TRANSPORT PLANNING AUTHORITY
MINISTRY OF TRANSPORT
THE ARAB REPUBLIC OF EGYPT

No.

MiNTS – MISR NATIONAL TRANSPORT STUDY

THE COMPREHENSIVE STUDY ON THE MASTER PLAN FOR NATIONWIDE TRANSPORT SYSTEM IN THE ARAB REPUBLIC OF EGYPT

FINAL REPORT

THE MASTER PLAN

March 2012

JAPAN INTERNATIONAL COOPERATION AGENCY

ORIENTAL CONSULTANTS CO., LTD.
ALMEC CORPORATION
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USD1.00 = EGP5.96
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(Exchange rate of January 2012)

1 INTRODUCTION

1 - 1 BACKGROUND

MiNTS, being a Republic-wide transport study, addresses the entirety of Egypt with emphasis on major national and international transport corridors. A basic premise of all investigations is that MiNTS shall be comprehensive in nature; that is, adopt approaches designed to mitigate transport problems and contribute to the development of the nation. All (excluding urban) major modes of transport are addressed; however, the practical master planning focus lies with modes falling under the mandate of the Ministry of Transport; i.e. the road, railway, maritime and inland waterway sectors.

A revolutionary spirit has been kindled within Egypt. As societal and economic evolution continues, changes in transport activities and behavior will follow suit. Thus, the Master Plan retains sensitivity towards both the alleviation of present deficiencies as well as realization of a transport system founded upon sustainable growth and integrated, mutually supportive transport solutions.

Source: JICA Study team

Figure 1.1 MiNTS Study Area

1 - 2 GOALS AND OBJECTIVES

Database

- Establish a nationwide, multi-modal database whose validity rests on a series of focused transport survey and data collection exercises;

Master Plan

- Formulate overall strategies and policies for development of the nationwide transport fabric;
- Develop an integrated, multi-modal transport master plan extending over a staged planning horizon to year 2027;
- Identify, within the master plan framework, high-priority projects; and,

Technology Transfer

- Implement an effective and productive technology transfer program with Egyptian counterparts.

1 - 3 A COOPERATIVE APPROACH

The final structure of MiNTS was realized as a direct result of cooperative efforts and close liaison between the Study Team, the client group and other local experts. Considerable efforts were expended in gathering information, reviewing previous studies and holding numerous discussions to enhance knowledge of, and sensitivity to, local transport conditions, norms and aspirations.

1 - 4 SCHEDULE

The initial mobilization of the MiNTS Study Team took place during December, 2009. The project culminated with submission of *The Master Plan* final report during March, 2012. Final documentation

includes, in addition to *The Master Plan* report, 13 technical *Appendix Reports* containing considerable detail. The interested reader is urged to consult this extensive informational resource.

1 - 5 THE MINTS VISION FOR TRANSPORT

Four core elements underpin a national vision:

- The intrinsic linking of transport with the form and extent of the national developmental fabric, thus catalyzing a dynamic interaction between transport and Egypt's social as well as economic evolution, while concurrently cementing the Republic's important role in the international arena, both regional and beyond.
- Effective planning, in concert with the shaping of developmental patterns which influence the location, scale, density, design and mix of land uses, thus enhancing the travel experience and creating safer as well as more convenient mobility opportunities.
- Defining 21st Century sustainable and environmentally friendly transport solutions that, for all of Egypt's citizens, seek to improve the quality, enhance the accessibility, and foster the affordability of systems and services needed over the next two decades and beyond.
- The development of an integrated and multi-modal transport concept within the broader context of national evolution while retaining sensitivity towards local norms, expectations and modal requirements inherent to the movement of persons and goods.

2 TRANSPORT SECTOR PERFORMANCE

2 - 1 INTRODUCTION

While much has been achieved in the transport sector, considerable work remains to be done. A synopsis of the current (generally year 2010) performance profile follows. The overview nature of the presentation is emphasized; the intent is merely to provide a "baseline setting" as background to the Master Plan structure. Considerable additional detail is contained in project documentation.

2 - 2 HARDWARE

- The growing dominance of road cargo transport is leading to stagnation in the other transport sectors. The road sector accounts for some 96 percent of daily tonne kilometer shipments. It obliges inland waterway and rail modes to focus present activities using old infrastructure and rolling stock/fleets that have exceeded their practical service life. Maintenance of existing assets suffers from a variety of ills.

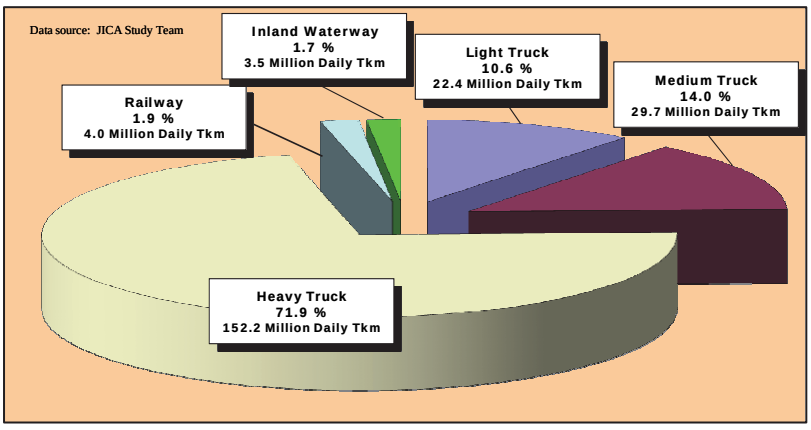


Figure 2.1 Freight Transport Modal Share (2010)

- The largest part of long-distance passenger movements can be attributed to road transport; cars, buses and shared taxis carry some 93 percent of daily passenger kilometers. As a direct consequence, main roads are confronted with congestion, delays and environmental degradation.

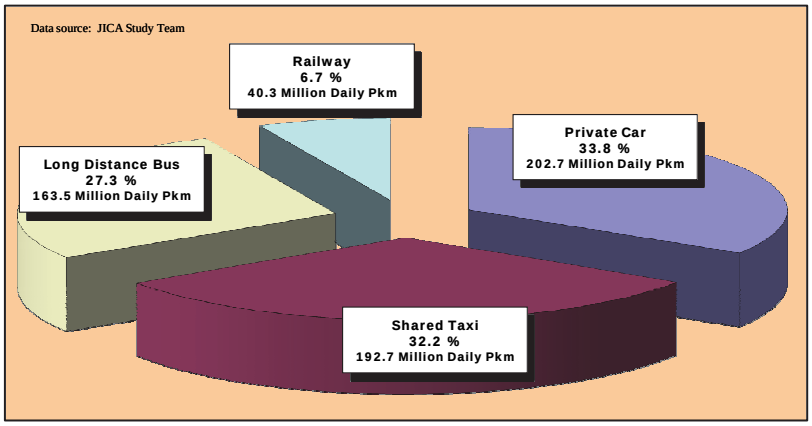


Figure 2.2 Passenger Transport Modal Share (2010)

- Road infrastructure is a valuable asset but inefficiencies exist due to less-than-optimum management (and policing), poor transport equipment (outdated and badly maintained) as well as abysmal safety practices. Road fatality rates are among the highest in the Middle East–North Africa Region. Modern logistics and intermodality are largely absent.
- Operational efficiency and available capacity of railway transport is low, which fuels continuing contraction of the sector. Over the last three decades, freight shipped by rail has declined from some six to less than one percent of national tonne shipments. Containers are, at present, not a priority for the rail sector due to a lack of infrastructure both for handling and transporting of this growing cargo potential.
- Commercial inland waterway transport is very modest because of impediments in river infrastructure (locks, bridges, fairway) and operational considerations. River vessels are aged and not adapted for modern cargo transport.
- Civil aviation is, in comparison to land modes, modest accounting for less than one percent of national cargo and roughly three percent of daily domestic passenger activity.

2 - 3 SOFTWARE

- Lack of modernization of the transport sector has led to low performance and poor capacity utilization. Some one-half of trucks, for example, travel empty.
- Externalities related to market access, administrative practices, lack of intermodal systems, regulatory frameworks and inability to operate in a competitive market all encourage shippers to use predominately road transport for their cargoes.
- A sustainable framework for the transport sector as a whole requires adapting the present approaches to the needs of modern transport, with a predominant aim to facilitate market-responsive, customer-oriented operations and private sector involvement.
- Commercial utilization of the inland waterway and railway modes is predominantly for low value bulk cargoes transported between dedicated destinations. Cargo consolidation is hindered not only by the lack of available infrastructure and equipment, but also by the absence of management and operational know-how.

- Integration of river and railway transport into the Egyptian transport system (multi-modal dimension) is therefore very low to non-existent. On the contrary, river and railway transport are confronted with unfair competition by road transport that benefits from rules and subsidy mechanisms interfering with free market principles and allowing market prices that do not reflect true operating costs.
- Technological innovation is a driving force in modern logistics and defines the competitiveness of the transport systems and services. There is a pressing need for the introducing of modern technology and logistics strategies into the Egyptian transport market.

2 - 4 HUMANWARE

- The sector suffers from a severe shortage of qualified staff.
- There exists a shortage of training and human resource development programs.
- Qualified personnel, and a unified data system (ideally computerized and/or GIS friendly) encompassing all transport modes, are both lacking.
- Coordination between Ministries and organizations is complex and time consuming. Approaches to transport planning, implementation and operations are currently fragmented among a myriad of organizations, entities and Ministries with little evidence of efficient, market-responsive overview guidance or control.
- Human resource responsibilities for transport activities are fragmented.

3 PLANNING FOR THE FUTURE

3 - 1 SOCIO-ECONOMIC CONSIDERATIONS

The population of Egypt has been steadily increasing over the past two decades at a pace slightly in excess of two percent per year, reaching an estimated 78.4 million persons in year 2010. Underlying reductions in future unit growth are seen as being achievable when coupled with intensified incentive and education programs. Still, population is expected to increase by almost 30 million persons over the MiNTS planning horizon to 107.3 million persons in year 2027.

The impact of the January, 2011 revolution has exerted considerable impact on future economic growth. While longer-term expansion is seen as again reaching pre-revolution rates of growth, near term economic activity is forecast as being more sluggish, in particular the initial year following the Revolution when expected real GDP growth is in vicinity of one percent per annum. The average annual compounded rate of growth over the planning horizon is consequently expected to average a still-robust 5.3 percent. GDP per capita is expected to increase from 13,900 to 24,600 constant LE between years 2010 and 2027.

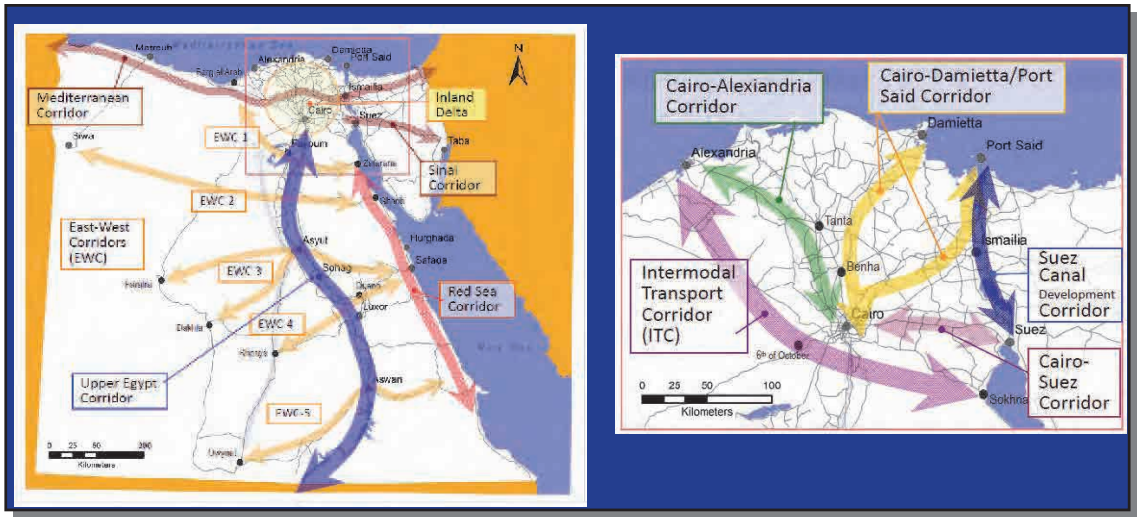
3 - 2 THE CORRIDORS

Eleven corridors (domestic and international, passengers and cargo) were defined. The most significant corridors are:

- The Mediterranean Corridor linking Libya with Palestine via Marsa Matrouh, El Alamein, Greater Cairo (northern segment of Cairo Outer Ring Road), Ismailia, and the Suez Canal-North Sinai Area.

- The Intermodal Transport Corridor linking the 6th of October Value Added Center with both the Alexandria-area seaports and Sokhna port. The corridor is expected to focus on the logistics of efficient freight flow.
- The Red Sea Corridor parallels the Red Sea/Gulf of Suez between approximately Zafarana and Bernees, with a potential for strengthening the current linkage with Sudan. Key intermediate points are Gharib, Hurghada and Safaga.
- The Upper Egypt Corridor paralleling the Nile River between Greater Cairo and Aswan, with a potential extension to create a new gateway to Sudan (Khartoum).

Four additional corridors service east-west axes within Central and Upper Egypt. These connect Siwa and Gharib; Farafra/Dakhla and Safaga (via Asyut); Kharga and Safaga (via Luxor/Quena), as well as Owynat and Bernees (via Aswan).

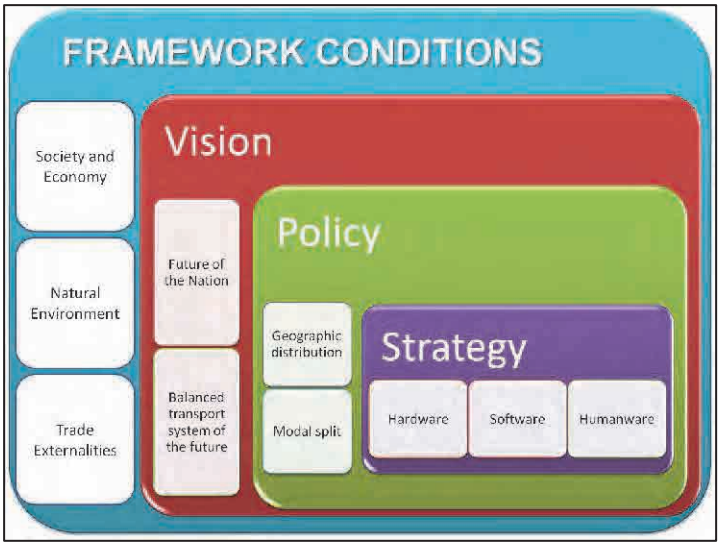


Source: JICA Study Team

Figure 3.1 Year 2027 MiNTS Transport Corridors

3 - 3 THE PLANNING CONTEXT

The MiNTS planning approach involves, sequentially, national framework conditions, a vision, a policy, and a strategy, all leading to the Master Plan. Each component, that is, vision, policy and strategy, is based on a cascading and mutually reinforcing chain of activities. These evolve within a broader set of (non-transport) framework conditions reflective of a variety of conditions to include, for example, societal, economic and trade indicators.

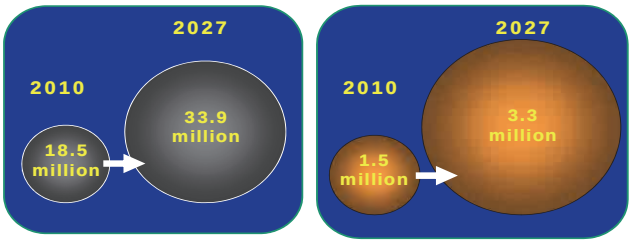


Source: JICA Study Team

Figure 3.2 Context of the Planning Pillars

3 - 4 CHANGES IN DEMAND

Key implications of demand forecasts together with important socio demographic characteristics are that daily person trips are expected to almost double (18.5 to 33.9 million) while daily cargo activity will more than double (1.5 to 3.3 million daily tonnes).



Source: JICA Study Team

Figure 3.3 Daily Person Trips / Daily Cargo (Tonne) Trips

The longer-term *Egypt Vision 2052*[1] strategy envisages a gradual shift in national growth from the Cairo metropolitan area and Nile Delta agglomerations to the Western Desert, New Valley, Sinai and Red Sea Regions. These spatial year 2052 concepts have been considered in the formation of the MiNTS year 2027 socio-economic framework.

Land use, both in terms of type as well as intensity, and transport demand are inexorably linked. Thus, by year 2027, trip generation is expected to gradually intensify, in line with new settlement policies, in what today are seen as more remote areas. This will consequently require focused transport initiatives. However, in a national transport demand sense, the role of the currently highly populated precincts, while reduced, will remain substantial in terms of requirements for transport systems enhancements.

The future modal implications include:

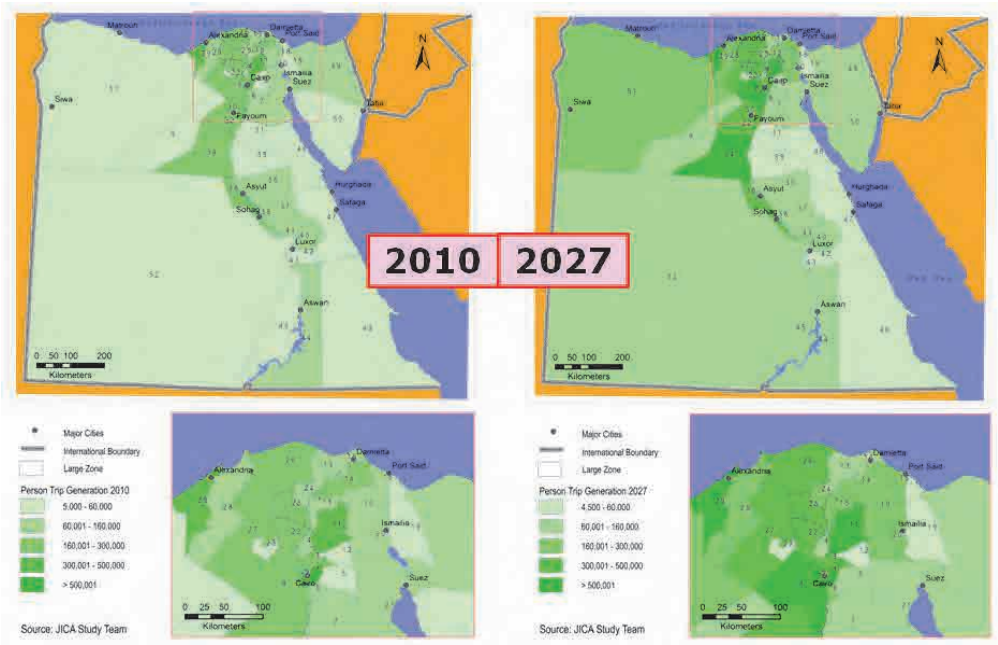
- Shift towards more efficient long-distance passenger transport via rail and bus modes, vis-à-vis shared taxi and private car transport; and,
- Shift towards non-road (railway, inland waterway) for cargo transport.

Table 3.1 Scenario Comparison

Characteristics	Year		Growth Factor
	2010	2027	
Population (000)	78.359	107.281	1.4
GDP (Constant 2009 billion LE)	1,092	2,642	2.4
GDP per Capita(Constant 2009 billion LE)	13,930	24,630	1.8
Total Daily Tonne - Km (Mil)	213	641	3.0
Daily Non-road Tonne - Km (Mil)	8	62	7.8
Daily Non-road Mode Split (Tonne-Km basis)	3.8%	9.8%	2.6
Long Distance Person-Km (Mil)	611	1,059	1.7
Long Distance Rail Person Km (Mil)	40	270	6.8
Long Distance Rail Person Km (Mode Split)	6.6%	25.5%	3.8

Note: Long distance person trips are those greater than 100km. Rail person trips include high speed rail passengers.
Source: JICA Study Team.

[1] *Egypt Vision 2052*, prepared by the GOPP, Ministry of Housing, Utilities and Urban Communities, 2010 (with updates).



Source: JICA Study Team

Figure 3.4 Person Trip Generation; Years 2010 and 2027

3 - 5 MASTER PLAN BENEFITS

The realization of the MiNTS Master Plan will result in significant economic benefits with an EIRR (Economic Internal Rate of Return) of 17.8 percent. The Master Plan is further expected to catalyze a string of positive initiatives for Egypt namely:

- The maintenance of the MiNTS geodatabase;
  - Planning tool for government initiatives such as enhancement of road maintenance; and
  - Updating of the national transport model.
- Reduction in global warming;
- Greater mobility of the Egyptian population;
  - Better connectivity for all Egyptians with centers of activity;
  - Better connectivity between all regions of Egypt; and,
  - Enhanced international linkages.
- Improved governance in the transport sector; and
- Enhanced trade linkage especially via the critical Asia – Egypt – Europe axis.

The Master Plan will support government policy specifically:

- Efficient use of transport infrastructure;
  - Modal shift of cargo movements to the non-road sector; and
  - Integration of passenger services.
- Improved transport safety;

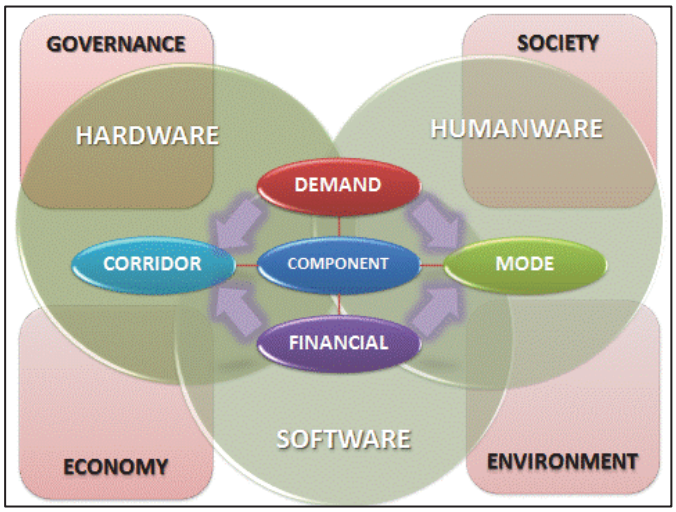
- Road safety initiative; and
- Rail safety initiative.

- Encouragement of private sector participation in the development of transport infrastructure;
- Creation of Jobs in the plan implementation; and
- Modernization of transport logistics across Egypt.

4 MASTER PLAN COMPONENTS

4 - 1 THE PILLARS OF SUCCESS

A core obligation of MiNTS is to support good governance, balance the needs of society with those of the economy while considering the long-term implications on the environment. Within that context, the Master Plan not only considers the creation of new infrastructure, but also strives to balance infrastructure building (hardware) with transport system management and efficiency by encouraging software (technology) and humanware (human resources) initiatives. The Plan framework embraces realism at four principal levels, namely the level of response to (present and future) demand, allocation of demand within strategic corridors and linkages with land uses contained therein, modal use of transport systems/services, and the availability of (public and/or private) financial resources.



Source: JICA Study Team

Figure 4.1 Transport Strategy Building Blocks

4 - 2 CANDIDATE PROJECTS

MiNTS has nominated a total of 103 initiatives, with an estimated implementation cost of 320 billion LE (current price). These include both upgrading of existing assets plus realization of new projects/programs. Discussions with the client group confirm a realistic future public investment goal is on the order of 50 billion LE per five year period. This clearly implies an important supportive role for private sector participation and/or alternative forms of sector funding.

Table 4.1 Candidate Projects

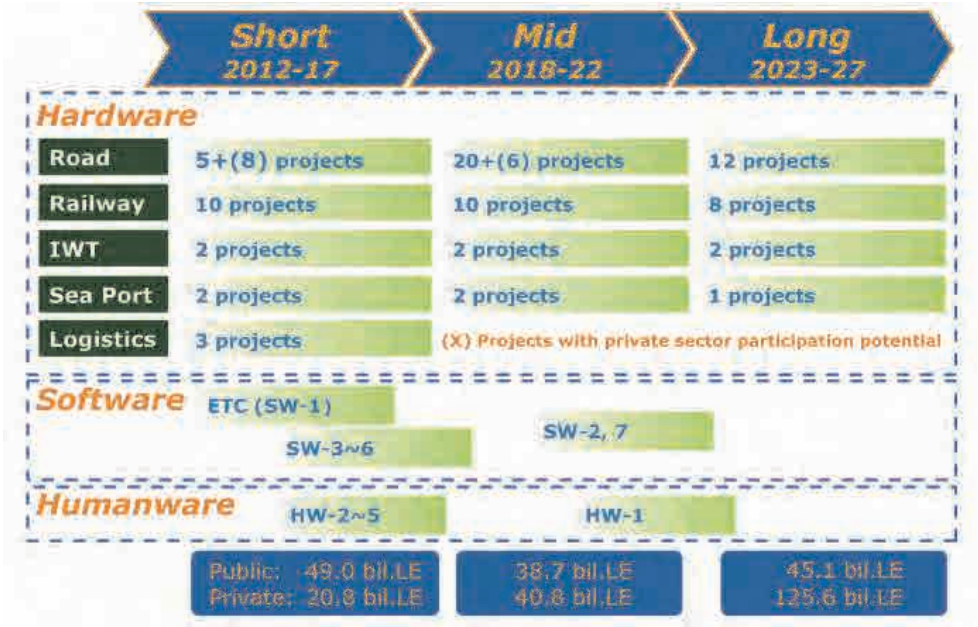
Sector or Activity Precinct	Number of Projects	Total Cost (Billion LE)
Road	51	90.8
Railway	24	40.2
High Speed Railway	Alex. - Cairo	22.1
	Cairo - Aswan	139.5
Inland Waterway Transport	6	4.0
Maritime	5	6.2
Logistics	2	3.5
Passenger Terminal	1	1.1
Software	7	11.1
Humanware	5	1.5
Total	*103*	*320.0*

Table 4.2 Candidate Projects for Software

Software (Technology)	Humanware
Ministerial Issue SW-1: Egyptian Transport Center SW-2: Establishment of dedicated transport fund	Ministerial Issue HW-1: Strengthening MOT's responsibility covering all transport modes for integrated multimodal transport system and logistics
Road Sector SW-3: Development of road function based design and capacity standards SW-4: Road safety initiative (education, engineering and enforcement)	Road Sector HW-2: Training in modern traffic management and control systems HW-3: Training in modern road maintenance techniques
Railway Sector SW-5: Railway safety initiative SW-6: Introduction of state of the art systems and control	Railway Sector HW-4: Extension of ENR transformation plan (training in modern railway operation and management)
Inland Water Sector SW-7: IWT navigation and control	Inland Water Sector HW-5: Extension of NICHE/RIRT program

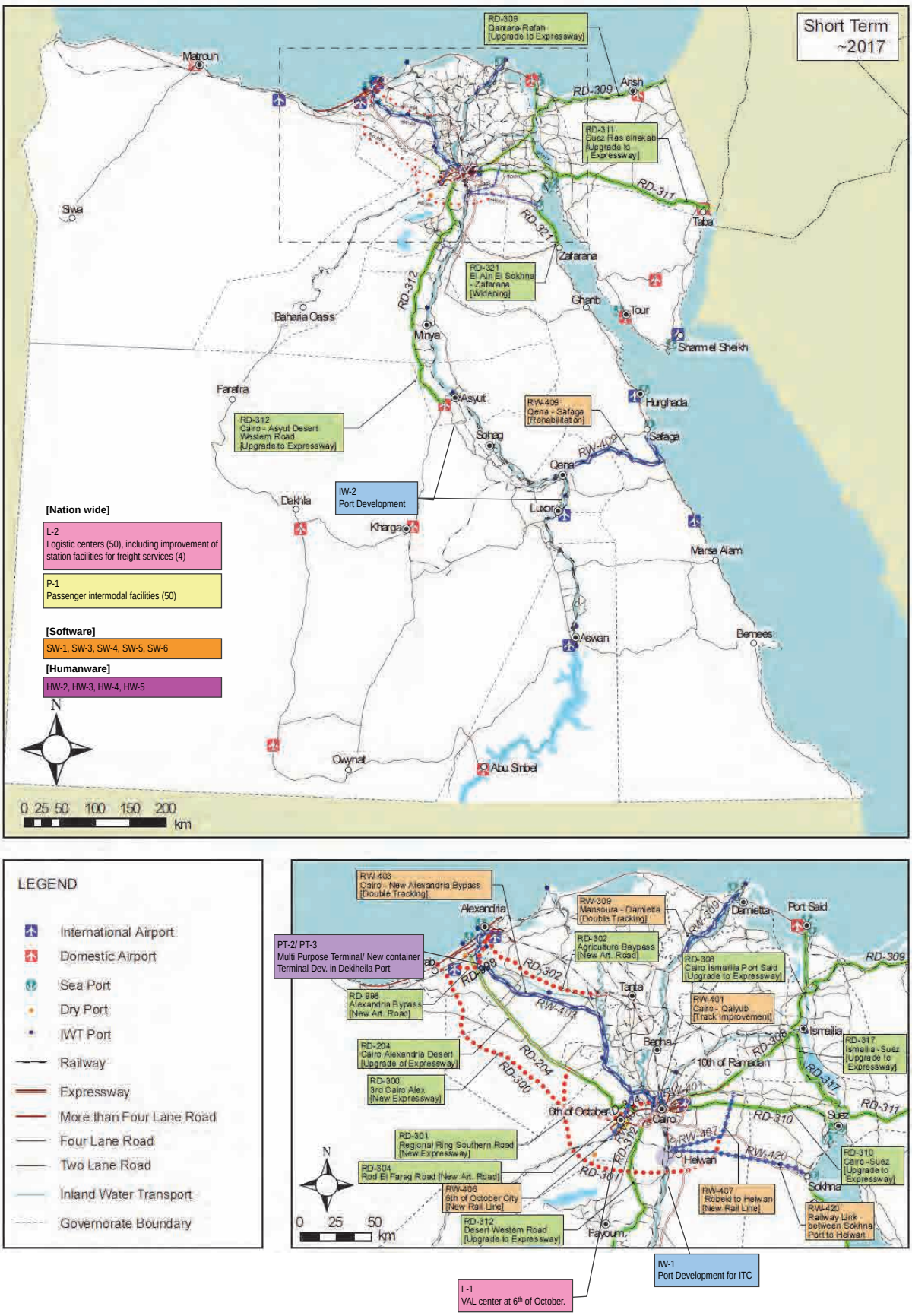
4 - 3 THE STAGED MASTER PLAN

The MiNTS Transport Master Plan is staged over three consecutive five-year periods; namely, short-term (present to year 2017), mid-term (years 2018-2022) and long-term (years 2023-2027). The staging and prioritization of the initiatives is founded on a multi-criteria analysis whose indicators were derived in close consultation with the client group. The adopted staging concept links improvements while concurrently introducing logic in terms of implementation considerations, relational strength, modal capabilities, transportation system continuity as well as elements of affordability. The future role of public-private partnerships is seen as pivotal given anticipated limitations in public financial resources.



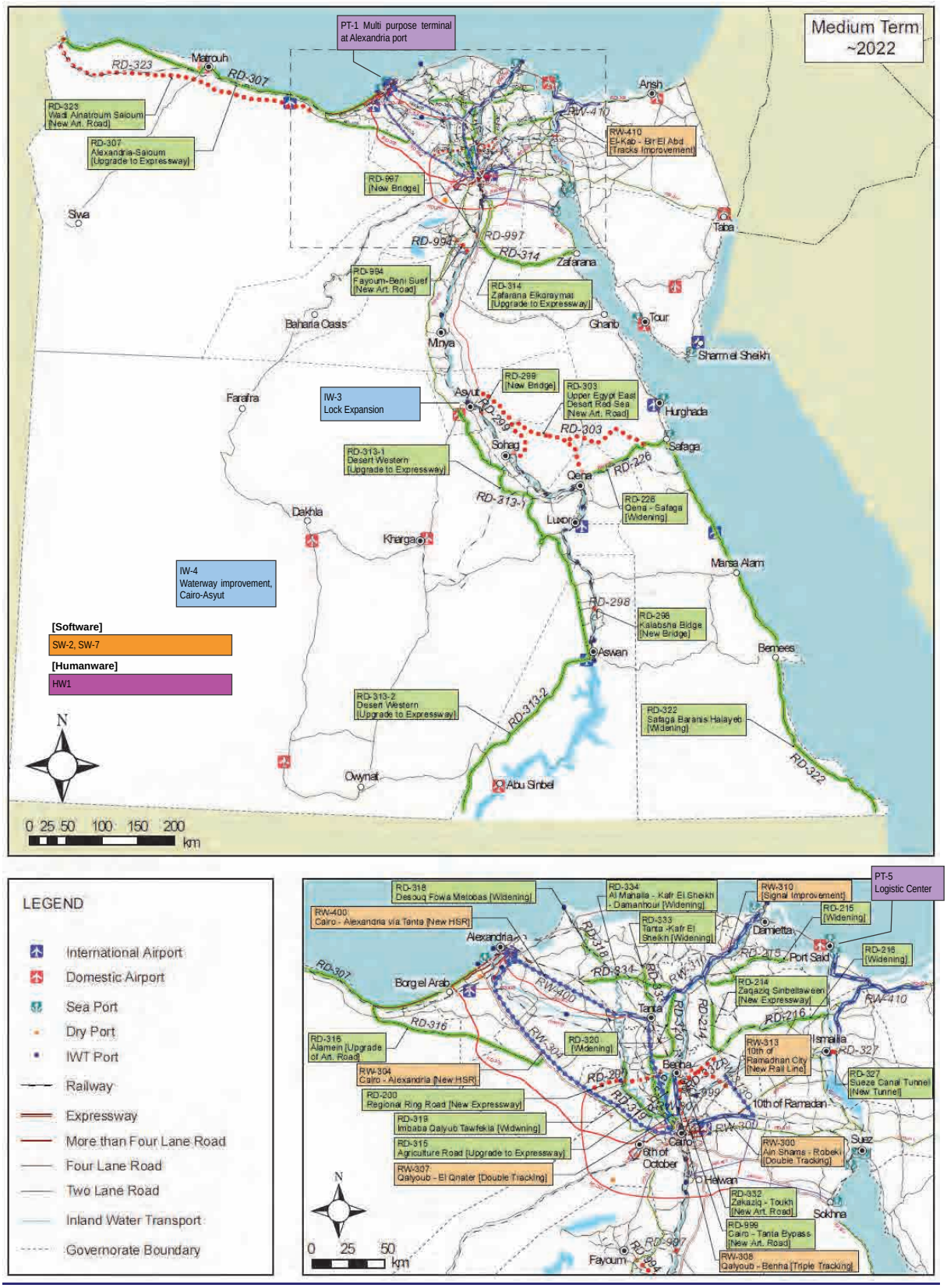
Source: JICA Study Team

Figure 4.2 Master Plan Staging



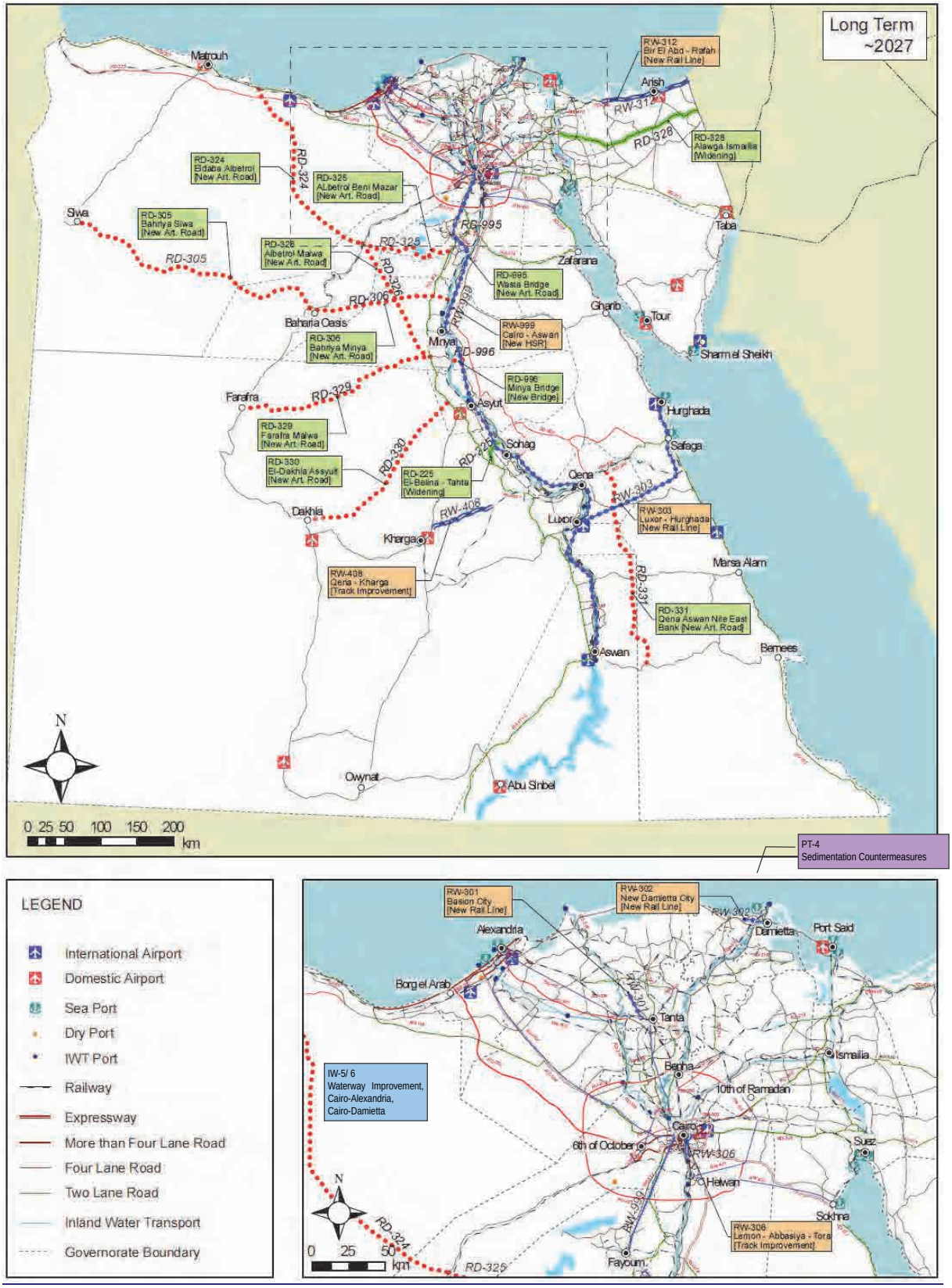
Source: JICA Study Team. Project details contained in Chapters 6,7 and 8 of the main volume as well as annexes to the summary.

Figure 4.3 Locations of Initiatives – Short Term Planning Period (Present to Year 2017)



Source: JICA Study Team. Project details contained in Chapters 6,7 and 8 of the main volume as well as annexes to the summary.

Figure 4.4 Locations of Initiatives – Mid-Term Planning Period (Year 2018 through Year 2022)



Source: JICA Study Team. Project details contained in Chapters 6,7 and 8 of the main volume as well as annexes to the summary.

Figure 4.5 Locations of Initiatives – Long Term Planning Period (Year 2023 through Year 2027)

5 NOMINATED PRIORITY INITIATIVES

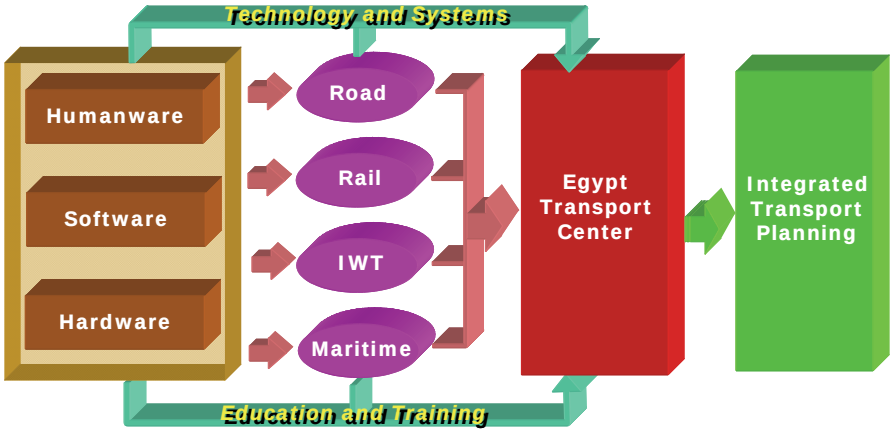
It is strongly urged that four initiatives be immediately considered for further feasibility or follow-on studies. All four are seen as being of critical importance to the realization of an Egyptian integrated transport system. The nominated projects and programs include not only infrastructure (hardware) projects, but also software and humanware initiatives. All have been ranked highly as part of the multi-criteria analysis.

A. Egypt Transport Center
B. Intermodal Transport Corridor
C. Road Maintenance and Safety
D. Mediterranean Corridor

A. EGYPT TRANSPORT CENTER

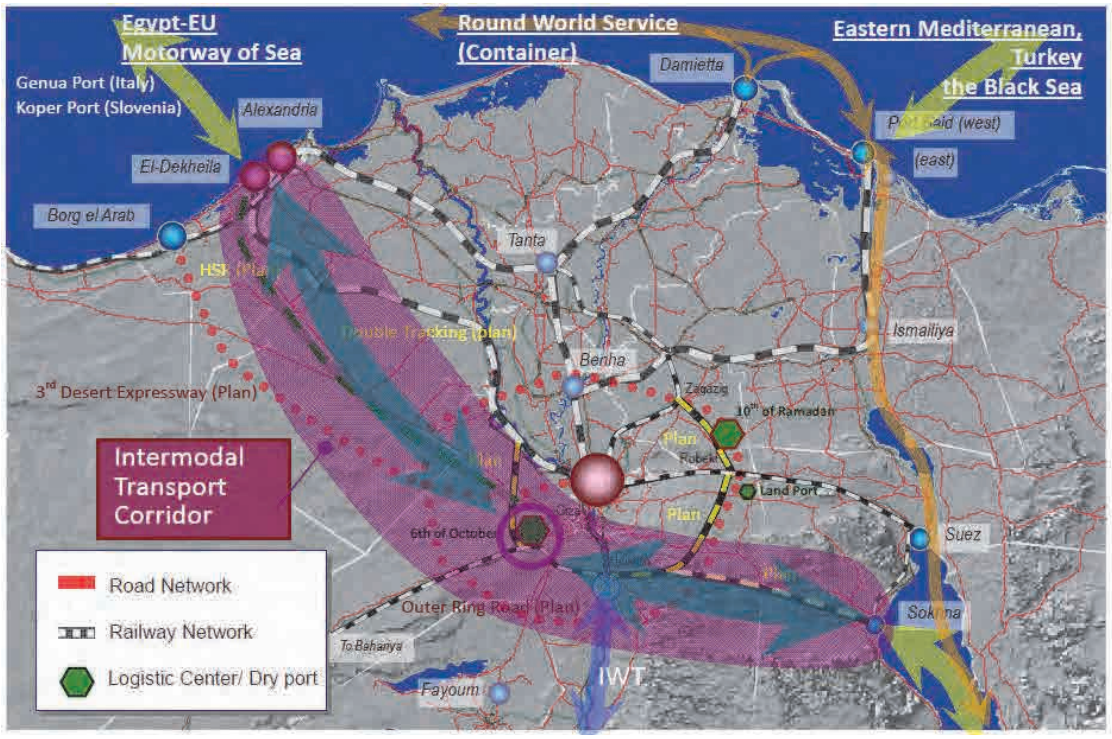
The Egypt Transport Center, the highest-priority MiNTS follow-on project, will play a crucial role in the enhancement and development of transport planning in Egypt. The Center is seen as fulfilling a variety of critical functions, among them:

- Maintain, enhance and expand the MiNTS national transport model and national geodatabase;
- Carry out Ministry-wide transport studies and reviews;
- Create "smart systems" for on-going data monitoring;
- Humanware development;
- Road safety systems as well as similar initiatives; and,
- Urban activities such as re-activating the recent CREATS (Cairo Regional Area Transportation Study) effort by integrating recent and on-going activities such as Metro network expansion.



B. INTERMODAL TRANSPORT CORRIDOR

An important corridor for sustainable freight transport (involving road, railway, maritime, inland waterway sectors) is the proposed Intermodal Transport Corridor, linking the new 6th of October Value Added Center with both the Alexandria-area seaports and Sokhna port. The corridor is seen as directly linking with the EU "motorway of the sea" connecting Alexandria, Genoa and Koper ports. The corridor, and proposed infrastructure therein, will focus initially on container traffic between Egypt and Europe. But the corridor will also and gradually concentrate on traffic from Asia, in particular China, destined for the European (and Maghreb) markets with the 6th of October VAL Center providing in-country value added and logistical services. These contemplated activities are seen as exhibiting a very high potential for job creation.



Source: JICA Study Team

Figure 5.1 Concept of Intermodal Transport Corridor

C. ROAD MAINTENANCE AND SAFETY

Road Safety Initiative

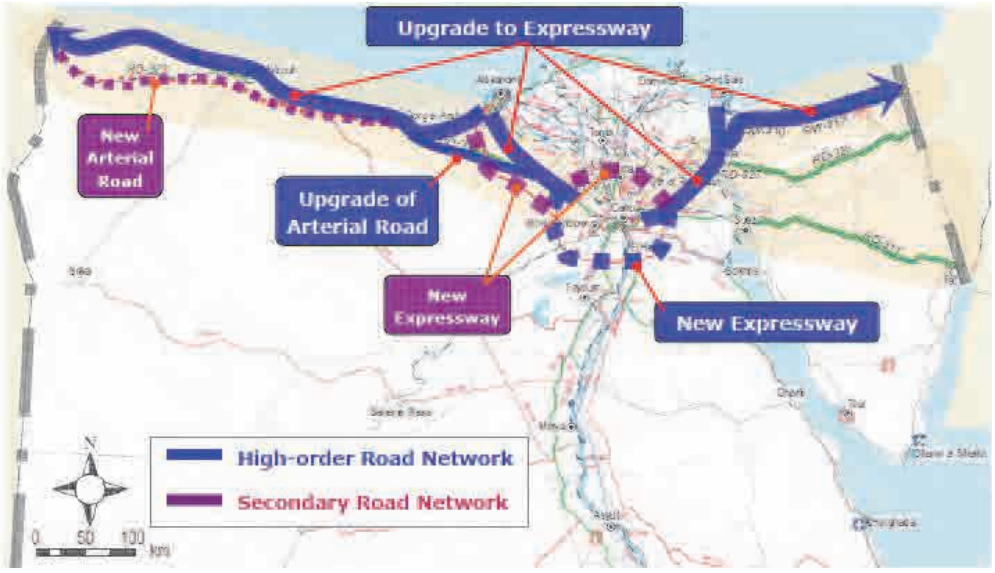
- Nationwide focus on 3 E's: Engineering, Education and Enforcement. Likely role for Egypt Transport Center. Intent is to establish, in the first instance, a cross-agency single national entity responsible for road safety.

Road Management and Maintenance

- Capacity development on targets officers with responsibility for managing and maintaining road assets. Improved road network management training ensures best performance and value-for-money is obtained from the road network, while concurrently offering quality facilities to road users.

D. MEDITERRANEAN CORRIDOR

The fourth-priority package establishes the Mediterranean Corridor transport network. This corridor is seen as fulfilling a number of domestic functions, including services to planned new settlements and contributing to the alleviation of current congestion in the Nile Delta. The corridor includes realization of key links of the Cairo Outer Ring Road. Considerable potential exists for realizing the Republic's international aspirations along the Mediterranean coast. Corridor infrastructure is seen as offering a role for private sector participation.



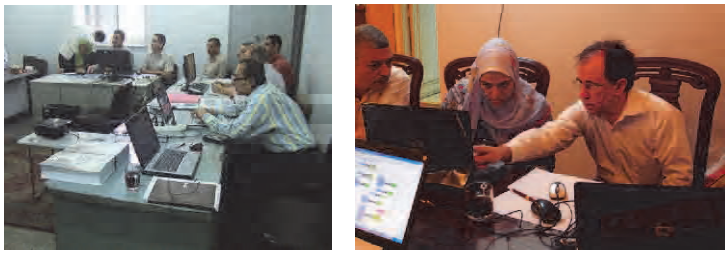
Source: JICA Study Team

Figure 5.2 Expressway Network of the Mediterranean Corridor

6 TECHNOLOGY TRANSFER

6 - 1 TECHNOLOGY TRANSFER AND TRAINING

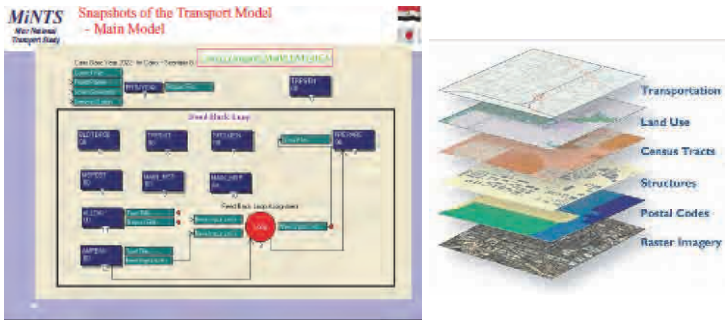
The planning process fully recognizes that Egyptian stakeholders must participate in visualizing and shaping their own future. This is of substantial importance in terms of ownership building and ensuring that MiNTS is adopted as well as used following the completion of technical investigations. Technology transfer and training is therefore seen as one of the most important elements of MiNTS.



Source: JICA Study Team

Figure 6.1 Elements of the MiNTS Training Program

A multi-stage training program was, in consultation with the client group, brought to successful fruition. This included training by members of the MiNTS study Team as well as task-specific training by external specialists from Citilabs (CUBE software) and ESRI (GIS software). These classroom sessions were further enhanced by counterpart involvement in MiNTS via practical, day-to-day "hands on" experience.



Source: JICA Study Team

Figure 6.2 CUBE software (in left), Concept of GIS (in right)

6 - 2 NATIONAL MODEL AND GEODATABASE

A massive national data collection exercise, one of the largest ever conducted in Egypt, was carried out across five major transport modes (road, railway, maritime, inland waterway and civil aviation sectors) during year 2010. Hundreds of thousands of samples were collected, processed and analyzed.

The MiNTS geodatabase contains information collected via the MiNTS transport surveys plus other supporting resources obtained from a variety of Egyptian institutions. This data base is seen as one of the most comprehensive in Egypt.

Table 6.1 Five survey groupings, 15 types of surveys

Roadside Interview and Vehicle Counting Survey		
Passenger Transport Terminal Survey - *Railway Stations* - *Bus Terminals* - *Shared-Taxi Terminals* - *Airport* - *Seaports*	**Freight Transport Terminal Survey** - *Railway Terminals* - *River Ports* - *Dry Ports* - *Free Zones* - *Airport* **Maritime Terminal Survey** - *Seaports*	**Freight Company Survey** - *Freight Forwarders (58 Companies)* - *Trucking Companies (63 companies)* - *Manufacturers (242 companies)*

Figure 6.3 MiNTS National Transport Survey Experiences

The national computerized transport model (MNaM) simulates passenger and cargo demand across all adopted modes of transport, for public and private means of conveyance. The MNaM is intrinsically linked with the MiNTS geodatabase.

Source: JICA Study Team

Figure 6.4 Example of MiNTS Geodatabase Graphics

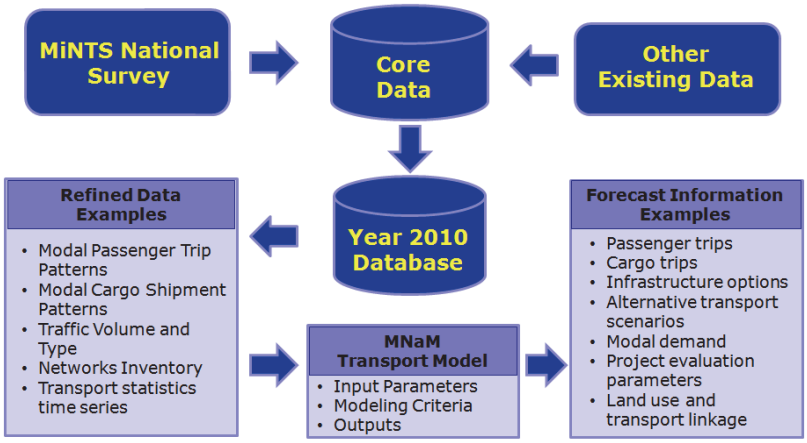


Figure 6.5 Linkage of Geodatabase and National Computerized Transport Model

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LIST OF ABBREVIATIONS

AAALT	Arab African Association for Logistics and Transport
AADT	Average Annual Daily Traffic
AAGR	Average Annual Growth Rate
AASHTO	American Association of State Highway and Transportation
AASTMT	Arab Academy for Science, Technology and Maritime Transport
ACS	Alexandria Chamber of Shipping
ADP	Aeroports de Paris
ADT	Average Daily Traffic
AEC	Agricultural Export Council
AfDB	African Development Bank
AFT	Arrow Freight and Trade
AICT	Alexandria International Container Terminal
AIT	Aviation Information Technology
AIT	Alliance International de Tourism
AIS	Automatic Identification System
AODB	Airport Operation Database
APA	Alexandria Port Authority
APM	Automated People Mover
ARA	Arab Road Association
ARMS	Airport Resource Management System
ARS	Automatic Route Setting
ATC	Automatic Train Control System
ATC	Air Traffic Control
ATCE	Automobile & Touring Club of Egypt
ATP	Automatic Train Protection
AULT	Arab Union for Land Transport
AVIT	Aviation Information Technology
BAT	Best Available Technology
BOD	Biological Oxygen Demand
BOO	Build, Own, Operate
BOOT	Build, Own, Operate and Transfer
BOT	Build, Operate and Transfer
BP	British Petroleum
BRS	Baggage Reconciliation System
BS	BIOMETRIC Systems
CAA	Competent Administrative Authority
CAC	Cairo Airport Company
CAD	Central Authority for Development
CAPMAS	Central Agency for Public Mobilization and Statistics

CAPWO	Organization for Execution of Greater Cairo and Alexandria Portable Water and Wastewater Project
CBA	Cost and Benefit Analysis
CBD	Central Business District
CBE	Central Bank of Egypt
CCTV	Closed Circuit Television
CDC	Cairo Demographic Center
CEPC	Cairo Electricity Production Company
CIA	Cairo International Airport
CILT	Chartered Institute for Logistics and Transport, UK
CMO	Cairo Metro Organization
CNG	Compressed Natural Gas
COD	Chemical Oxygen Demand
COMESA	Common Market for Eastern and Southern Africa
CREATS	Cairo Regional Area Transportation Study
CSC	Centralized Substation Control
CUBE	Modeling software used to develop the MiNTS National Transport Model
CUSS	Common User Self Service
CTA	Cairo Transport Authority
CTC	Centralized Train Control System
CUTE	Common Use Terminal Equipment
DB	Design Build
DBFO	Design Build Finance and Operate
DBO	Design Build and Operate
DC	Direct Current
DCf	Double Counting Factor
DCW	Digital Chart of the World
DEM	Digital Elevation Model
DF/R	Draft Final Report
DGPS	Differential Global Positioning System
DIPCO	Damietta International Port Company
DMA	US Defense Mapping Agency
EAA	Egyptian Aviation Academy
EAC	Egyptian Airports Company
EAFMS	Egyptian Authority for Maritime Safety
EAHC	EgyptAir Holding Company
ECMMO	Egyptian Company for Metro Management & Operation
EDHC	Egypt Demographic and Health Survey
EDI	Electronic Data Interchange
EEA	Egyptian Electricity Authority
EEAA	Egyptian Environmental Affairs Agency
EEHC	Egyptian Electricity Holding Company

EETC	Egyptian Electricity Transmission Company
EFCBC	Egyptian Federation for Construction & Building Contractors
EFTA	European Free Trade Association
EHCAAN	Egyptian Holding Company of Airports & Air Navigation
EGPC	Egyptian General Petroleum Cooperation
EIA	Environmental Impact Assessment
EIFFA	Egyptian International Freight Forwarding Association
EIRR	Economic Internal Rate of Return
EIU	Economic Intelligence Unit
EMA	Egyptian Meteorological Authority
EMDB	Egyptian Maritime Data Bank
EMRA	Egyptian Mineral Resource Authority
ENIT	Egyptian National Institute for Transport
ENR	Egyptian National Railways
ERL	Equipment Room Layout
ERSAP	Economic Reform and Structural Adjustment Program
ESA	European Space Agency
ESA	Equivalent Standard Axles
ESCWA	Economic and Social Commission for Western Asia
ESIA	Environmental and Social Impact Assessment
ESRI	Environmental Systems Research Institute, Inc.
ETA	Egyptian Tourist Authority
ETC	Egypt Transport Center
ETCE	Egyptian Training Center of Excellence
EU	European Union
EWC	East-West Corridor
F/R	Final Report
F/S	Feasibility Study
FDI	Foreign Direct Investment
FIA	Federation of International Automobiles
FIATA	International Federation of Freight Forwarders Association
FIDIC	International Federation of Consulting Engineers
FIM	Federation International de Motocyclisme
FIRR	Financial Internal Rate of Return
4PL	Fourth Party Logistics
FTA	Free Trade Agreement
GAFI	General Authority for Investment and Free Zones
GAFTA	Greater Arab Free Trade Area
GAID	General Authority for Industrial Development
GALDP	General Authority for Land and Dry Ports
GARBLT	General Authority for Roads, Bridges and Land Transport

GCBC	Greater Cairo Bus Company
GCR	Greater Cairo Region
GCRUPC	Greater Cairo Region Urban Planning Center
GCSDC	Greater Cairo Sanitary Drainage Company
GCWSC	Greater Cairo Water Supply Company
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographical Information System
GNCRT	General Nile Company for River Transports
GOE	Government of Egypt
GOJ	Government of Japan
GOPP	General Organization for Physical Planning
GPA	General Petroleum Cooperation
GPS	Global Positioning System
GRDP	Gross Regional Domestic Product
GTZ	Deutsche Gesellschaft fur Technische Zusammenarbeit
GUPCO	Gulf of Suez Petroleum Company
GWWC	Giza Water and Wastewater Company
HB	Home Based
HCMLT	The Holding Company for Maritime and Land Transport
HCRBLT	The Holding Company for Roads, Bridges and Land Transport
HCWW	The Holding Company for Water and Wastewater
HFO	Heavy Fuel Oil
HH	Household
HIS	Household Interview Survey
HSR	Higher Speed Rail
IBAs	Important Birds Areas
IBS	Information Broker System
IBRD	International Bank for Reconstruction and Development (World Bank)
ICD	Inland Container Depot
IC/R	Inception Report
ICT	Information Communication Technology
IDA	Industrial Development Authority
IEE	Initial Environmental Examination
IFR	Instrument Flight Rule
II	Implementation Indicators
IMF	International Monetary Fund
IPP	Independent Power Producer
IRF	International Road Federation
ISM	International Agreements for Maritime Safety
IT	Information Technology

ITC	Intermodal Transport Corridor
IT/R	Interim Report
ITSAM	The Integrated Transport System in The Arab Mashreq
IWT	Inland Water Transport
JETRO	Japan External Trade Organization
JICA	Japan International Cooperation Agency
KSA	Kingdom of Saudi Arabia
ktoe	kilo ton oil equivalent
LCCS	Land Cover Classification System
LDCS	Local Dep. Control System
LFO	Light Fuel Oil
LIM	Linear Induction Motor
LNG	Liquefied Natural Gas
LPI	Logistics Performance Index
LRP	Long Range Plan
LRT	Light Rail Transit
M/M	Minutes of Meeting
MCA	Multi-Criteria Analysis
MCBI	Misr for Construction and Building Information
MEDA	Mediterranean-European Development Agreement
MEDA-MOS	Mediterranean Motorways of the Seas
MENA	Middle East and North Africa
MEPPCO	Misr Edfu writing and Printing Paper Company
MERCUSOR	Mercado Comun de Sur
MERIS	Medium Resolution Imaging Spectrometer
MiNTS	Misr National Transport Study
MNAM	MiNTS National Transport Model
MOA	Ministry of Agriculture
MOCA	Ministry of Civil Aviation
MOD	Ministry of Defense
MoEA	Ministry of Environmental Affairs
MOED	Ministry of Economic Development
MOF	Ministry of Finance
MOHP	Ministry of Health and Population
MOPIC	Ministry of Planning and International Cooperation
MHUUC	Ministry of Housing, Utilities and Urban Communities
MOED	Ministry of Economic Development
MOI	Ministry of Interior
MOIC	Ministry of International Cooperation
MOINV	Ministry of Investment
MOP	Ministry of Petroleum

MOT	Ministry of Transport
MOTI	Ministry of Trade and Industry
MP	Master Plan
MRCC	Maritime Research and Consultation Center
MSEA	Ministry of State for Environment Affairs
MSLD	Ministry of State for Local Development
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
MTS	Maritime Transport Sector
MWRI	Ministry of Water Resources and Irrigation
NALPDP	National Authority for Land Ports and Dry Ports
NANSC	National Air Navigation Services Company
NASA	National Aeronautics and Space Administration
NAT	National Authority for Tunnels
NCATO	National Civil Aviation Training Organization
NGA	National Geospatial-Intelligence Agency
NHB	Non Home Based
NICHE	Netherlands Initiative for Capacity development in Higher Education
NMS	Network Management System
NOx	Nitrous Oxides
NUC	New Urban Community
NUCA	New Urban Community Agency
OC	Oriental Consultants Co Ltd
OCC	Operating Control Center
OD	Origin and Destination
OECD	Organization for Economic Co-operation and Development
OHD	Overhead Catenary
OI	Operational Indicators
OVI	Objectively Verifiable Indicators
Pax.	Passenger
PBC	Performance Base Contract
PC	Pre-stressed Concrete
PCS	Port Community Systems
PCU	Passenger Car Unit
PERT	Program Evaluation and Review Technique
PI	Performance Indicators
pphp	passengers per hour per direction
PPP	Public Private Partnership
PPP	Purchasing Power Parity
PPP	Polluter Pays Principle
PSA	Production Sharing Agreement

PSPA	Port Said Port Authority
PSO	Public Service Obligation
PT	Person Trip
PTI	Ports Training Institute
PTPS	Public Transport Passenger Survey
R&D	Research and Development
RI	River Information
RIRT	Regional Institute for River Transport
ROT	Rehabilitate, Operate, Transfer
ROW	Right of Way
RTA	River Transport Authority
S/W	Scope of Work
SAR	Search and Rescue System
SCA	Suez Canal Authority
SCF	Standard Conversion Factor
SCCT	Suez Canal Container Terminal
SOPs	Standard Operating Produceres
SOx	Sulfur Oxides
SPDC	Sokhna Port Development Company
SPV	Special Purpose Vehicle
SRTM	Shuttle Radar Topography Mission
SSI	System Sustainability Indicators
SUMED	Arab Petroleum Pipeline Company
SWERI	Soil, Water and Environment Research Institute
S/TIP	State Transportation Improvement Plan
SWM	Solid Waste Management
TAH	Trans-African Highway
TAZ	Traffic Analysis Zone
Tcf	Trillion cubic feet
TEU	Twenty-foot Equivalent Units
3PL	Third Party Logistics
TOA	Top Of Atmosphere
TOR	Terms of Reference
TPA	Transport Planning Authority
UCA	Urban Control Area
UDA	Urban Development Area
UGB	Urban Growth Boundary
UIC	Union Internationale des Chemins de Fer
UNDP	United Nations Development Program
UNESCO	United Nations Educational, Scientific and Cultural Organization
UPA	Urban Planning Area

USAID	United States Agency for International Development
VOC	Vehicle Operating Cost
VAT	Value added Logistics
VT	Vehicle Trip
VTIMS	Vessel Traffic Information Management System
VTS	Vehicle Tracking System
WB	World Bank
WHO	World Health Organization
WPP	Water Purification Plant
WWPT	Wastewater Treatment Plant

CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

The Japan International Cooperation Agency (JICA) and the Transport Planning Authority of the Ministry of Transport, Government of Egypt, are cooperating in the conduct of the *Comprehensive Study on The Master Plan for Nationwide Transport System in the Arab Republic of Egypt* (MiNTS – Misr National Transport Study), based upon agreements finalized during July, 2009[1]. Oriental Consultants Company Limited, headquartered in Tokyo, Japan, is the designated lead consultant for the study. Associated firms are Almec Corporation, Japan and Katahira & Engineers International, Japan.

1.2 THE MINTS FRAMEWORK

1.2.1 Study Scope and Objectives

A basic premise of all investigations is that the MiNTS shall be comprehensive in nature, that is, adopt approaches designed to mitigate transport problems and contribute to the sustainable development of the nation. Investigative efforts extend over the entirety of the Republic (Figure 1.2.1), with a particular focus being major corridors of movement for both persons and cargo. All major modes of transport are to be addressed including road, rail, maritime, inland waterway, air and pipeline. However, the practical master planning focus will be those modes falling under the jurisdiction of the Ministry of Transport; that is, the road, rail, maritime and inland waterway sectors.

Five key milestones form the foundation upon which planning efforts are based:

- Establish a nationwide, multi-modal database whose validity rests on a series of focused transport survey and data collection exercises;
- Formulate overall vision, policies and strategies for development of the nationwide transport fabric;
- Develop an integrated, multi-modal transport master plan with years 2017, 2022 and 2027 being short, medium and ultimate planning horizons, respectively;
- Identification, within the master plan framework, of high-priority projects; and,
- Implementation of an effective and productive technology transfer program with Egyptian counterparts.

[1] *Scope of Work - Comprehensive Study on The Master Plan for Nationwide Transport System in the Arab Republic of Egypt*, as mutually agreed upon between the Japan International Cooperation Agency and the Ministry of Transport, Government of Egypt, July 16, 2009.

Source: JICA Study Team

Figure 1.2.1 MiNTS Study Area

The transport vision embedded within MiNTS must concurrently contribute to an efficient economic structure, strengthen linkages within Egypt as well as with neighboring countries, and provide a base for market-oriented transport activity. As the post-revolution social structure continues to diversify, and economic growth again accelerates, changes in transport activities and behavior will follow suit. Thus, the foci of transport planning must gradually shift from alleviation of present deficiencies to realization of a transport system founded upon sustainable evolution and integrated, mutually supportive transport solutions. This philosophy is particularly valid given the almost 20-year planning horizon adopted by MiNTS.

1.2.2 A Consultative Planning Process

The final structure of MiNTS, and the successful reception thereof, was achieved as a direct result of cooperative efforts and close liaison between the Study Team, the client group and other local experts. Considerable efforts were expended in gathering information, reviewing previous studies and holding numerous discussions to enhance knowledge of, and sensitivity to, local transport conditions, norms and practices.

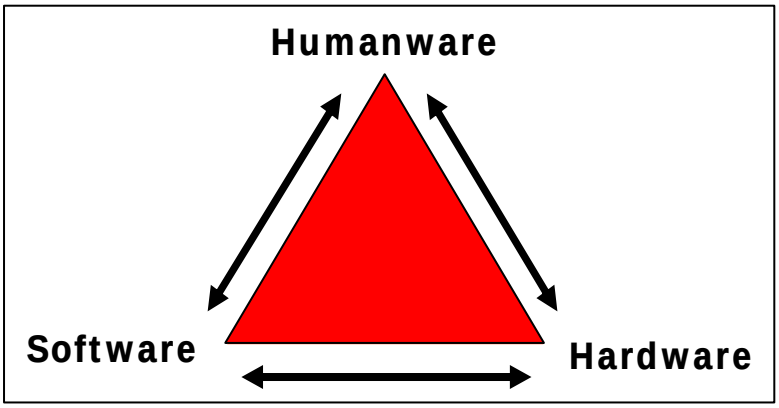
The Study Team, housed in the offices of the Transport Planning Authority, was strongly assisted by its designated counterpart Special Working Group, Coordination Committee and Steering Committee. Thus, continuous and productive technical liaison is being maintained with a number of organizations including the

Ministry of Transport and various entities thereof (Office of the Minister, Transport Planning Authority, Egypt National Railways, General Authority for Roads, Bridges and Land Transport, General Authority for River Transport, Maritime Transport Sector); the Ministry of Housing, Utilities and Urban Communities; Ministry of Civil Aviation; Ministry of Agriculture and Land Reclamation; Ministry of Trade and Industry; Ministry of Industrial Development; Ministry of Tourism; Ministry of Interior; Ministry of Local Development; Ministry of Finance; State Ministry of Foreign Affairs, Sector of International Cooperation; Ministry of the Environment; CAPMAS (Central Agency for Public Mobilization and Statistics); as well as various Governorates and entities thereof.

Likewise, effective consultations are programmed with various international agencies, funding institutions, donors, and consultant groups in order to obtain an overview of previous, current, and likely future activities and/or involvement in Egypt.

1.2.3 Sustainability and Human Resources Development

The components of the Master Plan diversify beyond the traditional "hardware" concepts associated with infrastructure provision. Additional key elements of the process consist of "software" aspects, that is, available technology, international standards, and modal integration needs (cargo/passenger terminals, logistics chains, transfer points) as well as "humanware" needs (Figure 1.2.2). In the latter case, this represents the cultivation of human resources via the designation of training and education programs as well as other requirements for developing expertise. In other words, "sustainability", or the notion that the planning process must allow Egyptian stakeholders to participate in visualizing and shaping their own future. This is of substantial importance in terms of ownership building if MiNTS is to be adopted and used by the people and their elected officials both during, and following, the conduct of MiNTS.



Source: JICA Study Team

Figure 1.2.2 Cornerstones of the MiNTS Planning Process

A participatory planning process is therefore seen as one of the most important elements of MiNTS.

1.2.4 Schedule

Technical efforts in Egypt commenced during December, 2009. The MiNTS schedule was stratified into two mutually supportive and cascading work phases:

- Phase 1, consisting of 25 technical tasks to include, in addition to reporting obligations, core investigative elements such as data collection and analysis, transport surveys, establish

counterpart training programs, formulation of transport model structure, quantification of socio-economic framework, derivation of base year (2010) trip matrixes, development of transport modeling elements and promulgation of strategic transport corridors. Phase 1 was completed at approximately May, 2011[2].

- Phase 2, consisting of an additional 13 technical tasks to include, in addition to reporting obligations, tasks such as re-examination of core socio-economic parameters as influenced by the Egyptian revolution, assessment of strategic transport corridors, formulation and prioritization of projects and programs, as well as development of the staged national transport Master Plan. Phase 2 culminated in completion of the *Draft Final Report* during January, 2012. The January 2011 Revolution (and subsequent related events), as well as natural disasters in Japan, all influenced the overall MiNTS study schedule. Nevertheless, there remained an unwavering commitment on behalf of the client group as well as the Study Team to bring this most important investigate effort to a satisfactory conclusion.

The post-field survey MiNTS schedule (May, 2010 onwards), to include scheduled Steering Committee meetings and public seminars, is noted in Figure 1.2.3.

1.2.5 Reporting

The MiNTS reporting structure incorporates a series of independent and self-contained documents. The interested reader is urged to consult the specific report in question for desired additional information. Submittals include:

- *Inception Report*[3], submitted during January, 2010, containing (then existing) detail regarding study methodologies, staffing plan and programmed study outputs. This document was finalized in close cooperation with JICA, committees associated with the study and other local experts.

- *Progress Report* [4], submitted in March, 2010, quantifies and clarifies study progress to near begin of the data collection and survey program. The *Progress Report* discusses the then-existing understanding of the transport sector, method of demand forecast and preliminary scope of transport surveys.

- *Interim Report 1* [5], submitted during September, 2010, includes results of the transport surveys. *Interim Report 1* also explores existing national and regional development strategies/scenarios and transport plans of the Ministry of Transport line agencies.

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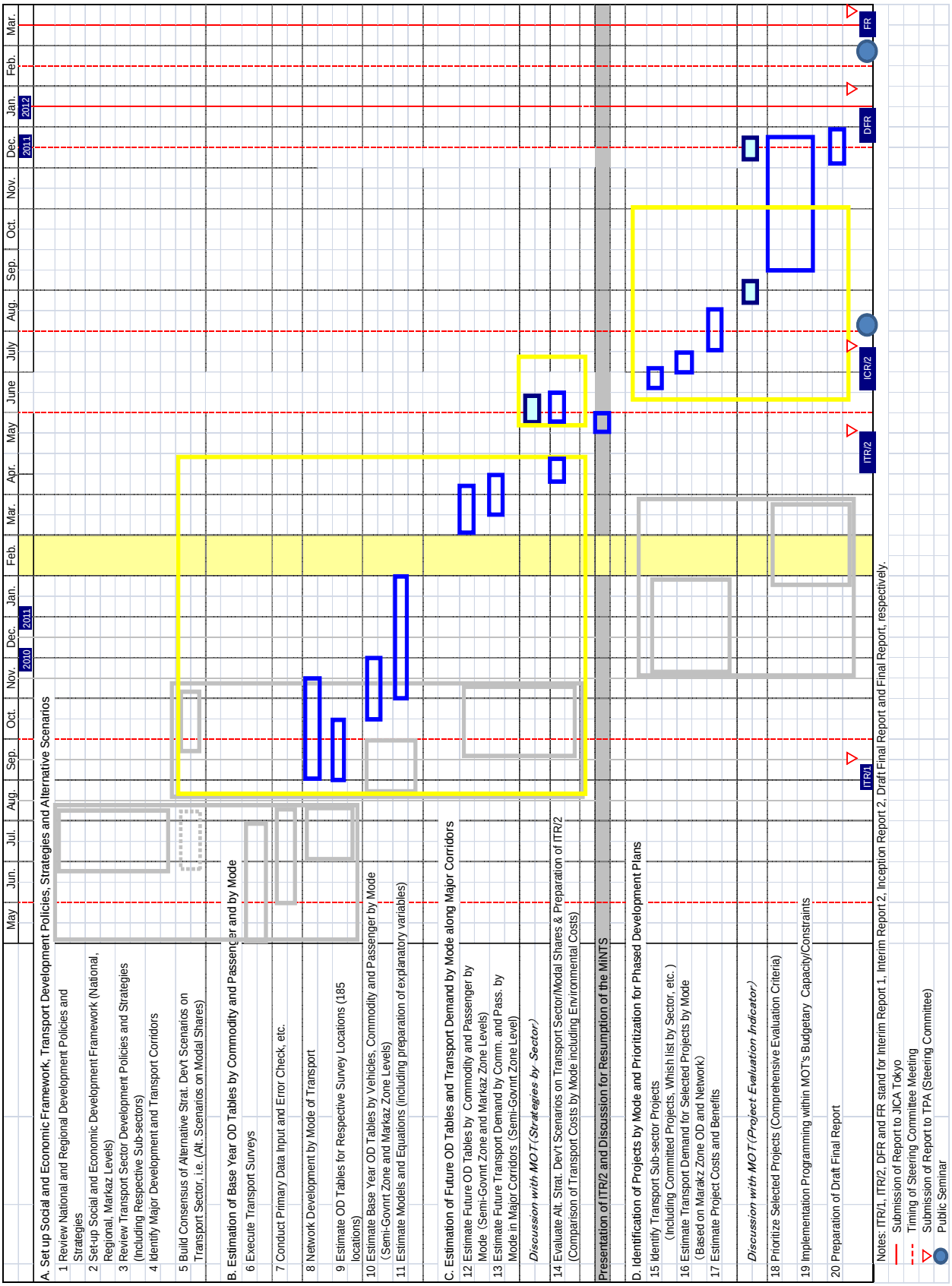
[2] Project schedules required adjustment from those presented in the *Inception Report*. This is due primarily to two factors (a) unanticipated delays in obtaining necessary permissions to conduct field surveys, and (b) a request to conduct demand forecasting at a level of (zoning) detail greater than anticipated, thus necessitating an approximately 20 percent increase in the number of roadside survey locations. Furthermore, an intensified counterpart training program was formulated at the request of the client group.

[3] *Final Inception Report - Comprehensive Study on The Master Plan for Nationwide Transport System in the Arab Republic of Egypt*, prepared for the Japan International Cooperation Agency and the Transport Authority, Ministry of Transport, by Oriental Consultants Co Ltd, et. al., January, 2010.

[4] *Progress Report - Comprehensive Study on The Master Plan for Nationwide Transport System in the Arab Republic of Egypt*, prepared for the Japan International Cooperation Agency and the Transport Planning Authority, Ministry of Transport, by Oriental Consultants Co Ltd, et. al., March, 2010.

[5] *Interim Report 1 - Comprehensive Study on The Master Plan for Nationwide Transport System in the Arab Republic of Egypt*, prepared for the Japan International Cooperation Agency and the Transport Planning Authority, Ministry of Transport, by Oriental Consultants Co Ltd, et. al., September, 2010



Source: JICA Study Team (December, 2011)

Figure 1.2.3 MiNTS Work Schedule (Mid 2010 Onwards)

- *Discussion Paper on Transport Policies and Strategies*[6], being a pre-cursor document to *Interim Report 2*. The document was used to establish the basis for vision, policy and strategy via a consultative series of discussions and Ministerial Consultations with the client group.

- *Interim Report 2*[7], submitted during April, 2011, builds on the *Discussion Paper* and describes how a balanced functioning of the road, rail and inland waterway modes is to be achieved within the framework of the master plan. The essence of *Interim Report 2* was also presented at a public seminar, conducted at the Ministry of Transport on 1 July, 2011.

- *Inception Report 2*[8], submitted during June, 2011, defines the technical and temporal frameworks for execution of requisite Phase 2 work tasks.

- *Discussion Paper on Transport Scenarios*[9], submitted during October, 2011, documents the definition of future transport scenarios, the evaluation thereof and recommendation of a selected/preferred scenario for further consideration as the basis of the MiNTS transport master plan. This document follows the *Workshop on Transport Scenarios*, conducted at the Ministry of Transport on 29 September, 2011.

- *Draft Final Report*, containing full detail as to MiNTS approaches, methodologies, analyses, findings and recommendations.

The complete reporting structure is depicted in Table 1.2.1.

1.3 STRUCTURE OF THIS REPORT

The structure of *t*he *Final Report* is consistent with essential formats and tenets voiced in the June, 2011 *Inception Report 2*, as well as subsequent guidance received from the client group. The *Final Report* consists of three elements: *The Master Plan* report, *Technical Reports* and *Appendix Reports*.

- *The Master Plan* report is seen as the main document whose intent is to present main findings of the MiNTS investigations. *The Master Plan* report is, at the request of the client group, a relatively synoptic document;

- *Technical Reports* represent a series of sector-specific reports which detail the technical underpinning of *The Master Plan* document; and,

[6] *Discussion Paper on Policies and Strategies - Comprehensive Study on The Master Plan for Nationwide Transport System in the Arab Republic of Egypt*, prepared for the Japan International Cooperation Agency and the Transport Planning Authority, Ministry of Transport, by Oriental Consultants Co Ltd, et. al., November, 2010

[7] *Interim Report 2 - Comprehensive Study on The Master Plan for Nationwide Transport System in the Arab Republic of Egypt*, prepared for the Japan International Cooperation Agency and the Transport Planning Authority, Ministry of Transport, by Oriental Consultants Co Ltd, et. al., April, 2011.

[8] *Inception Report 2 - Comprehensive Study on The Master Plan for Nationwide Transport System in the Arab Republic of Egypt*, prepared for the Japan International Cooperation Agency and the Transport Planning Authority, Ministry of Transport, by Oriental Consultants Co Ltd, et. al., June, 2011.

[9] *Discussion Paper on Transport Scenarios - Comprehensive Study on The Master Plan for Nationwide Transport System in the Arab Republic of Egypt*, prepared for the Japan International Cooperation Agency and the Transport Planning Authority, Ministry of Transport, by Oriental Consultants Co Ltd, et. al., October, 2011.

Table 1.2.1 MiNTS Reporting Products

Report	Submission Schedule	Focus
Inception Report	January, 2010	Outline, approach, methodology and schedule
Progress Report	March, 2010	Review of current transport sector, method of demand forecast, scope of transport surveys
Interim Report 1	September, 2010	Preliminary results of transport surveys, prerequisites for demand forecast
Discussion Paper on Transport Policies and Strategies	November, 2010	Consensus on national basis for vision, policy, strategy and action plan
Interim Report 2	April, 2011	Builds upon *Discussion Paper* consultations; base condition traffic demand analysis; framework for Master Plan formulation
Inception Report 2	June, 2011	Study Plan for remaining work elements
Discussion Paper on Transport Scenarios	October, 2011	Refining socio-economic framework, scenario formulation and evaluation.
Draft Final Report	January, 2012	The National Transport Master Plan
Final Report	March, 2012	Finalize *Draft Final Report* to reflect input from client group
Executive Summary		

Source: JICA Study Team

- *Appendix Reports* represent task-specific or activity-specific documents and other data summaries, most of which have been developed in response to requests of the Transport Planning Authority.

The Master Plan report, the current volume, is structured to consist of 11 chapters plus summary as noted in Table 1.3.1. Thirteen separate *Technical Reports* will provide considerable detail underpinning the main report. Volume content is noted in Table 1.3.2. The *Appendix Reports* will include:

> Further Information
>
> A series of text box cross-references are provided in relevant chapters of *The Master Plan* report linking chapter content with underlying *Technical Reports*.

- *A Survey Execution Manual,* detailing the MiNTS survey program plus resultant database*;*
- *A Modeling Manual,* describing application of the MiNTS computerized transport model; and,
- Various requested data outputs (hardcopy trip matrixes, data CD's, and similar).

Table 1.3.1 Chapter Content: *The Master Plan* Report

Chapter Number	Subject
ES	Executive Summary
1	Introduction
2	Socio-Economic and Demand Evolution
3	Sector Overview
4	The MiNTS Vision
5	Transport Scenarios
6	Hardware Opportunities
7	Humanware Opportunities
8	Software Opportunities
9	The Prioritization Program
10	Implementation Considerations
11	Staging the Plan

Table 1.3.2 Topic Content: *Technical Reports*

Report Number	Subject
1	Road Sector
2	Rail Sector
3	Inland Waterway Transport Sector
4	Maritime Sector
5	Civil Aviation and Pipeline Sectors
6	Demand Simulation and Scenario Testing
7	Organizational and Functional Aspects of the Transport Sector
8	Private Sector Participation
9	Environmental Considerations
10	The MiNTS Vision, Policies and Strategy
11	Transport Survey Findings
12	Project Prioritization
13	Counterpart Training Program

CHAPTER 2: SOCIO-ECONOMIC EVOLUTION

Considerable previous effort has been expended in the development of the MiNTS socio-economic framework. This has been documented in a series of MiNTS reports and technical discussion papers. Key elements of the framework have, via the established consultative process, been continuously reviewed between members of the client group, local experts and Study Team representatives. Furthermore, the January Revolution has clearly impacted both social and economic patterns of the Republic. Such impacts have been integrated with MiNTS technical procedures, as described in this chapter.

Further Information

The MiNTS planning approach involves, sequentially, a vision, a policy, and a strategy, each leading toward the Master (action) Plan. Each component, that is, vision, policy, strategy and action plan, is based on a cascading and mutually reinforcing chain of activities. These evolve within a broader set of (non-transport) conditions reflective of a variety of societal and environmental conditions. The socio-economic framework is seen as being an essential element that defines framework conditions for the broader vision, strategy and policy fabric.

Additional detail regarding the socio-economic framework is presented in *Technical Report 10, The MiNTS Vision*, and appendixes thereto.

2.1 AREAL STRATIFICATION

The analytical approaches embedded within MiNTS require that data be processed at varying levels of detail ranging from national totals to spatial (geo-based) analysis areas. The degree of detail, that is, zone size, is also influenced, in some instances, by a need to present data in a meaningful and understandable manner. Thus, a hierarchy of zones is required which retains a logical, interconnected structure. The zoning structure is defined in other parts of this report in considerable detail. However, a definitional recapitulation is included to enhance understanding.

The MiNTS zone structure stratifies the Republic at four levels of detail (Figure 2.1.1). This hierarchy is used consistently across all relevant MiNTS tasks. Zone systems include internal (domestic) zones and external (foreign) zones. The four zoning structures are the Regional Zones, Governorate Zones, Large Zones and

Source: JICA Study Team

Figure 2.1.1 MiNTS Analysis Zone Hierarchy

Small Zones.

The zoning hierarchy is defined as:

- The internal Small Zone boundaries, the most detailed building block for the entire zoning system, are patterned after Markaz[1] boundaries. A Markaz is sometimes divided geographically by, for instance, the Nile River. For the transport analysis, such sub-divided Markaz areas are considered as separate entities and uniquely defined as Small Zones. There are 385 internal Small Zones and 19 external zones, a total of 394 Small Zones.

- The Small Zones can be combined into 61 Large Zones, more specifically, 52 internal and 9 external zones. Large Zones, while representing an aggregation of Small Zones, may also be seen as subdivided Governorate Zones. This is particularly true in the Delta Region where Governorates were subdivided to ensure that no more than one major city be located in any Large Zone.

- Governorate Zones follow the Egyptian classification for 29 Governorates[2]. The Governorate Zones are aggregations of Large Zones.

- For the purpose of overall summary, the study area is also divided into eight internal regions (which mirror traditionally utilized terminology for Egyptian land areas) and one external region. Regional Zones are aggregations of Large Zones.

For purposes of current reporting, summaries are presented at the Regional Zone and Large Zone levels of detail. The regional zones, superimposed onto the large zone system, are depicted in Figure 2.1.2.

2.2 POPULATION

The population of Egypt has been steadily increasing over the past two decades at a pace slightly in excess of two percent per year, reaching an estimated 78.4 million persons in year 2010. The *Sixth 5-year Plan* (as have predecessor plans) sets a population target of 81.6 million with an underlying growth rate at 1.9 percent per year by the end of the plan period (year 2012). Population forecasts inherent to existing longer term planning imply an ultimate growth rates of some 1.2 percent per annum. The lessons of history suggest that considerable difficulties exist in reducing the Egyptian growth rate from historic norms.

Three population scenarios were derived within the MiNTS socio-economic framework (Table 2.2.1):

- Scenario A Historic Norm: This is a “high growth” scenario assuming that the historic growth rate (near two percent per annum) will continue until year 2027. While this scenario appears contrary to governmental expectations, it nevertheless reflects “reality”. Year 2027 population would be expected to exceed 110 million persons.

[1] The Markaz level is the CAPMAS boundary which is a semi Governorate boundary. This is in fact the initial basis of the small zone boundaries.

[2] Following the Revolution, the number of governorates was reduced to 27. This new change has not been incorporated at the present time.

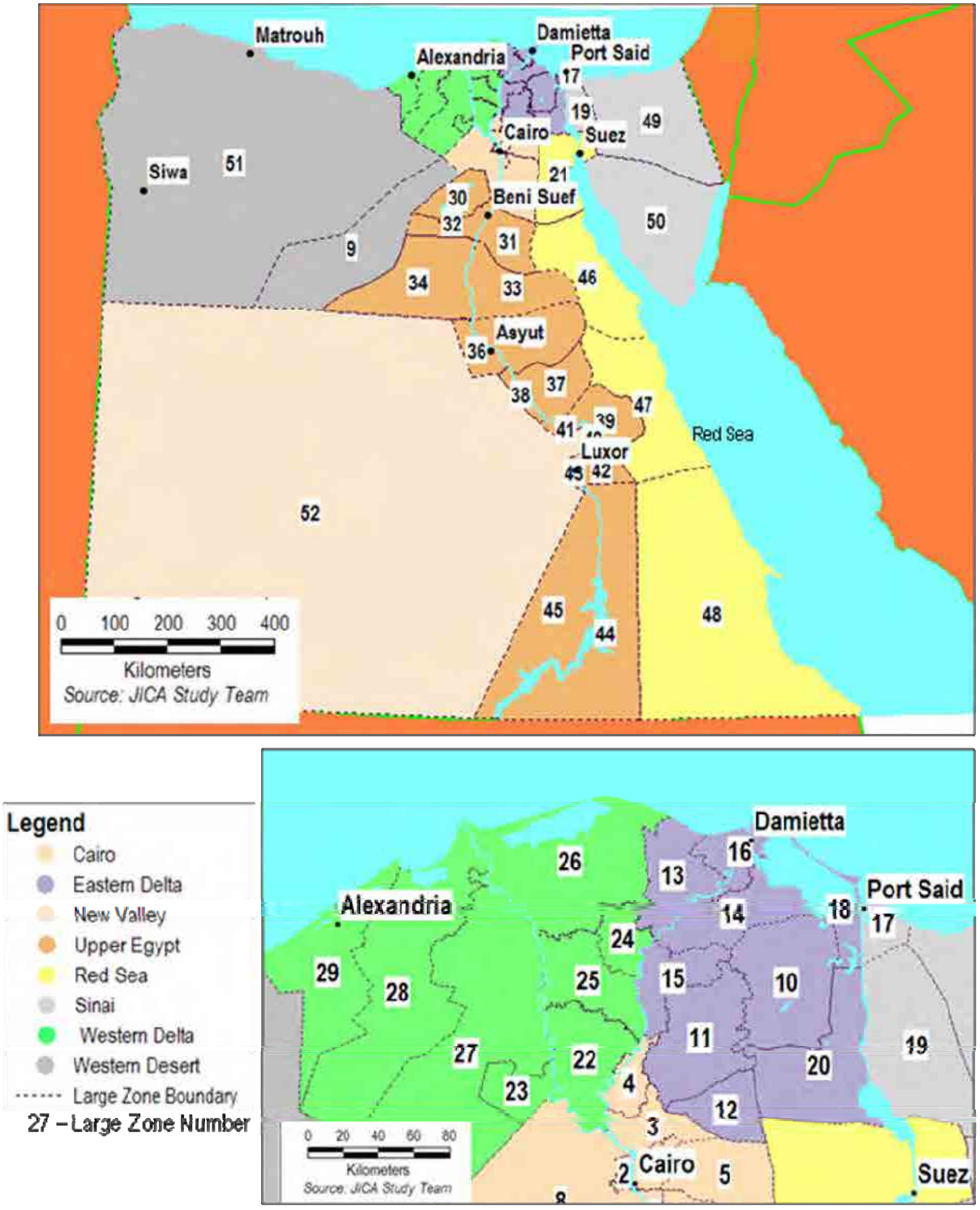


Figure 2.1.2 MiNTS Regional Zone and Large Zone Structure

- Scenario B Balanced Growth: This scenario strikes a balance between Scenarios A and C by adopting a diminishing growth rate towards year 2027. The target growth rate in 2027 is lies near 1.7 percent a year, a 15 percent reduction from recent achievements (near two percent). The year 2027 population is indicated as reaching 107 million persons.

- Scenario C Aspiration-centric: This scenario mirrors aspirations in terms of achieving vastly reduced rates of population increase in line with longer-term governmental forecasts. This scenario results in the lowest total population, some 99 million persons by year 2027.

The most likely scenario, following discussions with MiNTS stakeholders, is seen as the balanced growth scenario. The underlying reductions in unit growth are seen as being achievable when coupled with intensified incentive and education programs. Still, population is expected to increase by almost 30 million persons over the MiNTS planning horizon.

Table 2.2.1 Alternative MiNTS National Population Scenarios

Year	Scenario A (Historic Norm)		Scenario B (Balanced Growth)		Scenario C (Aspiration-centric)	
	Population (million)	Growth Rate (%)	Population (million)	Growth Rate (%)	Population (million)	Growth Rate (%)
2010	78.4	2.03	78.4	2.03	78.4	2.03
2017	90.2	2.03	89.7	1.90	87.7	1.20
2022	99.7	2.03	98.3	1.81	93.1	1.18
2027	110.2	2.03	107.3	1.73	98.7	1.17

Source: JICA Study Team

This forecast of 107.3 million persons is also in close agreement with the recent release of the *Egypt Vision 2052* document which places the year 2027 national population in vicinity of 108 million persons[3]. The *Vision* document envisages a shift in the population growth of the Cairo Delta agglomeration to the Western Desert, New Valley, Sinai and Red Sea Regions. These spatial strategies have been considered in the formation of the MiNTS demographic allocations. In 2010, the Western Desert, New Valley, Sinai and Red Sea Regions housed nearly two million persons. By 2027, these regions are expected to have attracted a total additional population of 4.5 million people. (the detailed change in population across the Large Zones and Regions is shown in Figure 2.2.1). In 2010, the four above regions held 2.5 percent of the total population. By 2027, these same four regions are estimated to hold six percent of the national population. This is still a relatively small proportion of the population. As also seen in Table 2.2.2, the large majority of population is concentrated in existing development areas.

[3] *Egypt Vision 2052,* prepared by the GOPP, Ministry of Housing, Utilities and Urban Communities, 2010 (with updates). This document represents the only long-term plan for Egypt. The *Vision* is understood to have been approved by the Prime Minister and the Supreme Council for Urban Development and Planning. The GOPP has started to disseminate the document through seminars/workshops and media interviews in order to attain public consensus, to be followed by Cabinet approval. Considerable technical elements of the document have been made available to the Study Team, which is gratefully acknowledged.

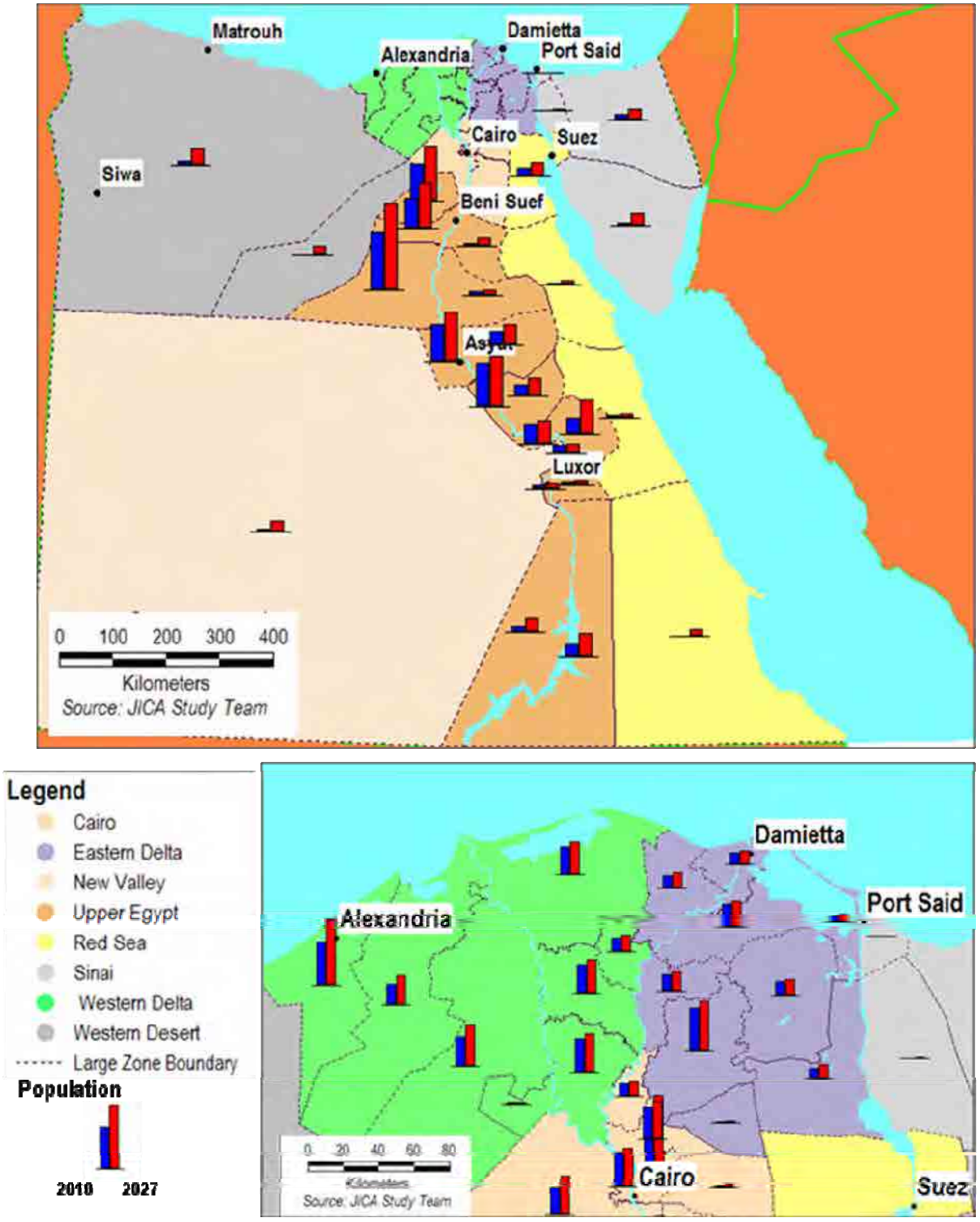


Figure 2.2.1 Distribution of National Population – Years 2010 and 2027

Table 2.2.2 National Population – Years 2010 and 2027

Region	Population (Million Persons)		Ratio: Years 2027 to 2010
	Year 2010	Year 2027	
Cairo	19.77	24.42	1.24
Eastern Delta	13.97	16.80	1.20
New Valley	0.20	0.85	4.22
Upper Egypt	22.45	33.20	1.48
Red Sea	0.86	2.07	2.40
Sinai	0.54	1.80	3.37
Western Delta	20.18	26.36	1.31
Western Desert	0.38	1.78	4.64
Total	78.36	107.28	1.37

Source: JICA Study Team. Refer Figure 2.1.2 for regional definition.

2.3 EMPLOYMENT

Employment is expected to increase in future; this was considered within the MiNTS socio-economic framework by observing several points.

- A consultative process with stakeholders was undertaken;
- Stratified approach to primary, secondary and tertiary employment was utilized;
- Sensitivity was retained to national income (GDP); and,
- A national production and consumption relationship was established.

The evolution of each main employment sector addresses:

- Significant development and enhancement of the tertiary sector (services). This includes knowledge-based services industry, as stated in the national plans of Egypt.
- Development of the secondary sector to more high value-added manufacturing industry. A structural shift from oil and gas industry to other hi-tech and environmentally friendly industries intended in the medium- to long-term.
- The primary sector will remain important in Egypt, given the MiNTS population forecast. Nevertheless, the relative share of the primary sector is expected to gradually decrease.

In 2010, the employment across the primary, secondary and tertiary sectors was 22.4 million persons yielding a participation rate in 2010 of 0.284 employment opportunities per head of population. Year 2027

[4] In some societies, this participation rate would be considered low. However as a result of the culture within Egypt, the female participation rate is low in comparison to other societies.

employment is expected to reach 34.2 million persons. The largest relative increase (year 2027 ratio to year 2010) is in the tertiary sector, with a ratio of 1.80. Primary and secondary ratios are 1.17 and 1.39, respectively (Table 2.3.1).

Table 2.3.1 National Employment – Years 2010 and 2027

Region	Year 2010 (Million Persons)			Year 2027 (Million Persons)		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Cairo	0.30	1.57	4.41	0.36	2.10	5.85
Eastern Delta	1.15	0.81	2.05	1.29	1.12	2.91
New Valley	0.03	< 0.01	0.05	0.10	0.02	0.25
Upper Egypt	2.65	1.03	1.99	2.96	1.54	5.28
Red Sea	0.01	0.05	0.15	0.05	0.08	0.52
Sinai	0.04	0.01	0.09	0.23	0.02	0.49
Western Delta	2.42	1.18	2.24	2.65	1.59	4.12
Western Desert	0.02	0.03	0.07	0.11	0.04	0.48
Total	6.63	4.69	11.04	7.74	6.51	19.91

Source: JICA Study Team. Both employment and GDP (refer following subsection) are prepared in three categories of primary, secondary and tertiary. In generic terms, primary refers to employment on the land such as farming whilst secondary is associated with the manufacturing sector. Tertiary is the service sector including the public sector. Refer Figure 2.1.2 for regional definition.

2.4 GROSS DOMESTIC PRODUCT

At the start of the economic structural reform program launched during the early 1990's by the government, with the assistance of the IMF and the World Bank, Egypt's economy experienced a situation of slow growth, high inflation, large fiscal- and current account deficits, and a considerable foreign debt burden. The Reform Program and other economic measures proved to yield substantial results: fiscal discipline was re-instated, inflation fell rapidly and real economic growth increased noticeably. The Egyptian government and the IMF subsequently agreed on a new program aiming at a broader package of structural economic reforms covering privatization of state enterprises, deregulation, trade liberalization, fiscal and financial sectors reform, and energy prices adjustments.

The recent (pre-revolution) economic crisis had, since 2008, placed severe pressures on the global economy. In general, Egypt has been protected from financial shocks but exposed to real shocks in the economy. "*Egypt's financial system is less integrated into the world's financial system than many other countries. Capital flows while increasing, they have been relatively limited. The amount of portfolio investments has also been fairly small, and the Egyptian banks are not very strongly integrated into the international system. Egypt, in that sense, has been fairly protected. However, it is not protected from the impact on the real economy from external shocks that may come from a drop in tourism revenues, volatility in oil prices, or shifts in foreign direct investment. Thus although on financial sector side Egypt was not*

highly exposed, its real economy is likely to be vulnerable through the external sector channel".[5] IMF reviews confirm that, despite such external shocks, recent (pre-revolution) economic performance has been favorable, and that continued positive trends were to be expected within defined macro and micro economic frameworks[6]. Pre-revolution growth in real GDP peaked, since 1987, at slightly over 7 percent during years 2007 and 2008, with lowest growth recorded being 1.1 percent during year 1991. The average annual pre-economic crisis two -decade rate of growth (from 1987 to 2008), stratified by five year periods, averaged to 3.8, 4.6, 4.1 and 5.8 percent, respectively. Pre-revolution MiNTS forecasts of GDP growth continued this trend falling, as supported by the MiNTS Steering Committee, into the five to seven percent per annum range.

However, the impact of the January, 2011 revolution has exerted considerable impact on future economic evolution. The Economic Intelligence Unit (EIU), IMF Report during the June Group 8 Summit, and the Ministry of Finance Economic Recovery Program suggest that GDP expansion will reduce from forecast pre-revolutionary levels, particularly so in the near-term future. While longer-term expansion is seen as again reaching pre-revolution rates of growth, near term economic activity is forecast as being more sluggish, in particular the initial year following the Revolution when expected real GDP growth is in vicinity of one percent per annum (Table 2.4.1).

Table 2.4.1 MiNTS Gross Domestic Product (GDP) Forecasts

(Average annual change in percent, constant value)

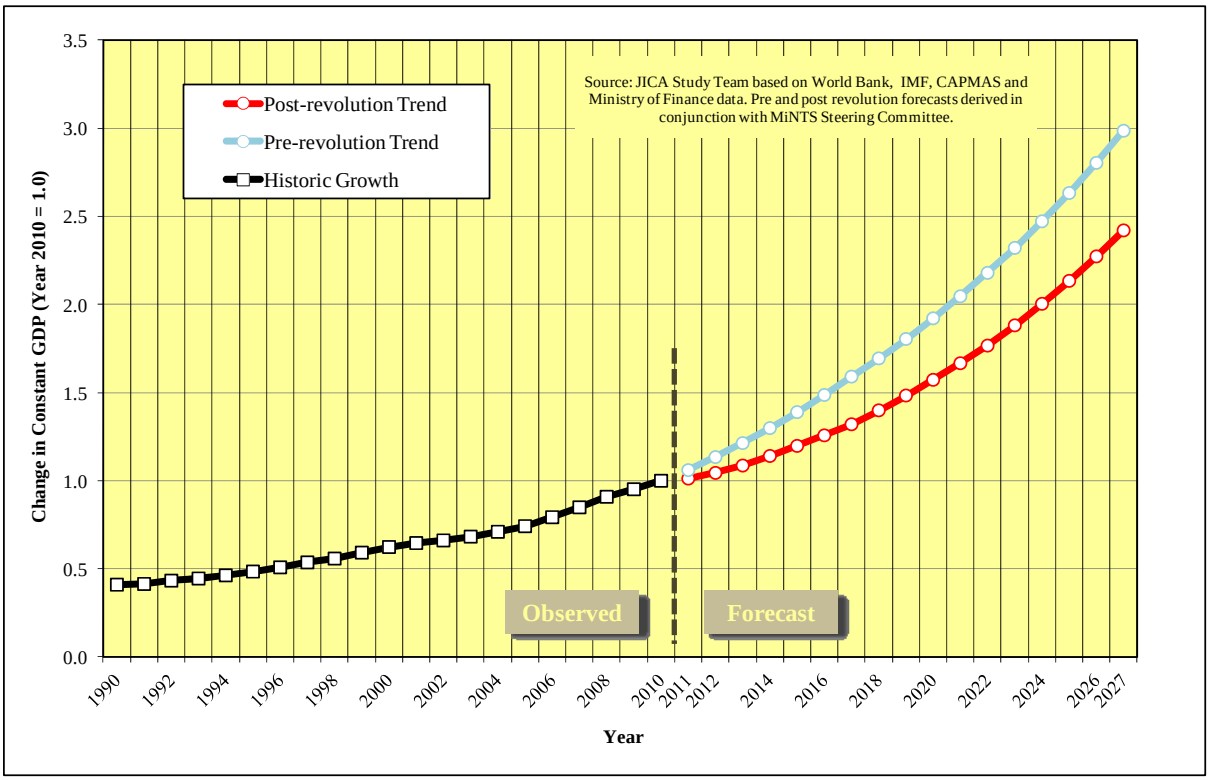
Forecast	2011	2012	2013	2014-2017	2018-2022	2023-2027
Pre-revolution	6.0	7.0	7.0	7.0	6.5	6.5
Post-revolution	1.2	3.2	4.0	5.0	6.0	6.5

Source: JICA Study Team in consultation with Steering Committee. Data reflect Ministry of Finance, World Bank, EIU and IMF information.

The average annual compounded rate of growth over the planning horizon (years 2010 to 2027) is consequently expected to average some 5.3 percent. On a cumulative relative basis, GDP in year 2027 will, via-a-vis year 2010, increase by a factor of 2.4 under the post-revolution forecast as opposed to 3.0 under the pre-revolution forecast (Figure 2.4.1) – a reduction of some 20 percent. The implications in absolute terms is a year 2027 GDP of 2,644 billion LE (in constant year 2009 monetary terms). As previously, the Cairo Region remains a strong contributor towards national GDP, particularly within the tertiary (services) sector (Table 2.4.2). The reduced post-revolution GDP levels will not only impact the generation of transport movements but also the overall funds available to improve and or upgrade transport infrastructure. Nevertheless, as noted previously, the growth forecast for the Egyptian economy over the next 20 years is still averaging a robust 5.3 percent per annum.

[5] *Recent Trends in the Egyptian Economy in Face of the Global Financial Crisis*, Ministry of Finance, Government of Egypt, 2009.

[6] *Concluding Statement*, Arab Republic of Egypt – IMF Staff Visit, July 16, 2009.



Source: JICA Study Team

Figure 2.4.1 Historic and Forecast Relative Trend in National GDP

Table 2.4.2 Gross Regional Domestic Product

Region	Year 2010 (Thousand Constant Year 2009 LE)			Year 2027 (Thousand Constant Year 2009 LE)		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Cairo	7,275,560	147,694,097	240,221,310	13,070,847	310,804,700	485,393,939
Eastern Delta	24,885,787	65,726,908	93,615,215	42,760,970	145,300,056	205,933,319
New Valley	801,807	226,220	2,227,063	3,691,113	2,160,227	18,606,273
Upper Egypt	56,032,096	80,227,826	87,543,873	96,052,034	191,557,328	359,322,732
Red Sea	249,707	5,013,285	8,488,364	2,013,796	13,510,791	46,134,281
Sinai	865,060	921,421	4,452,931	8,527,213	3,237,079	37,456,613
Western Delta	51,235,597	101,119,344	105,904,226	85,977,700	219,099,687	305,429,536
Western Desert	558,305	2,951,280	3,331,316	4,224,064	5,589,168	36,428,407
Total	141,903,918	403,880,382	545,784,300	256,317,737	891,259,035	1,494,705,098

Source: JICA Study Team. Refer Figure 2.1.2 for regional definition.

2.5 PRODUCTION AND CONSUMPTION FRAMEWORK

The current volume of productions, imports, exports and consumptions of major commodities by governorate was analyzed based on available data and information as of 2008 and subsequently extrapolated to base year 2010 conditions.

The evolution of national production and consumption was adjusted in line with changes in economic and demographic forecasts catalyzed by the Revolution. The adjustment basis for productions and consumptions, on a commodity basis. Further, impacts of the Revolution on the correlated imports and exports was considered. Post-revolution reviews suggest that, as is the case with GDP evolution, near-term activity is expected to be sharply reduced from historic norms (Figure 2.5.1).

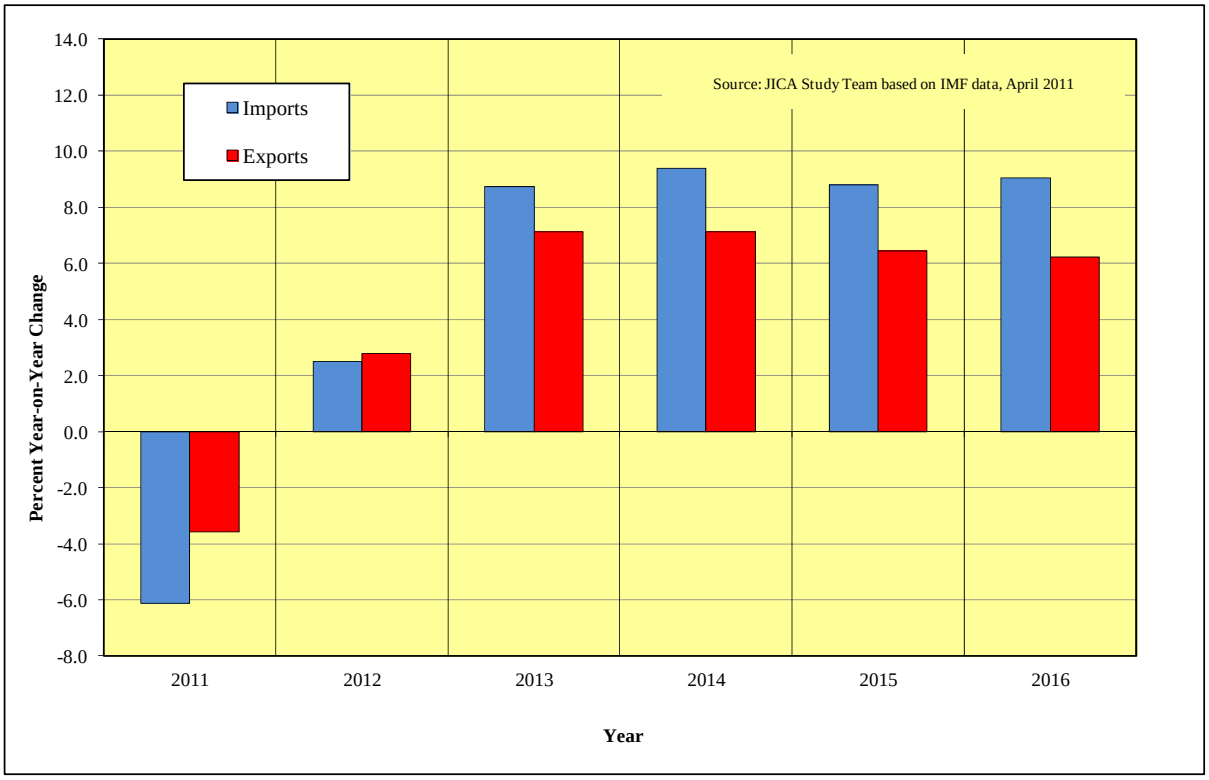


Figure 2.5.1 Near-term Trend: National Imports and Exports

The adjusted commodity volume (defined as productions plus imports or consumption plus exports) is consequently expected to increase from 1.51 million daily tonnes in year 2010 to 3.32 million daily tonnes in year 2027. In relative terms, imports and exports, despite reduced near-term demand, exhibit considerable greater long-term growth potential (Table 2.5.1).

Table 2.5.1 Total Volume of Major Commodities

Unit: Tonnes per day

Year	Production	Imports	Exports	Consumption
2010	1,333,930	175,962	84,339	1,425,554
2027	2,615,378	706,517	259,927	3,061,968

Source: JICA Study Team

The overall growth of commodity shipments, under post-revolution conditions, is expected to average near five percent per annum over the MiNTS planning horizon. Commodity grouping 10 (Machinery, Transport Equipment, Manufactured Articles and Miscellaneous Articles) represents a considerable proportion of both the absolute shipped tonnage as well as achieving highest relative growth (Table 2.5.2).

Table 2.5.2 Shipped Commodity Tonnage

Unit: Tonnes per day

Item	Product	2010	2027	Average Annual Change (%)
1	Agricultural Products	158,959	254,795	2.8
2	Food Stuffs and Animal Fodder	78,839	134,339	3.2
3	Solid Mineral Fuels	11,722	17,749	2.5
4	Petroleum Products	382,041	643,053	3.1
5	Ores and Metal Waste	50,129	87,762	3.4
6	Metal Products	9,177	33,162	7.9
7	Crude, Manufactured Minerals and Building Materials	514,601	973,335	3.8
8	Fertilizers	36,520	102,248	6.2
9	Chemicals	48,714	95,200	4.0
10	Machinery, Transport Equipment, Manufactured Articles and Miscellaneous Articles	206,931	965,069	9.5
11	Live Animal	12,262	15,183	1.3
	Total	1,509,892	3,321,895	4.8

Source: JICA Study Team. Tonnage by all modes. Defined as productions plus imports or consumption plus exports. Slightly over 80 percent of Commodity Group 4 (Petroleum Products) is shipped via pipeline.

CHAPTER 3: SECTOR OVERVIEW

The road mode is an essential factor in economic activity and has historically played a strong role in modal choice for Egypt. The use of the road-based modes of transport has increased exponentially in the last few years. While this phenomena has fulfilled a variety of social goals and expectations, unfettered growth is increasingly contributing to various negative social, economic and environmental impacts. This high level of usage is a historic consequence of growing vehicle ownership, pricing policies (such as the fuel subsidy), and "road focused" capital works programs. The client group has clearly supported the notion that a more balanced approach to providing mobility is desirable. This chapter therefore presents a "base year" (year 2010) overview of the transport sector. The synoptic nature of the presentation is emphasized; the intent is to provide a "baseline setting" as background to the discussion of alternative action plans for improvements, as documented in subsequent sections of this report.

Further Information

Considerable data and analysis underlie the brief discussions contained in this chapter. The extent, operation and performance of the main modes (focus on hardware) is described in detail in Technical Reports 1 through 5 for the road, rail, inland waterway, maritime and civil aviation/pipeline sectors, respectively. The organizational and functional aspects of the transport sector (focus on humanware, software) are presented in Technical Report 7. The collection and processing of base-year (2010) data via the national transport survey is described in Technical Report 11, as well as the specialized Appendix Report *Survey Execution Manual*.

The interested reader is urged to consult this extensive compendium of information.

3.1 THE TRANSPORT NETWORK

3.1.1 Road Sector

The road network in Egypt extends over approximately 100,000 kilometers, near 23,500 kilometers of which is managed and maintained centrally (Table 3.1.1). The major road network is densest within the Nile Delta, coastal areas, the Sinai Peninsula and flanking the Nile River. Cairo tends to serve as the "hub" of the national "spoke" roadways. The road network is varied comprising expressways, toll roads, primary inter-city roads and other road types (Figure 3.1.1). Responsibility for higher-order roads lies mainly with the General Authority for Roads, Bridges and Land Transport (GARBLT). Practically all of the remainder of Egypt's 59,500 kilometer paved roadway network is administrated by the country's governorate administrations, under supervision of the Ministry of Local Development. Coordination between GARBLT and the Governorates takes place at 12 GARBLT districts.

Table 3.1.1 Extent and Administrative Responsibilities of the National Road Network

Facility	Extent by Administrative Responsibility (kilometers)	
	GARBLT	Governorates
Expressway	395	
Primary Road	15,002	
Secondary Road	8,189	59,481(Paved)+16,903(Unpaved)
Total	23,586	76,384

Source: JICA Study Team based on year 2009 GARBLT and CAPMAS data

Traffic demand is pronounced particularly in the Delta where volumes within the Cairo-Qalubia-Alexandria corridor exceeds 100,000 vehicles per day. Network traffic has, in general, been recently growing at a rate of five to six percent per annum.

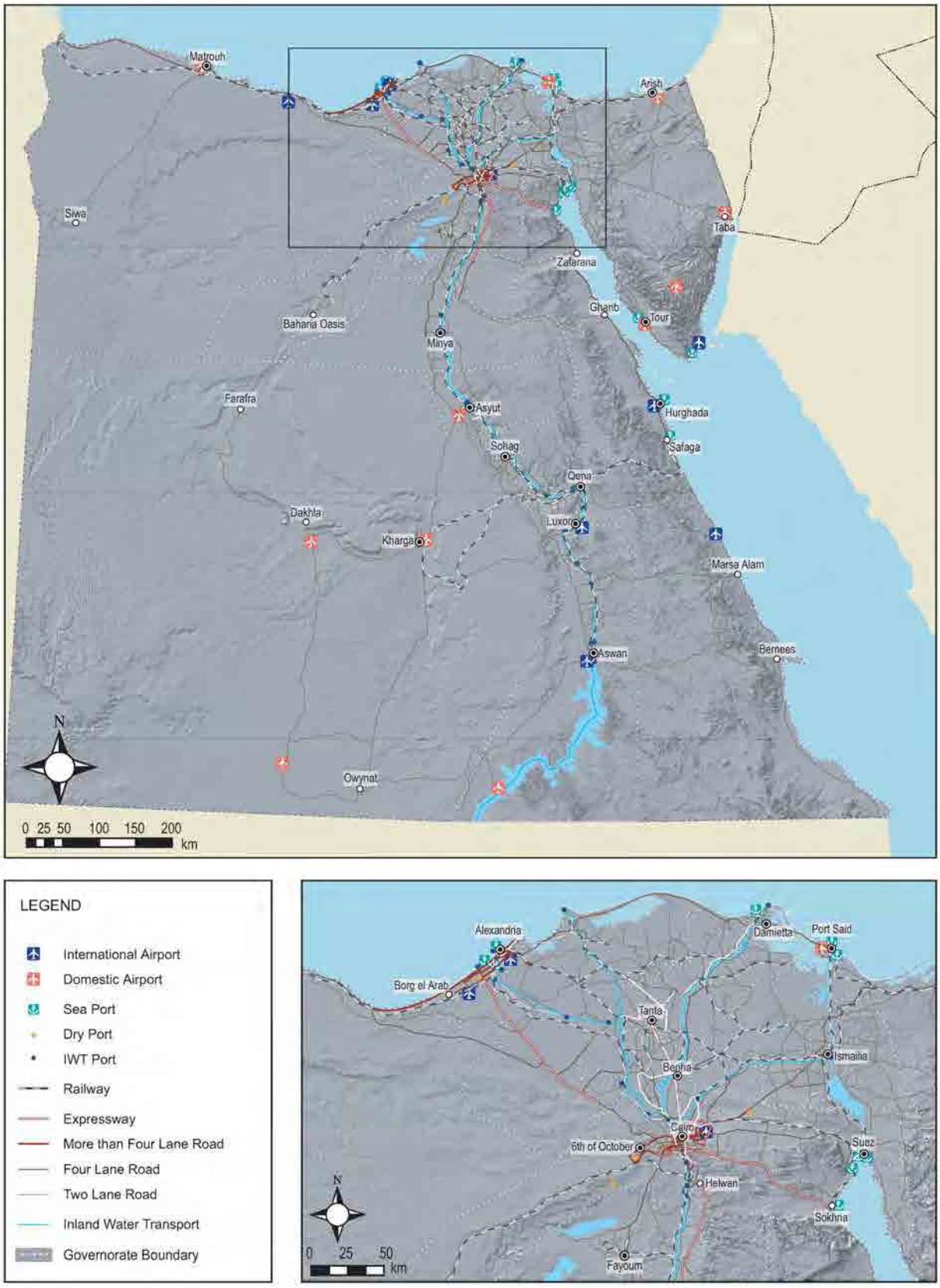
The network suffers from a series of operational deficiencies which are, to varying degrees, being addressed at present. Funding for both capital construction, and most certainly proper maintenance, continues to be problematic. There exists a need to define the road network in functional, as opposed to administrative, terms. Design practices as well as construction standards require review and linkage with a functional hierarchy. Congestion has reached intolerable levels, most certainly along key corridors in major metropolitan areas where different types of traffic (local, regional) as well as users (freight, passengers) must compete for scarce road space with non-motorized traffic. The impact of bus/shared taxi services, with largely undisciplined road behavior, further undermines road operations. Commercial vehicle overloading is notionally seen as widespread given the absence of on-going enforcement mechanisms.

Official records indicate that approximately 6,000 to 8,000 persons die every year as a result of road accidents. The number of fatalities is apparently higher because of an unsatisfactory system of reporting and follow-up; the World Health Organization, for example, indicated a recent all-inclusive total of near 16,000 annual road fatalities. This identifies Egypt as one of the highest unit fatality incidence nations within the Middle East/North Africa region. Direct causes of death and injury on Egyptian roads are seen as disregard of road warning signs and signals, changing lanes without due care, dangerous overtaking, poor maintenance of vehicles, driving too close to the vehicle in front, fatigue and speeding.

3.1.2 Rail Sector

Responsibility for rail systems and services rests with the Egyptian National Railways (ENR). The rail network extends over some 5,100 kilometers, or about 9,600 track kilometers. Almost 30 percent thereof are double tracked, the remainder single tracked. The entire system is standard gauge and not electrified. There exist some 700 stations, and almost 1,300 level crossings, only about one fourth of which are provided with electrical warning devices.

The ENR fleet consists of more than 800 locomotives and some 3,800 passenger coaches as well as 11,900 freight wagons. The maximum operable train length is 16 units or 640 meters. The flagship services are operated between Cairo and Alexandria, where operating speeds can reach some 120 km/hr. Operational speeds on lesser lines is considerably reduced. Signaling is, in general, performed manually with exception of the high-use Cairo-Alexandria corridor where signaling is automatic. Daily demand exceeds 150 trains on the busiest network sections. All operation is via diesel propulsion.



Source: JICA Study Team

Figure 3.1.1 The National Transport Network

Funding remains problematic. Workshops and depots are, by and large, out of date. Training programs in proper work procedures, uniform approaches to problem solving, maintenance techniques and similar issues are required. Accidents continue to plague the ENR. The last five years show a steady upward trend peaking at some 700 annual incidents in year 2007; the total has slightly ameliorated in recent years. Catastrophic fires appear to be a long-term legacy of the ENR. The second major incident type is derailments, typically representing some 30-40 percent of total accidents.

There exist few state-of-the-art facilities for the efficient transfer of goods between rail and other modes, in particular with maritime ports. Such linkages imply an increased potential for container activity, which again points to a lack of rail facilities to accommodate this vital international method of shipment.

The ENR has embarked on a program of improvements, largely within the framework of the on-going ENR Transformation Program. These include a variety of plans in projects in the hardware, humanware and software precincts.

3.1.3 Maritime Sector

Egypt has 15 commercial ports facing the Mediterranean Sea and Red Sea (Table 3.1.2). The Maritime Transport Sector is responsible for the administration of those ports, delegated according to four regional Port Authorities. Apart from the commercial ports, roughly fifty ports are in operation for a variety of specialized purposes to include petroleum ports, mining ports, tourist ports, and fishing ports.

Table 3.1.2 Overview of Egyptian Commercial Ports

Port	Total Area (km^2)	Land Area (km^2)	Maximum Capacity		Recorded Activity			Total Berths	Total berth length (m)	Max. water depth (m)
			Cargo (million tonne)	Container (million TEU)	Cargo (million tonne)	Container (million TEU)	Passenger (million)			
Alexandria	8.40	1.60	36.80	0.5	22.1	0.6	0.5	59	7,625	12.8
El-Dekhila	6.20	3.50	22.10	0.5	23.3	0.7	0	20	4,586	20.0
Damietta	11.80	8.50	19.75	1.2	29.3	1.1	0	18	4,750	14.5
West Port Said	3.00	1.30	12.18	0.8	8.9	0.8	0.2	32	4,400	13.2
El Arish	0.23	0.05	1.20	0	1.3	0	0	2	364	8.0
East Port Said	35.00	33.50	6.00	2.2	22.9	2.5	0	3	1,200	14.5
Suez	162.40	2.30	6.60	0	1.5	0.001	0.02	12	2,070	8.0
Petroleum Dock		1.16	4.14	0	0	0	0	7	828	9.0
Adabiya		0.85	7.93	0	6.4	0.03	0.01	9	1,840	12.0
Sokhna	87.80	22.30	8.50	0.4	4.9	0.4	0.5	6	2,350	17.0
Hurghada	9.90	0.02	0	0	0	0	0.2	3	340	5.0
Safaga	57.00	0.48	6.37	0	2.1	0	0.8	3	968	14.0
El Tour	1.65	0.43	0.38	0	0	0	0	1	75	5.0
Nuwaiba	9.87	0.34	1.9	0	1.0	0	0.8	4	380	8.0
Sharm El Sheikh	88.28	0.16	0	0	0	0	0.2	1	625	8.0
Total	481.55	76.49	134.45	5.6	122.3	6.1	3.23	180	32,068	

Source: JICA Study Team using year 2009 Maritime Transport Sector data.

Alexandria, El-Dekhila, Damietta, West Port Said, East Port Said, and Sokhna are the major commercial ports accommodating, on a composite basis, over 90 percent of maritime cargoes. Recent operations suggest that:

- Alexandria and El-Dekhila are growing steadily as gateway ports to the Cairo as well as Alexandria metropolitan areas in spite of growing port congestion.
- Damietta lost a major client, the Maersk Line, to East Port Said, resulting in a decline of cargo.
- West Port Said is losing customers due to the port congestion and competition against East Port Said.
- East Port Said is growing rapidly taking advantage of the status as an efficient transshipment hub as well as vast land areas available for port expansion.
- With vast land areas available for port expansion, Sokhna has a great potential as a gateway port to the Cairo metropolitan area but the potential has not yet fully materialized.

Near-term Risks

….Egypt continues to be very volatile ….. The two major threats are further political upheavals: strikes and demonstrations which disrupt normal port activities, and the possibility of a sharp downturn in economic activity if the government fails to control the deteriorating fiscal and financial situation. Both of these scenarios pose serious downside risk for the country's ports….

Egypt Freight Transport Report, Business Monitor International, Ltd, Quarter 4, Year 2011.

Judging from the productivity recorded in container terminals of major commercial ports, there is room for better utilization of existing facilities, with East Port Said being a notable exception. Productivity indexes need to approximate those of regional competitors (Table 3.1.3).

3.1.4 Inland Waterway Sector

The River Transport Authority (RTA) is responsible for inland waterway transport (IWT) in Egypt. The organization is also responsible for establishing IWT policies and strategies.

The Authorities' IWT network encompasses 2,635 kilometers consisting of 1,696 kilometers within the Nile Valley and 936 kilometers within the Nile Delta. Navigable waterways classified as 1st class by RTA, require specified vertical clearance, fairway width, maximum draft and minimum water depth. The 1st class network includes 980 kilometers between Cairo and Aswan, 205 kilometers between Cairo and Alexandria (Beheiry and Nubaria Canals) as well as 241 kilometers between Cairo and Damietta. These three waterways feature 3 locks and 24 bridges, 7 locks and 27 bridges, as well as 3 locks and 16 bridges, respectively.

Approximate 320 cargo vessels (comprised mainly of barges and tug boats) as well as 2,200 passenger vessels (including tourist boats, ferries and other light boats) are currently registered to operate on the IWT network. About 30 percent of the cargo vessels and 90 percents of the passenger vessels are owned by the private sector, the remainder being under public sector ownership.

Table 3.1.3 Container Terminal Productivity – Major National and Regional Commercial Ports

Port	Container Throughput (TEU)	Terminal Facility			Productivity		
		Berth length (m)	Terminal area (m^2)	Gantry cranes	TEU/m	TEU/m^2	TEU/gantry
Alexandria	615,977	900	273,000	7	684	2.3	87,997
El-Dekhila	661,456	1,552	596,000	9	426	1.1	73,495
Damietta	1,139,018	1,050	620,000	10	1,085	1.8	113,902
West Port Said	760,967	1,320	467,130	7	576	1.6	108,710
East Port Said	2,539,984	1,200	600,000	12	2,117	4.2	211,665
Sokhna	427,879	750	200,000	4	571	2.1	106,970
Dubai (UAE)	11,827,299	4,875	3,536,905	50	1,582	3.3	149,713
Gioia Tauro (Italy)	3,467,772	3,011	1,300,000	18	1,152	2.7	192,654
Marsaxlokk (Malta)	2,334,182	2,158	680,000	23	1,082	3.4	101,486

Source: Domestic ports: JICA Study Team, based on year 2009 MTS container data as well as year 2010 Containerization International and DP World (terminal facility) data. Regional ports: JICA Study Team based on year 2010 Containerization International data.

The IWT sector is, as are other sectors, coping with a series of issues. The sector has experienced a decreasing share of cargo transported in Egypt; this is attributed to structural and operational weaknesses inherent to the sector. The sector appears not to have kept pace with international "best practices" in terms of operations, design, management and maintenance practices. Difficulties remain in terms of linking the sector with hinterland potentials and establishing a robust feeder network for potential IWT cargoes.

RTA is, with the assistance of various foreign and local entities, in the process of implementing a year 2020 master plan. Various studies and implementation strategies are underway to include humanware enhancements, waterway improvement with hydrographic survey/mapping, navigation buoys and River Information System. The RTA also strives to establish public private partnerships for some new river ports development and, more recently, has overseen an investment for the acquisition of several 100 meter barges capable of transporting cargo containers.

3.1.5 Civil Aviation

The Egyptian air transportation sector has shown strong growth in recent years, achieving a record of 35 million passengers during year 2009. Since its establishment in 2002, the Ministry of Civil Aviation Authority has been implementing practical policies to improve and optimize aviation via two enterprises: the Egyptian Holding Company of Airports and Air Navigation and EgyptAir Holding Company.

Egypt is at present served by ten international and ten domestic airports. Cairo International Airport, located in the capital city of the Republic, is operated by the Cairo Airport Company, while the Egyptian Airport

Company is responsible for all other airports. The international[1] airports are, in addition to Cairo, located in/near the cities of Luxor, Hurghada, Sharm El Sheikh, Aswan, El Alamein, Assiut, Marsa Alam and Alexandria. Two airports at present serve Alexandria, specifically, Borg El Arab Airport and Nozha Airport. The ten domestic airports are dispersed throughout the country providing service to smaller settlements, strategic sites and locations of touristic interest.

Overall demand in terms of annual passengers has continued to increase from some 8.4 million persons in 1985 to 35.0 million persons in 2008. In terms of overall demand, several observations may be noted (Table 3.1.4):

- Cairo International Airport is the dominant facility, however, its role has gradually eroded with increasing popularity of other international airports. Cairo International Airport accounted for 6.5 million passengers in 1985, or near three-quarters of total Egyptian activity. By 2008, activity had increased to 13.5 million persons, which only accounted for near 40 percent of national air passenger activity.

- Sharm El Sheikh and Hurghada Airports are next busiest, accounting for 7.8 and 6.7 million passengers, respectively, during 2008. Other airports accommodating in excess of one million annual passengers wre Luxor, Alexandria Nozha and Aswan.

- The relative role of domestic airports is minor, with activity representing some 3-4 percent of the national total, with more than half of that occurring at Abu Simbel Airport.

- The role of unscheduled (charter) services has assumed a dominant role at some international airports. For example, over the last few years, charter international movements have exhibited very rapid growth at Sharm El Sheikh and Hurghada Airports. The focus of Cairo International Airport operations remains scheduled civil aviation services.

- The origins of international air passengers focus on two regions: Europe (principally) and the Middle East (generally the Gulf States).

Cargo activity at Egyptian airports is modest, having reached near 300,000 tons during year 2008. This is dwarfed by cargo moving via alternative land modes. However, the modest role of the air sector within the national cargo system is not surprising; indeed, very indicative of international aviation norms: that is, cargo traveling by air tends to be smaller, of higher unit value or urgent in nature.

Cairo International Airport is dominant accounting for almost 280,000 tons during 2008, which represents almost a doubling of activity over the last decade. In addition, some 8,000 tons transited at Cairo International Airport. Alexandria and Luxor airports accommodated roughly 6,000 and 1,000 tons, respectively. Cargo activity at remaining airports is scattered and of modest proportions.

[1] The international designation as used in this chapter is based on type of service provided. In addition to noted international and domestic airports, smaller aerodromes exist but do not offer, at time of writing, scheduled commercial air services.

Table 3.1.4 Annual Passengers at Egyptian Airports: 1985 to 2008

Year	Cairo Intl. Airport	Other International Airports										Domestic Airports											Grand Total
		Sharm El Sheikh	Hurghada	Luxor	Aswan	Nozha	Borg El Arab	Assiut	El Alamein	Marsa Alam	Subtotal	Abu Simbel	Taba	El Arish	Kharga	Dakhla	Marsa Matruh	Saint Catherine	Port Said	El Tur	Sharq el Owynat	Subtotal	
	Thousand Annual Passengers																						
1985	6,452.8	12.5	96.2	675.4	651.8	162.5	0.0	0.0	0.0	0.0	1,598.4	362.4	10.9	7.4	13.5	0.0	4.2	9.6	2.9	0.0	0.0	410.9	8,462.1
1986	5,280.9	8.9	89.6	630.7	550.3	116.0	0.0	0.0	0.0	0.0	1,395.5	318.3	6.5	5.6	16.0	0.0	4.8	7.2	2.2	0.0	0.0	360.6	7,037.0
1987	6,178.6	26.0	113.1	949.5	887.1	130.4	0.0	0.0	0.0	0.0	2,106.1	447.1	8.3	4.1	17.4	0.0	3.3	4.7	1.5	0.0	0.0	486.4	8,771.1
1988	6,890.3	41.1	132.0	1,063.2	1,089.3	135.8	0.0	0.0	0.0	0.0	2,461.4	545.9	4.4	1.5	13.8	0.0	4.4	4.4	0.5	0.0	0.0	574.9	9,926.6
1989	7,725.0	53.2	191.2	1,285.7	1,156.4	165.9	0.0	0.0	0.0	0.0	2,852.4	572.0	6.0	2.5	14.2	0.0	3.6	8.2	1.0	0.0	0.0	607.5	11,184.9
1990	7,493.6	60.1	223.6	1,358.5	1,023.5	178.9	0.0	0.0	0.0	0.0	2,844.6	537.6	5.1	1.6	16.1	0.0	7.0	2.9	0.4	0.0	0.0	570.7	10,908.9
1991	5,955.5	68.7	234.9	1,011.7	699.2	141.8	0.0	0.0	0.0	0.0	2,156.3	309.6	4.4	1.2	3.7	0.0	8.0	0.8	0.1	0.0	0.0	327.8	8,439.6
1992	7,637.4	209.3	432.5	2,268.6	1,418.6	192.7	0.0	0.0	0.0	0.0	4,521.7	646.3	10.0	1.2	8.3	0.0	12.8	1.0	4.3	0.0	0.0	683.9	12,843.0
1993	6,324.1	252.7	448.8	1,396.5	710.0	236.5	0.0	0.0	0.0	0.0	3,044.6	258.8	14.5	3.0	8.8	0.0	11.7	1.7	8.2	0.0	0.0	306.7	9,675.3
1994	6,630.3	428.0	665.9	820.0	467.4	291.0	0.0	0.0	0.0	0.0	2,672.3	179.0	9.2	2.4	11.5	0.0	1.1	1.0	9.7	0.0	0.0	213.8	9,516.4
1995	7,177.0	633.6	1,112.5	1,337.6	591.0	252.8	0.0	0.0	0.0	0.0	3,927.5	246.4	3.4	18.0	11.6	0.0	10.8	0.6	20.8	0.0	0.0	311.6	11,416.0
1996	7,900.1	780.0	1,536.3	1,825.3	783.8	278.0	0.0	0.0	0.0	0.0	5,203.4	324.3	10.5	11.3	11.4	0.0	10.5	0.4	22.7	5.0	0.0	396.1	13,499.6
1997	7,727.8	989.9	1,474.0	2,003.5	825.3	323.3	0.0	5.1	0.0	0.0	5,621.1	372.1	1.9	10.2	11.3	0.0	1.9	1.8	25.5	0.0	0.0	424.7	13,773.6
1998	7,129.0	1,060.6	1,215.3	1,170.4	731.9	337.0	0.0	23.8	0.0	0.0	4,539.1	370.4	13.7	17.9	10.0	0.6	13.7	0.2	16.9	0.0	0.6	444.0	12,112.1
1999	8,270.6	1,743.0	2,364.8	1,908.7	1,391.3	372.3	0.0	26.1	0.0	0.0	7,806.2	1,023.8	2.6	1.1	8.5	5.8	20.1	0.3	15.7	0.0	0.2	1,078.2	17,155.0
2000	8,777.5	2,251.5	2,730.3	2,250.0	1,666.5	263.5	91.6	25.3	0.0	0.0	9,278.7	1,238.6	2.7	2.6	11.6	6.2	22.3	1.6	18.4	1.3	1.7	1,307.2	19,363.4
2001	8,228.2	2,220.2	2,683.6	1,858.2	1,058.6	219.5	169.6	31.7	0.0	2.2	8,243.6	828.1	10.8	24.2	10.3	2.8	16.2	0.8	17.8	6.2	4.1	921.3	17,393.1
2002	8,393.0	2,920.0	3,049.0	1,831.0	834.0	334.0	118.0	49.0	0.0	170.0	9,305.0	547.0	41.0	15.0	10.0	0.2	28.0	0.2	19.0	2.0	3.0	665.4	18,363.4
2003	8,337.0	3,423.0	3,398.0	1,657.0	844.0	337.0	139.0	46.0	0.0	271.0	10,115.0	541.0	67.0	14.0	10.0	1.0	19.0	0.2	27.0	9.0	3.0	691.2	19,143.2
2004	9,534.0	4,594.0	4,576.0	2,129.0	1,167.0	447.0	90.0	64.0	0.0	430.0	13,497.0	759.0	103.0	12.0	0.2	0.2	19.0	1.0	36.0	10.0	3.0	943.4	23,974.4
2005	10,220.0	4,756.0	4,525.0	2,273.0	1,032.0	534.0	125.0	73.0	0.2	496.0	13,814.2	650.0	150.0	24.0	0.2	0.2	21.0	1.0	51.0	13.0	2.0	912.4	24,946.6
2006	10,778.0	5,059.0	4,834.0	2,052.0	874.0	620.0	231.0	92.0	18.0	500.0	14,280.0	499.0	210.0	15.0	2.0	0.2	42.0	1.0	54.0	0.2	3.0	826.4	25,884.4
2007	12,577.0	6,425.0	5,948.0	1,978.0	979.0	795.0	236.0	133.0	29.0	643.0	17,166.0	538.0	306.0	3.0	3.0	0.2	50.0	1.0	52.0	0.2	5.0	958.4	30,701.4
2008	13,506.0	7,759.0	6,743.0	2,165.0	1,107.0	1,163.0	189.0	329.0	28.0	815.0	20,298.0	634.0	448.0	1.0	4.0	0.2	43.0	1.0	43.0	0.2	8.0	1,182.4	34,986.4

Source: JICA Study Team based on Ministry of Civil Aviation and Egyptian Airport Company data.

3.1.6 Pipeline Sector

The head agency is the Ministry of Petroleum, with affiliated state owned companies being (a) Egyptian General Petroleum Corporation to generally supervise and manage all sectors of the oil & gas Industry, (b) Egyptian Natural Gas Holding Company for supervision and management of natural gas industry, (c) Egyptian Petrochemicals Holding Company to manage and market Egypt's petrochemical industry and (d) Granoub El Wadi Petroleum Holding Company responsible to promote and develop all oil and gas activities in Upper Egypt. One authority, the Egyptian Mineral Resource Authority conducts geological mapping and provides technical advice, among other functions.

Several issues exist in the sector: (a) competition with the industry and Suez Canal by facilitation of pipeline infrastructure as a continental connection, (b) anticipated scale down and/or liquidation of the relevant oil pipeline infrastructures by underproduction, (c) probable constraint to other existing and development infrastructures by the new gas pipeline networks, (d) expected increase of traffic volume by transferring oil and/or gas to remote areas, and (e) less coordination in the public sectors to tackle impact studies/policies between the oil and gas and transport industries.

The sector development vision is the basis of the all affiliated companies and authority, anchored by the short-term policies of the Sixth Five-Year Plan. These include (a) supporting oil and gas reserves and increasing their production, (b) meeting the local demand of oil gas and petrochemicals, (c) supporting the exports and increasing Egypt's income from foreign currency and the state's reserves, (d) setting up clear achievable national plans, (e) increasing job opportunities for youth and improving worker's skill and (f) developing and restructuring mineral resources sector.

3.2 YEAR 2010 TRIP CHARACTERISTICS

The base year (2010) trip characteristics, as based on the vast MiNTS national survey program and simulated via application of the national transport model, are presented in this section. Please refer Section 2.1, previous chapter, for Large and Regional Zone designations.

3.2.1 Internal Person Trips

Approximately 18.53 million national person trips were generated throughout (internal to) Egypt during a representative year 2010 day (Table 3.2.1). These include journeys by all modes of travel between the MiNTS analysis zones. Thus, by definition, short trips (in urban areas for road mode, commuter services for rail mode, cross-Nile and similar services for IWT) are excluded. As expected, the Cairo Region generates the highest number of trips. Upper Egypt also accounts for sizable activity, however, spatially speaking, the Upper Egypt Region is considerably larger than either Cairo or the Delta Regions.

The road mode is dominant accounting for some 93 percent of passenger trips. The largest single passenger mode is shared taxi, carrying roughly two-thirds of all passenger trips and catalyzing near half of national passenger kilometers (Table 3.2.2).

Table 3.2.1 Year 2010 Daily Person Trip Generation

Region Number	Region Name	Daily Trips
1	Cairo	5,959,784
2	Western Delta	3,576,573
3	Eastern Delta	2,817,112
4	Upper Egypt	4,796,241
5	Red Sea	491,217
6	Western Desert	387,775
7	New Valley	109,872
8	Sinai	393,124
Total		18,531,698

Source: JICA Study Team. Notes: Refer Figure 2.1.2 for regional boundaries.

Table 3.2.2 Modal Share of Year 2010 Daily Person Trips

Major Mode	Mode	Number of Trips	Percentage	Person Kilometers	Percentage Distribution
Road	Car	2,114,553	11.5	255,400,503	25.0
	Shared Taxi	12,561,223	68.1	490,213,310	48.0
	Bus	2,551,297	13.8	221,722,456	21.7
	Subtotal	17,227,073	93	967,336,269	95
Non Road	Rail	1,226,864	6.6	54,282,451	5.3
	Subtotal	1,226,864	6.6	54,282,451	5.3
Total		18,531,698	100	1,021,618,720	100.0

Source: JICA Study Team. Air passengers are excluded.

The previous table includes all trips. Such trips can, especially within built-up regions such as the Delta, contain substantial numbers of very short distance journeys for which the use of shared taxis is expected to dominate. It is, given the national perspective of MiNTS, of interest to also examine longer distance trips, that is, journeys of more than 100 kilometers. While the road mode retains its dominancy, the modal share of passengers cars is more pronounced accounting for almost one-fourth of journeys and one-third of passenger kilometers. Shared taxis, while still retaining the largest absolute share, have seen relative share decrease to under 40 percent (Table 3.2.3).

Table 3.2.3 Modal Share of Long-distance Year 2010 Daily Person Trips

Major Mode	Mode	Number of Trips	Percentage	Person Kilometers	Percentage Distribution
Road	Car	856,239	24.9	202,707,805	33.8
	Shared Taxi	1,367,846	38.8	192,668,731	32.2
	Bus	948,062	27.6	163,467,048	27.3
	Subtotal	3,172,147	92.3	558,843,584	93.3
Non Road	Rail	262,854	7.7	40,257,080	6.7
	Subtotal	262,854	7.7	40,257,080	6.7
Total		3,435,001	100.0	613,691,880	100.0

Source: JICA Study Team. Air passengers are excluded. Longer distance trips defined as being more than 100 kilometers in length.

The composite national trip origin-destination pattern, on a Large Zone basis, is depicted in Figure 3.2.1.The person trip origin-destination pattern for the highest-generator precinct (Cairo Region) confirms that the highest absolute number of trips lie within the Cairo Region; that is, between zones comprising the Cairo metropolitan area. This is followed by trips linking the Cairo Region with the Western Delta and Eastern Delta Regions, respectively (Table 3.2.4).

3.2.2 Internal Cargo Trips

Numerous studies have, in past, examined the demand on road, rail and inland waterway modes. In addition, MiNTS has conducted a comprehensive series of national surveys. Modal data (as presented in earlier reports) contain various information, although not necessarily according to similar formats. Nevertheless, several clear cargo patterns appear to be emerging on a tonne basis (Table 3.2.5):

- The role of the road mode is absolutely dominant, and growing.
- The rail mode is second to the road mode in terms of use, however, both relative and absolute shares of total cargo carried are decreasing quite rapidly.
- Inland waterway transport (IWT) activity has experienced a drop in relative share over the last decade. However, absolute cargo carried appears to have stabilized.
- Civil aviation (not included in Table 3.2.5) transported about 300,000 tonnes of cargo during year 2010, about 0.1 percent of the national total.

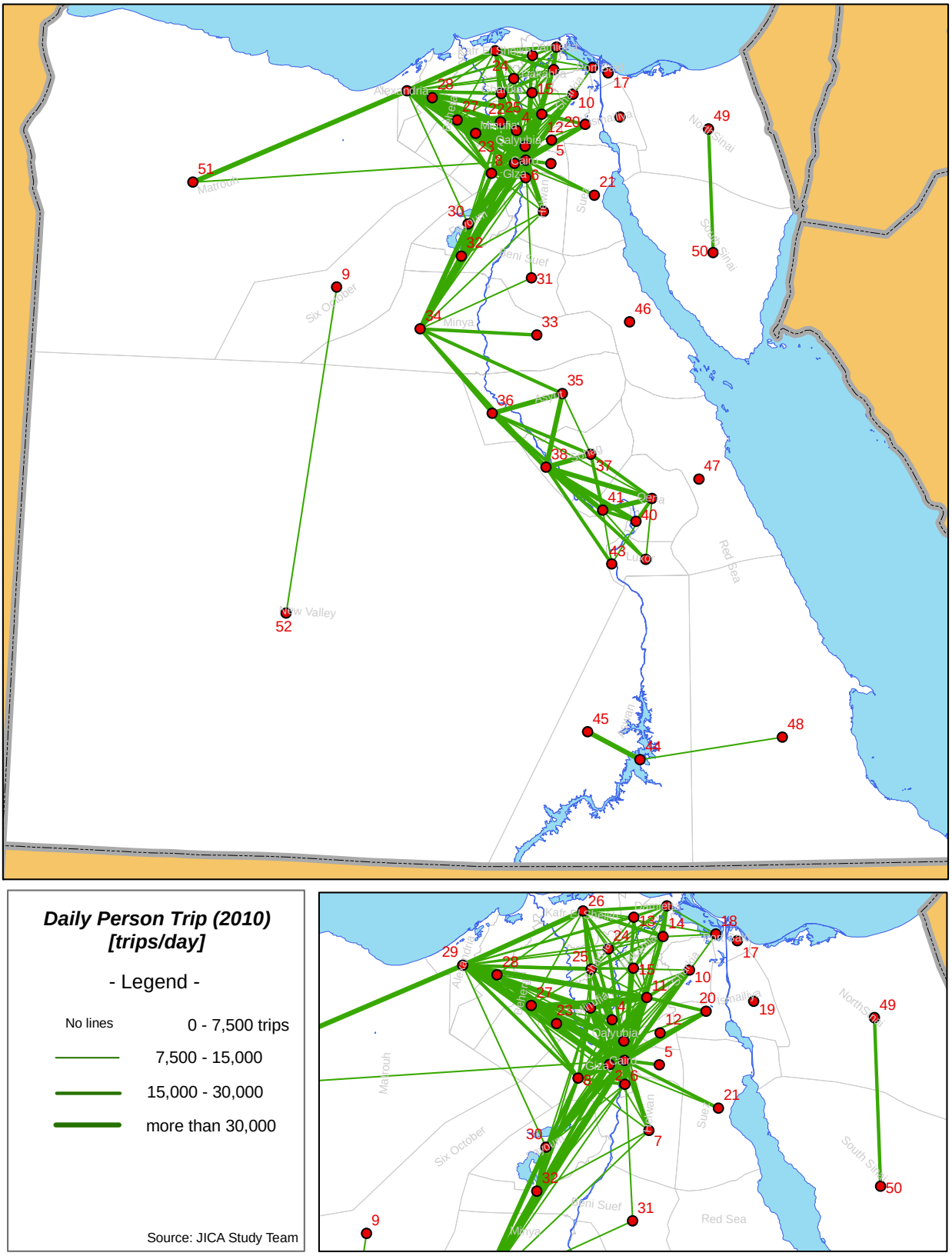


Figure 3.2.1 Year 2010 Passenger Trip Origin-Destination Pattern

Table 3.2.4 Regional Travel Pattern: Year 2010 Daily Person Trips

Region Name	Region Number	Region Number								
		1	2	3	4	5	6	7	8	Total
Cairo	1	4,821,003	444,343	349,665	295,870	31,778	10,649	1,817	4,659	5,959,784
Western Delta	2	437,409	2,815,006	241,098	40,661	4,910	36,083	204	1,203	3,576,573
Eastern Delta	3	343,867	242,874	2,183,314	31,017	10,125	1,554	141	4,218	2,817,112
Upper Egypt	4	283,610	39,752	30,347	4,402,934	28,823	946	9,576	254	4,796,241
Red Sea	5	31,931	5,030	10,337	30,186	411,234	69	116	2,314	491,217
Western Desert	6	10,781	36,797	1,602	995	70	332,091	5,434	*	387,775
New Valley	7	1,818	208	144	9,826	114	5,308	92,454	*	109,872
Sinai	8	4,806	1,282	4,391	272	2,369	*	*	379,997	393,124
Total		5,935,224	3,585,291	2,820,898	4,811,761	489,422	386,707	109,741	392,653	18,531,698

Source: JICA Study Team. Note: * denotes less than 20 trips.

Table 3.2.5 Trend in Modal Share: Annual National Freight Movement

Year	Annual Cargo Volume (000 tonne)				Modal Share (Percent)			
	Road	Railway	IWT	Total	Road	Railway	IWT	Total
1979	73,700	5,000	4,300	83,000	88.7	6.1	5.2	100.0
1992	165,495	9,642	3,214	178,351	92.8	5.4	1.8	100.0
2000	242,000	11,812	2,161	256,000	94.5	4.6	0.8	100.0
2010	433,361	4,042	2,226	439,630	98.6	0.9	0.5	100.0

Source: JICA Study Team based on (a) 1979 and 1992 data from *The Study on the Transportation System and the National Road Transportation Master Plan* (1993), JICA (b) 2000 data from *Development Study on the Inland Waterway System in the Arab Republic of Egypt*, (2003), JICA; and (c) 2010 information from MiNTS data surveys. Excludes pipeline transport (115 million tonnes in year 2010). Inland water transport (IWT) excludes short distance cross-Nile ferry traffic.

The aggregate year 2010 daily total of 1.51 million shipped tonnes (shipments between MiNTS Large Zones) includes some 0.32 million tonnes of pipeline product, roughly 21 percent of shipped tonnes and 31 percent of tonne kilometers (Table 3.2.6).

Table 3.2.6 Modal Share of Year 2010 Daily Cargo Trips

Major Mode	Mode	Number of Tonnes	Percentage	Tonne Kilometers	Percentage Distribution
Road	Light Truck	213,500	14.1	22,426,200	7.3
	Medium Truck	216,200	14.3	29,716,100	9.7
	Heavy Truck	734,512	48.6	152,234,900	49.7
	Subtotal	1,164,212	77.1	204,377,200	66.7
Non Road	Rail	9,080	0.6	3,963,668	1.3
	IWT	21,600	1.4	3,523,204	1.1
	Pipeline	315,000	20.9	94,520,500	30.9
	Subtotal	345,680	22.9	102,007,372	33.3
Total		1,509,892	100.0	306,384,572	100.0

Source: JICA Study Team. Assumes 300 kilometer average distance for pipeline transport. Inland water transport (IWT) includes cross-Nile ferry traffic.

The exclusion of pipeline transport confirms that some 62 percent of tonne cargo is carried by heavy commercial vehicles (large trucks) (Table 3.2.7). The modal split on a tonne kilometer basis confirms that:

- The role of large trucks becomes even more dominant account for near 72 percent of expended national tonne kilometers (and all trucks near 97 percent of tonne kilometers).

- Rail and inland waterway carry predominately large, bulky cargoes. Thus, in case of rail, the relative national tonne kilometer share increases considerably over tonne share. Tonne kilometer impacts of IWT are reduced due to very short distance cross-Nile ferry services. However, the tonne kilometer share remains minor compared to the road mode given the modest absolute totals carried by those two modes.

- The highest volume commodity shipments by road are represented by Commodity Group 7, Manufactured Material and Building Materials. In case of rail and IWT, highest volume commodities are Group 1, Agricultural Products, and Group 10, Machinery, Transport Equipment and Manufactured Articles, respectively (Table 3.2.8).

- The tonne trip origin-destination pattern confirms important differences from the passenger trip pattern. The highest volume of tonne trips is linked with the Western Delta Region, followed by the Cairo Region. Strong activity is noted for the Eastern Delta, Red Sea and Upper Egypt Regions (Table 3.2.9).

Table 3.2.7 Modal Share of Year 2010 Daily Cargo Trips (Excluding Pipeline)

Major Mode	Mode	Number of Tonnes	Percentage	Tonne Kilometers	Percentage Distribution
Road	Light Truck	213,500	17.9	22,426,200	10.6
	Medium Truck	216,200	18.1	29,716,100	14.0
	Heavy Truck	734,512	61.5	152,234,900	71.9
	Subtotal	1,164,212	97.4	204,377,200	96.5
Non Road	Rail	9,080	0.8	3,963,668	1.9
	IWT	21,600	1.8	3,523,204	1.7
	Subtotal	30,680	2.6	7,486,872	3.5
Total		1,194,892	100.0	211,864,072	100.0

Source: JICA Study Team. Assumes average distance for pipeline transport of 300 kilometers. Inland water transport (IWT) includes cross-Nile ferry traffic.

Table 3.2.8 Year 2010 Cargo Shipment by Mode of Transport

Commodity Group	Description	Mode of Transport (tonnes per day)					Percent of Total
		Road	Rail	IWT	Pipeline	Total	
1	Agricultural Products	155,775	2,811	374	-	158,959	10.5
2	Foodstuffs and Animal Fodder	78,270	36	533	-	78,839	5.2
3	Solid Mineral Fuels	9,949	1,723	50	-	11,722	0.8
4	Petroleum Products	64,071	1,461	1,409	315,100	382,041	25.3
5	Ores and Metal Waste	48,628	1,425	77	-	50,129	3.3
6	Metal Products	8,680	493	4	-	9,177	0.6
7	Manufactured Minerals and Building Materials	510,732	857	3,013	-	514,601	34.1
8	Fertilizers	35,530	60	931	-	36,520	2.4
9	Chemicals	48,714	-	-	-	48,714	3.2
10	Machinery, Transport Equipment and Manufactured Articles	191,579	166	15,185	-	206,931	13.7
11	Live Animals	12,189	48	26	-	12,262	0.8
Total		1,164,116	9,080	21,600	315,100	1,509,892	100.0

Source: JICA Study Team. Inland water transport (IWT) includes cross-Nile ferry traffic.

Table 3.2.9 Regional Travel Pattern: Year 2010 Daily Tonne Shipments

Region Name	Region Number	Region Number								
		1	2	3	4	5	6	7	8	Total
Cairo	1	98,715	90,792	40,516	15,447	12,898	3,146	445	3,446	265,407
Western Delta	2	81,352	261,564	33,218	7,676	5,751	3,487	*	1,407	394,463
Eastern Delta	3	38,200	25,259	96,934	3,618	5,514	175	44	2,651	172,395
Upper Egypt	4	22,584	8,717	8,692	109,578	6,130	212	1,516	220	157,648
Red Sea	5	59,776	51,729	40,950	10,900	6,301	643	140	1,700	172,139
Western Desert	6	2,936	12,080	134	48	42	1,045	*	*	16,300
New Valley	7	161	27	504	1,162	100	33	*	*	1,999
Sinai	8	5,347	619	4,409	453	1,198	*	*	2,358	14,386
Total		309,070	450,788	225,357	148,883	37,935	8,741	2,173	11,791	1,194,892

Source: JICA Study Team. Excludes Pipeline . Inland water transport (IWT) includes cross-Nile ferry traffic. * denotes less than 20 tonnes.

3.3 SYNOPSIS OF SECTOR PERFORMANCE

While much has been achieved in the transport sector, considerable work remains to be done.

3.3.1 The Hardware Element

- The growing dominance of road cargo transport leads to stagnation in the other transport sectors. It obliges river and rail modes to focus present activities using old infrastructure and rolling stock/fleets that have exceeded their practical service life, therewith limiting operating costs and increasing revenues. This compared to investing in new equipment and infrastructure. Maintenance of existing assets suffers from a variety of ills.

- The largest part of passenger volume can be attributed to road transport and also vehicle ownership is rapidly growing. As a direct consequence, main roads are confronted with more congestion, increasing delays and environmental degradation. Rail transport is under-utilized and is beginning to suffered from the lack of consideration as a serious transport alternative. This relative neglect has hindered modernization and a lack of investments underpins the gradual deterioration of the competitive strength as compared to road transport.

- Road infrastructure receives the highest investment priority but the utilization of this valuable asset is weak due to less-than-optimum management (and policing) as well as poor transport equipment (outdated and badly maintained) and abysmal safety practices. Motorists frequently lack the capacity to maintain their vehicles or modernize their operations (logistics, intermodality,

loading/usage practices), which leads to highly unsafe and inefficient traffic conditions. Shippers prefer using road transport in spite of congestion and safety concerns because the mode offers higher flexibility and lower prices. Some one-half of trucks travel empty.

- Operational efficiency and available capacity of railway transport is low, which leads to continued and possibly irreversible structural deterioration of the sector due to high maintenance and operating costs. Container shipments are, at present, not a priority for the rail sector due to a lack of infrastructure both for handling and transporting of this growing cargo potential. Controlled tariffs do not increase sector competitiveness and operational sustainability but only consolidate the downwards trend. To be competitive, the sector is in urgent need of adequate infrastructure, new equipment, but most of all a new operational and management philosophy.

- Commercial inland waterway transport is very modest because of impediments in river infrastructure (locks, bridges, fairway, etc.) and operational inconsistencies. River vessels are over-aged and not adapted for modern cargo transport. The fleet requires urgent refurbishment and in many cases needs to be replaced if the sector is ever to increase its role in the Egyptian transport system. River ports and other infrastructures are, in a modern sense, seldom available and lack equipment as well as professionalism to efficiently accommodate cargo, in particular containers. Passenger transport is focused on Upper Egypt tourist cruises along the Nile River.

3.3.2 The Software Element

- Lack of modernization of the transport sector has lead to low performance and poor capacity utilization. Some one-half of trucks, for example, travel empty.

- The IWT and railway sectors are limited in their capacity to capture cargo because of a wide range of hindrances, although not always generated by the sector itself. Externalities related to market access, administrative practices, lack of intermodal systems, regulatory frameworks and inability to operate in a competitive market all encourage shippers to use predominately road transport for their traffic.

- A sustainable regulatory framework for the transport sector as a whole requires adapting the present legislation to the needs of modern transport, with a predominant aim to facilitate market-responsive, customer-oriented operations and private sector involvement.

- Commercial utilization of the river and railways is predominantly for low value bulk cargoes transported in smaller quantities to and from dedicated destinations. Cargo consolidation is hindered not only by the lack of available infrastructure and equipment, but also by the absence of management and operational know-how. The lack of sustainable prospects to capture new and alternative traffic further reduces the willingness to invest in innovation and modernization and to attract new operators to expand markets.

- Integration of river and railway transport into the Egyptian transport system (multi-modal dimension) is therefore very low to non-existent. On the contrary, river and railway transport are confronted with unfair competition by road transport that benefits from rules and subsidy mechanisms interfering in free market principles and allowing market prices that do not reflect true operating costs.

- Infrastructure is not the only hardware component that requires attention and needs to be complemented by a program of modernizing equipment and operations. Technological innovation is a driving force in modern logistics and defines the competitiveness of the transport system and of logistics and transport services. There is a pressing need for the introducing of modern technology and logistics strategies into the Egyptian transport market.

3.3.3 The Humanware Element

- The sector suffers from a severe shortage of qualified staff.

- There is a lack of training programs and human resource development, in particular related to the introduction (and maintenance) of modern technologies in the sector.

- Qualified personnel, and a unified data system (ideally computerized and/or GIS friendly) encompassing all transport modes, are both lacking. This is seen as an urgent prerequisite for efficient transport planning.

- Coordination between related ministries and organizations should be enhanced. Approaches to transport planning, implementation and operations are currently fragmented among a myriad of organizations, entities and Ministries with little evidence of efficient, market-responsive overview guidance or control.

- Human resource responsibilities for transport activities are fragmented.

CHAPTER 4: THE MINTS VISION, POLICY AND STRATEGY

A basic premise of all investigations is that the MiNTS shall be comprehensive in nature, that is, adopt approaches designed to mitigate transport problems and contribute to the sustainable development of the nation. All major modes of transport are to be addressed including road, rail, maritime, inland waterway, air and pipeline. However, the practical focus of master planning are those modes falling under the jurisdiction of the Ministry of Transport; that is, the road, rail, maritime and inland waterway sectors. The derivation of the associated vision, policies and strategies was successfully completed as a direct result of cooperative efforts and close liaison between the Study Team, the Ministry of Transport and other local experts.

> Further Information
>
> The "top down" MiNTS framework, vision, policies and strategies are further discussed in Technical Report 10, and appendixes thereto.

4.1 THE PLANNING PILLARS

The analytical framework of MiNTS embraces two avenues of investigation (Figure 4.1.1). These are:

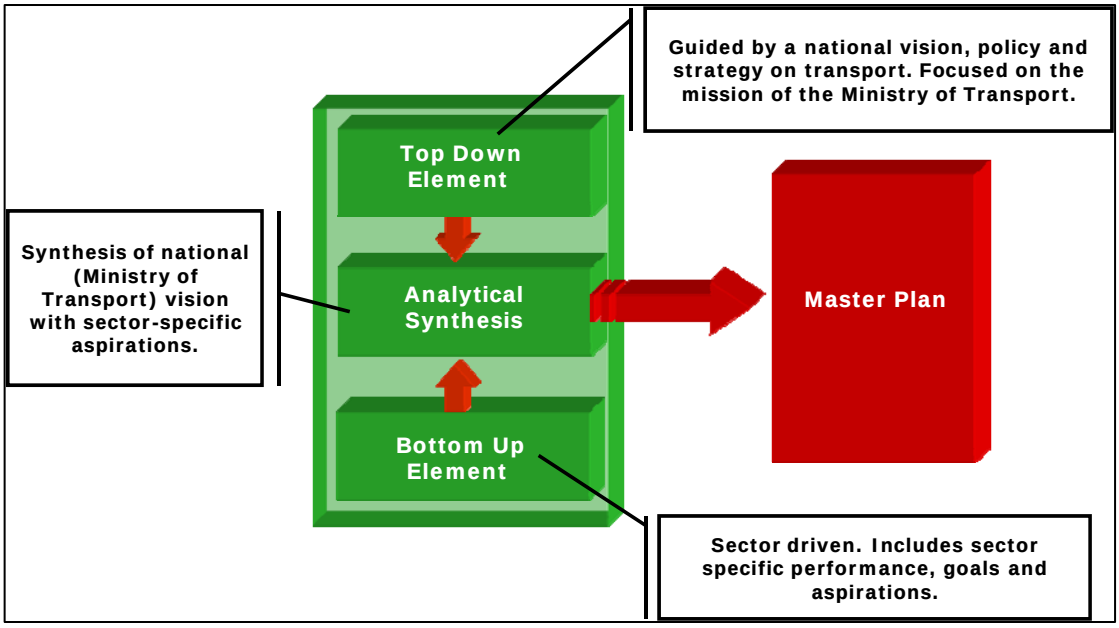
- A "bottom up" sector-specific element. This includes all modes within the MiNTS mandate, that is, the rail, road, inland waterway, pipeline and aviation sectors. The bottom up review focuses on mode-specific investigations of performance, operations and plans/projects promulgated by individual organizations and/or providers of transport services.

- A "top-down" element focused on the broader national, specifically Ministry of Transport, mandate. In other words, the overall perception as to how a balanced functioning of the road, rail and inland waterway modes is to be achieved within key demand corridors. Considerable consultation was undertaken to ensure broad consensus with the client group in terms of the Egyptian vision for transport[1].

The planning cornerstones involve, sequentially, a vision, a policy, a strategy (Figure 4.1.2), to be followed by the plans and projects derived within the framework of the Master Plan. Each component, that is, vision, policy and strategy, is based on a cascading and mutually reinforcing chain of activities. These evolve within

[1] This MiNTS perception of vision, policies and strategies was documented during the course of investigative proceedings.. Following review by the client group, consultations were carried out between the Study Team and HE The Minister of Transport, senior Ministry officials as well as Ministry Advisors. The policies and strategies of the Ministry of Transport, as clarified during this consultative process, were fully considered during the course of subsequent MiNTS investigations.

a broader set of (non-transport) framework conditions reflective of a variety of conditions to include, for example, environment, society and similar indicators.

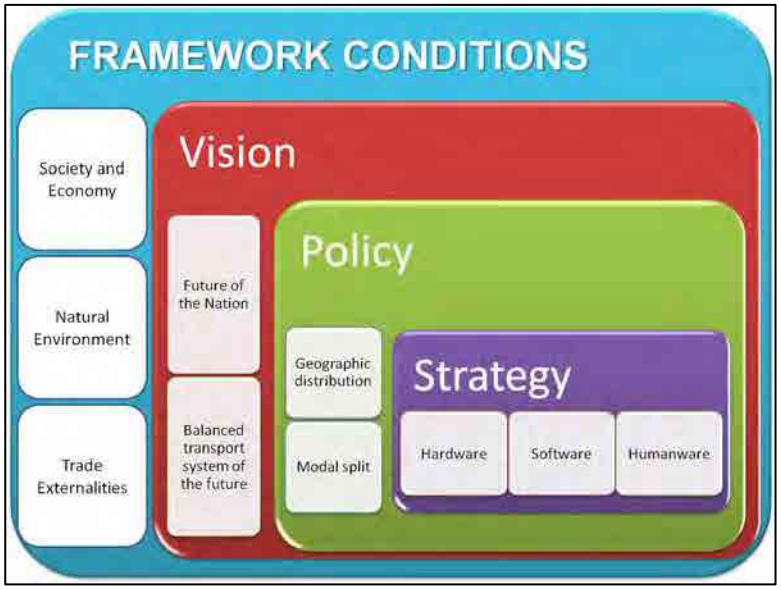


Source: JICA Study Team

Figure 4.1.1 The Cascading MiNTS Approach

- "Vision" in a practical sense represents an ideal in a distant future formulated in a number of key ideas and concepts. The transport vision is therefore the "final transport system", an image that must be translated into real public policy objectives. The vision could be summed up in different key goals to establish tomorrow's transportation system.

The vision remains the essential and unchangeable component in the MiNTS transport philosophy and intended to summarize the multidimensional key principles that will define Egypt in the future. This vision is likely to be oriented, on the one hand, towards a better distribution of the population via the creation of new industrial and economic areas in different parts of the country to reduce the unacceptable pressure on the Cairo Metropolitan Region and Nile River catchment. On the other hand, a modal shift to reduce



Source: JICA Study Team

Figure 4.1.2 Context of the Planning Pillars

the dominance of road transport is seen as essential.

- "Policy" encompasses, in a broader sense, actions needed to achieve objectives contained within the vision. The "strategy" follows the policy and represents the planning of governmental initiatives to carry out the policy. The strategy is thus the art of managing and coordinating concrete actions to achieve stated objectives. In practice, the strategy represents all political activities designed to achieve policy objectives.

Realism is the essential underpinning of the process, and should constitute the basis of the new, more structured, and integrated approach that will maximize the effectiveness and usefulness of future transport investments. In other words, the new transport philosophy upholds an integrated approach whereby different public authorities shall monitor and coordinate to ensure the efficient execution of the strategy that follows out of the new policy. It is important to emphasize that in this framework, the development of new infrastructures (hardware) will be a less dominant than in past, while priority is likely to be given to the technology (software) and management (humanware) aspects of the transport system.

The subsequent Master Plan converts policy into action using a coherent and integrated approach to cover all components relevant to the transport system of tomorrow.

4.2 FRAMEWORK CONDITIONS

The key framework conditions are discussed in Chapter 2 of this report. These include the population, employment, gross domestic product and production/consumption framework. The discussion will not be repeated at the current juncture. Two framework conditions, being natural environment and external trade, are noted.

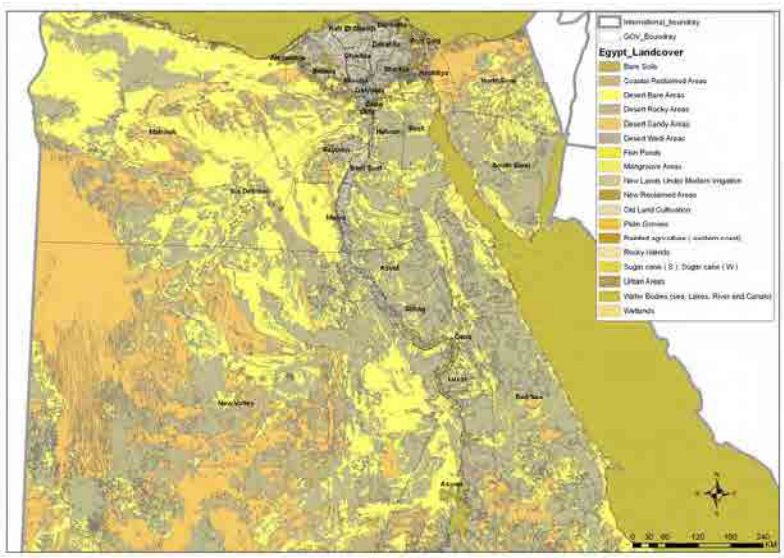
4.2.1 Natural Environment

Egypt has a unique and varied natural landscape consisting of fertile crop land, cliffs, mesas, coastal areas and plains (Figure 4.2.1). The Republic boasts a large land area: the greatest distance from north to south is 1,024 kilometers, and from east to west, 1,240 kilometers. Her natural boundaries include more than 2,900 kilometers of coastline along the Mediterranean Sea, the Gulf of Suez, the Gulf of Aqaba, and the Red Sea. Egypt has land boundaries with Libya, Sudan, Palestine and Israel. The nation is divided into four main areas being the Nile Valley and Delta, Western Desert, Eastern Desert and Sinai Peninsula.

Despite covering only about 5.5 percent of the total area of Egypt, the Nile Valley and Nile Delta are the most important regions, being the country's only cultivable regions and supporting the vast majority of the population. The Nile River is Egypt's main source of freshwater. The river supplies 56.8 billion cubic meters of freshwater every year, which represents 97 percent of all renewable water resources in Egypt. Average rainfall in Egypt is estimated at 18 mm or 1.8 billion cubic meters per year. Furthermore, Egypt has four different groundwater aquifers: the Nile Aquifer, the Nubian Sandstone Aquifer, the Moghra Aquifer and the Coastal Aquifer. "…*These figures give an impression that Egypt is a water rich country but the growth in population makes it a water scarce country. Since 2005, Egypt is classified as a water scarce country as it has less than 1,000 cubic meters of fresh water per year and capita. Furthermore, it is forecasted that in*

2025 the population will reach 95 million, which would mean a per capita share of only 600 cubic meters per year.."[2]

The realities of the natural environment, as well as the resultant demographic settlement patterns, have clearly, and understandably so, influenced the formation of the transport system. In principle, two core "T" corridors exist: the north-south corridor traversing the length of the nation vicinity of the Nile River, and the east-west corridor paralleling the Mediterranean Sea. These intersect, and diversify, within the Nile Delta. Subsidiary corridors have emerged within the Sinai Peninsula and along the Red Sea, with alignment strongly influenced by the physical environment. This important framework condition will remain in future. However, implicitly and in line with changes in demographics (see following section), it is equally obvious that diversification of transport corridors will be required in future.



Source: JICA Study Team

Figure 4.2.1 National Land Cover

4.2.2 Trade Externalities

Egypt has signed several important Free Trade Agreements (FTAs), among which COMESA, GAFTA, the EU-Egypt Partnership Agreement, the Agadir Free Trade Agreement, and the Egypt-EFTA Free Trade Agreement. The country also has preferential agreements with individual countries such as Syria and free trade agreements with Turkey and, more recently, with EFTA countries, and in the near future with the four MERCUSOR countries -- Brazil, Argentina, Uruguay and Paraguay. Quantitative reviews confirm the EU remains the dominant trading partner of Egypt with 33 percent of total trade volume, a relationship unlikely to change in the short or medium term future. On the contrary, the agreement on further liberalization of bilateral trade in agricultural, processed agricultural products and fish and fishery products, will further increase trade relations between the two partners. Thus, the form and extent of future trade patterns will be strongly dictated by services and/or needs involving the EU.

The expected growth of maritime traffic in the Mediterranean region will require the continued development of Egyptian ports on the international shipping routes, not only to link the Egyptian industry to the world's economies, but also the try positioning one or more key ports in Egypt as international hubs. A core tenet of the MiNTS planning effort is therefore to strengthen opportunities for landside cargo linkages, in particular the non-road modes.

[2] International Development Research Center, *Actualizing the Right to Water: An Egyptian Perspective for an Action Plan*, Shaden Abdel-Gawad, 2008

4.3 THE VISION

The Egyptian vision on future mobility embodies a successful intermodal transport system with integrated logistics development. This requires a clear linking of today's needs with the forces of future change.

Transport touches the lives of all peoples of Egypt, and contributes profoundly to the social, economic, environmental and cultural wellbeing of the nation. Transport includes not only infrastructure, but also the systems, facilities and services that move people and freight within the country, and across its borders. These include modal infrastructure systems; public transport services such as taxis, buses and rail; and freight shipment whether via the road, rail, inland waterway, maritime and air modes. The transport sector therefore has a major role to play in supporting other national development plans such as *Egypt Vision 2052* as well as (more short-term) planning/development instruments employed by various ministries. However, mainly due to its unprecedented demographic and economic growth, as well as post-revolution changes, Egypt faces a number of challenges to achieve a high quality transport network.

The MiNTS Vision for Transport

- The intrinsic linking of transport with the form and extent of the national developmental fabric, thus catalyzing a dynamic interaction between transport and Egypt's social as well as economic evolution, while concurrently cementing the Republic's important role in the international arena, both regional and beyond.
- Effective planning, in concert with the shaping of developmental patterns which influence the location, scale, density, design and mix of land uses, thus enhancing the travel experience and creating safer as well as more convenient mobility opportunities.
- Defining 21st Century sustainable and environmentally friendly transport solutions that, for all of Egypt's citizens, seek to improve the quality, enhance the accessibility, and foster the affordability of systems and services needed over the next two decades and beyond.
- The development of an integrated and multi-modal transport concept within the broader context of national strategies while retaining sensitivity towards local norms, expectations and modal requirements inherent to the movement of persons and goods.

The road mode is an essential factor in economic activity and has historically played a strong role in modal choice for Egypt. The use of the private motor vehicle has increased exponentially in the last few years. While this phenomena has fulfilled a variety of social goals and expectations, unfettered growth is also contributing to various negative social, economic and environmental impacts. This high level of car usage is a historic consequence of high vehicle ownership, pricing policies (such as the fuel subsidy), supported by "road focused" capital works programs and limitations to public transport services. Increasing car usage is beginning to impact the quality of life, particularly within urban conurbations such as Cairo. A more balanced approach to providing mobility is desirable. A key focus of MiNTS therefore is to mitigate the effects of high vehicle usage and the creation and promotion of high quality, multi-modal (and intermodal) transport system for persons and cargo.

Two core elements guide the formation of this vision:

- The longer-term spatial aspirations of the Republic; and,
- The equitable and realistic allocation of demand, for passengers and cargo, among the various modes (that is, sustainable mobility).

4.3.1 The Republic's Spatial Aspirations

Development planning has, in the Egyptian context, been conducted within the framework of a series of rolling five year plans, with the most recent Sixth 5-year Plan addressing the period between years 2007/08 and 2011/12. The Plan provides a comprehensive planning framework comprising socio-economic development goals, strategies and relevant policies. This is the official framework for development planning in Egypt. It is reviewed every year in view of progress and change of the proposed projects as well as emerging new projects. The Ministry of Economic Development functions as the center for coordination and integration of the plan, particularly for new investments.

In addition to the five year plans, which reflect tactical allocations of national resources, longer-term strategies have also been formulated under sponsorship of the General Organization for Physical Planning (GOPP), with *Egypt Vision 2052* being the most recent plan in this regard[3]. The *Vision* document envisages a shift in the population growth of the Cairo Delta agglomeration to the Western Desert, New Valley, Sinai and Red Sea Regions. These spatial strategies have been considered in the formation of the MiNTS demographic allocations.

Various Ministries and organizations also promulgate, generally within the framework of the five year plans, programs for future development in their relative areas of responsibility. However, these are generally seen as, vis-à-vis the longer-term year 2027 planning horizon of MiNTS, being of near to medium term relevance. Nevertheless, such plans are reflected, as practical and possible, within the overall MiNTS planning approach. Three particular examples include:

- Agricultural development strategy in Egypt is formulated generally within the nationwide development framework. The Ministry of Agriculture's development plan guides the current directions of agricultural activity. Focus areas include the West Delta, the northern coast of the Sinai Peninsula, and the Oases. The West Delta achieves highest production density at present and will, presumably, in future as well. Sustainable development is essential also in the agriculture sector. In Egypt, this sustainability issue is closely and directly related to water availability.
- The Ministry of Industry set forth long-term strategies for industrial development. While the long-term strategies are macroscopic and ambiguous to some extent, the Sixth 5-year Plan states the short-term targets more quantitatively. Industrial development in Egypt is largely characterized by industrial zones. Various types of industrial zones have been designated, and promotion

[3] *Egypt Vision 2052,* prepared by the GOPP, Ministry of Housing, Utilities and Urban Communities, 2010 (with updates). This document, successor to the *Egypt Vision 2050* effort, represents the only long-term plan for Egypt. The *Vision* is understood to have been approved by the Prime Minister and the Supreme Council for Urban Development and Planning. The GOPP has started to disseminate the document through seminars/workshops and media interviews in order to attain public consensus, to be followed by Cabinet approval. Considerable technical elements of the document have been made available to the Study Team, which is gratefully acknowledged.

activities are vigorously undertaken to invite foreign and domestic investment into these industrial zones.

- The Ministry of Tourism sets forth future tourism development plans based on the nationwide land use plan. The tourism development plans are closely related to the decentralization strategy by supplying jobs, residences, schools and hospitals. On-going projects cover areas of Southern Red Sea, Marsa Matruh and north of Lake Qarun. Lake Nasr and West Sinai areas are now under study as long term tourism development potentials. However, the immediate (post-revolution) focus of the Ministry lies in recovering previous levels of activity given that tourism has declined, at February 2011, by an estimated 80 percent over pre-revolution levels.

4.3.2 Sustainable Mobility

Numerous studies have, in past, examined the demand on road, rail and inland waterway modes. In additional, MiNTS has conducted a comprehensive series of national surveys. In addition, modal data (as presented in earlier reports) contain various information, although not necessarily according to similar formats. Nevertheless, several clear cargo patterns appear to be emerging on a tonne basis, as previously quantified in Chapter 2 of this report:

- The role of the road mode is absolutely dominant, and growing.
- The rail mode is second to the road mode in terms of use, however, both relative and absolute shares of total cargo carried are decreasing quite rapidly.
- The inland waterway modal share is extremely small, having experienced a drop in relative share over the last decade. However, absolute cargo carried appears to have stabilized.
- Civil aviation transports about 300,000 annual tonnes of cargo, about 0.1 percent of the national total.

Almost 63 percent of tonne cargo is carried by heavy commercial vehicles (large trucks). Surveys further confirm that a large proportion (slightly under half) of all trucks traveling empty or with empty containers. This implies a strong imbalance in loading efficiency, and quite likely a lack of logistics/communications capabilities.

In case of passenger activity, the road mode is also dominant accounting for some 91 percent of passenger trips. The largest single passenger mode is shared taxi, carrying near half of all passenger trips. The road share in terms of passenger kilometers remains dominant (albeit less than the passenger share) at some 86 percent of expended passenger kilometers.

The dominance of the road sector catalyzes, of course, implications beyond purely the carriage of persons and goods. "…*Road is the dominant mode of transport in Egypt, in both passenger and freight operations. Thus the transport sector is a major consumer of fossil fuels and therefore contributes a significant share of the country's emissions of air pollutants and green house gases*…[4]".

[4] *Egypt's Policies and Measures for Sustainable Transport*" by Ibrahim Abdel Gelil, International Development Research Centre, 2008

The global experience does point out some interesting lessons. Within the European Union, for example, the role of the road sector in cargo transport is expected to increase from the current 73 percent of modal share (expressed in tonne kilometers) to some 78 percent modal share by year 2030, while the relative shares of cargo shipped by rail and IWT are expected to modestly decline (Table 4.3.1). The share of road transport for the movement of passengers remains very stable and is commonly close to or above 80 percent of total passenger-kilometers. The high proportion of road transport is not surprising; similar trends have, for example, been observed in the United States. Egypt is neither the EU or the United States. However, what is important is that the role of the road sector is less dominating than that found in Egypt on a composite national basis, particularly so when examined on a specific city-pair basis or for certain commodity groupings.

Table 4.3.1 Forecast Cargo Modal Split, European Union

Year	Modal Share (% by tonne km)			
	Road	Railway	IWT	Total
2010	73.1	14.1	12.8	100.0
2020	75.4	12.6	12.0	100.0
2030	77.5	11.2	11.3	100.0

Source: JICA Study Team from *EU25 Energy and Transport Outlook to 2030*; The European Union, Brussels, Belgium 2009

When considering the development of new infrastructure in Egypt, the desired modal split should be pursued in a realistic manner taking these trends into consideration. But considering the trends does not mean that the use of road transport should be stimulated, on the contrary, the desire for a modal shift and the general international trends argue in favor of a specific policy that stimulates whenever possible the use of alternative transport modes, without imposing measures that penalize road transport to a level that it has a negative impact on economic and societal development. Realism is thus the key principle to follow.

Ministerial Consultations have clearly confirmed that, as part of the vision for transport in Egypt, two core requirements exist:

- Cargo shipments via non-road modes (rail, inland waterway) are expected to increase their share of total activity during the MiNTS planning horizon. This goal is founded on the clear need of a vastly (vis-à-vis current conditions) enhanced approach to intermodal facilities and logistics systems.
- Shared taxis fulfill an important role in the transport of passengers. This is not expected to change in future. However, long-distance passenger movements are expected to gradually transition from the current shared taxi dominance to more balanced use of high-order (large bus, rail) forms of transport.

4.4 THE POLICY

4.4.1 Overview Perspective

Transport is crucial for Egypt's economic competitiveness and commercial, social and cultural exchanges. However, there is a permanent contradiction between society, which demands ever more mobility, and

public opinion, which is becoming increasingly intolerant of chronic delays and the poor quality of some transport services. As demand for transport keeps increasing, the answer cannot be just to build new infrastructure. The transport system needs to be optimized to meet the demands of mobility and sustainable development, in particular given the considerable implications of growth noted in the MiNTS socioeconomic framework.

Planning for the transport sector must take into account its fiscal importance and "affordability", now and in future. Recent data suggest an annual investment in vicinity of 20 billion LE. Historically, annual investment has ranged, roughly speaking, from two to three percent of GDP (Table 4.4.1). This is a substantial investment, however, the experiences of fast growing economies such as Vietnam, China and Thailand suggest that expenditure should be increased to the order of four-eight percent of GDP. In other words, trebling or quadrupling the historic Egyptian norm.

Table 4.4.1 Past Egyptian Transport Investment

Year	Transport Investment (LE billion, current)			Transport Investment (% of current GDP)		
	Public	Private	Total	Public	Private	Total
2003	8.04	1.76	9.80	1.93	0.42	2.35
2004	9.91	2.72	12.63	2.04	0.56	2.60
2005	10.33	2.22	12.55	1.92	0.41	2.33
2006	7.87	7.34	15.21	1.27	1.19	2.46
2007	10.31	5.31	15.62	1.38	0.71	2.10
2008	12.90	12.02	24.92	1.44	1.34	2.78
2009	14.08	7.26	21.35	1.36	0.70	2.06

Source: JICA Study Team based on Ministry of Economic Development Data

A complex series of expectations must therefore be addressed in order to meet the needs of the transport sector. A series of policies consequently underpin MiNTS, details of which have been developed in close consultation with the Ministry of Transport. Policies include:

- Strengthening human resources with the ultimate view of developing a trained, motivated and properly compensated cadre of dedicated professionals within the umbrella of the Ministry of Transport.

- Ensuring a proper role for transport within the overall context of national social, demographic and economic development. This is particularly relevant given the considerable aspirations proposed by the *Egypt 2052 Vision* document, and spatial/developmental strategies contained therein.

- Enhancing opportunities for mobility to improve the quality of life for all peoples of Egypt. Opportunities for the safe, efficient passenger and customer-responsive travel options, designed to meet the needs of the traveling public, not operators or administrators, are paramount in this regard. There remains a pressing need for upgrading passenger interchanges among long-distance, as well as between long-distance and urban services, providers of public transport services.

- Shifting the balance between modes involves looking beyond the "rightful" place of each particular mode and securing intermodality. The biggest missing link is, in terms of cargo transport, the (largely) lack of a close connection between maritime, inland waterways and rail modes.

- Turning intermodal transport into reality. Intermodality is of fundamental importance for developing competitive alternatives to road transport. There have been few tangible achievements. Action must therefore be taken to ensure fuller integration of the modes offering considerable potential transport capacity as links in an efficiently managed transport chain joining up all the individual services. The priorities must be technical harmonization and interoperability between systems, particularly for containers.

- Revitalizing the railways in terms of both operations and management. Rail transport is seen as a critical sector on which the success of the efforts to shift the balance will depend, particularly in the case of goods.

- Promoting the growth on inland waterway transport. IWT (and possibly coastal short-sea shipping) are two modes which could provide a means of coping with the congestion of certain road segments and the lack of railway infrastructure. IWT remains vastly underutilized in Egypt.

- Improving quality and safety in the road transport sector. The greatest strength of road transport is its capacity to carry goods and transport passengers with unequalled flexibility and at a low price. This sector is irreplaceable. However, considerable fragmentation and pressures exerted on prices by consignors and industry may well undercut competitive market structures and encourage a disregard for social and safety legislation.

The Ministerial Policy Framework

The Ministry of Transport is committed to pursuing the challenging path of reform targeting the different sectors falling under the ministry's supervision. The Ministries' stated policy framework includes:

- Capacity building and human resources development;
- Improving service quality and upgrading safety measures;
- Restructuring the relevant transport authorities;
- Diversification of funding by maximizing the role of the private sector;
- Developing regulatory and legislative frameworks for the transport sectors;
- Developing a comprehensive plan to enhance the role of rail and inland water in freight transport; and,
- Conducting comprehensive technical and financial assessment for both ongoing and prospective transport projects.

- Improve safety across all modes. Although transport is considered essential for the well-being of society, safety issues are increasingly coming to the forefront. The fatality rate on Egypt's roads ranks as among the worst in the Middle East. Catastrophic incidents continue to plague rail operations.

- Leveling the "playing field" via an increasing reliance on free market and "user pays" principles. It is generally acknowledged that not always and not everywhere do the individual modes of transport pay for the costs they generate. This leads to dysfunction within the internal market and distorts competition within the transport system. As a result, there is no real incentive to use the cleanest modes or the least congested networks.

- Supporting the vital role of maritime transport. The ports are the lifeline of the Republic. External trade, focused on the European Union, dominates cargo activity.

- Developing environmental objectives which underpin sustainable transport. In particular, air pollution, sea and river pollution, noise pollution and visual pollution.

- Support the enhanced role of the private sector in the provision of transport systems, facilities and/or services. Opportunities in this regard are strongly supported by the Egyptian Government's recent approach to promote and increase the private sector involvement in the country's economic and social development plan. A PPP (public-private partnership) Central Unit was furthermore established within the Ministry of Finance.

4.4.2 The Spatial Transition

The policies must be addressed in both qualitative and spatial terms; that is, a building block process whose beginning point is the vision pillars. In more precise terms, the realization of policies within a spatial context of a developmental hierarchy and transport corridors. Transport services should, ipso facto, be provided for all socioeconomic activities at levels seen as being sufficient to support national vision and transport policies. For this purpose, a spatial structure encompassing the entire country-wide transport network structure, with a view to interconnecting key urban centers and/or economic activity concentrations, is depicted as a basis for corridor-specific planning efforts (Figure 4.4.1). Such centers may also be seen as agglomerations of various activities, and thus regarded as transport nodes which either generate or attract freight and passenger demands, or serve as important distribution centers for hinterland activities.

The identified centers follow a hierarchical system, taking into account several factors, among them:

- Level of existing population and employment density, economic agglomerations and infrastructure;

- Economic importance of major industrial centers and/or hinterland economies;

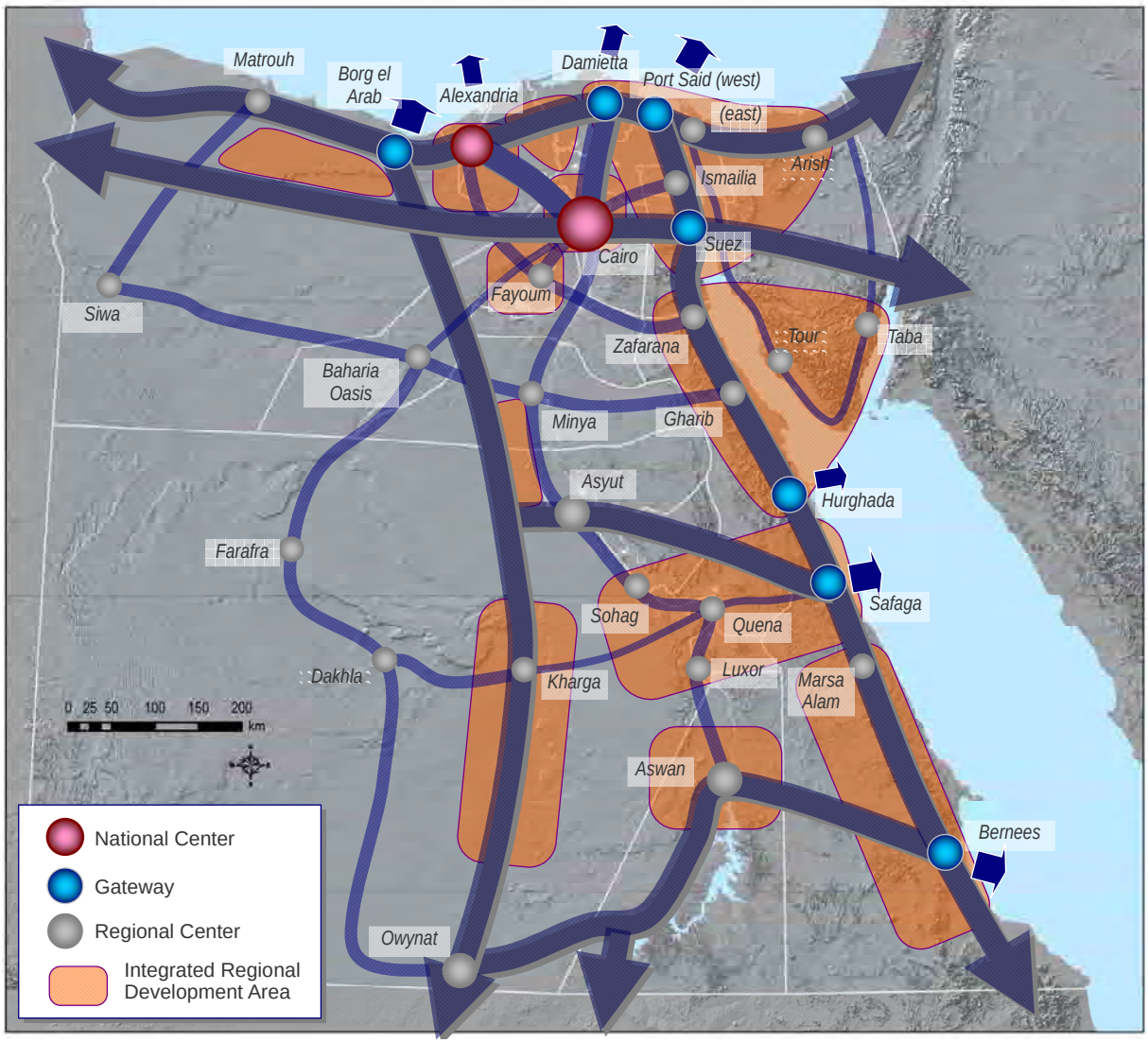
- Important points of national production and consumption;

- Current administrative/governmental structures;

- Potential accessibility to future transportation systems and services;

- Proximity of committed and planned mega projects or other major Government developments including the *Egypt 2052 Vision* document; and,

- Strategic importance of locations as gateways for international trade and cross-border transport activities with neighboring economies.



Source: JICA Study Team

Figure 4.4.1 The Spatial Policy Structure
Development Center Hierarchy and Transport Corridors

Consequently, three functional levels of urban centers are proposed, namely (a) national centers, (b) gateway centers; and (c) regional centers.

- The two national centers, Cairo and Alexandria, are the primary urban centers for Egypt. They are the focus for Government administration, retail, commercial, office, specialized personal and professional services. In addition, these centers accommodate financial, tourism, trade, cultural, entertainment, health and educational facilities of national and international significance. They contain the vast majority of Egypt's population, now and in future. Transport facilities tend to be of

pronounced importance in terms of air, dry port, seaport, logistics services, truck terminal, railway and domestic/international transport services.

- Egypt's regional centers serve catchments of city-wide significance and/or accommodate employment concentrations. They also serve, in some instances, business, core tourism, retail, and service uses. These centers provide a regional administrative focus. Typically, regional centers provide a variety of social/economic services for their hinterland. Regional centers tend to be well served by a variety of transport modes and systems, and/or are located at critical transport junction points. Regional centers can likewise serve as tourism magnets.

- Gateway centers serve a duality of purpose, and can be both, in functional terms, regional centers plus linkages to international movement of persons and cargoes (air, land and sea). The gateway activities range from the existing core import/export facilities such as Red Sea and Mediterranean seaports (seen as the lifeline of the Egyptian economy), to sites whose potential lies more in future terms; for example, transport linkages to Sudan.

The centers are shown as being connected via a series of transport corridors[5]. These are multi-modal in nature, and can represent road, rail and inland waterway systems, either in isolation or in combination. Anticipated (long term) major corridors are identified as linking the identified hierarchy of urban centers, major concentrations of economic production or consumption, and regional/international transport linkages. More specifically:

- Economic integration is promoted within Egypt and with neighboring countries along core north-south and east-west axes.

- The north-south international linkage consists of two axes. One lies west of the River Nile, passing through the Nile Valley, and linking the Mediterranean Sea with Sudan. The second axis parallels the Red Sea/Gulf of Suez between Port Said and Sudan.

- The east-west international linkage consists of four axes. The first lies along the northern (Mediterranean) coast of Egypt to linking Libya with Palestine via Marsa Matrouh, El Alamein, Alexandria, Damietta, Port Said and Arish. The second axis parallels along a more southerly alignment and is intended to secure the planned development of northern Matrouh, Alexandria Urban Area, West Delta, Greater Cairo, Suez Canal-North Sinai Area continuing to Israel, Jordan and Saudi Arabia and points beyond (to include the Gulf States, Syria, Iraq and Turkey).

- The third east-west axis lies in the central area of Egypt connecting the two north-south axes and Asyut and Safaga (at present), maritime linkages with Saudi Arabia.

- The fourth east-west axis lies in Upper Egypt, linking north-south corridors as well as Aswan and, as activity intensifies, Bernees.

- The east-west international axes should be developed to strengthen the eastern gateways of Egypt as the global economic growth have moved from Europe towards Asia.

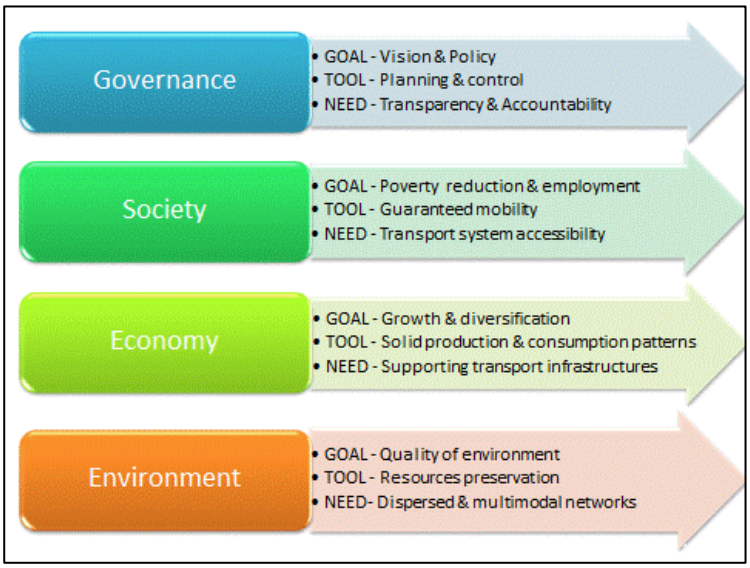
[5] [5] The concept of national corridors also exists in varying concepts, with a notable recent document being *Development Corridors,* by Dr. Farouk El Baz, http://faroukelbaz.com/index.php?option=com_content&view=article&id=22&Itemid=59, February, 2011.

4.5 THE STRATEGY

4.5.1 Building Blocks

A sustainable long-term transport strategy needs to support the government policy and guarantee its sustainability by translating the policies into concrete and feasible action plans that can be easily adapted to changing socio-economic conditions. In other words, the new transport strategy defines capacity needs and specifies the conditions of using capacity available now or in the future.

The new transport policy incorporates initiatives for hardware, software and humanware development and finds its generic expression in four conceptual building blocks which combined define the nation (Figure 4.5.1). Three basic components shape a country, namely its society, its economy (productivity) and its environment. "Governance" is the fourth building block and relates to the government's obligation to balance between the needs of its population and its economy while considering at the same time the future effects of these initiatives on the environment. Balancing between population aspirations and economic needs commonly finds its consolidation in short-term initiatives while the environmental impact is a long-term effect that requires government to consider the impact of present initiatives on the living conditions of future generations.



Source: JICA Study Team

Figure 4.5.1 Building Blocks of the New Transport Strategy

It is for that reason that sustainability of any political strategy is guaranteed only when the four building blocks are considered and find their foundation in a solid long-term policy and vision that allows establishing strategic guidelines for each of the four building blocks.

4.5.2 Strategic Principles

As noted in previous paragraphs, the new MiNTS transport strategy should pursue the realization not only of the hardware component of the new transport policy but should also take into consideration what is needed at the software and humanware level in order to create a sustainable and integrated transport system in accordance with the building blocks of the Egyptian transport system of the future.

A new strategy for the transport system of the future is only sustainable if it not only considers desires (vision), aspirations (policy), and strategic fundamentals (building blocks), but it also is based upon realistic strategic principles. The strategic principles that guide the development of the new MiNTS strategy are schematized in Figure 4.5.2. These include the actual and future demand for transport services, project financing, the corridors where projects will be implemented and the mode or modes that are involved. Each of these four principles will give guidance to determining the priority of projects and will be instrumental in

the development of concrete action plans, regardless whether they relate to hardware, software, or humanware developments.

Demand is logically the key principle for any comprehensive strategy. Demand for transport services will determine in which corridors or regions in Egypt and for which transport modes projects can expect the highest rate of success/return and will therefore attribute priority to hardware, software and humanware projects dealing with high-demand corridors and regions and with transport modes that capture high numbers of passengers and high volumes of cargo.

Source: JICA Study Team

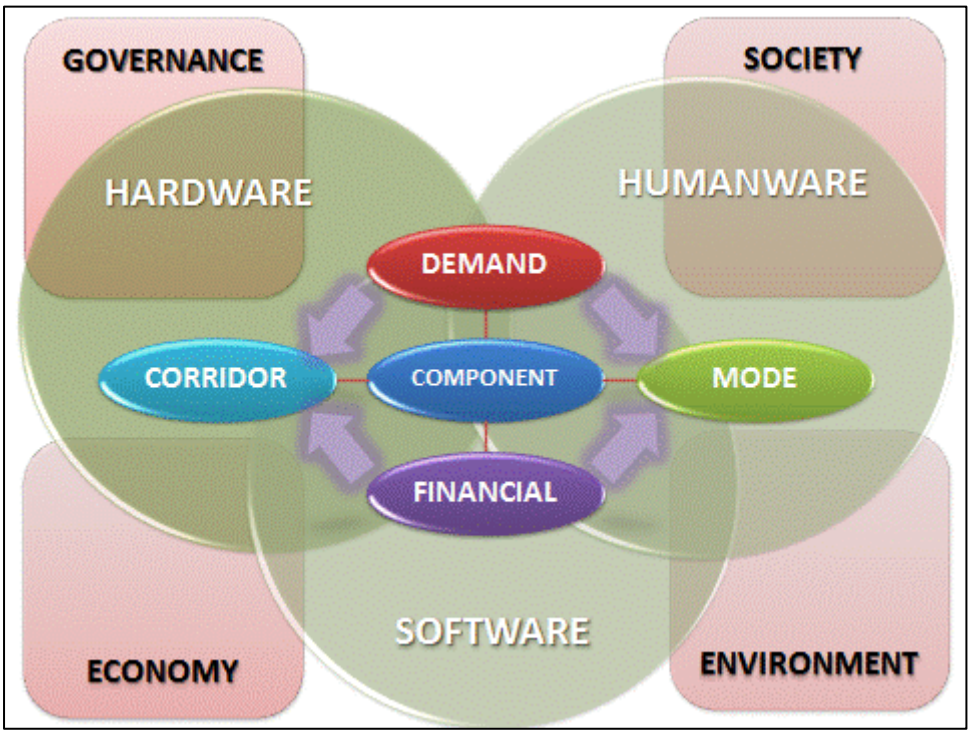
Figure 4.5.2 Strategic Principles for the New Transport Strategy

The second key component that directly relates to the demand is the financing of projects. Setting priorities based upon demand is one thing, but being able to concretely finance these projects is another. While financing projects in high-demand corridors can be easily realized, finding financial resources to finance projects in low-demand or emerging corridors is more complex. Because public budgets are frequently insufficient to realize the transport policy, the issue of financing transport sector developments is also closely related to the question of privatization and private sector participation.

But the relationship between the four strategic principles is far from straight-forward and seldom guided exclusively by demand and financing considerations. In the development of a long-term strategy, the vision and policy considerations will often interfere with the selection and prioritization logic based upon demand and financing considerations. Particular corridors will have higher priority than others because initiatives in these corridors will contribute to realizing some particular policy objective. The creation of new settlements is undoubtedly one of the prime policy considerations that can impose investments in some corridors although demand might attribute priority to some other corridors. The same is true for the modal choice of investments, where priorities could favor alternative transport modes, either to reduce the pressure of passenger and cargo transport on the road network, to obey to increasingly demanding environmental considerations, or to satisfy both. Further implications are catalyzed by the international aspirations of the Republic, and its transport (role) vis-à-vis neighboring and regional countries.

4.5.3 The New Transport Strategy

The role of the new transport strategy is therefore NOT to create an additional decision-making layer between vision and reality. On the contrary, the role of the new strategy is to make explicit the generic policy attributes into concrete strategic objectives and to ensure these objectives are realistic within the time and space continuum of its design. At the same time, the new strategy will need to incorporate sufficient flexibility to react swiftly to rapidly changing socio-economic conditions without in doing so, diverting from the implementation of the agreed-upon policy objectives. Figure 4.5.3 integrates all strategic considerations into a comprehensive and sustainable framework for the MiNTS transport strategy for Egypt.



Source: JICA Study Team

Figure 4.5.3 Integrated Framework for the New Transport Strategy

A first obligation of the new strategy is that it promotes good governance, balances the needs of society with those of the economy while it finally considers the long-term implications on the environment. The proposed new transport strategy therefore can only be validated if and when it complies with the conditions and specifications of its four fundamental building blocks.

Within that context, the new strategy should not only consider the creation of new infrastructure, but should on the contrary shift its focus from infrastructure building to transport system management and efficiency, focusing software and humanware projects to improve and optimize the utilization of existing capacity. New infrastructure should be carefully considered in the new transport strategy and should prioritize projects that directly relate to strengthening at least one but preferably more than one of the four strategic building blocks.

But the new transport strategy cannot remain at the generic level and needs to be specific as it is the only direct link between policy objectives and Master Plan initiatives. It therefore needs to be realistic and requires confirmation at two principal levels, namely the level of response to (present and future) demand and the availability of (public and/or private) financial resources.

Demand and/or financial considerations not always are the sole decision-factors. The demand for realism will sometimes need balancing against the needs defined by the long-term vision for (the transport system of) Egypt and the therewith related (transport) policy priorities. Sometimes, realism has to be waived to policy decisions that prioritize projects that have no strong financial or demand justification but find validation in the role they play in achieving vision and policy.

CHAPTER 5: TRANSPORT SCENARIOS

Significant energy has already been expended in the development of transport scenarios for MiNTS. This has been presented in the earlier workshop with government. Key elements of the preferred scenario structure have, via the established consultative process, been continuously reviewed between members of the client group, local experts and Study Team representatives. The physical infrastructure projects, included as part of the scenarios were prepared after consultation with the line agencies and on review of the future transport forecasts prepared from the numerical analytical procedures within the framework of the MiNTS national transport model (MNaM).

Further Information

The MiNTS scenario approach was formulated during discussions with government and other stakeholders. Several scenarios were developed for consideration in the input for the finalization of the preferred scenario.

Additional detail regarding the formation of the transport scenarios is presented in *Technical Report 6, Demand Simulation and Scenario Testing*. The background and further description of the MiNTS transport model is found in the appendix report, titled, *Modeling Manual*.

5.1 THE STEPWISWE APPROACH

The analytical approaches embedded within MiNTS require that data be processed at varying levels of The current approach, as documented in this report, relies on several logical components:

- The base case as presented earlier represents the year 2010 condition. That is, “existing” transport networks, simulated trip demand and current assignment conditions (for example, fuel costs reflect the existing price, in year 2010 terms[1]).

- Alternative future scenarios represent the logical follow-on of the vision, policy and strategy chain noted in *Interim Report 2*. These account for a linking of transport demand with land use, modern – yet affordable and sustainable – transport systems, increasing reliability on free market (fuel) pricing mechanisms, and capability of enhancing societal quality of life.

Scenario building can involve a large number of permutations and combinations of events and procedures.

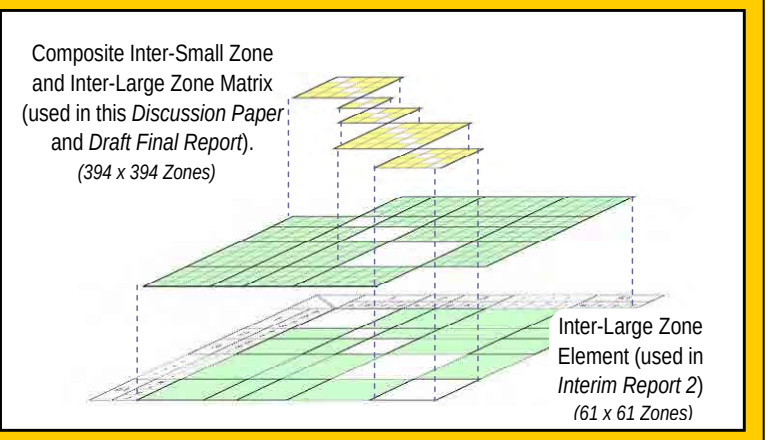
[1] The existing price reflects the current levels of fuel subsidy on gasoline and diesel.

Following sections represent additional details for core aspects; that is, the transport networks, typical results from the scenario analysis are also presented in the following sections. This is a two stage process with a discussion on the initial scenarios followed by the specification of the preferred sceanario.

What trips are being used?

A trip refers to travel between an origin and a destination, for persons, vehicles or cargo. Results discussed in the previous *Interim Report 2* reflected technical progress at that time. Demand analysis for MiNTS is based on trips of longer distance, that is, in general, journeys between pairs of the 61 unit national Large Zone system. However, in case of person trips, origins and destinations for the longer distance inter-Large Zone trips were geographically linked to the 394 unit Small Zone system.

Thus the scenario analysis includes the addition of shorter distance person journeys to the then-existing trip tables. Thus the total trips unless otherwise specified includes these trips but not urban trips.



The primary vehicle for scenario discussion and formulation was, in addition to Committee consultations, the previously-referenced Transport Scenario Workshop[2] , and comments received thereafter.

5.2 MANAGED DEMAND AND SUSTAINABLE TRANSPORT

Transport touches the lives of all in Egypt, and contributes profoundly to the social, economic, environmental and cultural wellbeing of the nation. Transport includes not only infrastructure, but also the systems, facilities and services that move people and freight within and outside of the country.

[2] A workshop, chaired by HE The Minister of Transport, and involving representatives of the Ministry of Transport, members of the Study Team, as well as other experts, was undertaken, at the request of the client group, on 29 September, 2011. . A PowerPoint presentation addressing the methodology, approach and findings of the scenario evaluation procedure was undertaken by Study Team representatives. This was followed by a robust and valuable exchange of information and ideas. Key discussion points are integrated, as practical into the formation of the preferred scenario.

The road mode is an essential factor in economic activity and has historically played a strong role in modal choice for Egypt. The use of the private motor vehicle has increased exponentially in the last few years. While this phenomena has fulfilled a variety of social goals and expectations, unfettered growth is also contributing to various negative social, economic and environmental impacts. This high level of car usage is a historic consequence of high vehicle ownership, pricing policies (such as the fuel subsidy), supported by "road focused" capital works programs and limitations to public transport services. Increasing car usage is beginning to impact the quality of life, particularly within urban conurbations such as Cairo (Figure 5.2.1). A more balanced approach to providing mobility is desirable, that is, a cohesive approach to the managing of demand. A key focus of MiNTS therefore is to mitigate the effects of high usage of road orientated transport[3] and the creation and promotion of high quality, multi-modal (and intermodal) transport system for persons and cargo.

Figure 5.2.1 Increasing Car Use is Impacting Quality of Life

The estimation of future demand is linked with a series of variables to include vehicle operating cost (price of fuel, tickets, unit cargo cost, value of time, and similar). Vehicle operating cost is seen as an excellent tool from a demand-side management perspective. Indeed, within the Egyptian context, it may be argued that transportation demand management and the realization of additional revenues for construction and maintenance of transport facilities as well as systems can proceed hand-in hand.

The culling and selecting of a preferred transport scenario is thus conducted within various ranges of vehicle operating cost; that is, future-year increases over current (year 2010) levels in real monetary terms. Underlying such increases are three considerations, all of which represent the realization of "user pays principles" and the introduction of market fuel pricing. These are:

- Fuel subsidy;
- Fuel ("at the pump") taxes; and,
- Road pricing for commercial vehicles.

The ultimate choice in selection of a preferred approach is, of course, the purview of Government.

5.2.1 Market Fuel Price

Vehicle operating cost is a key determinant of modal choice relationships. Fuel price is a variable in this relationship. In Egypt, the cost of fuel is heavily subsidized. The Steering Committee has earlier confirmed the relevance of the subsidy, not only from a perspective of financial "cost at the pump", but also in terms of

[3] In the case of person movement, this means as a minimum the promotion of person travel by means other than the private motor vehicle.

impacts upon the national budget. Year 2009/2010 conditions, for example, confirm that the average pump price of gasoline (across all octane ranges) accounts for near half of the market cost of the fuel. The situation in case of diesel fuel is more pronounced. Annual national fuel (gasoline plus diesel) subsidy[4] outlays are escalating and (then) accounted for some 34.05 billion LE[5]. Of course, not all of these subsidies can be linked directly to transport; nevertheless, the indicated totals represent some 3 percent of GDP – a sizable impact.

A variety of initiatives have been considered in past for reducing and/or eliminating the subsidy in some form. Clearly, societal pressure continues to grow with the recognition that unbridled subsidies represent a threat to economic sustainability. As noted in a recent Reuters News Service article[6] "*……The government has said it wants to better target subsidies to the most needy in a country where a fifth of its 78 million people live on less than $1 a day. Economists say targeting subsidies would help cut the budget burden and reduce waste….*".

A View on Fuel Subsidies

… Governments should look for opportunities to move away from fuel price subsidies as rapidly as possible and replace them with targeted assistance to the poor. Preparatory work to identify beneficiaries and design efficient ways to deliver assistance should be given high priority, especially since high oil prices are likely to continue in the coming years...

Source: *Phasing Out Subsidies: Public Policies for the Private Sector*, by R. Bacon and M. Kojima, Note 310, The World Bank, 2006.

The impact of the reduced fuel price (due to subsidy) is substantial in terms of the pump trip making. The observed base year modal split for passenger cars is, for trips in excess of 100 kilometers, near 25 percent (the remainder being allocated to shared taxi, bus and rail modes). The impact of roughly doubling the price of fuel (the equivalent of removing subsidy) can be substantial. For example, if pump price equals unsubsidized market cost the modal share of passenger cars would decrease by roughly one-third to slightly over 16 percent (Figure 5.2.2).

It is fully understood that the issue of fuel subsidy is very contentious and can, as witnessed by historical events in Egypt, catalyze social ramifications. The Study Team has introduced this subject not with the expectation of "immediate change", but as a gradual transition within the 20 year planning horizon of MiNTS. Two considerations, among others, underlie this approach. Firstly, domestic and international

[4] "Currently in Egypt, petroleum subsidies are more than the country's education budget ….Right now, the petroleum budget is unsustainable, oil prices will continue to rise everywhere, but Egypt has one of the highest subsidies for petroleum products…..Egypt currently imports oil products like diesel and butane gas because the country produces only 50 percent of its butane gas usage and 75 percent of the local consumption of diesel oil, according to public statements…", an extract from the Egyptian Daily News of 6th December, 2011.

[5] The current average cost of fuel at the pump across all types of gasoline is 1.59 LE per litre. However the cost to government ie the market fuel cost is 3.10 LE per litre. The difference in the two costs represents the current fuel subsidy in Egypt. (This is based on the annual fuel sales datasets from 2009 /2010 supplied to JICA Study Team by TPA)

[6] Online at http://af.reuters.com/article/investingNews/idAFJOE6180FQ20100209ost to government is

financial institutions have clearly suggested that the use of "blanket subsidy" can have unanticipated consequences; instead, there exist more targeted approaches toward providing support to needy segments of society. Secondly, one would expect that, certainly under post-revolution conditions, that the Government of Egypt will, likely with increasing urgency, consider sustainable, long-term budgetary approaches which balance the needs of society with fiscal limitations.

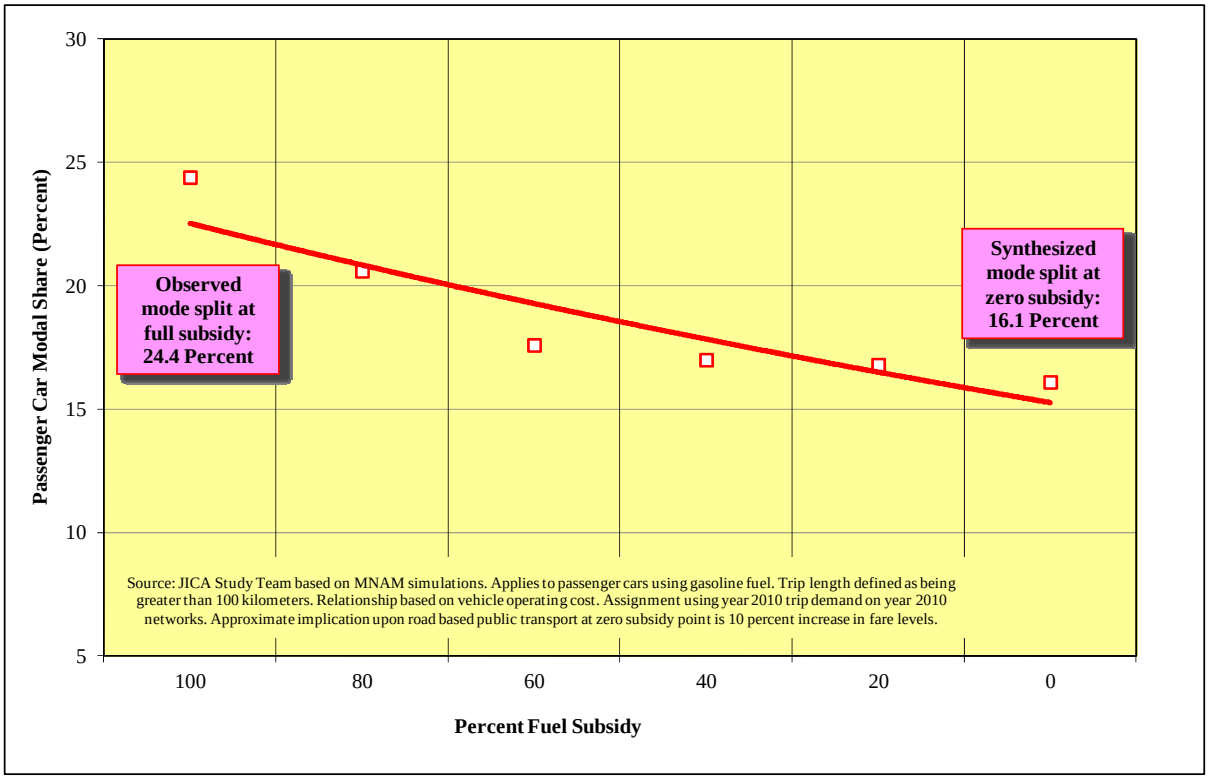


Figure 5.2.2 Simulated Impact of Fuel Subsidy on Year 2010 Passenger Car Mode Split

5.2.2 Fuel Tax

"At the pump" taxes are common in other countries, where their use is justified on a variety of grounds, to include funding for transport projects and/or maintenance of transport facilities and/or systems; input to general revenues; encourage energy conservation; catalyst for transportation demand management; revenue-neutral tax shift (fuel tax revenues take the place of other, more economically negative, taxes); internalize the external costs of fuel production and consumption; and, fund vehicle insurance pool.

What are representative applications of an "at the pump" tax?

- March, 2011 prices for regular gasoline in the United States averaged $3.56 per gallon (about 5.50 LE per liter). The unit cost breakdown was crude oil 68 percent; refining 13 percent, distribution/marketing 7 percent and taxes 12 percent.

- Taxes on fuel sold within the European Union generally represent 40-60 percent of per liter cost. Thus, taxes yield some 5 - 6 LE per liter.

- Recent prices for gasoline in Japan reached 151 Yen per liter (about 11.5 LE) including a five percent Value Added Tax. Also included are two fixed taxes totalling 53.8 Yen for national and regional authorities. These taxes (about 4.1 LE per liter) have historically been earmarked for road construction and maintenance, although some recent use for public transport activity has been approved.

- Fuel taxes are typically collected “at the pump” from motorists. Other forms of fuel, such as cooking and heating fuel, tend to have different tax structures and collection mechanisms.

It is therefore of interest that the application of fuel tax, levied “at the pump” in the form of increased fuel price, be considered within an Egyptian context as a valuable mechanism for sourcing transport revenues.

5.2.3 Road Pricing for Commercial Vehicles

Roads are capital investments which deteriorate over time and which require maintenance. While weather and climate contribute to road damage, deterioration is strongly linked to heavy commercial vehicles, in particular over-loaded vehicles. The American Association of State Highway and Transportation Officials estimates that the effective damage done to roads is proportional to the 4th power of a vehicle’s axle weight. For example, a tractor- trailer unit weighing 36.3 t with 3.6 t on the steer axle and 16.3 t on both of the tandem axle groups can be expected to do 7,800 times more damage than a passenger vehicle with 0.9 t on each axle. Thus, to a good approximation, almost all damage done to roads by vehicle use is caused by heavy commercial vehicles.

The maximum axle load determined by the regulation of GARBLT is 13 t. GARBLT has established weighing stations at selected points on the main road, but GARBLT has no power to enforce trucks to enter these stations. Police presence is required to compel the truck driver to enter the weighing station which is not always available. If the axle load is more than the allowable load, the truck is fined. It is notionally expected that overloading of Egyptian commercial vehicles is rife. This catalyzes a number of direct consequences:

- Overloaded trucks damage roads. They create worn ruts, pot holes, cracks, and other irregularities that can be dangerous, especially for motorcycle riders or drivers battling inclement weather conditions.

- Overloaded trucks have more trouble stopping. Trucks carrying a legal amount of cargo require more distance to stop, accelerate or avoid obstacles than passenger cars. This problem is, needless to say, magnified for overloaded vehicles thus potentially introducing additional road safety hazards.

- Overloaded trucks may face mechanical failures. For example, an overloaded truck's brakes will wear out much faster, putting not only the truck, but also fellow motorists, in danger.

- Overloaded trucks collide with more force. The heavier an object, the more force it carries. An overloaded truck will, in case of accident, strike other vehicles with higher force, thus leading to a greater chance of serious blunt force injuries and deaths.

Clearly, these issues bring into play the Ministry of Interior which has responsibility for road safety, vehicle operating license and driver license procedures, among others (refer *Technical Report 2: Organizational and Functional Aspects of the Transport Sector,* for additional detail). However, this issue is clearly linked with operating cost, road safety, modal split and levied fees. Thus, the introduction of load (capacity) specific road pricing (ESA – equivalent standard axles - being the basis) for heavy commercial vehicles (which impact operating cost), and the establishment of a rigorous truck weight enforcement mechanism, is seen as a vital objective with the capability of catalyzing a number of benefits in the road operations and financing precinct.

5.3 THE INITIAL SCENARIOS

Five scenarios were created for testing within the framework of MNaM. In the first instance, Scenario A and Scenario B represent the "do minimum" and "do nothing" cases.

- Scenario A: "Do Minimum" scenario, embodies future (year 2027) demand on the existing network in addition to the on-going and committed projects[7]. That is, the transport networks include the year 2010 facilities plus those committed for implementation by the road, rail and inland waterway sectors. Assignment reflects modal split under current transport costing conditions to include fuel prices. The findings of Scenario A represent the case against which evaluations of more elaborate future scenarios are compared.

- Scenario B: "Do Nothing" scenario is driven by future demand on the existing network. The assignment operates under identical conditions as Scenario A, with the major difference being that committed transport projects are excluded from consideration. This provides a more direct comparison to observed year 2010 conditions; that is, how existing networks cope with future (year 2027) demand.

Scenario C contains variants of future scenarios.

- Scenario C-1: "Maximum infrastructure" scenario. The "existing plus committed" transport network is enhanced by the inclusion of (a) some elements of the strategic MiNTS corridors; (b) additional projects proposed (but not committed) by transport service providers, and (c) transport linkages contained in the *Egypt Vision 2052* document. The rail network includes provision for "high speed" (TGV/Shinkansen-class) services in some corridors. The analysis reflects a more market oriented approach ("user pays principle) with the adoption of market fuel cost[8] forcing an emphasis on the non- road modes.

- Scenario C-2: "Reduced infrastructure" scenario evolves towards a less complex/expensive network vis-à-vis that of Scenario C-1. For example, high speed rail is replaced by "higher speed rail" (operating speed 160-200 km/hr). Fuel price increases are less severe than Scenario C-1.

- Scenario C-3: "Revenue generation" scenario builds upon previous tests by utilizing reduced infrastructure (as per Scenario C-2). In addition, the Scenario C-1 fuel pricing structure is

[7] In this instance, the committed projects is a reference to those projects considered committed by their transport service provider sponsor. These projects are now considered as part of the MiNTS evaluation procedure.

[8] This is in essence in equivalent to the removal of the current fuel subsidy.

increased by some 20 percent of per-liter costs. The intent is to simulate possible revenues which can be derived from levying a simple fuel tax at the pump as in many other countries or an environmental tax as is under consideration currently in many countries. In this scenario there is a significant shift towards the non-road modes of transport.

The scenarios are summarized in Tab le 5.3.1.

Table 5.3.1 Overview of Transport Scenarios

Scenario	Scenario Reference	Fuel Price(1)	Input Network	Modal Focus
A	Do Minimum	Current	Existing plus Committed	Road
B	Do Nothing	Current	Existing	Road
C-1	Maximum Infrastructure	Market Price	Existing plus Committed plus All New	Non Road
C-2	Reduced Infrastructure	Less than Market Price but higher than Existing Price	Existing plus Committed plus Most New	Non Road-Passenger Road-Cargo
C-3	Revenue Generation(2)	Market Price plus "at the pump" tax	Existing plus Committed plus Most New	Maximum Non Road

Source: JICA Study Team.

(1) Fuel price expressed in constant year 2010 terms. Increase percentages are approximate for presentation and discussion purposes. One hundred percent increase in fuel prices approximates removal of all fuel subsidy. More than 100 percent increase in fuel price includes additional "at the pump" tax approximately equal to 20 percent of per liter cost. In scenario C2, the overall fuel price increase approximates to the removal of the fuel subsidy on commercial transport only.

(2) Revenue generated via imposition of "at the pump" per-liter tax.

The current "road focused" capital works programs and limitations to public transport services. Increasing car usage is beginning to impact the quality of life. A more balanced approach to providing mobility is desirable. A key focus of MiNTS, strongly supported by both the Study Team and client group, is therefore is the creation and promotion of high quality, multi-modal (and intermodal) transport system for persons and cargo (this is discussed in more detail in the previous *Interim Report 2*). The evaluations of the scenarios therefore focuses on two aspects: diversion of cargoes to non-road (rail, inland waterway) modes of transport, and refocusing the role of passenger transport onto those means of conveyance seen as being compatible with longer trips.

The MNaM simulations suggest that, in case of cargo[9] (Table 5.3.2):

- The road mode is expected to retain its vital role; however, the dominance is reduced depending on scenario.

[9] Pipelines are not included in this analysis.

- The impact of the adoption of market fuel price (for example, for trucks) is reinforced by Scenario C-1 where non-road cargo shipments absorb near five percent of totals.

- Partial increase in fuel price (Scenario C-2) confirms that the road mode is resuming its overall dominancy by approaching observed modal splits.

- The most optimistic modal split is Scenario C-3, where non-road cargo tonne transport is on the order of 10 percent. Under Scenario C-3, fuel costs have, in year 2010 terms, more than doubled with the adoption of market fuel price together with an "at the pump fuel tax".

- Rail and inland waterway tend to carry "heavier and bulkier" cargoes, often over longer distances, than the road mode. Thus, tonne kilometer modal splits are expected to exceed those of tonne transport. In case of Scenario C-3, for example, the tonne kilometer modal share for non-road modes approaches 20 percent.

Table 5.3.2 Modal Split – Year 2027 Cargo Shipments

Scenario	Road	Rail	Inland Waterway	Total
Daily Tonnes				
A	2,742,400	16,700	30,700	2,789,800
B	2,742,400	16,700	30,700	2,789,800
C-1	2,664,300	64,200	61,400	2,789,800
C-2	2,736,800	22,300	30,700	2,789,800
C-3	2,535,600	139,800	114,400	2,789,800
Tonne Modal Allocation (Percent)				
A	98.3	0.6	1.1	100.0
B	98.3	0.6	1.1	100.0
C-1	95.5	2.3	2.2	100.0
C-2	98.1	0.8	1.1	100.0
C-3	90.9	5.0	4.1	100.0
Daily Tonne Kilometers (Million)				
A	633.01	6.13	3.31	642.45
B	647.45	5.78	3.11	656.34
C-1	568.21	37.22	23.48	628.92
C-2	623.21	5.19	2.27	630.67
C-3	517.95	75.72	48.23	641.91
Tonne Kilometer Modal Allocation (Percent)				
A	98.5	1.0	0.5	100.0
B	98.6	0.9	0.5	100.0
C-1	90.3	5.9	3.7	100.0
C-2	98.8	0.8	0.4	100.0
C-3	80.7	11.8	7.5	100.0

Source: JICA Study Team.

The increased diversion of cargo from road to non-road modes also carries considerable implications in terms of required infrastructure. In case of road, being the dominant carrier, demand over base year 2010 increases, across all scenarios, by a factor of 2.2 to 2.4 (Table 5.3.3). Thus, road systems are less sensitive to cargo activity in terms of underlying infrastructure required. However, the situation is very different for the rail and IWT modes.

- It may be stated that, for rail and inland waterway, tonnage is expected to increase to year 2027 by factors of 1.7 and 1.4, respectively, assuming the current modal split is largely maintained and given the expected expansion of the Egyptian economy. This situation is represented by Scenarios A and B. Thus, enhancements are required which permit these modes to almost double their present tonnage.

- Rail carriage is shown as increasing by factors of 6.7, 2.3 and 14.6 for Scenarios C-1, C-2 and C-3, respectively. Based on existing annual carriage of 4.04 million tonnes, the year 2027 demand would be 27.1, 9.3 and 58.9 million tonnes, respectively. The highest totals carried by rail over the past decade is on the order of 12 million tonnes; thus, Scenario C-2 can be seen as "regaining past capabilities". That is, under the assumption that having carried such volumes before, rail upgrading can focus on rehabilitation of existing resources with minimal network expansion. However, this is unlikely to be the case for other scenarios, in particular C-3. The notion of carrying near 60 million tonnes is daunting.

- Inland waterway carriage is shown as increasing by factors of 2.9, 1.4 and 5.3 for Scenarios C-1, C-2 and C-3, respectively. Based on existing annual carriage of 2.23 million tonnes (excluding cross-Nile ferry services), the year 2027 demand would be 6.5, 3.1 and 11.8 million tonnes, respectively. This highest recent totals carried by IWT is on the order of three million tonnes; thus, Scenario C-2 can be seen as "regaining past capabilities". However, this is unlikely to be the case for other scenarios, in particular Scenario C-3 (11.8 million tonnes) which his likely to require considerable system upgrades.

Table 5.3.3 Relative Increase in Tonne Shipments: Year 2010 to Year 2027

Scenario	Road	Rail	Inland Waterway	Total
Base Year 2010	1.0	1.0	1.0	1.0
A	2.4	1.7	1.4	2.4
B	2.4	1.7	1.4	2.4
C-1	2.3	6.7	2.9	2.4
C-2	2.4	2.3	1.4	2.4
C-3	2.2	14.6	5.3	2.4

Source: JICA Study Team

The implications for carriage of persons are (Table 5.3.4):

- The air sector ("true" domestic travel without international connections) is likely to remain modest in extent, however, can be challenged by other modes as infrastructure is improved.

- The modal share of passenger cars is, as discussed earlier, sensitive to vehicle operating costs, including the price of fuel. Thus, as fuel prices increase modal share falls. Under Scenarios C-1 and C-2 (about 100 percent and 50 percent increases in fuel price but differing road networks) modal share falls from roughly 18 to 11 percent. Under Scenario C-3, which more than doubles the price of fuel, modal share for longer distance car trips falls to eight percent.

- Under all scenarios, the main benefactor of modal shift are long distance bus services. Under Scenarios A and B (full subsidy) shares hover near 24 percent. However, these escalate to the mid to upper 30's under the C scenarios.

- Shared taxi modal shares remain within defined ranges for all scenarios. This may imply that the shared taxi network is more oriented to shorter trips and functions, to varying degrees, as a de-facto feeder service for bus and rail modes.

- The opportunities for high speed, or higher speed, rail passenger services are noted. However, the modal shares imply that high(er) speed rail passengers may, in fact, be largely "cannibalized" from lower speed rail services.

Table 5.3.4 Modal Split – Year 2027 Person Travel

Scenario	Air	Car	Shared Taxi	Bus	Rail	High(er) Speed Rail	Total
Daily Person Trips							
A	124,781	1,089,089	1,980,669	1,473,352	1,412,872	0	6,080,763
B	220,333	1,079,346	1,882,524	1,449,681	1,448,880	0	6,080,763
C-1	60,608	631,969	2,181,262	2,077,215	785,015	344,694	6,080,763
C-2	80,227	638,396	2,110,816	2,072,182	877,390	301,753	6,080,763
C-3	76,804	461,390	2,083,399	2,363,700	822,866	272,604	6,080,763
Person Trip Modal Allocation (Percent)							
A	2.1	17.9	32.6	24.2	23.2	0.0	100.0
B	3.6	17.8	31.0	23.8	23.8	0.0	100.0
C-1	1.0	10.4	35.9	34.2	12.9	5.7	100.0
C-2	1.3	10.5	34.7	34.1	14.4	5.0	100.0
C-3	1.3	7.6	34.3	38.9	13.5	4.5	100.0
Daily Person Kilometers (Million)							
A	24.92	301.94	271.16	267.29	218.98	0.00	1,084.29
B	42.40	302.10	259.12	262.60	244.96	0.00	1,111.18
C-1	12.99	180.44	310.97	412.25	118.79	42.32	1,077.75
C-2	16.95	176.63	298.78	420.67	132.70	36.68	1,082.41
C-3	16.28	125.91	295.76	488.52	127.02	33.11	1,086.60
Person Kilometer Modal Allocation (Percent)							
A	2.3	27.8	25.0	24.7	20.2	0.0	100.0
B	3.8	27.2	23.3	23.6	22.0	0.0	100.0
C-1	1.2	16.7	28.9	38.3	11.0	3.9	100.0
C-2	1.6	16.3	27.6	38.9	12.3	3.4	100.0
C-3	1.5	11.6	27.2	45.0	11.7	3.0	100.0

Source: JICA Study Team. Includes long distance trips of more than 100 km in length.

5.4 THE PREFERRED SCENARIO

The MiNTS Study Team preferred Scenario is a hybrid between Scenarios C-1 and C-2; to wit:

- The preferred scenario includes the adoption of a "user pay principle" vis-à-vis the market cost of fuel. That is, operating cost calculations reflect the adoption of market fuel price (as per Scenario C-1), in constant year 2010 terms, over the 20 year MiNTS planning horizon but the scenario does not include any allowance for an "at the pump" fuel tax;
- The Networks proposed across all modes for the preferred scenario are derived recognizing both quantitative (MNaM outputs) plus qualitative (MiNTS vision, policy and strategy) parameters;
- Rail networks will not consider any TGV/Shinkansen-class systems, instead focuses on Higher Speed Rail(HSR) defined as rail with an average operating speed of 200 km/hr (a HSR link between Cairo and Aswan is included in the preferred scenario project list for evaluation;
- The road transport networks will tend towards improvements consisting of ongoing plus planned projects, as per Scenario C-1;
- As befitting a national-scope transport study, MiNTS planning focuses on longer distance trips. This excludes, by definition, urban trips in the road sector, commuter services in the railway sector and cross-Nile ferry services (and similar) in the inland water sector; and,
- The need for enhanced intermodal and/or logistics systems is to be fully considered to ensure full potential for the movement of persons and goods among the various modes. The preferred scenario now includes a western intermodal corridor linking the Red and Mediterranean seas to a proposed value added logistic center to the west of the 6th October. This is discussed in further detail in later parts of this report.

5.4.1 Preferred Scenario Synopsis

The evaluation of scenarios is based on a series of cascading applications of the MNaM. The presentation format in following sections focuses on the main evaluation points of the initial scenarios in comparison to the preferred scenario. These include conformity with transport vision and policy, transport system capacity,

Conformity with Transport Policy	Non-Road Modal Share (percentage) for Cargo and Person Trip
Transport System Capacity	Road Congestion (percentage of all roads congested), Average of Road Network Speed
Environmental Impacts	Reduction of CO_2 emission (tonnes base)
Economic Efficiency	Benefit *first year* /Cost *(Benefit: VOC saving, Time saving)*
Affordability	Total Project Cost (Road, Rail, IWT)

Source: JICA Study Team

Figure 5.4.1 Scenario Evaluation Criteria

environmental impacts, economic efficiency and affordability (Figure 5.4.1).

Following is firstly an initial comparison of the preferred scenario, D with reference to Scenario A and Scenario C with respect to vision conformity and thence a discussion of the preferred Scenario D with respect to all the scenarios and the broader network, environmental and economic performance.

5.4.2 Conformity with Vision and Policy

The road mode remains under the preferred scenario an essential factor in economic activity as this sector has historically played a strong role in modal choice for Egypt. While this phenomena has fulfilled a variety of social goals and expectations, unfettered growth is also contributing to various negative social, economic and environmental impacts. However there is now a modal focus away from the road sector in the case of cargo and away from the private car in the case of passenger transport.

The high level of car usage is a historic consequence of vehicle ownership characteristics, pricing policies (such as the non- adoption of market fuel price), supported by "road focused" capital works programs and limitations to public transport services. Increasing car usage is beginning to impact the quality of life. A more balanced approach to providing mobility is desirable. A key focus of MiNTS, strongly supported by both the Study Team and client group, is therefore is the creation and promotion of high quality, multi-modal (and intermodal) transport system for persons and cargo. The performance of the preferred scenarios therefore focuses on two aspects: diversion of cargoes to non-road (rail, inland waterway) modes of transport, and refocusing the role of passenger transport onto those means of conveyance seen as being compatible with longer trips.

The MNaM simulations suggest that, in case of cargo as stated earlier (Table 5.4.1):

- The road mode is expected to retain its vital role; however, the dominance is reduced.
- The impact of adoption of market fuel price (for example, for trucks) is confirmed in Scenario D.

The increased diversion of cargo from road to non-road modes also carries considerable implications in terms of required infrastructure. In case of road, being the dominant carrier, demand over base year 2010 increases, across all scenarios, by a factor of 2.3 in terms of tonnes (Table 5.4.2). Thus, road systems are less sensitive to cargo activity in terms of underlying infrastructure required. However, the situation is very different for the rail and IWT modes.

It may be stated that, for rail and inland waterway, tonnage is expected to increase to year 2027 by a factors of 5.8 and 2.6, respectively, in the preferred scenario. This is in contract to Scenario A where the existing mode split is essentially maintained even given the expected expansion of the Egyptian economy. Thus, enhancements are required which permit these modes to almost double their present tonnage.

The implications for carriage of persons are (Table 5.4.3):

- The air sector ("true" domestic travel without international connections) is likely to remain modest in extent, however, can be challenged by other modes as infrastructure is improved.
- The modal share of passenger cars is, as discussed in Section 5.3. of this report, sensitive to vehicle operating costs, including the market price of fuel. Thus, as fuel prices increase modal share falls. Under Scenarios C-1 and D (about 100 percent increases in fuel price but differing road

networks) modal share falls from roughly 18 to 15 percent. The introduction of HSR infrastructure including the link from Cairo to Aswan attracts modal share from road based public transport in particular between Scenario C1 and D, the modal passenger share for bus and shared taxi decreases by 7% and 8.5% respectively. However in Scenario D the additional road network improvements also attracts further car trips.

Table 5.4.1 Modal Split – Year 2027 Cargo Shipments[10]

Scenario	Road	Rail	Inland Waterway	Total
Daily Tonnes				
A	2,742,400	16,700	30,700	2,789,800
C-1	2,664,300	64,200	61,400	2,789,800
D	2,678,200	55,800	55,800	2,789,800
Tonne Modal Allocation (Percent)				
A	98.3	0.6	1.1	100.0
C-1	95.5	2.3	2.2	100.0
D	96.0	2.0	2.0	100.0
Daily Tonne Kilometers (Million)				
A	633.01	6.13	3.31	642.45
C-1	568.21	37.22	23.48	628.92
D	579.02	39.18	23.15	641.35
Tonne Kilometer Modal Allocation (Percent)				
A	98.5	1.0	0.5	100.0
C-1	90.3	5.9	3.7	100.0
D	90.3	6.1	3.6	100.0

Source: JICA Study Team.

Table 5.4.2 Relative Increase in Tonne Shipments: Year 2010 to Year 2027

Scenario	Road	Rail	Inland Waterway	Total
Base Year 2010	1.0	1.0	1.0	1.0
A	2.4	1.7	1.4	2.3
C-1	2.3	6.7	2.9	2.3
D	2.3	5.8	2.6	2.3

Source: JICA Study Team

[10] Tables 5.4.1, 5.4.2 and 5.4.3 include only selected scenarios for comparative purposes. The results of all scenarios are presented in Tables 5.3.2, 5.3.3 and 5.3.4 respectively.

Table 5.4.3 Modal Split – Year 2027 Person Travel

Scenario	Air	Car	Shared Taxi	Bus	Rail	High Speed Rail	Total
Daily Person Trips							
A	124,781	1,089,089	1,980,669	1,473,352	1,412,872	0	6,080,763
C-1	60,608	631,969	2,181,262	2,077,215	785,015	344,694	6,080,763
D	66,518	885,238	1,632,491	1,617,833	936,607	815,853	5,954,540
Person Trip Modal Allocation (Percent)							
A	2.1	17.9	32.6	24.2	23.2	0.0	100.0
C-1	1.0	10.4	35.9	34.2	12.9	5.7	100.0
D	1.1	14.9	27.4	27.2	15.7	13.7	100.0
Daily Person Kilometers (Million)							
A	24.92	301.94	271.16	267.29	218.98	0.00	1,084.29
C-1	12.99	180.44	310.97	412.25	118.79	42.32	1,077.75
D	13.36	253.88	221.05	301.88	138.18	131.58	1,059.93
Person Kilometer Modal Allocation (Percent)							
A	2.3	27.8	25.0	24.7	20.2	0.0	100.0
C-1	1.2	16.7	28.9	38.3	11.0	3.9	100.0
D	1.3	24.0	20.9	28.5	13.0	12.4	100.0

Source: JICA Study Team. Includes long distance trips of more than 100 km in length.

5.4.3 Road Network Performance

Findings suggest that (Figure 5.4.2):

- Operating speeds for the C-series of scenarios, all of which include considerably enhanced infrastructure vis-à-vis Scenarios A and B, are considerably higher averaging near 55 kilometers

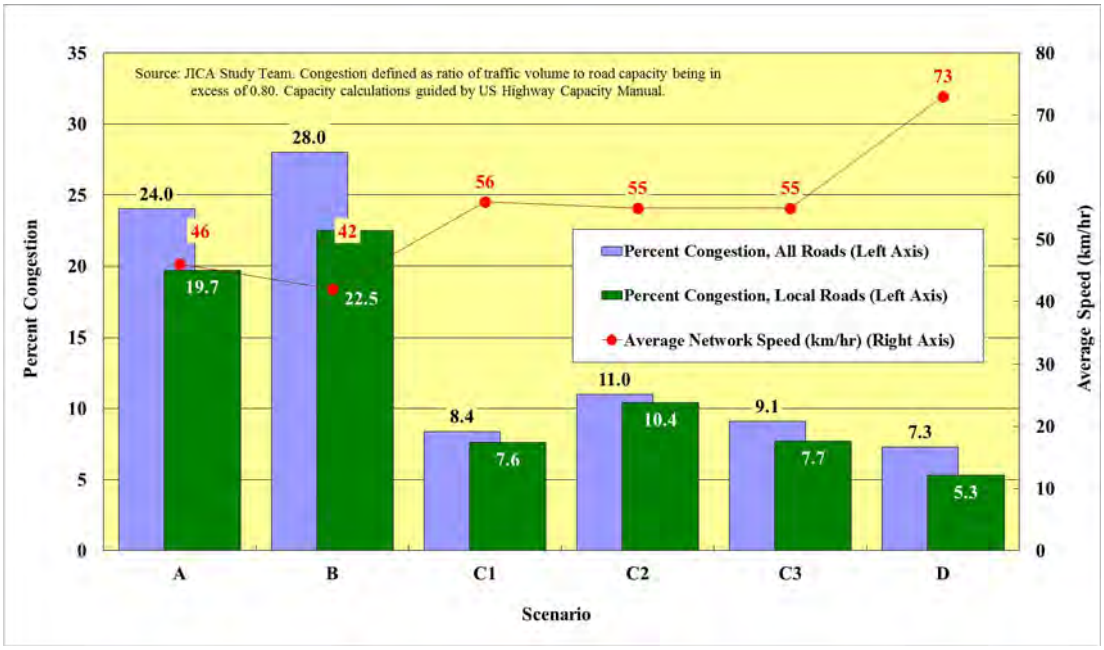


Figure 5.4.2 Comparison of Road Network Performance Indicators

per hour across all road network links. Scenarios D which also focuses on non- road transport including a HSR link between Cairo and Aswan exhibits a strong network performance.

- The congestion rate, that is, percent of all road links operating at unacceptable levels of service (defined as a volume to capacity ratio in excess of 0.8) is noticeable higher under Scenarios A and B. This is not surprising given the more limited networks and the fact that full fuel subsidy is in place. Scenarios D records least congestion; again, this is expected in that not only does this include the adoption of market fuel costs but also an extended HSR network.

5.4.4 Environmental Impacts

One of the criteria for the selection of the preferred scenario is that the scenario with the best environmental performance should attract a high score in any evaluation of alternative scenarios. Measures that are often considered in the environmental evaluation of transport scenarios include carbon dioxide, carbon monoxide, sulphites and particulate matter. Carbon dioxide is the measure most often linked with greenhouse emissions. It is for that reason that this measure has been chosen to order the impact of the five transport scenarios on environment performance.

If Scenario B is set at an index of 100, then in the case of both Scenario C-1 and D from both sources, there is a reduction of between 7 percent and 10 percent in carbon dioxide emissions as seen in Figure 5.4.3. In the case of the more expansive Scenario C-3, the emission reduction varies between 10 percent and 18 percent. Both data sources suggest that even Scenario D will have a positive impact on the reduction of carbon dioxide emission.

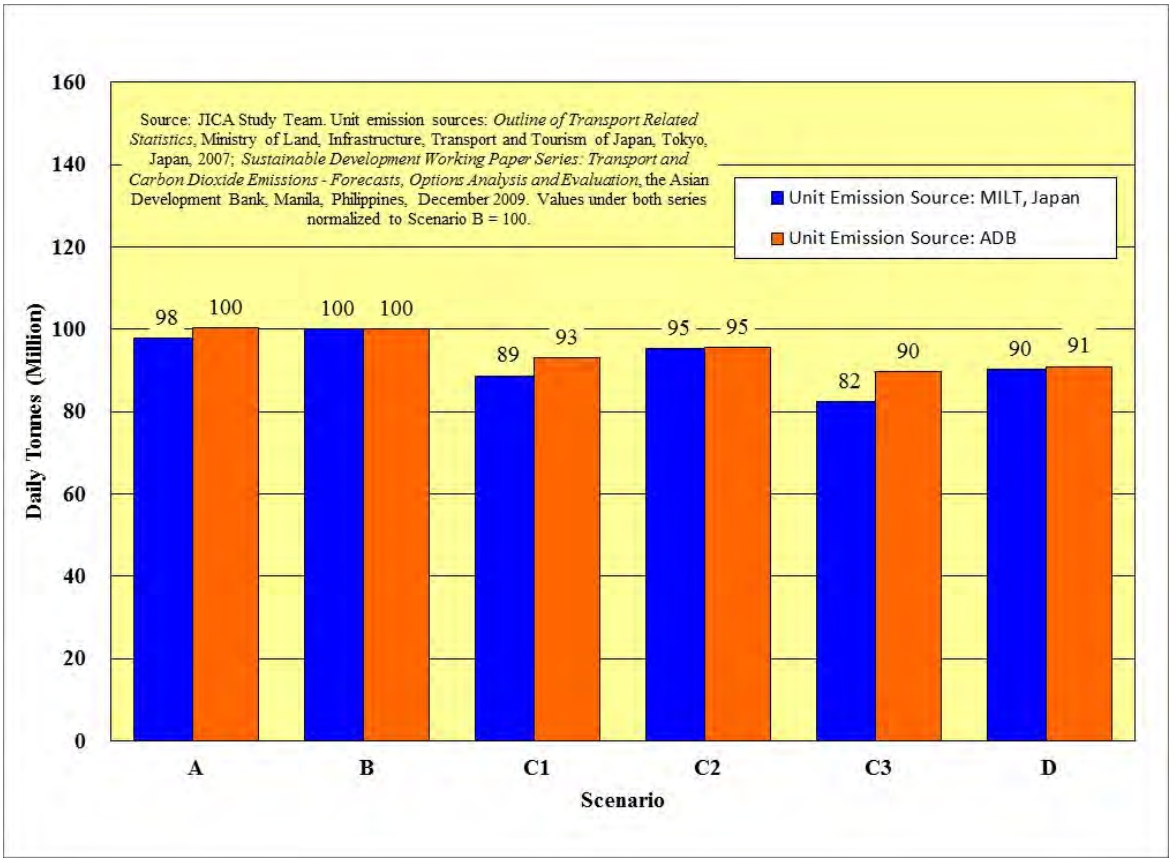


Figure 5.4.3 Comparison of Carbon Dioxide (CO_2) Emissions

5.4.5 Affordability

The cost of the scenarios varies with highest cost being Scenario D as this scenario includes the most extensive HSR network. A detailed cost analysis of the project list included in the preferred scenario is presented later in this report. The issue of affordability must also be considered in association with budget availability.

5.4.6 Economic Efficiency

One of the criteria for the selection of the preferred scenario is that the scenario with good economic performance should attract a high score in any evaluation of alternative scenarios. For even a preliminary economic evaluation, it is necessary to estimate both the project costs and the economic benefits associated with each scenario. The economic benefits are estimated from savings in both in operating costs for both person and cargo and transport operational cost savings in the case of cargo.

The economic implications are presented in Figure 5.4.4. Scenario A incurs the lowest cost of any of the scenario but is associated with a relative low return of economic benefits. Scenarios C-1, C-2 and C-3 incur a capital cost increase of the order of around three times whilst he capital cost of Scenario D is even higher. However, the evaluation of Scenarios results in an increase in economic benefits or savings of more than ten times of that as Scenario A. (Scenario B is used as the base in the estimation of economic savings.) A comparison of the ratio of the annual economic benefits to scenario costs suggests that Scenario D performs good in economic terms.

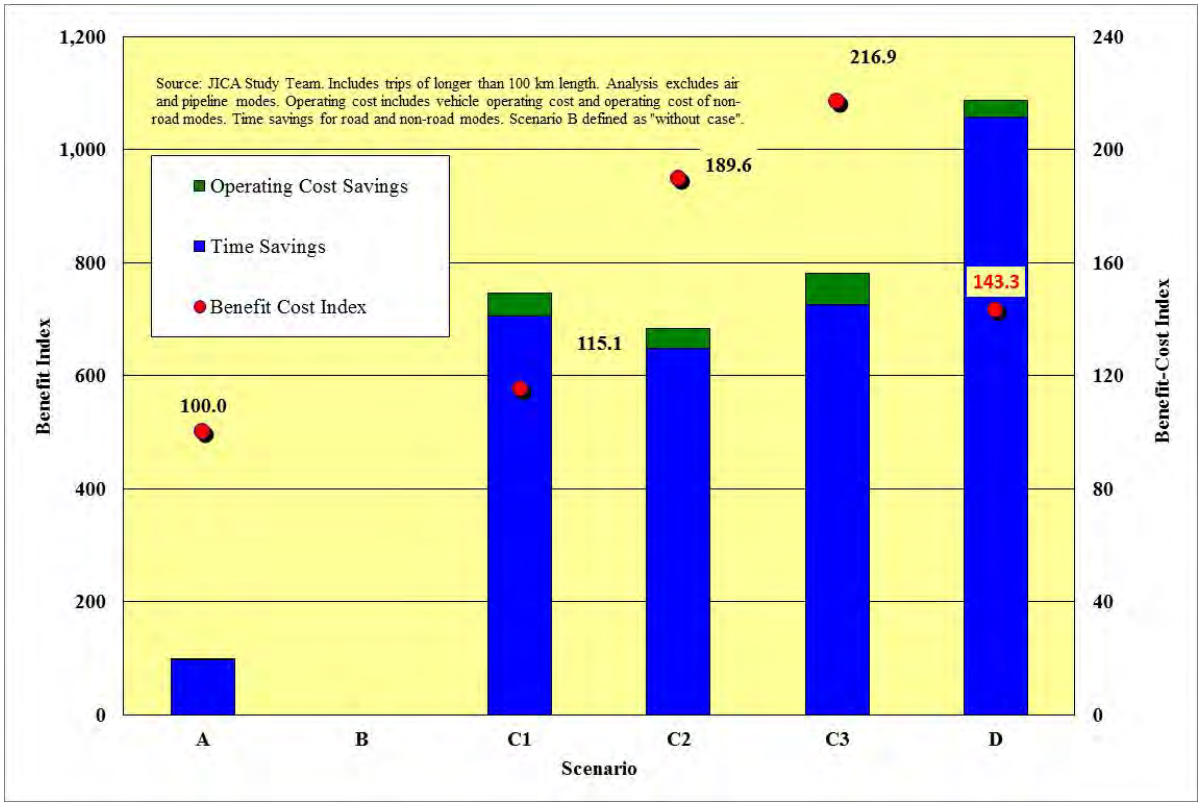


Figure 5.4.4 Comparison of Economic Performance Indicators

5.5 CORE CONCLUSIONS

Key implications of the preferred scenario together with important socio demographic characteristics are shown in Table 5.5.1. The adoption of the preferred scenario will enhance national development namely:

- Modal Shift towards more efficient passenger transport in terms of rail and movement other than the car mode;
- Modal Shift towards IWT and rail for Cargo transport;
- Long Distance Passenger infrastructure requires a seven fold increase in rail capacity in terms of passenger kilometers of travel; and
- Cargo rail infrastructure requires an eight fold increase in rail capacity in terms of tonne kilometers of travel.

The preferred scenario exhibits enhanced performance in road network efficiency, environmental indicators and economic efficiency in comparison to other scenarios investigated by the JICA Study Team.

Table 5.5.1 Preferred Scenario Comparison with Base Year

Characteristics	Year		Growth Factor
	2010	2027	
Population	78,358,829	107,280,786	1.4
GDP (Constant '09 Bil LE)	1,092	2,642	2.4
GDP per Capita (Constant '09 Bil LE)	13,930	24,630	1.8
Daily Tonne - Km (Mil)	213	641	3.0
Daily Non Road Tonne Km(Mil)	8	62	7.8
Daily Non Road Mode Split (Tonne-Km basis)	3.8%	9.8%	2.6
Long Distance Car Trips	329,323	443,500	1.4
Long Distance Person-Km (Mil)	611	1,059	1.7
Long Distance Rail Person Km (Mil)	40	270*	6.8

Source: JICA Study Team.

*: long distance person trips are those grater than 100 km, rail person trips includes HSR passengers.