment Climate Facility for Africa (ICF) and the Senegalese government contributed 58% and 42% of the funding, respectively.

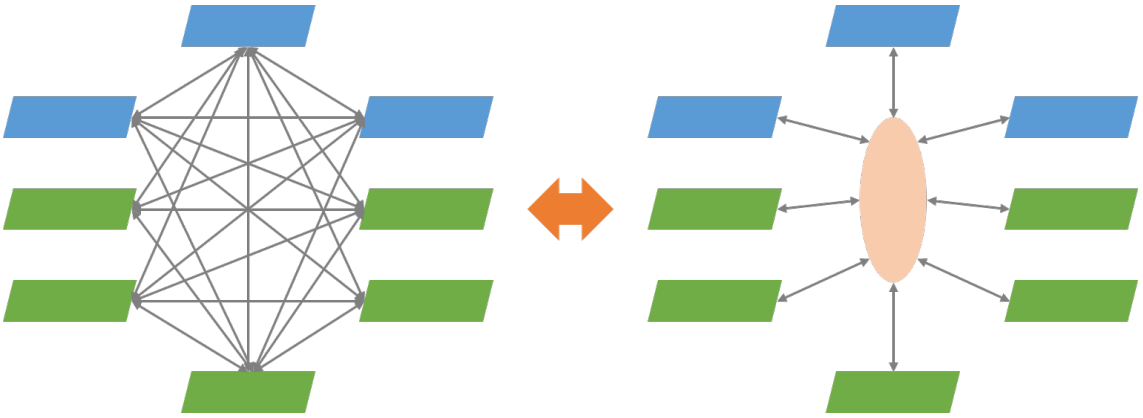
[11] https://www.ippapublicpolicy.org/file/paper/593bf68c089e5.pdf

3. Basic Concept of Data Sharing Platform

3.1 Need for Data Interoperability

From the above, the challenges of digitization in each sector have been identified in the previous chapter, and we can understand that there is a need to link data and information systems. However, simply connecting each system individually is not enough. In general, connecting each of them individually leads to concerns about information leakage due to the complex mesh structure and low scalability. Even if something goes wrong, it will be difficult to find the cause and fix it. The Data sharing platform, on the other hand, has no data to link themselves to, so the risk of information leakage is relatively low. In addition, it takes time to identify the disability when connected to multiple systems, making it difficult to determine the cause and respond to any problems; however, the system configuration of the data sharing platform makes it relatively easy to identify the cause of the problem and thus speed up the response.

Figure 3.1 Methods of Sharing Data and Information Systems



Source： JICA Study Team

By designing a highly secure data sharing platform, it is possible to provide robust security and ensure a secure exchange. By connecting to the data sharing platform, the same security policy can be applied and by agreeing on common rules and protocols, uniformity of data sharing can be guaranteed. In addition, compared to working with each of the individual systems, the configuration is simple and the maintenance is easy. Moreover, because more connections can be made based on rules and protocols that have already been defined and agreed upon, it will be extremely expandable compared to their connection one by one.

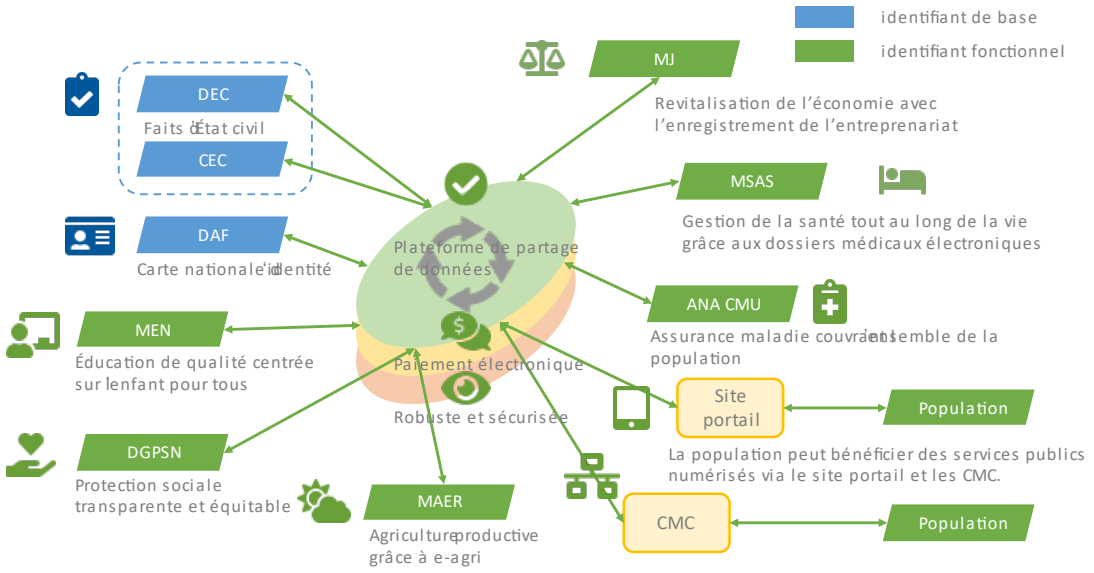
The EU-supported central database will issue a unique ID at birth that will last a lifetime. Newborns do not have an ID card, but by issuing an identical or linked ID, children under 15 will get a national ID card instead of the current analog birth certificate/registration certificate and it will be possible to receive public services such as immunization and basic education and keep these records. Even when obtaining a national identity card, it is not necessary to prepare the necessary documents in analog and the procedure can be done quickly. Also, it is believed that it will be possible to provide the necessary public services efficiently and equitably to as many people as possible.

For example, Chile's Social Registry (Registro Social de Hogares, RSH) is often cited as one of the most

advanced cases in integrated data management for social protection. RSH provides one-stop services across sectors by building interoperability with all social assistance programs, as well as other sectors such as national ID, health and education, and social insurance management information systems. In addition, RSH shared data and information with citizens to create a two-way communication channel. This has contributed to effective and efficient service delivery through 1) equitable allocation of resources based on objective and comparable information, 2) supervision of multiple schemes, and 3) coordination with other sector services.

The diagram below shows conceptually that based on the cooperation between DAF, DEC, DSISS of MSAS and MJ, MEN, DGPSN, MAER, ANACMU, etc. will be able to provide more efficient and equitable public services[12].

Figure 3.2 Advantages Provided by the Data Sharing Platform



Source： JICA Study Team

The data sharing platform does not directly store data but exchanges specific information to provide value-added public services according to the protocol agreed by the users who are connected to it. The data sharing platform aims, for example, to provide high-quality education to all children in the field of education, to provide transparent and equitable social protection in the field of social protection, to increase the productivity of farmers in the field of education. in the field of agriculture and in the field of health care, and to provide health insurance that covers the entire population in administrative services of each ministry. To this end, the data sharing platform aims at platform which enables secure and efficient data exchanges.

[12] The official names of the institutions are as follow: DAF (Direction de l'automatisation des fichiers, Ministère de l'intérieur) DEC (Direction de l'état civi, Ministère du développement communautaire, de l'équité sociale et territoriale), DSISS (Division du système d'information sanitaire et sociale, Ministère de la santé et de l'action sociale：MSAS), MEN (Ministère de l'éducation nationale)、DGPSN (Délégation générale à la protection sociale et à la solidarité nationale), (Ministère de l'agriculture et de l'équipement rura), ANA CMU (Agence nationale de la couverture maladie universelle)

The data sharing platform is equipped with a robust and secure cybersecurity device; electronic payment is possible and personal information needs protection with the use of the national identity card as a reliable identifier for the connection. The Senegalese government's vision of digital public administration is the provision of a wide range of public services to end users through portal sites and Community Multimedia Centers (CMC), with the aim of addressing issues of the digital divide such as geographical constraints, Information and Communication Technology (ICT) illiteracy, and lack of possession of devices.

3.2 Benefits of the Data Sharing Platform

In addition to the function of reception desk for the requests of the populations to the administration, the data sharing platform has the function of making it possible to link the data and information systems of the ministries and agencies and thus makes it possible to implement functions that lead them to take proactive actions towards the populations.

Many people have been financially affected by COVID-19, but in Germany and the United States, benefits were quickly provided thanks to the national ID without the beneficiary requesting it. Even in normal times, Estonia automatically enrolls children in kindergarten without request.

In the field of education, for example, the Ministry of National Education will be able to identify children whose births have not been registered and, in cooperation with the Ministry of Justice, have them enrolled in civil status, grant them an end-of-study diploma, and monitor graduates.

In the field of maternal and child health, a birth certificate may be issued through the intermediary of traveling midwives who will contact the commune's CEC, online or offline, to inform of the birth of a child and to support the declaration of births.

In the agricultural field, based on the address of the registered farmer, it will be possible to provide crop-appropriate market information and weather information and to provide timely subsidies and other aids. in the event of disasters such as floods and pests.

In the social protection sector, collaboration with other ministries can be expected to improve the targeting of beneficiaries from the point of view of equity and transparency.

Table 3.1 Expected Benefits through the Utilization of the Data Sharing Platform

Sector	Issues related to ID use and data linkage	Examples of benefits of data sharing platform	
		Proactive action by the administration with the populations	People's actions with the administration
Education	• Many school-going children are not registered as births, which makes it impossible to correctly assess the birth rate and school attendance rate • Low acquisition rate of CFEE, so birth rate and	• The Ministry of National Education will be able to identify children whose births have not been registered and, in cooperation with the Ministry of Justice, register them as residents and grant them diplomas. More accurate	• Parents of disabled or withdrawn children can apply for homeschooling to the Ministry of Education online and receive basic and secondary education through online learning and increase the school attendance rate.

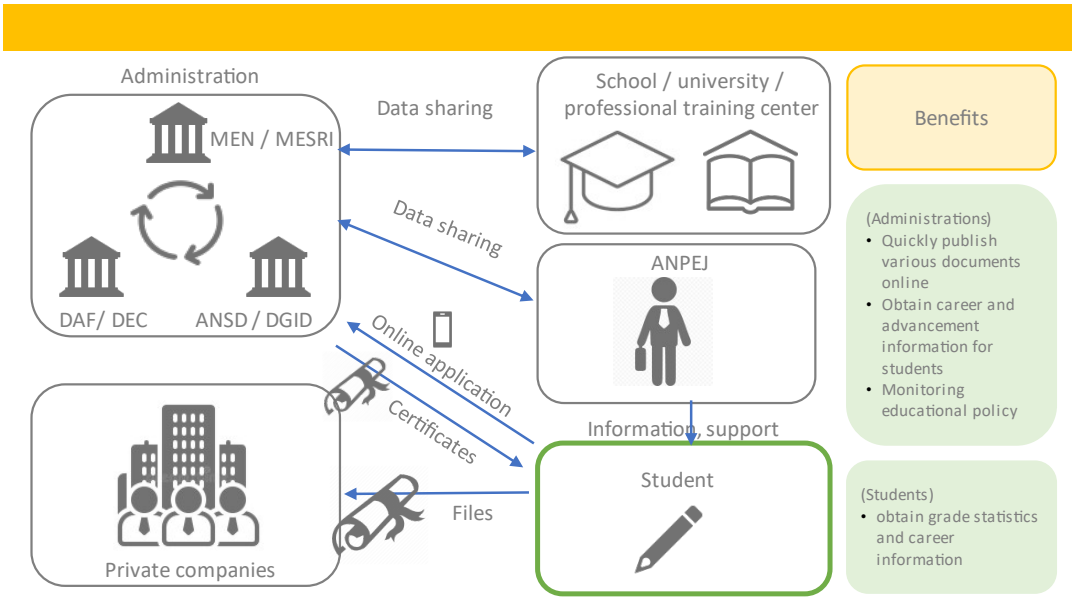
	enrollment rate cannot be determined correctly, and the country's education level cannot be assessed correctly. • Lack of coordination between the Ministry of National Education and the Ministry of Higher Education. Difficult to track students， and hence lack of data analysis to support policy formation	fertility and school attendance rates can be ascertained. • The Ministry of Higher Education will be able to automate clerical work such as transcripts and track graduates. It will be possible to analyze the linked data in the future and provide useful evidence for policy formation.	• Official transcripts and other documents can be downloaded from the national ID portal, eliminating the need to go to the police station to get certified copies. • Job seekers will only need to provide their national ID, and companies will be able to refer to their past diplomas, transcripts, and certificates without having to provide them, making it more convenient for both companies and job seekers.
Maternal and Child Health	• Lack of real-time linkage with birth registration and resident registration, resulting in inaccurate identification of relevant persons and time taken to provide administrative services. • Lack of timely sharing of information on home deliveries in the birth register prevents appropriate administrative services (e.g. vaccination information).	• MSAS can issue birth certificates to mothers by exchanging data with visiting midwives and linking them to the DEC through the data sharing platform. The registration offices of the communes are also linked through the data sharing platform and can support the registration of births directly applied for by the parents.	• Pregnant mothers can apply for antenatal check-ups through the portal of the data sharing platform of the Ministry of Health and Social Action and the visiting midwives. The portal also allows mothers to make appointments for regular check-ups without having to go to the commune health post, and to receive necessary consultations and information about vaccinations for their newborn children via SMS on their mobile phones.
UHC	• The lack of real-time linkage between the required data from the relevant ministries (e.g., birth registration from DEC, personal income (taxes) from the Ministry of Finance, etc.), SIGI CMU may make the registration of new insured persons time-consuming and prone to manual entry errors and make it difficult to set premiums on a pay-as-you-go basis. It may be also difficult to set premiums based on reimbursement. • Management of community health insurance data only (still no unified management and administration of other health insurance schemes).	• When cross-referenced with personal income data, ANA CMU will be able to calculate premiums on a proportional basis, which will result in a more equitable burden (from a flat premium to higher premiums for those with higher incomes and lower premiums for those with lower incomes). The financial resources of the ANA CMU will be stabilized, and residents will benefit from a gradual increase in the health care services package.	• The data sharing platform between the SIGI CMU and the health facilities allows the patient to have a continuous medical history under a single medical record number, which reduces the physical burden and costs for the patient due to the reduction of duplicate tests and medication, even when changing health facilities. • Through the data sharing platform between MSAS and ANA CMU, patient information is shared between health facilities to ensure that patients receive tailor-made health care specific to their needs.
Social Protection	• There is no interoperability among different management information systems of social protection programs. There	• Ministries and agencies in social protection will be able to identify poor and vulnerable households and disaster-affected people and provide	• Poor and vulnerable households will be able to apply for social protection services at one-stop and online. No more waiting at the counter but receiving cash

	is no one-stop service, and household data is not shared among different social protection programs. • There is no interoperability with CNI and civil registration. ID verification is unable to be done quickly and accurately in examining the applications to select recipient households.	them with rapid, equitable, and transparent services in peacetime and emergencies through one-stop service and online. This will be made possible by expanding the scope of the RNU data in the DGPSN from the beneficiary households to all households, and by enhancing interoperability with management information systems of the respective social protection programs.	benefits through mobile money.
Agriculture	• There is no system in place for the rapid distribution of subsidies to victims of disasters. • -No system exists to collect information on weather and market prices.	• The Ministry of Agriculture and Rural Facilities can track the addresses of registered small-scale farmers, provide online market and weather information specific to cultivation, and quickly distribute subsidies to victims of disasters (floods, pests, etc.) through a data sharing platform.	• Small-scale farmers can apply to the Ministry of Agriculture and Rural Facilities for input subsidies, such as seed and fertilizer, and receive online vouchers (which cannot be diverted to other uses) to buy from cooperatives and agro-dealers.

Source： JICA Study Team

The following figures show more concretely the flow of data and the flow of actions.

Figure 3.3 Example of Use in the Education Sector



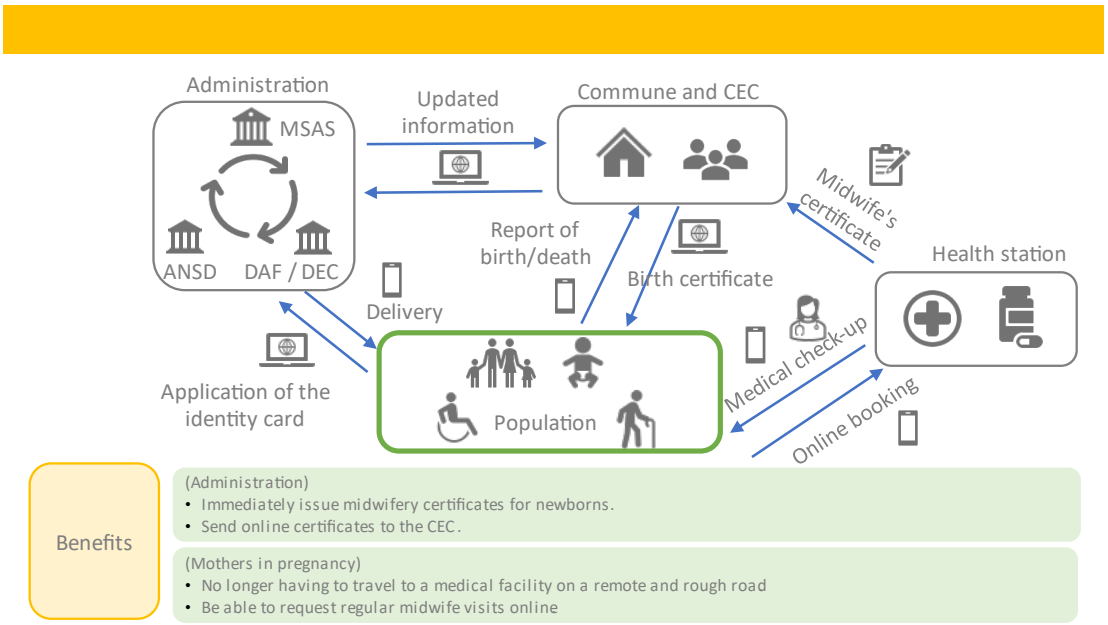
Source： JICA Study Team

The figure shows an example of the use of the data sharing platform in the education sector. By sharing the necessary information between ministries and agencies, the administration will be able to quickly publish various documents online and obtain the latest information on student careers and advancement. The platform

will also be useful for monitoring education policy.

On the other hand, students will be able to obtain grade statistics and career information.

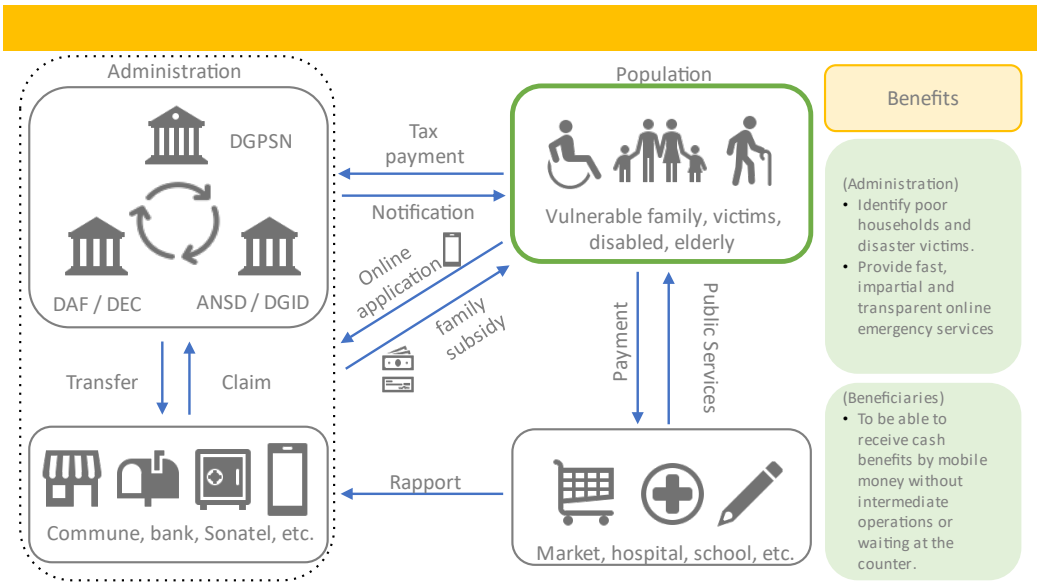
Figure 3.4 Example of Use in the Health Sector



Source： JICA study team

In the health sector, for example, the administration will be able to immediately issue midwifery certificates for newborns and send them online to the CEC, even during mobile visits.
In addition, pregnant mothers will no longer have to travel to a medical facility on a remote and rugged road and will be able to request regular online visits from midwives.

Figure 3.5 Example of Use in the Social Protection Sector



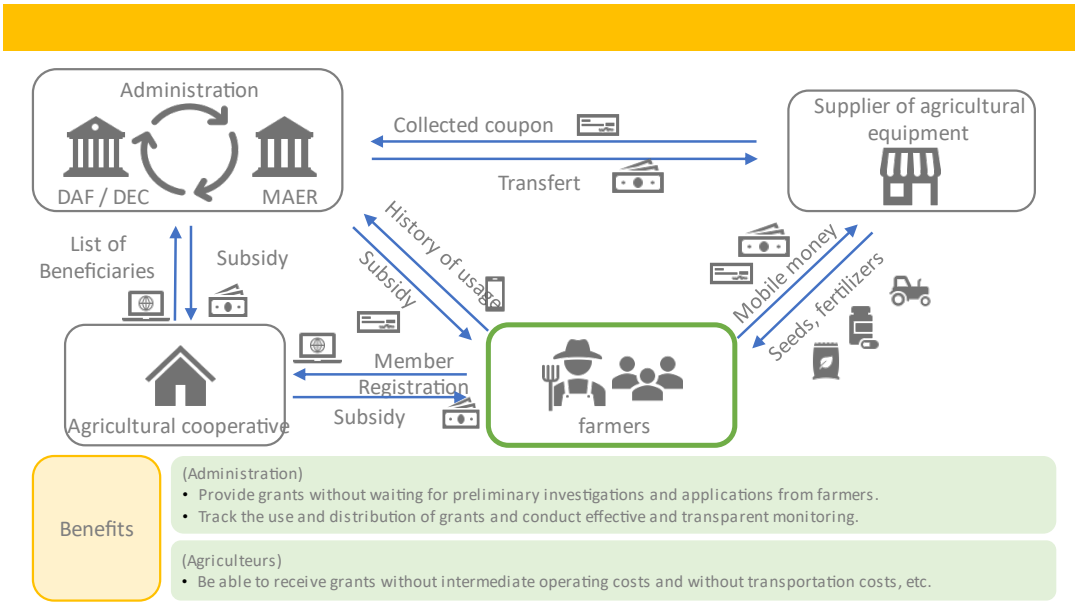
Source： JICA Study Team

In the social protection sector, the administration will be able to identify poor households and disaster victims

and provide fast, impartial, and transparent online services in emergencies. Beneficiaries will be able to receive cash benefits via mobile money with no middleman or without waiting at the counter.

In the further, the user can be expected by linking the data sharing platform to more open data and information systems.

Figure 3.6 Example of use in the Agriculture Sector



Source： JICA Study Team

In the agricultural sector, based on information from farmers in each region managed by agricultural offices and agricultural cooperatives, it will be possible to grant subsidies without waiting for preliminary inquiries and requests from farmers. In addition, by providing grants with vouchers and mobile money, it is possible to trace their use and distribution and to provide efficient and transparent support.
On the farmer's side, by receiving payment by electronic vouchers or mobile money, the farmer can receive subsidies without intermediary operating costs and without visiting government offices.

Table 3.2 Expected Benefits through the Utilization of the Data Sharing Platform (Long-Term)

	Benefits	Linkage of information
Education	Children born in remote villages will also have access to the same educational content and learning opportunities as children of Dakar through a digital platform	In conjunction with the Ministry of National Education's SIMEN, access digital educational content easily with a single sign-on. Connect with the Ministry of Higher Education's system to present students' diplomas, transcripts, and credentials through their national IDs.
Maternal and child health	Pregnant mothers can get the medical care and consultations they need on their mobile phones without having to go to a hard-to-reach and expensive community center.	Through tracking and collecting data on the status of pregnant women in every household, it is possible to conduct regular antenatal and postnatal check-ups. In addition, by promptly birth registration at the time of delivery, it is possible to register and inform about the essential social

		protection/welfare services (e.g. vaccinations, regular medical check-ups, nutritional supplements, etc.).
Social Protection	The process of verifying the identity of beneficiary households through national IDs, which is part of the current operations of RNUs and PNBSFs, will be strengthened. This is expected to reduce targeting errors in RNU and other social protection programs that utilize RNU, thereby promoting effective resource allocation and operational efficiency. It is also expected to improve the effectiveness and efficiency of child protection programs by monitoring the fulfillment of civil registration, which is one of the conditions for cash benefits, and by strengthening the linkage between child protection programs and birth registration.	RNU has three means to collect data of the poor and vulnerable households: 1) geographic targeting, 2) community targeting, and 3) field surveys. This household data has been shared with 25 agencies implementing social protection programs. In the future, it is expected that big data will be used to analyze the current situation, forecast the future, and measure the effectiveness of policies through evidence-based policy planning, and implement solutions that will lead to the planning of preventive measures needed in each region and the effective allocation of resources such as cash benefits.
Agriculture	Rural smallholder farmers can find the best market prices for crops and livestock, through mobile apps, and easily and frequently get advice from extension workers and weather information.	Although there is no existing system, future linkages between the Ministry of Agriculture and Equipment, Establishments, farming organizations, and farmers through an information exchange platform will enable farmers affected by floods and food shortages to receive timely digital remittances and vouchers that will improve their resilience in times of crisis.

Source： JICA Study Team

4. Overview and Technical Specifications of Data Sharing Platform

4.1 Options of technologies to be applied

（1） Analysis of candidate technologies

As shown in the previous chapter, the data sharing platform is a platform that enables to refer to the information owned by each organization efficiently and securely by exchanging the data mutually among administrative agencies based on the national ID. In the world, there are several systems and services in a practice that have similar concepts and functions to this data sharing platform and the portal site, focusing on digitalization of administrative services and providing one-stop services for citizens, such as X-Road from Estonia, Modular Open Source Identity Platform (MOSIP) from India, both of which are already expanding into multiple countries, a Japanese government's initiative called the Cooperation Network System for Personal Information (CNSPI), and FIWARE which is a European Union's (EU) initiative in which Japanese companies also participated. In order to examine how to realize the concept of the data sharing platform technically, features of these four systems are analyzed and their applicability to this case is evaluated. Although there is an option to develop the system from the scratch without referring to the existing systems, both JICA and the Senegalese government expect to quickly introduce the data sharing platform without spending too much time. In addition, since X-Road and India Stack have already been recognized internationally as successful cases, and they are being expanded to other countries. Therefore, considering the possibilities of utilizing the existing systems and open-source systems is prioritized given the past experiences and lessons would be helpful to install the system faster.

a） X-Road

X-Road is an Estonian national data sharing platform for realizing "e-Estonia" which is one of the earliest initiatives in the world that has embarked on materializing the digital government and digital society. It is an essential foundation to fulfill Estonia's ideas, such as the once-only principle (a principle that does not require re-provision of information once provided), decentralization, and a high degree of security and transparency, with features mentioned as follows.

- Since existing data owners can realize data exchange by utilizing open-source modularized APIs, the impacts on the existing systems and data as well as the burden of implementation are small.
- Since X-Road offers a linkage mechanism to mutually refer to existing data or systems via the Internet, it is highly expandable.
- As data and systems are decentralized, there is no single point of failure.
- There are several mechanisms to maintain high security, such as dependable access control, secure data transmission, and notifications to users when accessing personal information.
- Since it is a mechanism that leads to the improvement of the efficiency of administrative work and the enhancement of services for citizens by exchanging the existing data owned by administrative organizations on the back-end, it is highly similar to the data sharing platform.

These features seem suitable for this project because of the following points: data and infrastructure already

owned by each government organization could be utilized; data and network security are highly focused; open-source APIs can be applicable. Besides, as X-Road has already been expanding overseas and promoting multilateral data linkage with Scandinavian countries, such as Finland, it would be considered the possibility of applying to the standardization of the ID system within the Economic Community of West African States (ECOWAS) in the future.

On the other hand, there are not many cases to install it in developing countries because its mechanism is based on a stable and reliable network and its main target for overseas expansion is European countries. In addition, not only the infrastructure and systems, but also soft components, such as the administrative organizations, institutions, and procedures are well-established and are considered to be a major success factor.

On the other hand, it has been pointed out that X-Road is not so suitable for developing countries because its mechanism is based on a stable and reliable network and its main target for overseas expansion is European countries. In addition, not only the infrastructure and systems, but also soft components, such as the administrative organizations, institutions, and procedures are well-established and they are considered to be a major success factor.

b） MOSIP (Modular Open Source Identity Platform)

MOSIP is a third-country expansion package of India’s digital ID program, "India Stack" based on its national ID "Aadhaar" owned by more than 90% of the population. In India, centering on digital national ID which contains biometrics data, various types of players have been encouraged to develop and offer many services on the platform based on the idea of open innovation. It helped to create some killer services such as subsidy payment and payment function that eventually led to the voluntary spread of the national ID.
MOSIP aims to make the identities of individuals around the world the public goods by expanding its success story overseas. It is based on the MOSIP principles such as "inclusion" that treats all people without disparity, "design" that is highly secure, interoperable and vendor-neutral, and "governance" that protects privacy and user rights. As for the applicability to this project, the following features can be considered particularly beneficial.

- MOSIP is designed for expansion to developing countries based on India Stack's good practice in India and has already been introduced in several developing countries.
- Since it is a platform that can be interoperable with external systems, the impacts on the existing systems and data are small whereas the expandability is high.
- Since it is composed of modularized open-source APIs, it has a high degree of flexibility in development and customization.
- It ensures adequate security by making the ID information is centrally saved and managed.
- As it is a digital ID-based platform, it has a similarity to the concept of this project.

On the other hand, while MOSIP focuses on digital ID management as an "ID management platform", in Senegal, digital ID is already widespread and the national ID management system is in operation by DAF.

According to the interviews with the government agencies, there are great expectations for the creation of a system that utilizes the existing national ID management system. Based on this point, if constructing a system based on MOSIP, it will be necessary to apply its components other than ID management and link them with the existing ID management system. Although this seems technically possible, little useful information regarding the existing system which was originally constructed by IRIS of Malaysia has been obtained so far. Therefore, there are concerns about its adaptability and load of implementation as it will require a detailed analysis of the current situation and the way of linkage. Besides, although the Philippines, Morocco, Guinea, Ethiopia, etc. are proceeding with the introduction of MOSIP, it seems that the progress is not necessarily moving smoothly. The causes of these problems are said to include lack of sufficient understanding of MOSIP, lack of resources, and implementation without appropriate customization in accordance with the local circumstances. Thus, it is necessary to give due consideration to these points for this project as lessons learnt.

c） FIWARE

FIWARE is a group of open source modules for a data management platform developed and proven in Europe, focusing on cross-sectoral data exchange, collaboration, processing, analysis, etc. Although it is a project led by EU, NEC has also participated from the early stage of development phase. The free software components called "Generic Enabler" that consists of about 40 types of modules in 7 categories can be freely combined and utilized through its common interface according to the purpose. The main purpose of the development of FIWARE is to materialize data utilization and cooperative service provision across industries among local governments and companies. It is envisioned with a particular focus on making cities smarter and realizing the smart society.

To date, more than 1,000 companies have been utilizing FIWARE while more than 350 organizations including NEC are members of "FIWARE Foundation", a non-profit organization that promotes the spread of FIWARE. Its laboratories and business hubs are located around the world including Tunisia in Africa. As for Japan, it has also been adopted by one of the Cabinet Office initiatives called “Smart City Takamatsu” with more than 60 stakeholders having taken part in under the industry, government, academia collaboration. The following points can be advantages in case of applying FIWARE to this project.

- Since it is a mechanism designed for interoperability that systems owned by each organization is connected with each other, the impacts on the existing systems and data are small whereas the expandability is high.
- Since it is composed of modularized open source APIs, desirable functions can be selected and utilized. Therefore, it has a high degree of flexibility in development and customization.
- There are some extent of knowledge, experiences, and resources in Japan as well because NEC has participated in the FIWARE initiative from the development phase and has some experiences of practical introduction in Takamatsu City and Kakogawa City.

On the other hand, since the main purpose of FIWARE is to build an environment where anyone can openly use existing data for more advanced data utilization and service provision, the basic concept could be said different from this project whose main target is public service provision based on the digital ID platform. In

fact, even in the cases in which NEC has been involved so far, there was no case to develop data linkages with personal IDs whereas their focus is to create smart cities on a city or local government basis. In addition, FIWARE seems more suitable for developed countries as FIWARE-based initiatives generally expect that existing players have a great amount of data regardless of industry, government, or academia. In fact, cases of implementation in developing countries are rare.

d） Cooperation Network System for Personal Information (Japan)

The Cooperation Network System for Personal Information (CNSPI) and its Portal site are Japan's platform system in order to improve the efficiency of administrative operations and convenience of citizens by utilizing the My Number Card, which is the national ID of Japan. It offers one-stop digital public services based on fulfilling mutual personal information inquiries between related organizations. The former is a system for mutual data linkage via a dedicated network among the government organizations, such as Local Government Wide Area Network (LGWAN), and the latter is a portal site that serves as a contact point for general users to receive various public services online. By logging in to the portal with the My Number (ID), following types of services are offered via the portal: confirming the status of personal information and available services; receiving various personal notifications regarding public services; and conducting public service procedures. Considering the applicability to this project, the following features can be particularly beneficial.

- High degree of security is ensured since information sharing within government agencies is realized through a closed network dedicated to government agencies.
- Since the basic concept of CNSPI, which is digitizing public services and provide them as one-stop service via the portal site with the digital national ID, is common to the concept of this project.
- CNSPI could be relatively easy to adopt its knowledge and experiences because Japanese government agencies and companies have been involved in the design and development of CNSPI.

On the other hand, since it is still in the process of expanding even in Japan and has no experience of exporting it overseas, the knowledge and experiences could be not sufficient compared to the initiatives of other countries such as X-Road and MOSIP. In addition, since it is not an open source system, load on introduction could be heavy if certain vendors who have experiences are not involved. Also, it might be inferior in terms of future system updates and expansion.

（2） Evaluation of candidate technologies

The evaluation of the applicability of the four technologies to this project is summarized in Table below. Each item is evaluated on a three-point scale, and the larger the score is, the higher the evaluation is. (Note that this evaluation is based on the features of each technology which are explained and valued generally and has not compared each other)

Table 4.1 Evaluation of Candidate Technologies

Technology	Experience of adoption	Workload on installation*	Scalability	Security	Similarity with this project	Applicability of Japan's resources	Total
X-Road	2	3	3	3	3	1	15
MOSIP	2	2	3	3	2	1	13
FIWARE	1	3	3	3	1	2	13
CNSPI	1	1	2	3	2	3	12

Note: The higher number is, the lower the introduction load is.

（3） Detailed investigation on X-Road

In order to specify the functions that should be equipped with the data sharing platform in Senegal, details of X-Road, which is highly valued for its high applicability in the previous section, such as i) basic concept, ii) operating model, iii) architecture configuration, and iv) main functions are investigated.

i) Basic concept of X-Road

X-Road is designed according to the Estonian e-Government principles shown in the table below. As shown in these principles, it can be said that the basic concept of X-Road is to realize the efficient and non-duplicated information management through interoperability with keeping the systems and information distributed in various places as they are and ensuring high security and transparency.

Table 4.2 Estonian e-Government Principles

Principle	Description
Once-only	Data is collected only once by an institution, eliminating duplicated data and bureaucracy
Decentralization	There is no central database and every stakeholder, whether a government department, ministry, or business, gets to choose its own system
Interconnectivity	All system elements exchange data securely and work smoothly together
Integrity	Data exchanges, machine to machine communications, data, and log files are independent and fully accountable
Open platform	Any institution may use the infrastructure and it works as an open source
No legacy	Continuous legal change and organic improvement of the technology and law
Transparency	Citizens have the right to see their personal information and check how it is used by the government via log files

Source: Developed by JICA Study Team based on "e-Estonia guide" (e-estonia.com)

ii) Operating model of X-Road

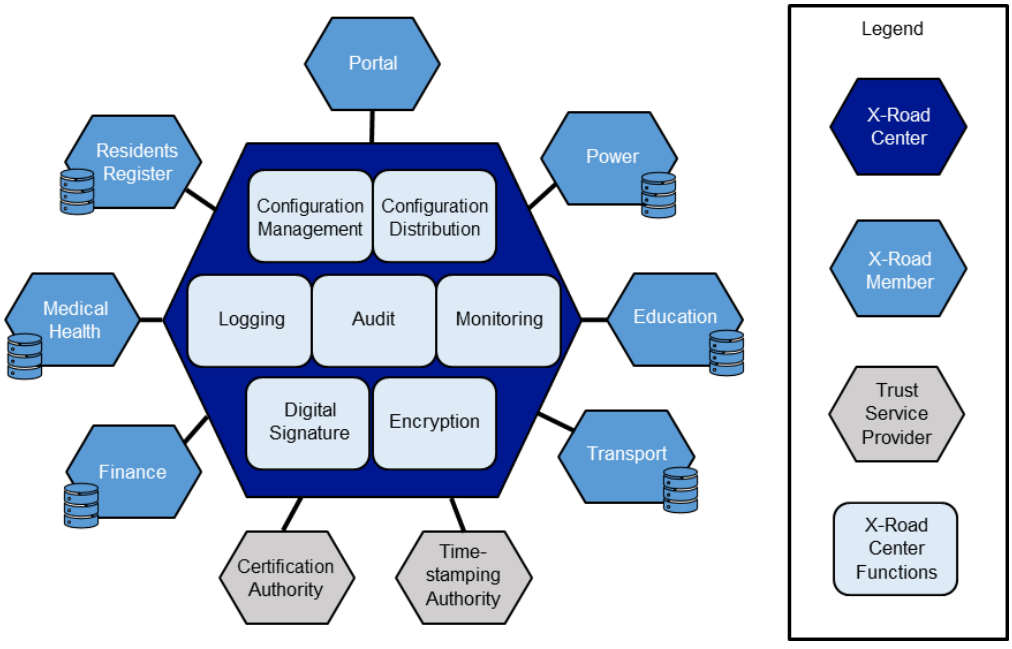
There are three main actors responsible for the operation of X-Road: "X-Road Center", "X-Road Members", and "Trust Service Providers." The X-Road Center is responsible for the operation and management of the entire system as the operating body of X-Road. On the other hand, X-Road members provide various services via information systems connected to X-Road, whereas trust service providers provide electronic certificate issuance and timestamping services. The detailed roles of each entity are shown in the table below while, a bird's-eye view of X-Road is demonstrated in the figure below.

Table 4.3 Entity and its main role in the X-Road operating model

Name	Main roles	Corresponding institutions in Estonia
X-Road Center	Administrating the entire X-Road: responsible for managing configurations on X-Road members connected to X-Road, servers, and information systems, operating help desk, formulating security policy and rules, monitoring servers, and auditing data communication	Estonian Information System Authority (RIA)
X-Road member	Developing and operating information systems that connect to X-Road and providing services to users, as well as exchanging data via a security server (described later). Basically, it is composed of organizational units, such as ministries, companies, organizations, and institutions. They are approved as an X-Road member by introducing the security server / adapter server (described later) required for data exchange and making an agreement with the X-Road Center.	Ministries, companies, and organizations
Trust service provider	Providing digital certificate issuance and timestamping services for digital signatures. It is operated based on the laws, rules, and accreditation system such as the Electronic Signature Law established by each country.	SK ID Solutions (established by Estonian two major banks and two telecommunications companies)

Source: Developed by JICA Study Team based on “x-road.global”

Figure 4.1 X-Road operating model bird's-eye view

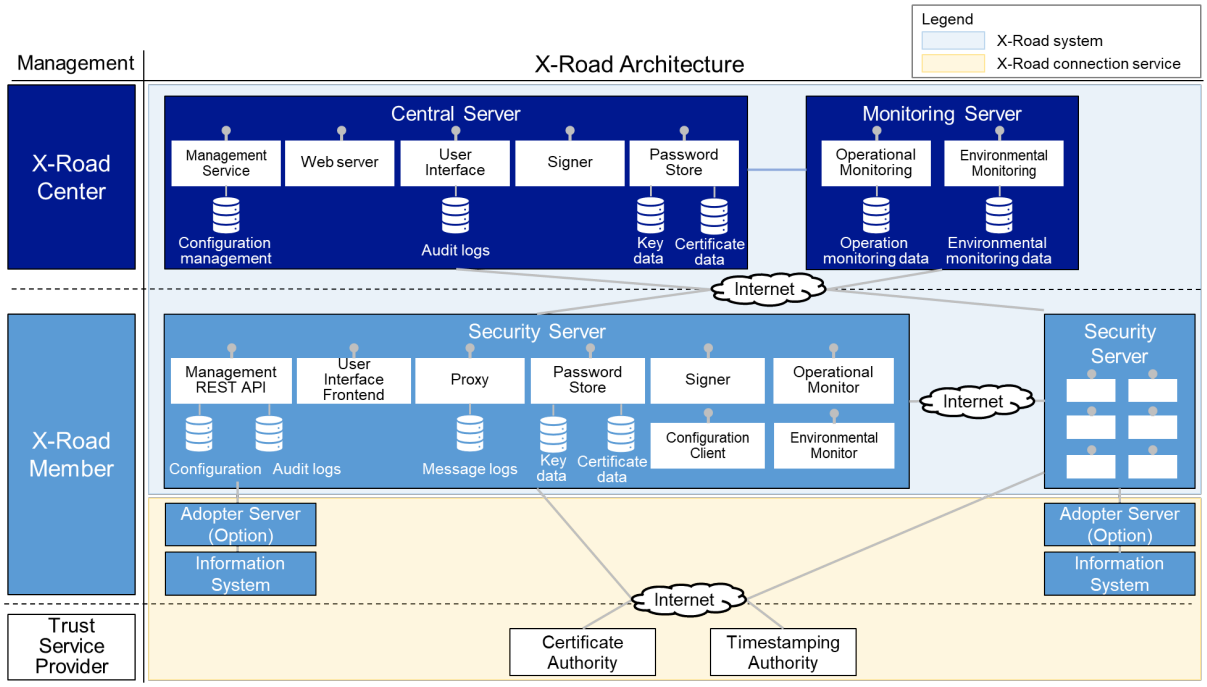


Source： JICA Study Team

iii) Architecture of X-Road

The X-Road architecture is shown in Figure 3.2 according to the above-mentioned operating model. X-Road consists of two layers: "X-Road main unit" and "X-Road connection service". The X-Road main unit provides the core functions required for information exchange, and consists of three elements: "Central server," "Security server," and "Monitoring server". Of these components, the central server and monitoring server are administrated by the X-Road Center, while the security server is managed by the X-Road member. On the other hand, the X-Road connection service provides services to users and issuance services, such as digital certificates used for digital signatures, and consists of "information system", "adapter server", "certificate authority", and "timestamping authority". Regarding these components, the information system and adapter server are managed and operated by X-Road member, whereas the certificate authority and timestamping authority are provided by the trust service providers. The role of each component is summarized in Table 3.4.

Figure 4.2　architecture of X-Road



Source： JICA Study Team

Table 4.4　X-Road components and roles

Layer	Component	Management entity	Main roles
X-Road main unit	Central server	X-Road center	Responsible for managing the X-Road configuration regarding X-Road members, security servers, certificate authority, and timestamping authority and distributing the list of them to each security server.
	Monitoring server		Monitoring the environment and operation of the security servers. Whereas environmental monitoring monitors the status of the servers, such as OS, memory, disk capacity, and CPU load, operational monitoring watches the operating status, such as the called service and the number of their times, and the average response time.

	Security server	X-Road member	By being owned by each organization and functioning as an access point based on common technical specifications, it mediates service calls and responses between information systems operated by X-Road members for enabling secure data exchange. Specifically, it sends and receives data via a security server, provides digital signatures and timestamps, and logs.
X-Road connection service	Information system		Providing services to users through portal sites as well as providing data to other systems for data exchange. Information systems are registered in the security server owned by each organization by the X-Road members. Then, realizing data exchange directly between the security servers or via the optional adapter server after being approved by the X-Road Center.
	Adapter server (Option)		An optional server that is installed between the security server and each information system to convert the data to the specified communication protocol if the information system connected to X-Road is not designed with the communication protocol specified by X-Road. In addition, based on the interface defined in advance, it sends requests of process to its information system with the range of data provision according to the organization / information system. Then, it returns the result of the process with converting it to the specified communication protocol.
	Certificate Authority	Trust service provider	Issuing digital certificates to the security servers and digital signatures to the X-Road members. Enabling secure data exchange by certifying the identity of the security server using a digital certificate and providing a digital signature to the data for non-tampering proof.
	Timestamping Authority		Issuing timestamps to prove the existence and non-tampering of electronic data. The existence proof proves the existence of the electronic data when timestamped, while the non-tampering proof proves that the data has not been tampered after timestamped.

Source: Developed by JICA Study Team based on “x-road.global”

iv) Functions of X-Road

Main functions of the central server, monitoring server, and security server are shown in the table below with classifying into three categories, namely "management function", "monitoring function", and " "data exchange function". The management function is responsible for managing X-Road configuration information, such as the organizations that connect to X-Road, the security servers and information systems managed by each organization, and the list of trust service providers, and distributing it to security servers. The monitoring function monitors the operational information and environmental information of the security server. While each security server collects such monitoring information and transmits to the central server, the central server centrally manages the operating status of X-Road with it through its monitoring function. The data exchange function performs secure data exchange by encrypting data and providing digital signatures and logs all processing records of data transmission.

Table 4.5 List of main functions of X-Road

#	Category	Function	Responsible entity	Description

1	Management function	Management Services	Central server	- A service for managing X-Road configuration information. Generating the configuration information of the X-Road instance and place it in the distribution directory of the Web Server. - Configuration information includes security policies of X-Road instance and lists of X-Road members, security servers and management services (information system trust service providers).
2		Web Server		- Distributing the configuration information received from the Management Service to each security server.
3		User Interface		- Providing the user interface for system administrators to manage X-Road members and security servers. - Recording user actions of changing system status or configuration information on the audit log as events.
4		Management REST API	Security server	- Providing API to change and refer to security server configuration information. It is used by the User Interface Frontend (discussed below), and configuration changes are recorded in the audit log.
5		User Interface Frontend		- Providing the user interface for system administrators to manage security server configuration information on a Web application.
6		Configuration Client		- Downloading the configuration information from the central server and reflect it on the security server.
7	Monitoring function	Operational Monitoring	Monitoring server	- Collecting operational monitoring information of the security server and save it on the database. - Operational monitoring information includes IDs of all the security servers and information systems, timestamps of request and response, and communication data size.
8		Environmental Monitoring		- Collecting environmental monitoring information of all the security servers, such as OS, memory, disk capacity, CPU load, execution process, installation software, etc. and save it on the database.
9		Operational Monitoring	Security server	- Collecting operational monitoring information of each security server and transmit it to the central server based on the request from the central server.
10		Environmental Monitoring		- Collecting environmental monitoring information of each security server and transmit it to the central server based on the request from the central server.
11	Data exchange function	Proxy	Security server	- Mediating the data exchange between the service client and the service provider. Messages are transmitted over the Internet and digitally signed and encrypted to protect communications. - Recording all messages that pass through the security server on the database as message logs. The messages are stored with the signature timestamped.
12		Signer	Central server Security server	- Managing the keys and digital certificates used for the digital signature of each server.
13		Password Store		- Storing the password for the security token (a key and a digital certificate) on the shared memory segment of each server's operating system. Keeping the login status of the security token until the server is restarted.

Source: Developed by JICA Study Team based on “x-road.global”

4.2 Ideas on technical specifications for the data sharing platform

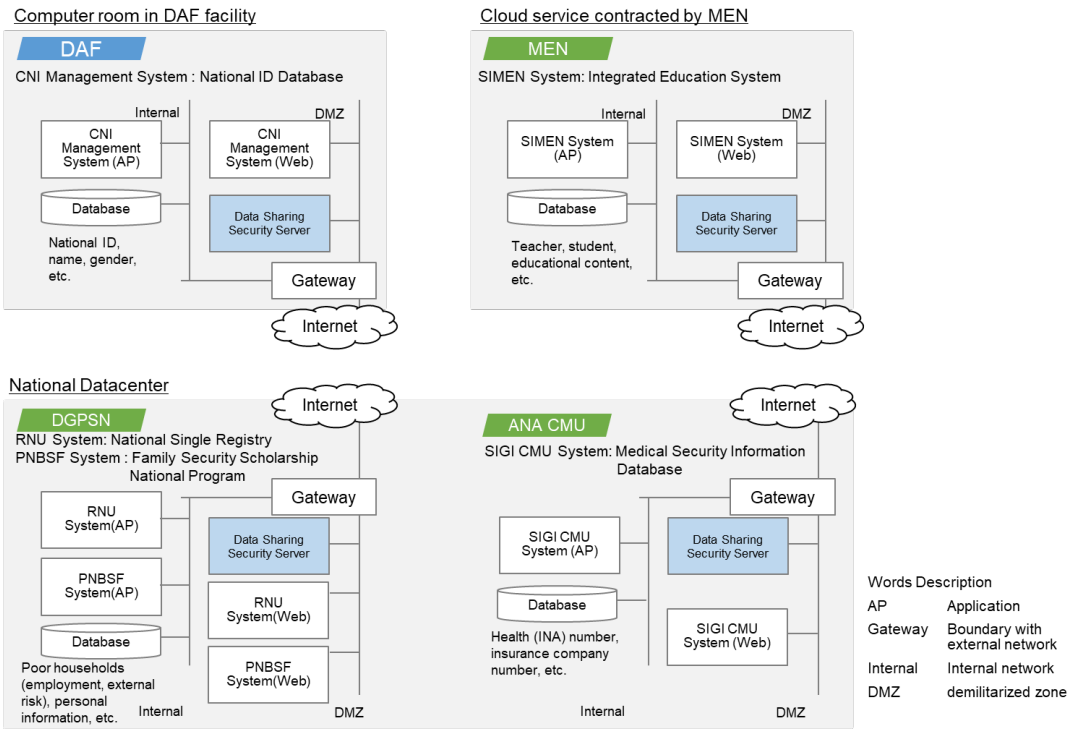
As a result of examining the applicable technologies in the previous section, it is concluded that the specifications of the data sharing platform in Senegal is recommended to be considered with reference to X-Road. This section indicates assumed system functions and architecture of the data sharing platform based on the status of the existing system owned by the Senegal government and the detailed information on X-Road confirmed in the previous section.

（1） Installation status of the existing system

It is confirmed that there are at least three types of locations for information systems owned by Senegal government agencies. The first is the computer room in the facility where the office is located. The second is the cloud service that each agency contracts. And the third is the national data center managed by ADIE. Since it is recommended that the information system of the government agency be installed in the national data center (the installation mandatory is under discussion), the utilization of the data center will be considered with priority when installing the information system by the government agencies.

The following figure is an image of the existing systems owned by relevant government agencies in this survey. Since available information on the physical configuration of the systems was limited, the survey team assumed the servers (web servers, application servers, and databases) and network architecture (DMZ and internal) based on the interview results and disclosed materials.

Figure 4.3　Existing systems of government agencies surveyed (with assumption)



Source： JICA Study Team

The overview of the systems owned by each government agency with their locations is as follows.

i) Installed in the server room in their own facility

- DAF installed and operates a national ID (CNI) management system in the server room in their own facility. The system holds the personal information (name, gender, date of birth, face photo, signature, biometric data, etc.) associated with the national ID. It is referred by public and private organizations that have the right to use.

ii) Installed in the Cloud service

- The Ministry of National Education installed and operates the National Education Information and Management System(SIMEN) in a cloud service. SIMEN holds teacher information, student information, and educational contents for online education and teacher/student management.

iii) Installed in the national data center

- DGPSN installed and operates two systems, the Single National Register (RNU) system and the National Family Security Grant Program (PNBSF) system in the national data center. The RNU system holds personal information in poor households (employment, external risks, etc.). It is referred by ANA CMU, the Ministry of Finance, the Ministry of Agriculture, and NGOs (PLAN, OXFAM, etc.) that support the poor and vulnerable groups . The RNU system and PNBSF system are linked with each other.

- ANA CMU installed and operates the Integrated management information system of the universal health coverage (SIGI CMU) at the national data center. SIGI CMU holds the insurance number and company insurance number associated with the insured person's insurance number (INA number) which is also used by GDPSN’s health facilities.

As illustrated Figure 2.4, the data sharing platform is expected to be connected and used by a good number of organizations. Further, the more organizations connect with it and share and utilize information with each other, the more effective and efficient the data sharing platform will become with its functions being enhanced. However, its development process will be more complicated and require more time if it is developed with connecting with lots of organizations from the beginning, since the necessary coordination, tasks, and the number of parties involved will increase. So, it would be preferable to start the introducing the platform on a small scale as the initial stage while it should be designed with considering the future condition which many organizations are being connected with it by ensuring expandability and flexibility for making future scaling up more easily.

Therefore, the implementation plan will be envisioned that four sectors would be connected with the platform in addition to the database of national ID and resident registration in the first phase, which are maternal and child health, social security, education and agriculture. In particular, the former two sectors seem relatively advanced in digital utilization and are more compatible with national ID utilization according to the result of the survey so far. Figure 3.1 shows the configuration of the data sharing platform at the time of the implementation of the first phase.

（2） Functions and architecture required for the data sharing platform

Since each system is installed in a different place in accordance with the business operation and responsibility of each government agency, the data sharing platform is required to have a mechanism in which the systems of each government agency can access the necessary data with each other for reference without changing the ownership and location of the data.

Therefore, it would be necessary to provide the following functions to realize safe and efficient mutual access of data between governmental organizations.

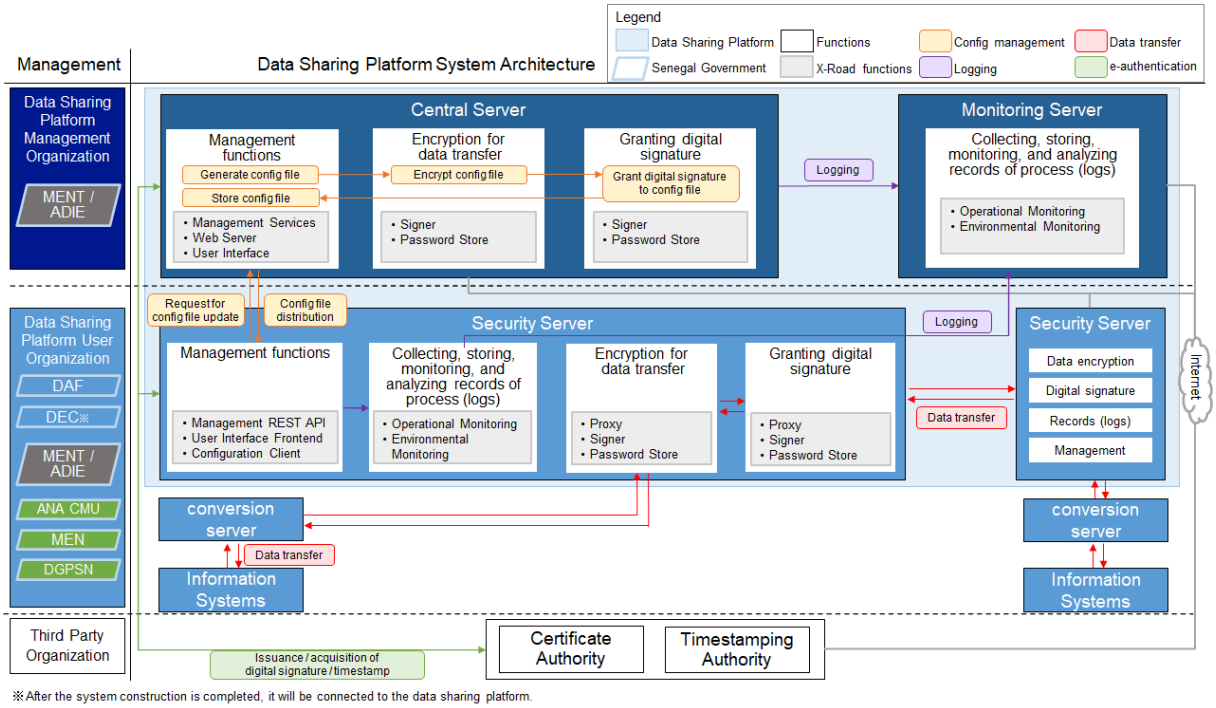
Table 4.6 Functions required for the data sharing platform and their reasons

Required functions	Reasons
Data encryption of transmission / reception	The data of government agencies are installed in different environments. They are not connected via a highly confidential network line like a dedicated line, and thus should be referred via the Internet. Therefore, it is necessary to prevent intercepting by encrypting data at the communication path.
Providing digital signature	It is necessary to detect falsification of data on the Internet and confirm that both systems are in the legitimate communication by digital signature.
Collecting, storing, monitoring, and analyzing records of process (logs)	Most of the information handled by organizations is highly confidential and essential, including national IDs. Therefore, it is necessary to efficiently monitor and analyze processes whether transmission / reception process is performed conforming to the rules of the data sharing platform.
Management functions	The data sharing platform is assumed to be used with multiple systems. Thus, it is necessary to conduct management operations through the management interface for configuration management, distribution of setting information, and various management tasks by the administrator.

Source： JICA Study Team

The system configuration of the data sharing platform for realizing these functions is shown in the figure below. Servers that encrypt data and provide digital signatures (described as the security server) sould be installed in both systems that send and receive data. The central server and monitoring server manage encryption, digital signatures, and records (logs). In addition, the system uses a certificate authority and time-stamping authority service provided by a third-party organization to issue digital certificates. Note that the system configuration shown in the figure below also describes the related functions of X-Road for reference.

Figure 4.4 System architecture image for the data sharing platform



Source： JICA Study Team

（3） Technical views for the introduction of data sharing platform to the current system environment of Senegal government agencies

When introducing the data sharing platform into the existing system environment of the Senegal government, the platform will be installed in the national data center managed by ADIE, which is recommended as the location of the government systems. In the same environment, the citizen portal site will also be installed to serve as a contact point for various services for citizens. Then, the security server will be installed in order for the portal system to safely connect the organizational systems when the portal site acquires their information. Security servers will also be installed in the system environment of government agencies that hold information to be shared to ensure the security of data exchange.

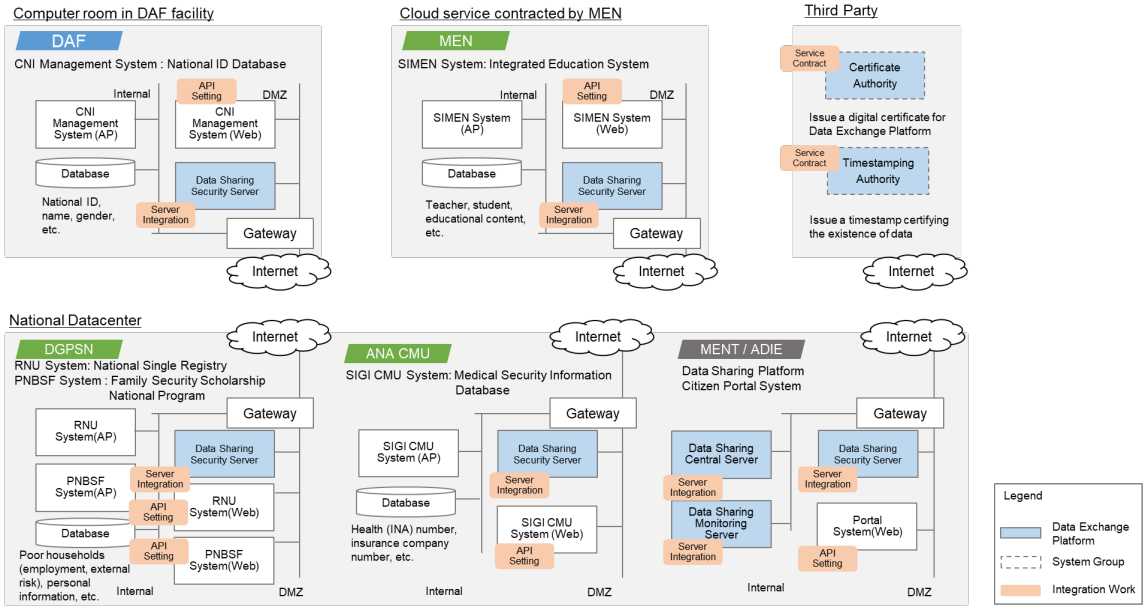
In addition, in order for the data requester and the data provider to communicate using the same protocol, settings for the existing information system to communicate with the shared API needs to be conducted. For example, in X-Road, the security server adopts communication methods called SOAP (Simple Object Access Protocol) and REST (Representational State Transfer) for data requests and responses from information systems. Therefore, setting work would be required if the information system does not support these methods. In addition, if it is difficult for the information system to be adapted with the communication methods (impact on the existing system, etc.), it would be necessary to install an optional server that converts the communication methods.

Even if a certain system already has a means for data exchange with other systems, basically, it will not affect the existing means since the data sharing platform will introduce a new exchange route. However, if various exchange routes exsit, it will complicate the management of data exchange as well as investigations when

system incident occurs. Therefore, it would be desirable to integrate all the means into the one through the data sharing platform. In this respect, it is also essential to create policies and rules for the government to encourge their organizations to utilize the data sharing platform.

Regarding the issuance of digital certificates, since the cryptographic authority (Direction Générale du Chiffre et de la Cryptologie) is currently establishing a national PKI (Action 312 of Senegal's Digital Strategy 2025), it is appropriate to consider utilizing the national PKI in accordance with the current rule making.

Figure 4.5 The data sharing platform architecture considering the layout of the existing system (with assumption)



Source： JICA Study Team

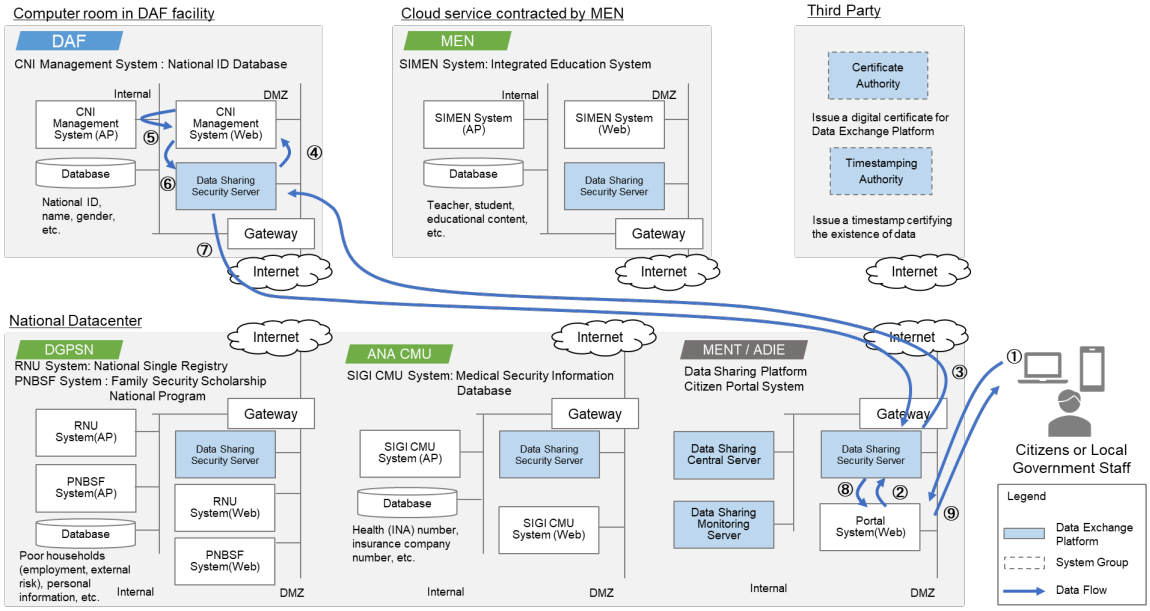
（4） Data flow of utilizing the data sharing platform

The following is examples of two patterns of communication data flow when the data sharing platform is used. The first is the data flow between the citizen portal site and the national ID database when referencing national ID information through the portal that will be newly introduced. The second is the data flow between the health information database and the national ID database when using the SIGI CMU managed by ANA CMU.

i) Reference of national ID information using the portal site

Citizens and officers of local government agencies will be able to use the citizen portal site as a window to securely send and receive data with the national ID database via the data sharing platform. As a result, it will become possible to search and apply for various government services as well as refer to national ID-related information based on preset authority.

Figure 4.6 Data flow of reference of national ID information using the portal site



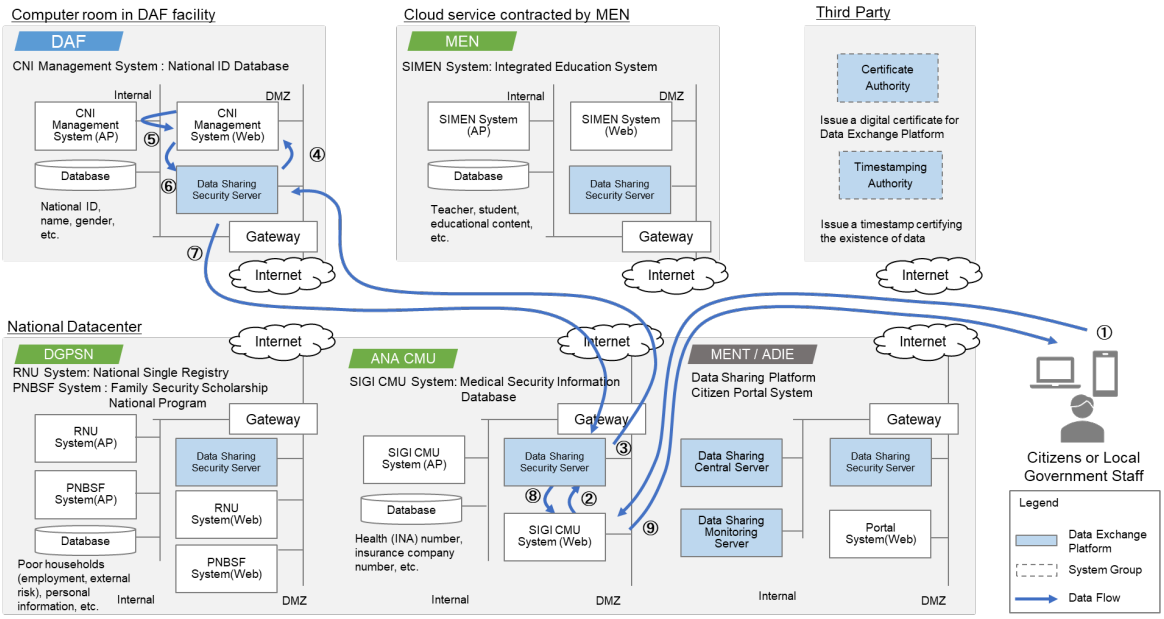
Description of Data Flow
① Connection to the citizen portal for referencing national ID information, etc.
② Request for national ID related data in the form of the data sharing platform
③ Data request to national ID database by encrypted communication with a digital signature.
④ Request for national ID related data in the form of the data sharing platform
⑤ Acquisition of national ID related data via AP server based on the original specifications of the existing system
⑥ Response of national ID-related data in the form of the data sharing platform
⑦ Data response to the citizen portal by encrypted communication with a digital signature
⑧ Response of national ID related data in the form of the data sharing platform
⑨ Displaying a page containing national ID information from the citizen portal

Source： JICA Study Team

ii) Data exchange between ANA CMU system and national ID management system

When citizens use the medical security information database, the database and the national ID database securely send and receive data via the data sharing platform. Therefore, the user does not need to input the information associated with the national ID.

Figure 4.7 Data exchange flow between ANA CMU system and national ID management system



Description of Data Flow

① Connection to the medical security information database for referencing national ID information, etc.
② Request for national ID related data in the form of the data sharing platform
③ Data request to national ID database by encrypted communication with a digital signature.
④ Request for national ID related data in the form of the data sharing platform
⑤ Acquisition of national ID related data via AP server based on the original specifications of the existing system
⑥ Response of national ID-related data in the form of the data sharing platform
⑦ Data response to the citizen portal by encrypted communication with a digital signature
⑧ Response of national ID related data in the form of the data sharing platform
⑨ Displaying a page containing national ID information from the medical security information database

Source： JICA Study Team

4.3 Necessary Work for the operation of the data sharing platform

Regarding the operation of the data sharing platform and the portal site considered above, the work required during normal times and when failure occurs are summarized in the table below. It only describes the work required regarding the system operation of the data sharing platform and the portal site. Therefore, all the work listed in the table are expected as under the jurisdiction of MENT / ADIE, which are envisioned as the operating entity of both systems for the moment. According to that, the list was finalized in consultation with the MENT.

Table 4.7 List of Necessary Work

No.	Work	Purpose	Details	Remarks
1	Management of rules and regulations	For appropriate usage based on the rules and standards To prevent inconsistent usage among users and rule violations	Formulate, update and review guidelines, rules, and standards	Including ways of using data sharing platform and shared APIs, communication and data protocols, procedures for responding to system failure, etc.
2			Notify users of the above-mentioned additions and updates	
3	Shared API management	To provide shared APIs and update them in a timely manner	Add and update shared APIs	
4			Notify users of the above-mentioned additions and updates	
5	Monitoring data sharing	For stable operation of data	Monitor operating status	
6			Detect system failure and notify	

	platform	sharing platform	related parties	
7		For error detection and response	Respond to system failure	
8	Management of expansion	For proper expansion according to the rules	Execute the approval process for connecting a new service	
9			Advise on connecting a new service	
10	Operation and management of Helpdesk	To provide technical support for users	Establish and operate helpdesk (user support service)	
11		For troubleshooting	Respond to inquiries from users	
12	Operation and management of portal site	To stably operate the portal site and timely update it	Monitor operation status	
13			Detect system failure and notify related parties of it	
14			Respond to system failure	
15			Update the portal site	
16	Access control management	For user identity verification and prevention of spoofing	Manage users (register, update, delete)	For all users, including civil servants who provide services to citizens and citizens who access the portal site
17		Authority management for information and service usage	User authentication	
18			Grant authority to use specific information and services based on usage authority	
19			Notify the person when accessing the personal information or services	
21			Time authentication (issuance of time stamp)	
22	Management of transaction records	To check the usage status of the data sharing platform	Collect and store transaction records (logs)	Type of logs commonly recorded: operation, access, authentication, communication, event, error, etc.
23		To prevent incidents and cybercrimes	Monitor and analyze transaction results (logs)	
		To investigate the circumstances and causes of their occurrences		
25	Audit	For appropriate operations in accordance with rules & regulations	Regular confirmation of compliance with laws and regulations	
26		Crackdown on violations	Implement measures against violators	Cautions, recommendations, suspension of usage, etc.

Source： JICA Study Team

Category		Work	Description
Normal time	Monitoring	Monitoring the data sharing platform	Monitoring the operating and usage status of the central server and security server and detecting when an abnormality or failure occurs
		Portal site operation	Monitoring the operation and usage status of the portal site and detecting when an abnormality or failure occurs
		Logging	Monitoring and confirming processing records (logs) collected from each server and communication device of the data sharing platform
		Audit	Periodically checking the compliance status of the laws and regulations of each organization that manages and uses the data sharing platform

	User support	Operating the helpdesk for users of the data sharing platform	Operating a help desk (user support window) that responds to inquiries from each organization connected to the data sharing platform and responding to inquiries
		Operating the helpdesk for users of the portal site	Operating a help desk (user support window) that responds to inquiries from portal users and responding to inquiries
	Administration	Managing rules and regulations	Formulating, updating, and reviewing rules, guidelines, and standards regarding the operation and usage of data sharing platform and the portal site and notifying users
		Access right management	Managing access rights of administrators and users to the central server and security server
		Shared API management	Adding and updating the common APIs provided by the data sharing platform and notifying users
		Expansion management	Managing approval procedure and connection work for organizations and systems being newly connected to the data sharing platform
		Operation improvement	Taking corrective actions to violations found in audit
	Maintenance	Hardware maintenance	Conducting periodic inspections of hardware managed on the data sharing platform side and reviewing, updating, and replacing hardware and firmware if necessary
		Software maintenance	Updating software managed on the data sharing platform side and distributing software update files to related organizations
Incident management	Recovery	Recovering the data sharing platform	Handling failures occurred inside the data sharing platform, such as isolating failure, notifying related parties, and implementing recovery measures
		Recovering the portal site	Handling failures occurred regarding the portal site, such as isolating failure, notifying related parties, and implementing recovery measures

Source： JICA Study Team

4.4 Necessary laws and regulations for the development and operation of the data sharing platform

As shown in the table below, since the security policy for the government systems (Presidential instructions on information system security policy (PSSI-ES)), the personal information protection law (Law No. 2008-12 of January 25, 2008 on the Protection of personal data), the electronic transaction law (Law No. 2008-08 of January 25, 2008 on the electronic transaction), and the decree on digital certificates (Decree No. 2008-720 of June 3, 2008 relating to electronic certification adopted for the application of law 2008-08 of January 25, 2008 on electronic transactions) are stipulated in Senegal, it is necessary to comply with them when introducing the data sharing platform. It should be noted that the personal information protection law is currently under consideration for revision according to the CDP. In addition, as for digital signatures, related rules are currently being created regarding public key infrastructure (PKI) according to MENT. If having formulated, it is necessary to confirm the content and take measures. Table 4.8 summarizes the items that are considered to require technical measures regarding the above-mentioned laws and instructions when introducing the data sharing platform. It can be said that in the technical point of view, there would be no major obstacle to the introduction of the data sharing platform if the PKI system is established since the laws

and regulations required for the data exchange via the data sharing platform is generally in place. Above all, However, It should be noted that as there might be other governmental or ministerial ordinances which stipulate more detailed instructions, confirming with MENT, ADIE, and CDP for the rules that need to be dealt with needs to be conducted when developing the actual system.

Table 4.8 List of related Laws and Regulations

Item	Description
Information system	Presidential instructions on information system security policy (PSSI-ES) has been formulated. It stipulates security policies that government information systems must comply with.
Personal information protection	The Personal Information Protection Law (Law No. 2008-12 of January 25, 2008 on the Protection of personal data) was enacted in January 2008. Currently, examination for revising the law is proceeding with by mainly CDP.
Digital signature	The Electronic Transaction Law and the decree on digital certificates have been formulated. Currently, the creation of rules regarding public key infrastructure (PKI) is undergoing.

Source： JICA Study Team

Table 4.9 Technical measures to related legal systems in introducing data sharing platform

Legal System	Section	Technical Requirement	Technical measures of data sharing platform
Presidential instructions on information system security policy (PSSI-ES)	Section 2 Definition of information systems and information system security	The definition of information system security is the state of being protected from certain risks by combining general and special measures to ensure the confidentiality, availability, and integrity of information and information system.	● The platform would sign and encrypt to ensure confidentiality and integrity in communications over the Internet. ● The platform would record all messages that pass through the security servers in the database as a message log.
	Section 3 Scope of PSSI-ES	Information systems of all national agencies are applied without exceptions.	
	Annex III. Obtaining new systems	To consider requirements of access control, responsibilities for user awareness, protection for confidentiality and integrity, logging, monitoring, and data leakage detection as risk mitigation measures	
	Annex VII Security for exchange	To take measures to ensure the security of both the exchanged data and the transmission medium	
		To protect data sent over public networks according to levels	
Personal Information Protection Law	Section 22 Handling of personal information	Items that need to be declared/applied to CDP include measures taken to ensure security in interconnection or cooperation with other processing operations.	● The Platform would provide the strict access control, secure data exchange, and notification to users when accessing the personal information. ● The Platform would collect, store, monitor, and analyze various processing records (logs), to grasp the situation, and

			investigate the cause of problems. ● The Platform would encrypt transmitted and received data to prevent communication theft.
Electronic Transaction Law	Section 41 Reliability of digital signature	When using a digital signature, it is necessary to use a reliable identification method that can guarantee the relevance of the signing act with the signature.	● The Platform would confirm that the service provided by the third party meets the conditions, and with the digital signature, would conduct the identity verification for the creators of the electronic data, prevent falsification of, and verify the validity of the documents.
Decree on Digital Certificates	Section 37	A secure signing device must not modify the data to be signed or prevent data from being submitted to the signer before the signing process.	
	Section 39	The data structure that meets the conditions of digital signature are (1) enabling to identify the signer, (2) uniquely connected with the signer, (3) created with the means that signer can put it under the exclusive control, and (4) based on an electronic certificate.	

Source： JICA Study Team

5. Operation and Maintenance Management System

5.1 Operation and Maintenance Management of Data Sharing Platform

In order to develop, design, and introduce the data sharing platform, it is necessary to create an institutional arrangement of stakeholders from the planning stage, because stakeholders, including owners of the database to which data sharing platform is linked, are diverse.

Each major organizations involved in the data sharing platform (MENT, DAF, DEC, etc.) is aware of its strategic position in the data sharing platform and wants to be deeply involved from the design phase to the construction and operation phases. The following promotion structure will be formed around these major organizations to operate the data sharing platform.

i) Steering Committee

- Responsibilities: i) review the progress of the entire project, ii) decision making on important matters, and iii) coordinate the interests of multiple organizations.
- Overview of members: Representatives of relevant organizations that serve as stakeholders, with the project implementing agency as chair
- In addition to the key organization, MENT, ADIE, DAF and DEC, the following organizations are expected to be involved in this project: CNN (the National Digitalization Council), COPIL SN 2025 (the Digital Strategy 2025 Steering Committee), MEPC (the Ministry of Economic Planning and Cooperation), and MDCEST (the Ministry of Community Development and Social Equality). The ANA CMU (*Mouhamed Mahi Saikho Sy, Director General of the ANA CMU, also serves as "ID4A Senegalese Ambassador"), which is leading the parallel UNDP ID integration project, is also expected to be a strong member.

ii) Project Management Unit (PMU)

- Responsibilities : i) handle task management and schedule updates, ii) balance workload between project members, iii) outreach to project members, and iv) coordinate stakeholders' requests
- Overview of members: Implementing organization and PMU are cross-sectoral temporary organizations from project start-up to implementation, and may continue to operate until operations are on track to some extent, as it is responsible for the execution of the project itself. It consists mainly of management from the organizations involved and is engaged in the project management.
- More specifically, these are the implementing agencies and related organizations, such as MENT, ADIE, DAF, DEC, as well as ANA CMU and other organizations to be connected.

iii) Project Implementation Unit (PIU)

- Responsibilities : i) procure components for project implementation, ii) establish the data sharing

platform, iii) carry out tests (including draft of test items and post implementation evaluation), and iv) design and implement Proof of Concept (PoC) as well as direction review based on the outputs, etc.

- Overview of members：PIU is a temporary organization that operates until the project is implemented. PIU consists of members who are in charge of the system in each related organization and is responsible for the practical implementation of the project.

- In addition to the major organizations involved in the data sharing platform (MENT, ADIE, DAF, DEC, ANA CMU, etc.) and the contracted SI providers for project implementation, the Agency for Regulatory of Telecommunications and Posts (ARTP) and the Committee for the Protection of Personal Information (CDP) are expected to be core members..

iv) System Integrator

- Responsibilities： plan and implement system configuration based on requirement definition documents

- Overview of members： SI companies are normally responsible and they work under the supervision of PIU. Depending on the system to be built and specifications, System Integrator may be composed of several companies.

v) Operation Management Unit (OMU)

- Responsibilities : i) develop operational management regulations (formulation and updates of guidelines, etc.), ii) monitor operations (system access, authentication, extensions, troubleshooting, etc.), and iii) train operational staff, etc.

- Overview of members：OMU is not only responsible for the maintenance of the system, but also for the operation and maintenance of the system to ensure its stable operation. Because OMU may be required to make decisions on system expansion and emergency incident response, it is composed mainly of executives and are responsible for overall operations. By nature, OMU is permanent organization.

- As for the specific members, the maintenance and operation will be managed depends on either the "In-house model" within the government organization or the "Semi-governmental model" as described later, but it is essential and efficient to make the key organizations involved in the construction of the system as members to establish regulations related to various operations.

vi) Platform Operator

- Responsibilities : i) plan and implement system operation based on the requirement definition document, ii) support general operation (support of access management, authentication, expansion of functions and sector, troubleshooting support, etc.), and iii) deal with troubles and problems of the data sharing platform, etc.

- Overview of members：the business operator who build the system is usually responsible, but other business operators may also undertake it. Platform operator works under the guidance of OMU.

In addition to the above-mentioned organizations, we would like to consult with the Senegalese side on the formation of a "Technical Committee" that brings technical experts from relevant organizations on a cross-organizational basis, including technical experts from outside the project framework, and on technical collaboration with the PMU and PIU.

5.2 Operating Model and Operational Responsibilities of the Data Sharing Platform

Multiple operational model plans are considered for operation and maintenance, and they will be decided upon through discussion with the Senegal side. Hardware installation location for the data sharing platform has been assumed at the new data center in Diamniadio run by ADIE. The operation and maintenance entities should be made by the time of the project starts. Either i) in-house model or ii) semi-governmental model is considered as the operational model.

Because the project will be a large enough to affect the entire country, and because of the nature of the data, it is difficult for a pure private company to operate the system alone. It is assumed that government organizations will be involved in some way. In the case of i) in-house model, engineers of as private companies can be hired within the Ministry of Digital Economy and Telecommunication (MENT) or the National IT Agency (ADIE) to operate directly under the government. This allows organizations to be established quickly and smoothly, but there might be concerns on human resources mobility and employee turnover. In the case of ii) semi-governmental model, several examples can be seen in other countries such as Estonia (e-Estonia), Japan (My Number Portal), and Rwanda (IREMBO). In this case, a joint company or special-purpose company is established, and operation is outsourced to the company which is independent of the government organization or private companies. Although there are concerns that establishing such companies may take time, and reliance on specific subcontractors may increase, it has characteristics of reducing the workload and operational risks while securing a wide range of human resources due to the nature of cross-sectoral entity.

As for the data to be linked to the data sharing platform using the National ID as the key, each government ministry and agency organization shall be responsible continuously for the maintenance (including updating) of each data. As described above, it is assumed that the data sharing platform itself does not own any data, and that it is equipped with an interface that makes possible authentications and mutual reference of data. After data sharing platform side prepares the standard specification of API, the database of each sector needs to customize API to the requirement of the standard specification. Each ministry is in charge of the operation and maintenance of the API.

As for the sectors to be linked to the data sharing platform, sectors such as education, social security, health, and agriculture is assumed at this stage, but they will be decided upon the formation of an agreement with stakeholders.

The main items regarding the task demarcation of project planning, implementation, and operation are summarized in the following table (major items only). The detailed items associated with each item below will be discussed by the time of the project starts.

Table 5.1 Task Demarcation for Plan, Implementation and Operation

Task Item	Senegal government side	Japan side
(JICA assistance)		
1) I. Plan		
2) Steering Committee Composition	Implementing body	Support for setting up an organization
3) Definition of business requirements and system requirements	Implementing body	Implementation support (funding support, etc.)
4) Basic design and functional design	Implementing body	Design support (funding support, etc.)
5) Cost estimates and budget allocation	Implementing body	Estimation support (funding support, etc.)
Creation of Road Map	Implementing body	Support for development (funding, etc.)
1) II. Execution		
2) Composition of Execution Organization such as PMU, PIU, etc.	Implementing body	Support for setting up an organization
3) Equipment (H/W, S/W) Procurement	Implementing body	Procurement management support (funding support, etc.)
4) Encourage related organizations	Implementing body	N/A
5) Disclosure of information on existing systems and data specifications	Shared by relevant organizations	N/A*
6) Verifying the database to be linked	Implementing body	Verification support (funding support, etc.)
7) Validation of access rights and authentication	Implementing body	Verification support (funding support, etc.)
8) Selection and installation of hosting sites	Implementing body	Implementation support (funding support, etc.)
9) Development of network and other infrastructure environments	Implementing body	Implementation Support (Technical Cooperatives, etc.)
10) Verification of the applicable legal system required	Implementing body	Verification support (funding support, etc.)
11) PoC implementation and evaluation, path modification	Implementing body	Preparation of evaluation items and support for evaluation (technical collaboration)
12) Publishing (web, etc.)	Implementing body	Support for public information activities (technical collaboration, etc.)
Preparing the training program	Implementing body	Guideline development support (technical collaboration, etc.)
1) III. Operation and maintenance		
2) Organization of operation and maintenance organization such as OMU	Implementing body	Support for setting up an organization
3) Training for operation staff	Implementing body	Training Implementation Support (Technical Cooperatives, etc.)
4) Selection and contract of maintenance and operation business operator (in case of outsourcing)	Implementing body	N/A
5) Troubles and Incident Response	Implementing body	Support for a limited period of

		time (Technical Cooperatives, etc.)
6) Adding functions, adding sectors, etc.	Implementing body	N/A

Note: The databases of each organization to be linked are not supported.

5.3 Estimate of Operation and Maintenance Costs

Operation costs are roughly divided into i) maintenance and operation costs, and ii) software component activity costs. In terms of i), there are costs associated with operations such as personnel costs, outsourcing costs, data center usage costs (including network costs and electrical charges), software costs (license usage charges), and equipment replacement costs in the event of problems and upgrading. In terms of ii), there are costs related with training for people in charge of the operation and promotional activity.

When we interviewed ADIE, the operator of the Diamnanidio Data Center, which was a leading candidate for the hardware installation site of the data sharing platform, during this survey, they planned to rotate the operation and maintenance in three shifts of eight hours each (6:00-14:00, 14:00-22:00, and 22:00-6:00): 00). Each shift was expected to require six personnel (one for each function, such as normal operations personnel (monitoring) and crisis response personnel (incidents, etc.)), and one manager class (supervisor), resulting in a total of about 20 personnel. Furthermore, the soft component activity personnel in above ii) must be viewed as a separate resource. Although the personnel costs will vary depending on the qualifications of the personnel and the required specifications, the average salary level of an engineer in Senegal is 1,400 euros (equivalent to around 180,000 yen) per month, and 4,000 euros (equivalent to around 520,000 yen) per month for a manager. (Assuming that the number of operation and maintenance staff required is 22 in total).

In addition to personnel costs, data center usage fees are also expected to be an expense item, but since the number of racks required at the time of initial operation is about half a rack, the monthly budget is expected to be less than US$1,000, or more than US$ 10,000 annually. In addition, there are software license renewal costs, but although they depend on the software, they are generally on the order of US$ 100, so we assumed that they would be covered as part of the US$ 500,000 contingency.

Also, depending on the choice of the proposed operation model mentioned above, the cost will vary greatly, whether it is within the government's budget or outsourcing costs be required. Alternatively, if the calculated operation and maintenance costs are not commensurate with the budget, it is assumed that specification changes, such as cutting a part of specifications, may occur. Since the scale of operations is mostly linked to the scale of system construction, and the estimated amount of full-scale construction depends largely on the number of systems to be connected, the above amount may vary, but it should be considered as a rough estimate of maintenance and operation costs.

6. Pilot activities

（1） Objective and contents

As mentioned in the previous section, one of the purposes of the Survey is “to conduct pilot activities for disseminating the usefulness of digital national ID and benefit of the “Data Sharing Platform” after its introduction, and to examine further development in the future based on lessons learned from the pilot activities.” The pilot activities particularly aim to raise awareness of the agencies and organizations concerned, the main users of the Data Sharing Platform as service providers, about its effectiveness and benefits.

JICA Survey Team drafted the pilot activities composing three activities of creating a simulation application, creating a promotion video, and organizing workshops, as illustrated in the table below, and proposed them to the MENT.

Table 6.1 Pilot Activities (tentative)

Objectives	To disseminate benefits brought by the introduction of the Data Sharing Platform To examine lessons learned from the implementation of the pilot activities to elaborate JICA’s further assistance
Implementation Period	July to October, 2021
Activity components	(1) Creating a simulation application of a new online platform portal for citizens’ access to public service (subcontract) (2) Creating a promotion video (subcontract) (3) Organizing workshops (to demonstrate the promotion video and the simulation app)

Source： JICA Study Team

JICA Study Team subcontracted the activities of the creation of the simulation application and promotion video to SYNAPSYS CONSEILS, a Senegal enterprise, who was awarded based on the tender.

Table 6.2 Contents of the Subcontracted Activities

Subcontracted Activities	(1) Creating a simulation application of a new online platform portal for citizens’ access to public service (2) Creating a promotion video (3) Demonstrating the promotion video and the simulation app at the workshops
Subcontractor	SYNAPSYS CONSEILS
Timeline	(1) July to October 2021 (2) July to October 2021 (3) November 2021
Contents of each activity	(1) Creating a simulation application of a new online platform portal for citizens’ access to public service • The app is to demonstrate that citizens can complete several administrative procedures all at once on the online portal, with a national digital ID and its authentication system, through the interoperability of the Data Sharing Platform connecting to databases of the relevant agencies and organizations. • The app shall not be connected to any database, but demonstrate dummy input data. • The online administrative services shall include three services of birth registration, registration for the social protection program, and history tracking of medical insurances. • Language should be French. (2) Creating a promotion video • The promotion video is planned and created to demonstrate usefulness of the Data Sharing Platform. • The simulation app can only demonstrate the functions shown on the screen of the device. It does not demonstrate the data exchange mechanism of the backend system. The promotion video shall show the backend system to facilitate government officers’ grasp of the entire picture of the Data Sharing

	Platform and its usefulness. • The promotion video shall be created in short version (within 3 minutes) and long version (within 5 minutes). • Language should be French. (3) Demonstrating the promotion video and the simulation app at the workshops • The promotion video and the app will be demonstrated and shared with government officials in the workshops to facilitate their understanding of the Data Sharing Platform. • The minutes on discussions on the introduction to Senegal will be summarized and submitted to JICA Study Team.

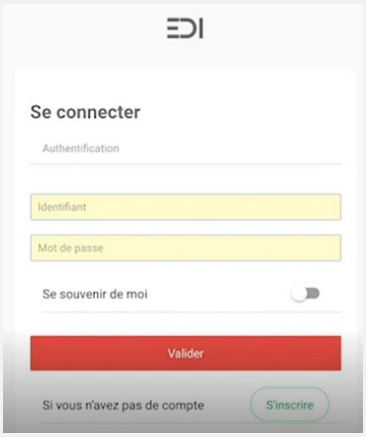
Source： JICA Study Team

The first pilot activity is to create a simulation application of a new online platform portal for citizens' access to public service (civil online portal app). The app is planned to demonstrate that citizens can complete several administrative procedures all at once on the online portal, with a national digital ID and its authentication system, through the interoperability of the Data Sharing Platform connecting to databases of the relevant agencies and organizations. The details of this pilot activity are described in the table below.

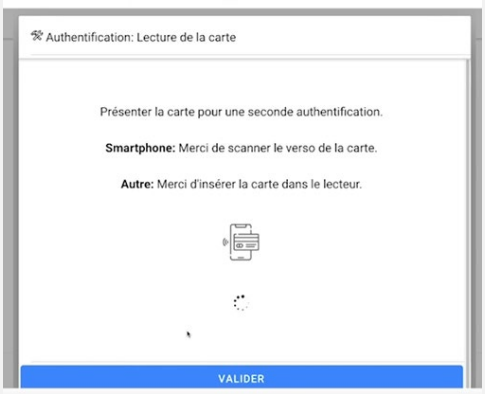
Table 6.3 Pilot Activity 1: Creating a Simulation App of a Civil Online Portal

(1) Two-step verification for login

1) The first step: verification by entering the registered username and password
2) The second step: authentication by holding ID card over the smartphone/inserting the card into the reader



1) Login page (username & password)

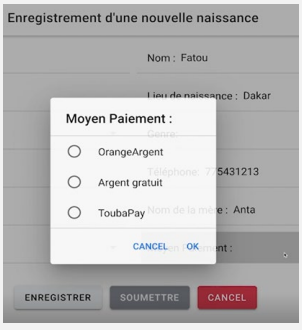


2) Authentication page by holding ID card over the smartphone or inserting the card into the reader

(2) Administration Procedure

1) Birth registration: Parents can complete birth registration by submitting the application and making payment and receive notices of the child registration with ID number and invitation for vaccinations.

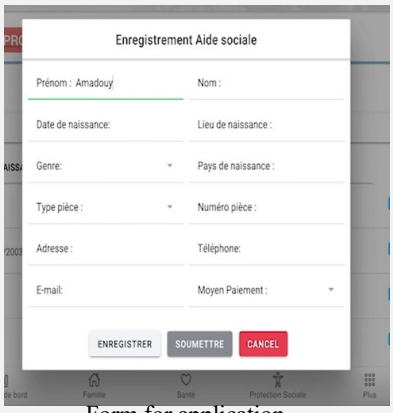
Page for birth registration



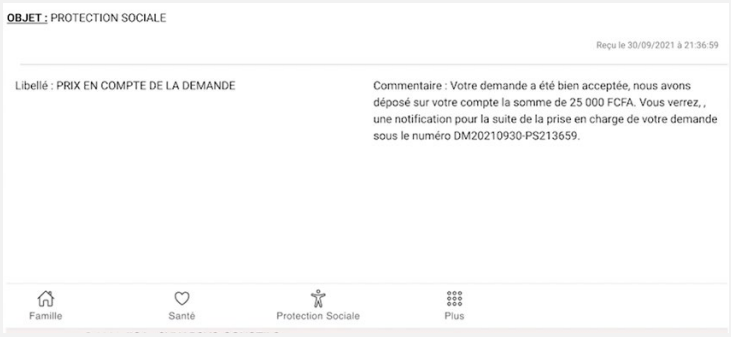
Page for online payment

Notices of registration & vaccination

2) Social Protection:
A citizen can receive a notice of the approval and payment immediately after applying to a social protection program by using the portal.



Form for application



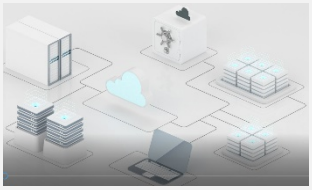
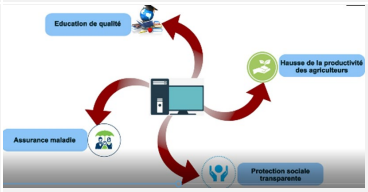
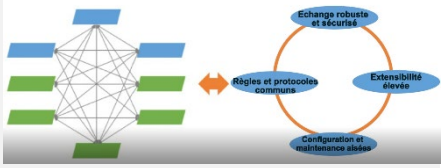
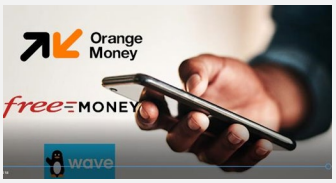
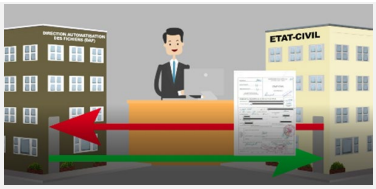
Notices of registration completion and payment receipt

※ Apart from 1) and 2), there are pages that allow citizens can track medical insurance history.

Source： JICA Study Team

The second pilot activity is to create a promotion video. The simulation app can only demonstrate the functions shown on the screen of the device. It does not demonstrate the data exchange mechanism of the backend system. The promotion video can facilitate government officers' grasp of the entire picture of the Data Sharing Platform and its usefulness by illustrating the backend system. The table below shows the contents of Pilot Activity 2.

Table 6.4 Pilot Activity 2: Creating a Promotion Video

Contents	Relevant Images
Interoperability among public services and national digital ID through the Data Sharing Platform enhancing the well-being of the population, Examples of the Data Sharing Platform of X-Road in Estonia and India Stack in India	 
Visions and Interoperability of the Data Sharing Platform	 
Demonstration of the application (front-end and back-end)	 
Key messages	It is highly expected that introducing and widespread digital national IDs and authentication using them will enable the provision and delivery of public and private services to everyone who needs them. 

Source： JICA Study Team

The third pilot activity is to organize workshops targeting government agencies and organizations, development partners and private sector representatives for the better understanding of the data sharing platform and demonstrate the promotion video and the app created in the pilot activity 1 and 2. They were scheduled to be conducted in October 2021. However, due to scheduling conflicts in MENT, JICA Study Team and SYNAPSYS demonstrated the promotion video and the simulation application only for MENT, DAF and DEC, separately.

（2） Discussion with the Government Agencies on the introduction of Data Sharing Platform

As mentioned in the previous section, JICA Study Team and SYNAPSYS demonstrated the promotion video and the simulation application for MENT, DAF and DEC, separately, and exchanged views with them on the introduction of the Data Sharing Platform. All the three organizations expressed their understanding of the usefulness of the data sharing platform, and as well as their expectations for JICA's cooperation in introducing the platform. On the other hand, all of them emphasized that their organizations should be positioned to play a central role in the implementation of JICA's cooperation. In view of this, the balance among the three organizations should be considered when finalizing the implementation structure of JICA's cooperation.

Since the three organizations had already been informed about the progress of the study, they showed a good understanding of the contents of the promotional video and the application, and provided the Team with positive feedback. In particular, MENT, the main counterpart of this study, expressed a high level of interest in the implementation of the Data Sharing Platform, with an emphasis on its importance and timeliness. It was suggested that agreement should be reached at the higher level of the ministry, such as the minister. The three organizations also expressed their concerns about the protection of personal information, fraud prevention, and the use of cloud, and agreed to work together to resolve these issues while the system is developed.

Table 6.5 Discussion with the Key Government Agencies on the Data Sharing Platform

Key Depts	Major Discussion Points
MENT	Date: November 9, 2021 Venue: MENT Conference Room Participants of MENT: Modou Mamoune Ngom /Director of Telecommunications, Achime Malick Ndiaye/ICT Director, Thiam /Director of Survey Planning & Follow-up Unit, and 4 other staff members Main discussion points: • MENT staff expressed a high level of interest and intention to introduce the Data Sharing Platform that will improve efficiency through data exchange among government agencies, and also emphasized its importance and timeliness, as well as the alignment with SN2025. • It is important to involve Senegalese companies in the development of the system and to establish a sufficient maintenance and management system. • Consent at the ministerial level is necessary for the introduction of the Platform. • It is also important to foster the ownership of DAF and DEC, which are the main sources of data, and to obtain their cooperation.
DAF	Date: November 9, 2021 Location: DG Office Participants of DAF: Fiacre BADIANE/Director General, Ablaye NDIAYE/Director of Development Support Division • The promotional video was well produced, and the introduction of the Data Sharing Platform was timely. • Although the relationship between DAF and DEC was well demonstrated, DAF should be considered as the

	main player in the implementation/operational system of the Platform. • As concerns, prevention of fraud in birth registration, security measures for personal information, use of cloud in Senegal, and the possibility of introducing biometric authentication were raised, and it was agreed that each of these will be addressed as the system development takes shape.
DEC	Date: November 8, 2021 Place: DEC conference room Participants: Aliou Ousmane SALL/Director, Djiby KONATE/Computer Engineer, Ndeye Mery MBAYE • DEC showed its willingness to cooperate with JICA. However, DEC also expressed concerns about the creation of two different platforms, as a similar data exchange platform is already being developed between DAF and DEC. • The DEC is in charge of civil registration, which should be core component of the Data Sharing Platform. Therefore, DEC should be placed at the center of the implementation system of the Platform. • After the signature between the Senegalese government and JICA, a meeting with all the concerned stakeholders should be held before implementation of the Platform. • Attention should be paid to the protection of personal information.

Source： JICA Study Team

7. JICA Schemes of Assistance for the Introduction of Data Sharing Platform

7.1 Business Scope and Schemes of Assistance

（1） Business scope

Since the introduction and operation of the data exchange platform will be the first attempt for the Senegalese government, it is important not only to develop and provide the data sharing platform system, but also to ensure its proper and autonomous operation. Therefore, it is essential to improve the management system and environment for the operation.

Building management system is to make the data sharing platform autonomously operate through the establishment of main operating entity, a set of rules of the organization, and the development of guidelines and manuals related to system operation and maintenance.

The improvement of the environment related to the operation aims to provide the entire administrative services smoothly and efficiently through the operation of the data sharing platform, and it includes the legal system related to the development of the administrative ICT infrastructure, and a wide range of businesses for improving the environment (maintenance of hardware and software infrastructure, etc.) for the service providers and end users who utilize the data sharing platform.

For example, for end users, it is important to improve the usage environment, such as providing opportunities to access online at CMC for people who do not have the means to use administrative services online. Based on the operation work and management system proposed in the previous section, the scope of the expected data sharing platform is summarized in the table below.

Table 7.1 Proposed Scope of the Project to Develop the Data Sharing Platform

Predicted work	Main contents
Design and Development of the data sharing platform	● Creation of roadmap (including development/ operational Milestone) ● Definition of system requirements, designing and developing system ● Infrastructure and office automation environment for system operation
Establishment of management system	● Launch of related organization ● Preparation of guidelines and manuals related to operation and maintenance work ● Training related to operation and maintenance work ● Supervision of operation and maintenance work
Improvement of operational environment	● Development of related institutions ● Explanation and publicity activities to users ➢ Explanation and training for ministries (service providers) ➢ Publicity activities to end users ● Improvement of user's infrastructure environment ➢ For ministries: Establishment of connections between each database and the national ID database, etc. ➢ For end User: Strengthening CMC

Source： JICA Study Team

（2） Scope of JICA support and responsibilities of the Senegalese government

As mentioned above, the data sharing platform development project is not limited to the development and

provision of administrative ICT systems. In order for the data sharing platform to be utilized, it is important for the operating organization to carry out appropriate operations and improve the environment. To this end, JICA is expected to support the development of data sharing platform, as well as providing technical cooperation for the establishment of the management system of the platform and environmental improvement.

On the other hand, in order for the operation work to be carried out autonomously, the responsibilities required for the Senegalese government are: the establishment of management system, the allocation of necessary personnel and the improvement of the working environment, the securing of the operation and maintenance budget, and the liaison and coordination between the parties concerned, establishment of related institutions, creation of operational rules, guidelines, manuals, and explanations and publicity activities to users under the support of technical cooperation project.

The table below summarizes the proposed scope of JICA's support and the scope of the Senegalese government's responsibilities.

Table 7.2 Proposed Scope of JICA's Support for Data Sharing Platform Development Project

Expected business	Responsibilities of Senegalese government	Scope of JICA's support
Design and development of the data sharing platform (System development)	● Procurement management	● Defining system requirements, design and development of the platform ● Assistance for procurement management
Establishment of the management system	● Launch of related organizations ● Creation of rules, guidelines, manuals, etc. related to operation and maintenance ● Execution of operation and maintenance work ● Supervision of operation and maintenance work ● Securing Personnel / budget and coordination to carry out the above	● Support for the launch of related organization ● Support for creating guidelines and manuals related to operation and maintenance ● Training related to operation and maintenance, including training in Japan and training in third countries) ● Supervision support for operation and maintenance
Improvement of operational environment	● Development of related institutions ● Explanation and publicity activities to users ➢ Explanation and training for ministries (service providers) ➢ Public relations to the public (end users) ● Improvement of the infrastructure environment improvement of users ➢ Ministries: establishing connections between each database modification of the workflow and the relevant manuals, etc. ➢ End users (citizens): Strengthening CMC	● Support for the development of related institutions ● Support for the explanation and publicity activities to users ➢ Support for the explanation and training for ministries (service providers) ➢ Support for public relations to the public (end users) ● Support for the infrastructure environment improvement of users ➢ Ministries: support the database connection, modification of the workflow and the relevant manuals, conduct training, etc. ➢ End users (citizens) : support for the strengthening CMC

Source： JICA Study Team

（3） JICA's Assistance Schemes

In order to realize the project with JICA's support, several risks can be assumed. As for the risk assumed in system development, if the "system requirement definition" process and the "development" process of the project are separately contracted with different operators, there might be a discrepancy in the interpretation of the system requirement definition between the operators, which will turn out to be a redundancy as the operator of the system development need to redefine the system requirements. The operational risk will also increase when the data sharing platform is introduced in such a way that the national information systems of the ministries and agencies are connected all at once.

To deal with such risks, a contract should include system requirement definition, design and development to procure a sole operator or consortium. Therefore, it is suggested that the project should start with "small start," by developing the data sharing platform on the smallest scale while ensuring the expandability. At the small start, the project should also start with connecting between the systems of the ministries and agencies, instead of starting by connecting with citizens for online administrative services. Instead of connecting the ministries' systems all at once, the connection destinations should be limited and gradually expanded through verification during PoC. As described in Chapter 4, all of the candidate technologies of the data sharing platform including X-ROAD were verified in this study and highly evaluated in terms of scalability, which suggests any of them can handle expansion of the number of connections.

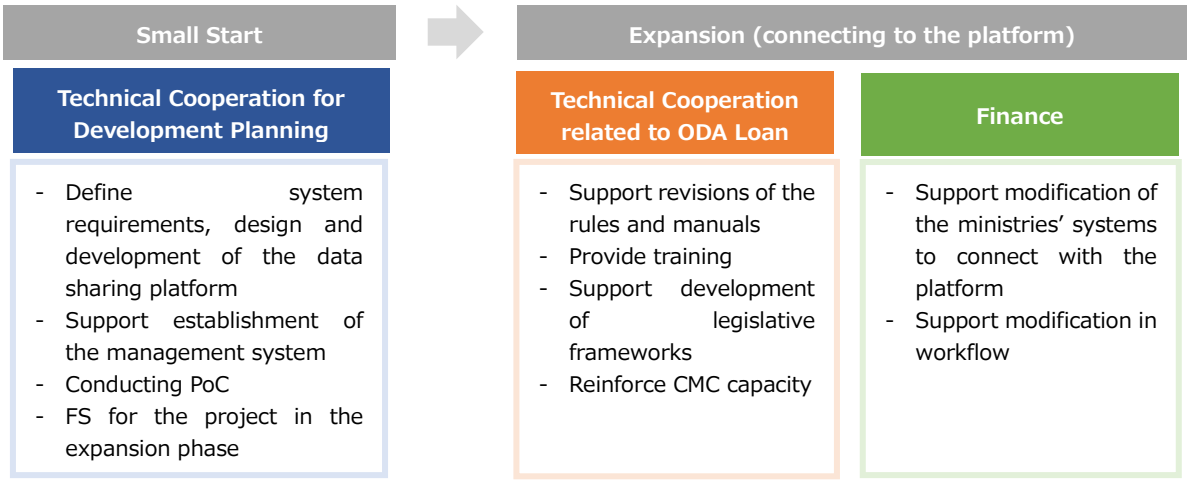
The project in the expansion phase is envisioned to include modification of the ministries' systems to connect to the platform and the relevant workflow, as well as the relevant revision of the rules and guidelines and provision of necessary training.

In terms of JICA's assistance scheme, at the small start, a scheme of "Technical Cooperation for Development Planning" can satisfy the above requirements and is expected to include project components of defining system requirements, designing, and developing the data sharing platform (all inclusive), supporting establishment of necessary legal and the management system, conducting PoC, scoping to connect three ministries and one sector, demonstrating to relevant ministries, reaching consensus on the importance of data sharing platform, and leading to financial assistance.

In the expansion phase, which will be funded by a finance scheme, Technical Cooperation for Development Planning will be utilized to support the establishment of the data sharing platform and targeted ministries' systems to connect with the platform and a technical cooperation project can support tasks of revising rules and manuals to reflect the modification of the system and the workflow, and providing the related training, in addition to reinforcing capacity of CMC to improve end users' access to the administrative services.

The approach of JICA support plan is illustrated in the figure below.

Figure 7.1 Draft Proposal of JICA's Assistance Schemes



Source：JICA study team

The fieldwork in Senegal investigated the following points in order to assess the validity of the proposed schemes.

With regard to Technical Cooperation for Development Planning, the points include:

- Cost evaluation of procuring define system requirements, design and development of the data sharing platform; and
- Feasibility of completing the components of system development, establishment of the management system and PoC implementation.

With regard to finance and technical cooperation during the expansion phase, the point includes:

- Methodologies to connect the ministries' systems to the platform, the relevant costs and benefits incurred consequently

In this survey, small start is assumed that Senegal's data sharing platform will connect the systems of 4 ministries in total, namely three ministries (DAF, DEC, MENT) and one user ministry.,As a candidate of "user ministry", interviews with ANA CMU were conducted and an in-depth analysis of the SIGI CMU (Système Intégré de Gestion de l'Information de la Couverture Maladie Universelle) was reviewed. Regarding the business requirements and needs to connect the data sharing platform and the systems of the sectoral ministries, a hypothesis was drafted and presented to the three ministries (MINT/DAF, MCTDAT/DEC, MENT) to reach common ground before the review of the required functions. The presented hypothesis included a system configuration proposal for the data sharing platform based on X-ROAD, taking into account the layout of the existing system, since X-Road ranked highest among its peers in terms of technology applicability in Senegal, as described in Chapter 4.

Regarding ODA loan as financial assistance for the expansion phase, a “Project Loan” or “Development Policy Loan (DPL)” is considered as appropriate, since the project content is specific to increase the number of connections between the data sharing platform and databases of the remaining ministries. The other schemes of “Project-Type Loans,” such as Engineering Service (E/S) Loans which provide loans for engineering services necessary at the survey and planning stages of projects in advance, Financial Intermediary Loans (two-step loans) through financial institutions in the partner country, and Sector Loans which cover multiple small-scale sub-projects to implement the development plan of a specific sector. Comparing with these, “Project Loan” is considered easier to use as a scheme, since the project is relatively large in scale and should be identified in advance.

In the case of DPL, each tranche of the DPL can be planned to be disbursed according to each ministry’s formulation of the system development plan as a policy action. However, additional technical cooperation is required to the ministries to formulate such plans (including hiring specialists to support the government officers). When taking these points into account, it is suggested that “Technical Cooperation related to ODA Loan” will be started prior to the implementation of DPL.

（4） Estimated cost of a small start and scale of funding

The approximate cost of a small start is calculated as follows, using rough estimates based on similar cases in other countries (mainly in Africa)

- Technical Cooperation：60 man-months (Mainly local support of working group operation and project management), System design：60 man-months (Mainly domestic support of system design)
- System equipment：100-200 million yen
- Total：600 to 700 million yen[13]

（5） Schedule

The Table 7.3 shows the draft support schedule of JICA.

Table 7.3 Schedule

	2021	2022	2023	2024	2025	2026	2027	2028
Information gathering / confirmation survey								
Technical Cooperation for Development Planning								
Examination / detailed design / bidding								
Technical cooperation project								
Financial cooperation (Implementation)								

[13] 5 million per person per month for technical cooperation (local) and 4 million per person per month for the same (domestic) is assumed

7.2 Development Impact

This section summarizes development impact of the use of data sharing platform in general, based on the qualitative and quantitative information.

The development impact of utilizing the data sharing platform is expected in a variety of ways, ranging from the government's expenditure reduction owing to the improved efficiency of administrative procedures through interoperability between the databases of each ministry and agency, to the financial inclusion of vulnerable groups by ID authentication using digital national ID in the private sector. However, information on the effects of a data sharing platform in developing countries is limited. Therefore, in this section the development impact of data sharing platform is analyzed based on the World Bank's ID4D initiative analysis framework[14] and is summarized from the perspective of fiscal saving of the government and the social and economic impacts of the private sector.

（1） Fiscal Saving

The World Bank's ID4D Initiative classifies the characteristics of digital national ID system development into four categories: "Digitalization," "Unique ID," "Integration and Interoperability," and "Digital Authentication," and organizes the fiscal saving of each category (see the figure below).

Figure 7.2 Feature of Digital ID System and Key Benefits

Feature	Description	Key Benefits
Digitization	transition from paper to digital-based systems, including of databases, credentials, data transfer, etc.	• *Direct:* reduces operating and transaction costs • *Indirect:* enables unique ID, integration, digital authentication
Unique ID	creation of a unique identifier –often biometric-based–for each member of the target population	• *Direct:* eliminates duplicates; increases efficiency • *Indirect:* enables integration; boosts digital authentication
Integration and Interoperability	connections between different identification systems, including their ability to exchange information	• *Direct:* reduces operating and transaction costs; enables identity verification across databases, fee-charging
Digital Authentication	electronic process that uses one or more identity factors to prove that a person is who they claim to be	• *Direct:* decreases risk of impersonation; reduces transaction costs; enables fee-charging revenue models

Effects of Data Sharing

Source：World Bank 2018 "Public Sector Savings and Revenue from Identification Systems: Opportunities and Constraints"

In Senegal, efforts are underway on "Digitalization" and "Unique ID." On the other hand, "Integration and Interoperability" and "Digital Authentication" are in the discussion stage. Through the introduction of the data sharing platform, it is expected that the former will be more efficient by simplifying identity verification work and avoiding duplicate collection of authentication information in procedures and transactions related

[14] World Bank 2018 "Public Sector Savings and Revenue from Identification Systems: Opportunities and Constraints" および "Private Sector Economic Impacts from Identification Systems"

to IDs. The latter is expected to help prevent double payments and identity theft, especially in personal funds and benefit transfers (G2C transfers[15]) from the government. In fact, it is hard to identify the development impact of data sharing platform, but the main effects of reducing expenditures and increasing revenues through the combination of the above four features are: 1) reduction of fraud at the time of G2C transfer, 2) Reduction of administrative costs, 3) increase in tax revenue, and 4) collection of ID authentication service usage fees (see the figure below).

Figure 7.3 Mechanism of Fiscal saving Created by Digital National ID

	A. Decreasing Expenditures		B. Increasing Revenue	
Mechanism	**1. Reducing Fraud in G2P transfers**	**2. Reducing Administrative Costs**	**3. Increasing Tax Collection**	**4. Charging Fees**
Description	reducing ghosts, duplicates, ineligible beneficiaries, and impersonation	eliminating redundant systems and reducing transaction costs	identifying tax evaders and widening the tax base	to individuals for ID services and to third parties for verification/authentication
Location	• Payroll • Pensions • Safety nets • Targeted subsidies • Education • Health insurance, etc.	• Identity providers • Agencies or programs that require identity proofing, verification, authentication, or credentials	• Tax administration	• Identity provider

Source : World Bank, (2018) "Public Sector Savings and Revenue from Identification Systems: Opportunities and Constraints

a) Reduction in fraud in G2C transfers

As for fraud of G2C transfers, in the area of the salary of civil servants, pension, social protection benefits, beneficiary-only subsidies, education, health insurance, there are government officers who are registered in the country's payroll but do not actually work, duplicate benefits due to fraud or human error as "inclusion error" whereas there is identity theft as "authentication error", each of which is commonly observed in developing countries. In many developing countries, G2C transfers account for about 15% of GDP, but it is inefficient because the budget is expanded or wasted due to fraud. In Tanzania, a 2015 probe estimated that some 1.5 percent of the wage bill in the previous year had been paid to fake workers who were either deceased, retired, or resigned.

The table below illustrates other countries' cases of reduction in fraud in G2C transfers. Various G2C benefits are also implemented in Senegal, but for example, in social protection, as mentioned above, there is a problem in the accuracy of targeting the recipients. If it becomes possible to instantly evaluate information related to eligibility such as national ID, civil registration, tax payment, assets, and other receipt history in addition to RNU registration information through the data sharing platform, and recipients are identified, fraud will be prevented and transaction costs associated with conventional eligibility screening can be significantly reduced, and the amount of benefits can be increased and used for other support programs.

[15] World Bank uses the term "G2P (government to person)" in ID4D. However, this survey uses the term "G2C (government to citizen)" in light of the theme and scope of this survey.

Table 7.4 Country Cases (Reduction in Fraud in G2C Transfers)

Country	Cases
India	The unique Aadhaar number has been seeded into databases and used to authenticate beneficiaries for dozens of social programs, resulting in significant savings from removing fakes and duplicates. 56 ministries and 35 states and union territories have begun to make direct benefits transfers (DBTs) directly to Aadhaar-linked bank accounts via the Aadhaar Payment Bridge System (APBS). Of the approximate USD 61.7 billion that the Government of India spends on core social protection programs and subsidies, approximately USD 25 billion relies on Aadhaar-enabled DBTs.
Pakistan	In 2010, the government launched the program in response to devastating floods. Individuals registered using Pakistan's Computerized National Identity Cards (CNICs) at centers across the country, and its National Database and Registration Authority (NADRA) then cross-checked these applications to verify the validity of the CNICs, whether other family members had enrolled, and whether the address of residence was in a flood-affected area. Initially, some 2.7 million people applied to claim the flood grants. Of this total, around 1.1 million were found to be ineligible or were duplicate family members. This translates to an estimated savings of some USD 248 million. By reconciling these records against the unique CNIC number, NADRA was able to identify government officers who are registered in the country's payroll but do not actually work and double-dippers, including 20,000 in Sindh province alone.
Uganda	Verifying the identities of civil servants against the national ID database reportedly saved the government US$6.9 million in less than a year by removing some 4,664 ghost workers from the public payroll of 307,916 public officers.
Argentina	Using its Sistema Nacional de Identificación Tributaria y Social (SINTyS) system to link databases at the federal, provincial, and local levels (covering over 200 agencies and 500-some databases by 2008), the government identified inclusion errors in its pension and social program databases, saving at least US$300 since implementation in 1999 until 2007.
Thailand	In implementing a program in 2016 to give subsidies to individuals, in order to register for the scheme, beneficiaries were required to present their national ID cards, and the national ID number was then checked against a number of databases to determine eligibility, including the identity database maintained by the Ministry of the Interior, the Revenue Department database, and the list of agriculturalists held by the Ministry of Agriculture and Cooperatives (MOAC). In total, these checks eliminated approximately 660,000 (7.9%) of the 8,375,383 people who applied. Most of these (around 600,000) were individuals who claimed to be agriculturalists on their applications, but who could not be found in the MOAC database. This translates into a potential savings to the government of between US$29.7–59.4 million in transfers.

Source：World Bank 2018 "Public Sector Savings and Revenue from Identification Systems: Opportunities and Constraints"

b） Reduction in administrative costs

As for administrative costs, the departments of each ministry and agency have adopted their own ID registration / authentication systems for collection, management, and use of personal information of citizens. This incurs enormous transaction costs. IDs are also managed by various systems for each ministry and agency, such as creating a voter list, verifying identity at polling stations, checking passports for immigration, and issuing driver's licenses. Due to the duplication of system for "ID ecosystem", huge transaction costs are incurred. For example, the UK would save between USD 2.3 to 2.4 billion per year if 82% of the services that process over 10,000 transactions[16] were moved online. Other countries' cases are summarized in the table below.

In Senegal, each government agency registers and manages its own ID, and it is thought that the same procedure is repeated. By integrating the ID authentication of each government agency into the national ID through the data sharing platform, it is possible to significantly reduce the working hours of these civil

[16] A transaction, in the context of a database, is a logical unit that is independently executed for data retrieval or updates.

servants and the transaction costs associated with administrative procedures. In addition, the ANACMU is promoting the participation of community insurance for the poor and vulnerable groups identified by PNBSF in cooperation with DGPSN, but the list of poor and vulnerable groups provided by DGPSN. However, there are errors in the list such as gender and age, and the agency are sometimes obliged to verify the list[17]. Various transaction costs caused by such duplication of work have led to financial pressure.

Table 7.5 Country Cases (Reduction in Administrative Costs)

Country	Cases
Slovenia	Slovenia operates a number of social security programs, including child benefits, cash grants and income support, rent subsidies, education benefits, and support for health services and insurance. After the financial crisis in 2009, demand for these services was high, and the government needed to improve the efficiency and transparency of eligibility determinations and ensure that limited resources reached those who needed it most. To overcome these inefficiencies, the government began developing an "e-Social Security Interoperability platform" in 2011. This platform allows approximately 6,000,000 queries per year. By eliminating paper-based queries, this system has saved EUR 12.3 million per year, which is almost nine times the initial investment of EUR 1.4 million.
United States	The U.S. Internal Revenue Service (IRS) spends significant resources on transactions with taxpayers. In 2012, this included processing over 30 million paperbased tax returns, sending over 220 million pieces of mail, and fielding some 90 million phone calls. In total, phone and mail correspondence with taxpayers cost the IRS an estimated USD1 billion. A report by the National Institute of Standards and Technology (NIST) estimates that the initial cost of implementing digital authentication would be US$40 million less—and ongoing operational costs would be USD2 to USD19 million less per year—if the IRS were to adopt a foundational credential rather than an IRS-only system.
Estonia	the Estonian X-Road system provides an interoperability layer for the country's many identity databases. The smart cards, along with mobile-based eID applications offered since 2007, use PKI technology based on secure certificates and PINs to provide digital authentication and digital signatures for thousands of online services. As of 2017, X-Road processes some 500 million queries annually. The eID has increased GDP by some 2 percent annually (around US$500 million), as a result of improving the efficiency of identity-related transactions. According to a cost-benefit analysis by the Estonian Certification Centre, digital signatures alone have saved over EUR 200 million. Another study estimates each of the 113 million X-Road transactions in 2014 saved approximately 15 minutes, this results in a savings of some 3,225 years of time, which is the equivalent of over 200 million euros in yearly salary of staff.
South Africa	Integration between the national ID and voter registration contributed to some of the falling costs of elections (from US$250 million in 1994 to US$32 million in 2009.
Malawi	Integration between the national ID and voter registration eliminated the need for a separate voter ID card, saving approximately US$44 million ahead of the 2019 elections.

Source：World Bank 2018 "Public Sector Savings and Revenue from Identification Systems: Opportunities and Constraints"

c） Tax Revenue Increase

As for tax revenue, taxpayers are usually managed by assigning a taxpayer number. In many developing countries including Senegal, taxpayer evasion such as breach of duty and violation cannot be sufficiently captured, and tax revenue remains low. If information necessary for verifying tax obligations can be exchanged through the linkage between the national ID and taxpayer number, and cooperation between the Revenue Agency and other ministries, tax revenue and tax collection efficiency will be increased. The table below illustrates other countries cases in tax revenue increase.

d） Charging Fees

Charging fees for ID authentication services, the government which provides the authentication information for national IDs, imposes usage fees on services related to ID authentication for individuals and third parties

[17] JICA Project Completion Report, 2016, "Programme d'appui à la couverture santé universelle (CSU) au Senegal"

and uses them as financial resources. In particular, if the data sharing platform can be used to provide ID authentication services to private businesses such as banks and MNOs, it will be possible to secure new financial resources for the government. It is also expected to be a financial resource for the operation and maintenance of the data sharing platform in Senegal. However, charging fees to individuals, particularly for obtaining basic credentials, can work against the principle that identification is a public good and should be accessible to all individuals, regardless of ability to pay. Setting fees requires a balance between earning revenue and ensuring that services are in demand.

Table 7.6 Country Cases (Charging Fees)

Country	Cases
Peru	RENIEC has earned approximately USD 45 million in revenue annually by charging fees for verification and other services, while ensuring that services remain free for the poor.
Pakistan	NADRA charges both public and private sector users to verify identities against its database; for example, it earns approximately USD 9.3 million per year from verifying the identity of the beneficiaries. Public sector agencies are charged USD 0.14 per transaction, while private firms are charged around USD 0.33 per transaction. NADRA verified 100 million SIM card identities for the Pakistan Telecomm Authority in 2014, which would have netted approximately USD 14.7 million.

Source：World Bank 2018 “Public Sector Savings and Revenue from Identification Systems: Opportunities and Constraints”

In order to obtain such fiscal saving, the penetration rate of national ID needs to be high in the national ID system and the database and authentication information need to be robust. Furthermore, the more serious the frequency of fraud and error in G2C transfer, the scale of ID-related transactions, the inefficiency of the ID ecosystem, and the situation of fraud related to tax payment as described above, the higher the fiscal saving.

In Senegal, issues related to G2C transfer, an inefficient ID ecosystem, and the capture of inadequate taxpayers have already been confirmed, and it is thought that the fiscal saving of utilizing the information exchange infrastructure, especially the effect of spending cuts, is high.

（2） Economic and Social Impact in the Private Sector

Economic and social impacts by utilizing the Data Sharing Platform is described in this section.

According to the World Bank's ID4D Initiative, just like fiscal saving, large economic impacts in the private sector can be created by the combination of four features of digital national ID development, "Digitalization," "Unique ID," "Integration and Interoperability," and "Digital Authentication," One of the main economic impacts is the reduction of the huge transaction costs of private service providers and customers in ID authentication, especially the transaction costs of face-to-face and paper-based ID authentication. Private service providers ensure Know Your Customer (KYC) which is confirmed at the time of transaction, in order to comply with compliance, while incurring huge transaction costs related to ID authentication throughout the customer's onboarding and life cycle. According to Fiserv[18], financial institutions’ average cost of an in-person transaction is around USD 4.25, while mobile transactions reduce that figure to only USD 0.10. The average Indian firm’s onboarding cost was reduced from around USD 23 to USD 0.15, with the increased queriability, digitization, and interoperability of the Aadhaar system.

Therefore, if a private service provider can quickly access to a strong ID system with the above four features,

[18] Fiserv 2016 “Mobile Banking Impact: Quantifying the ROI and Customer Engagement Benefits”

it can be expected that the transaction costs of both the provider and the customer will be significantly reduced. The lack of a digital identity represents a direct cost inefficiency to service providers and consumers alike. It also prevents fraud and identity theft in ID authentication, reduces the risk of damages related to customer information leakage, and contributes to ensuring the security of private sector transactions.

Other economic impacts include encouraging participation by those who have previously been restricted from participating in economic activities, including financial access, thanks to reliable ID credentials and lower transaction costs. It is also expected to have the effect of creating new employment, revitalizing financial activities and boosting economic growth. According to the World Bank report[19], the percentage of adults who have official accounts at financial institutions is as low as 17%, and it is expected that the utilization of data sharing platform will improve financial access and revitalize economic activities. It is also believed to lead to the promotion and empowerment of economic activities of women and vulnerable groups.

One of the examples of social impact is a birth registration program in Tanzania. Tigo, Mobile Network Operator, partnered with UNICEF and the national government to develop a birth registration platform that has registered nearly 1.5 million children and broadened Tigo's consumer base in growing markets. Tigo SMS-based mobile app registered 127,000 children, increasing registration rates from 9% to more than 30%.

On the other hand, ID authentication requires private businesses to bear initial costs such as biometric authentication, installation of ID card readers, and re-registration of Subscriber Identification Module (SIM) cards for mobile phones to support national IDs, which can be considered as a negative economic impact.

7.3 Data Sharing Platform Construction Assistance Project（draft）

Based on the results of this study, a framework for a project to support the establishment of a data sharing platform was developed and discussed with the Senegalese side, including MENT, DAF and DEC, and a basic agreement was confirmed.

（1） Background

In Senegal, national IDs linked to birth and residence registration and to the right to vote have been developed and are being actively digitized. In the future, data linkage with public services such as health, social security and education, as well as private services such as finance, is expected through the use of national IDs.

By linking national IDs with various public services through a data sharing platform, the efficiency of intergovernmental operations will be improved and the welfare and convenience of citizens will be greatly enhanced.

（2） Central theme

Ministries' information systems are siloed and the interoperability is low, resulting in low administrative efficiency, including duplication of government budgets.

[19] World Bank 2016 "Financial Capability and Inclusion Survey Report: Senegal"

（3） Implementing bodies

- Ministry of Digital Economy and Telecommunications (MENT) and State IT Agency (ADIE)
- File Automoation Directorate (DAF), Ministry of the Interior.
- Civil Reigstaration Directorate (DEC), Ministry of Community Development, Social and Territorial Equity (MCTDAT)

（4） Organisations concerned

- National Digitalization Council (CNN)
- National Digitalization Council for Digital Senegal 2025 (COPIL SN 2025)
- Ministry of Economy, Planning and Cooperation (MEPC)
- Ministry of Community Development and Social Equality (MDCEST)
- Directorate of Dematerialization and Automation of Judicial Services (DDASJ), Ministry of Justice
- Others (to be decided before the start of project)

（5） Framework of the project supporting data sharing platform (draft)

Outcome	The Senegal Emerging Plan (PSE), which aims to become an emerging country by 2035, and the plans in the Digital Strategy 2025, which are aligned with it, will be promoted.
Objective	The creation of a single data sharing platform for multi-use public services will improve interoperability between information systems of government departments and improve the delivery of online public services to the public.
Output	1. Effective system for the establishment of data sharing platform is organized (Within 3 months of project start) 2. Overall roadmap for the creation of data sharing platform is developed (Within 6 months of project start) 3. Legislation that needs to be enacted or revised in order to establish and operate a data sharing platform is identified (Within 12 months of project start) 4. A small-start version of the data sharing platform is established (Within 24 months of project start)
Activity	1-1 Select and organize the members of the Steering Committee, Technical Committee, PMU and Working Groups. 1-2 PMU defines TORs for each of its working groups 1-3 The working groups develop an overall action plan and a quarterly action plan 1-3 The working groups will carry out their activities in accordance with their action plans 2-1 The PMU approves the action plans developed by the working groups 2-2 The PMU will develop an overall roadmap for the data sharing platform in the medium to long term, taking into account the work plans of the working groups. 2-4 The PMU consults the Steering Committee on the overall medium to long term roadmap it has developed and obtains its approval. 3-1 The Working Group and PMU will identify legislation that needs to be revised or enacted based on the overall medium- to long-term roadmap. 3-2 The Working Group on Legal Systems, Regulations and Guidelines will work with relevant organizations to revise and enact the legal systems and regulations that have been identified as requiring revision or enactment. 4-1 Based on the roadmap and the scope of the small start, the business and system requirements for the introduction of the data sharing platform are defined. Based on the requirements, an implementation plan will be drawn up and approved by the steering committee. 4-2 Determine the specific implementation of the functions of the data sharing platform in line with the technology to be applied.

	4-3 The implementation of the data sharing platform will be based on the drafted design. In addition, a migration plan and an operational plan will be developed for the changes in the business after the implementation of the data sharing platform. 4-4 Based on the operational plan, we will develop the operational system and train users. In addition, based on the migration plan, testing will be carried out in stages to ensure that the post-implementation processes meet the defined requirements. 4-5 With the approval of the Steering Committee, work begins and the changeover to a maintenance and operational structure takes place.	
Institutional Arrangement	• Steering Committee (also serves as JCC) (Including organizations outside the project framework) • Technical Committee (A cross-sectoral team of engineers from the relevant organizations, including those outside the project framework) • Project Management Unit (PMU) (Consisting of the relevant organizations within the project framework) • Working Groups 1. Training, publicity and awareness 2. System design 3. Personal data protection, cyber security, etc. 4. Legal system, regulations and guidelines	
Input	＜Senegal side＞ 1. Organization of the counterpart team and its participation in the project 2. Development of the legal system necessary for the construction and operation of a data sharing platform 3. Others	＜Japan side＞ Technical cooperation for development phase (grant, 2 to3 years) 1. Dispatch of a team of Japanese experts 2. Recommissioning study by local consultants, etc. (legal system, organization, development of data sharing platform, etc.) 3. Counterpart training (10 people, two sessions) 4. Participation in issue-specific training (Cyber security, data protection, etc.) 5. Participation in training in third countries (Rwanda, Mauritius, etc.) 6. Construction of Data sharing platform for small start Financial Cooperation phase (10 to 20 billion yen, about five years) 1. Construction of the data sharing platform (expansion phase) 2. Technical Cooperation

Source： JICA study team

（6） Plan of Operation（PO）（Technical Cooperation for Development Planning Phase）

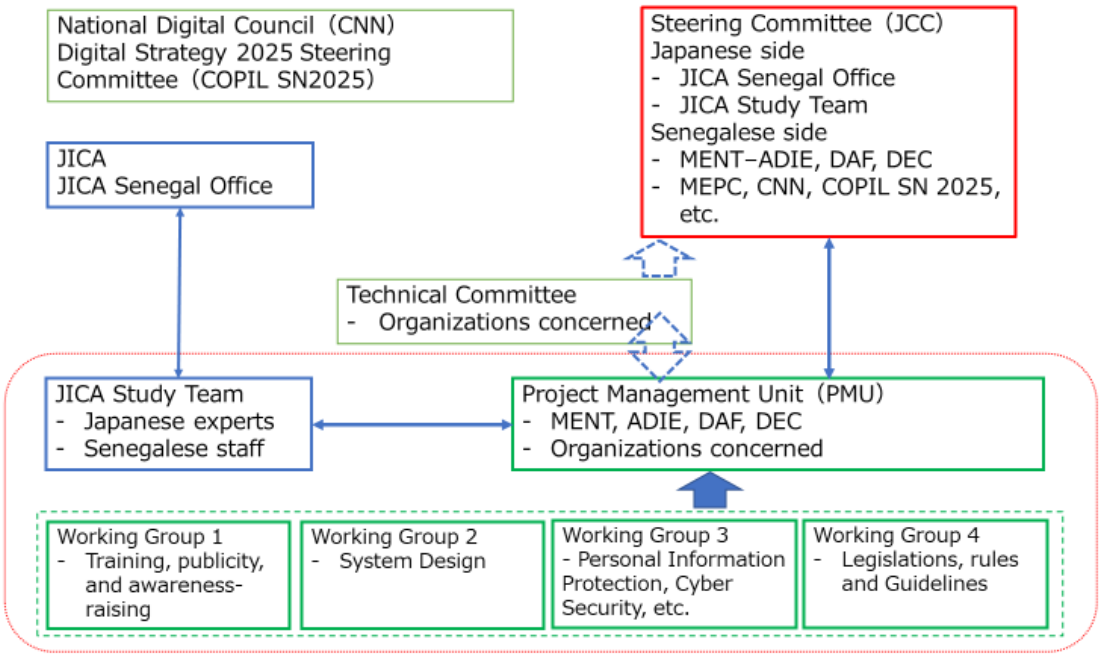
Output		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
1	System establishment										
2	Roadmap										
3	Identification of legislations										
4	Data sharing platform for small start										

Source： JICA study team

（7） Institutional arrangement of the data sharing platform support project (draft)

Institutional arrangement of the data sharing platform support project (draft) is illustrated in Figure 7.4.

Figure 7.4 Institutional arrangement of the data sharing platform support project (draft)



Source： JICA Study Team

Appendix

Appendix 1：Survey Schedule (February to November 2021)

Date		Organization（JST）
15 February	Mon.	16:00-17:00　JICA STI/DX
22 February	Mon.	18:00-19:00　The World Bank, Senegal Office
1 March	Mon.	18:00-19:30　JICA, Senegal office
3 March	Wed.	13:00-13:30　DIVE INTO CODE
8 March	Wed.	11:00-12:00　Mitsubishi Corporation
11 March	Thur.	10:00-11:45　NTT Data
16 March	Tue.	17:00-18:00　Ryobi Systems
19 March	Fri.	16:00-17:00　Kobe City
23 March	Tue.	20:00-21:00　Synapsis
25 March	Thur.	20:00-21:00 Agence nationale de la couverture maladie universelle (ANACMU)
26 March	Fri.	19:00-20:45　Direction de l'état civil (DEC)
30 March	Tue.	19:00-20:30　Direction de l'automatisation des fichiers (DAF)
31 March	Wed.	19:00-20:30　Enabel
1 April	Thur.	19:00-20:00　Ministère de l'Economie Numérique et des Télécommunications (MENT)
2 April	Fri.	10:00-11:30　Engineering meeting at JICA（the 1st session）
7 April	Wed.	18:00-19:00　JICA, Senegal Office（meeting with officers from various sectors） 21:30-23:30　Commission de Protection des Données Personnelles (CDP)
9 April	Fri.	19:00-21:00　Délégation Générale à la Protection Sociale et à la Solidarité Nationale (DGPSN)
14 April	Wed.	19:00-21:00　Agence de l'informatique de l'Etat (ADIE) 22:45-23:45　Chamber de commerce, d'industrie et d'agriculture de Dakar(CCAID)
20 April	Tue.	10:00-11:00　NEC
21April	Wed.	14:00-15:30　Engineering meeting at JICA（the 2nd session）
26 April	Mon.	19:00-19:30　Ministère de l'Economie Numérique et des Télécommunications (MENT)
5 May	Wed.	21:00-22:30 Agence nationale de la couverture maladie universelle (ANACMU)
7 May	Fri.	16:00-17:30　Engineering meeting at JICA（the 3rd session） 19:00-21:00　Agence Nationale de Promotion de l'Emploi des Jeunes (ANPEJ)
11 May	Tue.	09:30-10:40　UNDP Legal Identity Agenda 23:00-24:00　WHO, Senegal Office
12 May	Wed.	18:00-19:30　UNICEF, Senegal Office 21:00-22:30　Organisation des Professionnels des Technologies de l'Information et des Télécommunications (OPTIC)
19 May	Wed.	21:00-22:40　The World Bank, Senegal Office
21 May	Fri.	20:00-21:00　BOS-PSE
26 May	Wed.	20:00-21:00　Institution de Prévoyance Retraite du Sénégal（IPRES）
27 May	Thur.	19:00-21:00　Online seminar
10 June	Thur.	18:00-19:30　Ministère de l'Economie Numérique et des Télécommunications (MENT)
6 July	Tue.	13:00-14:00　CIVIPOL
7 July	Wed.	09:30-10:30　Ministère de l'Economie Numérique et des Télécommunications (MENT)
8 July	Thur.	10:30-11:30　Direction de l'automatisation des fichiers (DAF)
9 July	Fri.	10:00-11:00　Direction de l'état civil (DEC)
12 July	Mon.	10:30-11:30　CEIN 15:00-16:00　SYNAPSYS
13 July	Tue.	11:00-12:00　Agence de l'Informatique de l'Etat (ADIE)
5 August	Thus.	10:00-11:00　SYNAPSYS
13 August	Fri.	10:00-11:00　SYNAPSYS

20 August	Fri.	10:00-11:00 SYNAPSYS
27 August	Fri.	10:00-11:00 SYNAPSYS
3 September	Fri.	10:00-11:00 SYNAPSYS
10 September	Fri.	10:00-11:00 SYNAPSYS
13 September	Mon.	11:00-12:00 Délégation Générale à la Protection Sociale et à la Solidarité Nationale (DGPSN)
14 September	Tue.	10:00-11:00 Direction de l'automatisation des fichiers (DAF) 13:00-14:00 Ministère de l'Economie Numérique et des Télécommunications (MENT)
15 September	Wed.	11:00-12:00 Agence de l'informatique de l'Etat (ADIE)
17 September	Thur.	10:00-11:00 SYNAPSYS
23 September	Thur.	09:00-10:00 Ministère de l'Economie Numérique et des Télécommunications (MENT)
28 September	Tue.	10:00-11:00 SYNAPSYS 11:30-12:30 Délégation Générale à la Protection Sociale et à la Solidarité Nationale (DGPSN)
1 October	Fri.	11:00-12:00 FANN HOSPITAL
6 October	Wed.	10:00-11:00 GIZ 12:30-13:30 Meeting with Achime Ndiaye 15:00-16:00 SYNAPSYS
7 October	Thur.	10:00-11:00 Commission de données Personnelles (CDP)
11 October	Mon.	10:00-11:00 SYNAPSYS 12:00-13:00 Agence de l'informatique de l'Etat (ADIE)
13 October	Wed.	15:00-16:00 Ministère de l'Economie Numérique et des Télécommunications (MENT) Technical Meeting
14 October	Thur.	10:00-11:00 World Bank 15:00-16:00 Agence nationale de la couverture maladie universelle (ANACMU) SG
15 October	Fri.	10:00-11:00 Ministère de la Santé et de l'Action Sociale (MSAS) 15:00-16:00 Direction de l'automatisation des fichiers (DAF)
18 October	Mon.	11:00-12:00 Agence de l'informatique de l'Etat (ADIE) DATACENTER VISIT 15:30-16:30 SYNAPSYS
20 October	Wed.	10:00-11:00 Direction de l'automatisation des fichiers (DAF)
21 October	Thur.	11:00-12:00 Agence Nationale de la Statistique et de la Démographie (ANSD) 16:00-17:00 Direction de l'état civil (DEC)
26 October	Tue.	10:00-11:00 SYNAPSYS
27 October	Wed.	10:00-11:00 United Nations Development Program (UNDP)
1 November	Mon.	06:00-08:00 JICA 14:30-15:30 SYNAPSYS
4 November	Thur.	08:30-09:30 JICA 11:00-12:00 Ministère de l'Economie Numérique et des Télécommunications (MENT)
8 November	Mon.	10:00-11:00 Direction de l'état civil (DEC)
9 November	Tue.	12:00-13:00 Direction de l'automatisation des fichiers (DAF)
17 November	Wed.	14:00-15:00 JICA

Appendix 2：Main Interviewees

1. Senegal

Ministère de l'Economie du Plan et de la Coopération (MEPC)

M. Mamour Oudmane Bâ

M. Babacar Ndiaye (Adjoint au Directeur)

Ministère de l'Economie Numérique et des Télécommunications (MENT)

M. Issac Cissokho (Secrétaire Générale)

M. Achime Malick NDIAYE (Directeur des TIC)

M. Modou Mamoune NGOM (Directeur des Télécommunications)

Agence de l'informatique de l'Etat (ADIE)

M. Innocent Izeyimana

M. Mayoro Fall

M. Ousmane Bob (Manager du Datacenter de Diamnanidio)

BOS-PSE

M. Ibrahima Fall, Communication officer

M. Mamadou Ndir

Ministère de l'intérieur (MINT)

Direction de l'automatisation des fichiers (DAF)

M. Fiacre Bruno BADIANE (Directeur de l'automatisation des fichiers)

M. Abdoulaye Ndiaye

Ministère des collectivités territoriales, du développement et de l'aménagement des territoires (MCTDAT)

Direction de l'état civil (DEC)

M. Aliou Ousmane SALL (Directeur de l'état civil)

M. Djiby Konate (Ingénieur)

M. Khadidiatou Thiam (Statisticien)

Ministère du développement communautaire, de l'équité sociale et territoriale (MDCEST)

Agence nationale de la couverture maladie universelle (ANACMU)

M. Mouhamed Mahi Saikho SY (Directeur des systèmes d'information)

Commission de Protection des Données Personnelles (CDP)

Mme. Awa Ndiaye (Présidente)

M. Mamoudou Niane (Gestionnaire, Juriste)

Délégation Générale à la Protection Sociale et à la Solidarité Nationale (DGPSN)

Mmm. Aminata Sow (Déléguée)

M. Ousseynou Diop (Directeur RNU)

Agence Nationale de Promotion de l'Emploi des Jeunes (ANPEJ), Ministère de la Jeunesse, de l'Emploi et de la Promotion des Valeurs Civiques (MJEPVC)

Mr. Abdoulaye Diatta, (Secrétaire Général)

M. Maixent Kabou (Partnerships Manager)

SIMEN, Ministère de l'Education Nationale

M. Seyni Ndiaye Fall (Coordonnateur du SIMEN)

Institution de Prévoyance Retraite du Sénégal（IPRES）

M. Code Diop (Director of Information System)

Agence Nationale de la Statistique et de la Démographie (ANSD）

M. Oumar FALL (Director, DMIS)

M. Massogui CISSE (DMIS)

Ministère de la santé et de l' action sociale (MSAS)

M. Ibrahima Khaliloulah DIA (DESU in Medical Informatics, DIU eHealth Coordinator of Digital Health Department)

Hôpital Fann

M. Tacko Diop (Director)

CCAID (Chamber de commerce, d'industrie et d'agriculture de Dakar)

M. Arona Ndiaye, (Chef, Service Informatique)

Organisation des Professionnels des Technologies de l'Information et des Télécommunications (OPTIC)

M. El Hadj Seye (Permanent Secretary)

M. Tidiane Sarr

Sysnapsis

M. Socé Camara, Mr. Abdoukhadre Diagne

Civipol

M. Michel Viano

Banque Mondiale

Mme. Aneliya Muller

M. Arthur Denis Pascal Foch

Mme. Anna Zita Metz (ID4D)

M. Dame Seck Thiam (Social protection specialist)

Enabel

M. Joël Leroy

M. Seyni Thiam

UNDP

Legal Identity Agenda

Risa Arai

WHO

Jeff Kabinda Maotela (Coordinator of Health System)

UNICEF

Jeff Diouf

GIZ

Stephan Kun (project leader)

JICA Senegal

Masakatsu Komori (Représentant Résident, Directeur Résional)

Koichi Kato (Premier Adjoint au Représentant Résident)

Kikuo Oishi (Conseiller en Formulation de Projet)

Mamadou Ndome (Senior Program Officer)

2. Japan

Kobe City Hall

Mr. Kozo Mori

Mr. Tsuyoshi Ito

Mr. Shigenori Tanabe

Mitsubishi Corporation

Mr. Tetsuhiro Yoshida

Mr. Akihiro Watanabe

Mr. Mandla Mabunda

Ms. Yuko Sakawa

NTT Data

Mr. Masahiro Hanatani

Mr. Ryo Kawaguchi

Mr. Hanako Saito

Ms. Yutaka Sakuta

NEC

Mr. Kohei Kameoka

Mr. Tooru Nonaka

Mr. Hiroki Yoshifuj

Ms. Yuko Ozaki

Ryobi Systems

Mr. Nobuyuki Shimizu

Mr. Tokuda

Mr. Shinji Matsuda

Ryobi Lao

Mr. Yasushi Ono

Mr. Katsuaki Nakano

DIVE INTO CODE

Mr. Hiroyoshi Noro

Mr. Tomoya Ichikawa

Kanematsu Corporation

Mr. Akira Kobayashi

Mr. Itaru Nose