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PRELIMINARY THOUGHTS ON ITSAM INFORMATION SYSTEM (ITSAM-IS)

A discussion paper
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1. Introduction

The development of an "Integrated Transport System for Arab Mashrek (ITSAM)" constitutes a central part of the work programme of the Transport Section (TS) of the Sectoral Issues and Policies Division (SIPD) of ESCWA. Since its inception in the first session of the intergovernmental Transport Committee of ESCWA countries in February 1999, ITSAM development has been pursued along three main tracks namely:

- An integrated regional network;
- An associated information system; and
- An analytical framework for policy analysis.

The first edition of the map of the integrated regional network and its associated statement has officially been cleared and announced by the commission in its 20th session held in Beirut in the period from 25 to 28 May 1999. Efforts are currently underway to enhance the map and develop it through an appropriate GIS software. This activity is envisaged as a continuous endeavor to be conducted in close consultation with Member States and published periodically on regular intervals.

The purpose of this paper is to initiate a substantive and brain storming discussion on the second track namely the associated information system, hereinafter referred to as ITSAM-IS; its purpose, scope and its structure. Several schemes are readily suggested by regional institutions with varying degrees of maturity that have to be taken into account as regards their prospects of implementation. At this stage however, as will be pointed out in this paper, emphasis should be made on harmonization measures that have to be effected in order to render subsequent stages of system development an easy and smooth undertaking.

2- The Normative Goal: A Bottom-up Approach

The rapid changes in information technology in the last few decades or so have introduced several modifications in the traditional information concepts. On the one hand there has been a wide expansion in the set of applications required from a certain data system that is related to a geographic base. On the other hand, drastic developments have been introduced in information dissemination through intra nets and the global INTERNET.

Thus, in its normative picture, the envisaged system could be conceived ultimately as one integral and logical DATABASE that is relational to a geographic base map and made up of mutually accessible nationally distributed transport information systems (NTIS's) in countries of the region.

Fig (1) gives a schematic representation of the conceptual NTIS and its possible domestic and foreign (regional and international) relations.

The architecture of an individual database could be viewed from several perspectives or levels namely;

1. The INTERNAL view or level which is the one closest to the internal physical storage.
2. The EXTERNAL view or level which is the perspective of individual user.
3. The CONCEPTUAL view or level which is the abstract representation of the whole database in its entirety.

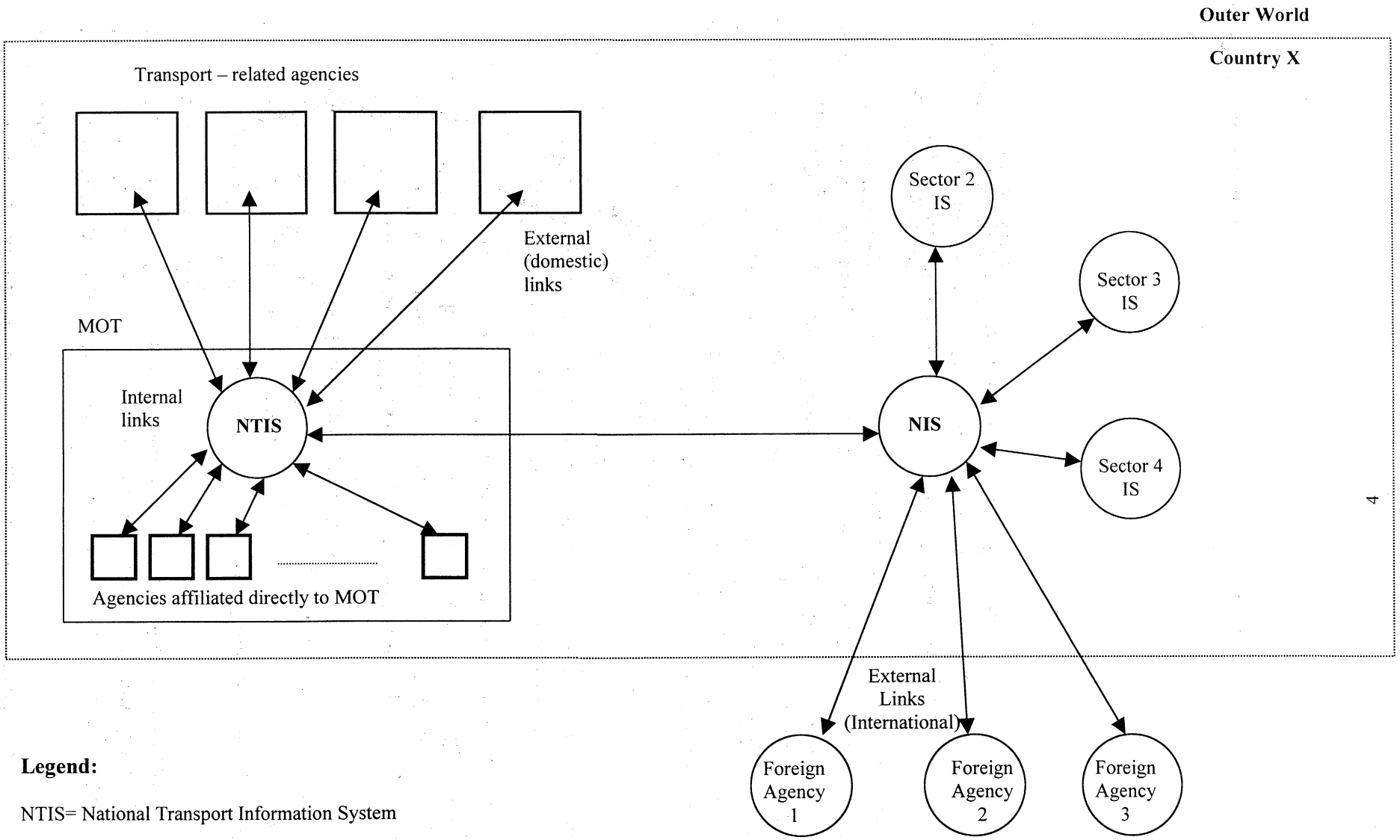
At the national levels, it is necessary to make a clear distinction between the identification of the sector as a functional entity in the national economy and its institutional set up. While the administrative jurisdiction of the MOT might not cover all the units comprising the sector, yet the extent of coverage of the NTIS should entail all such units.

Hence, the individual NTIS has to integrate all the transport proper agencies of the country in the sense that it should be shared by these agencies in a way that avoids to a good extent data redundancy. Therefore, the national system, in turn, would be a distributed system whose components are interconnected or accessible to each other through appropriate means.

Fig. (2) is an attempt to put the above concepts in a schematic form. The area of the outer circle in the figure is divided into several individual sectors. The national agency in charge of each individual sector is indicated outside the circle.

Three layers could be distinguished on each individual sector on the circle representing the NTIS. Layer 1, the outer layer, is an operational layer. It encompasses all the data and applications required for the daily functioning of the sector. Layer 2, the middle layer, would contain all the data and applications required for a Management Information System (MIS) of the agency in charge of the sector. Layer 3, the inner core circle, will contain the data and applications required for a sector policy and planning Decision Support System (DSS). While Layers 1 & 2 of the system may reside in the respective agency (or the respective ministry other than transport as is the case with air transport), layer 3, the core of the whole system should reside in the respective MOT.

For a particular individual sector, say ports, the degree of aggregation of data will increase as we move towards the inner layers and visa versa. Similarly, applications will increasingly be geared towards national objectives as we move in this direction.



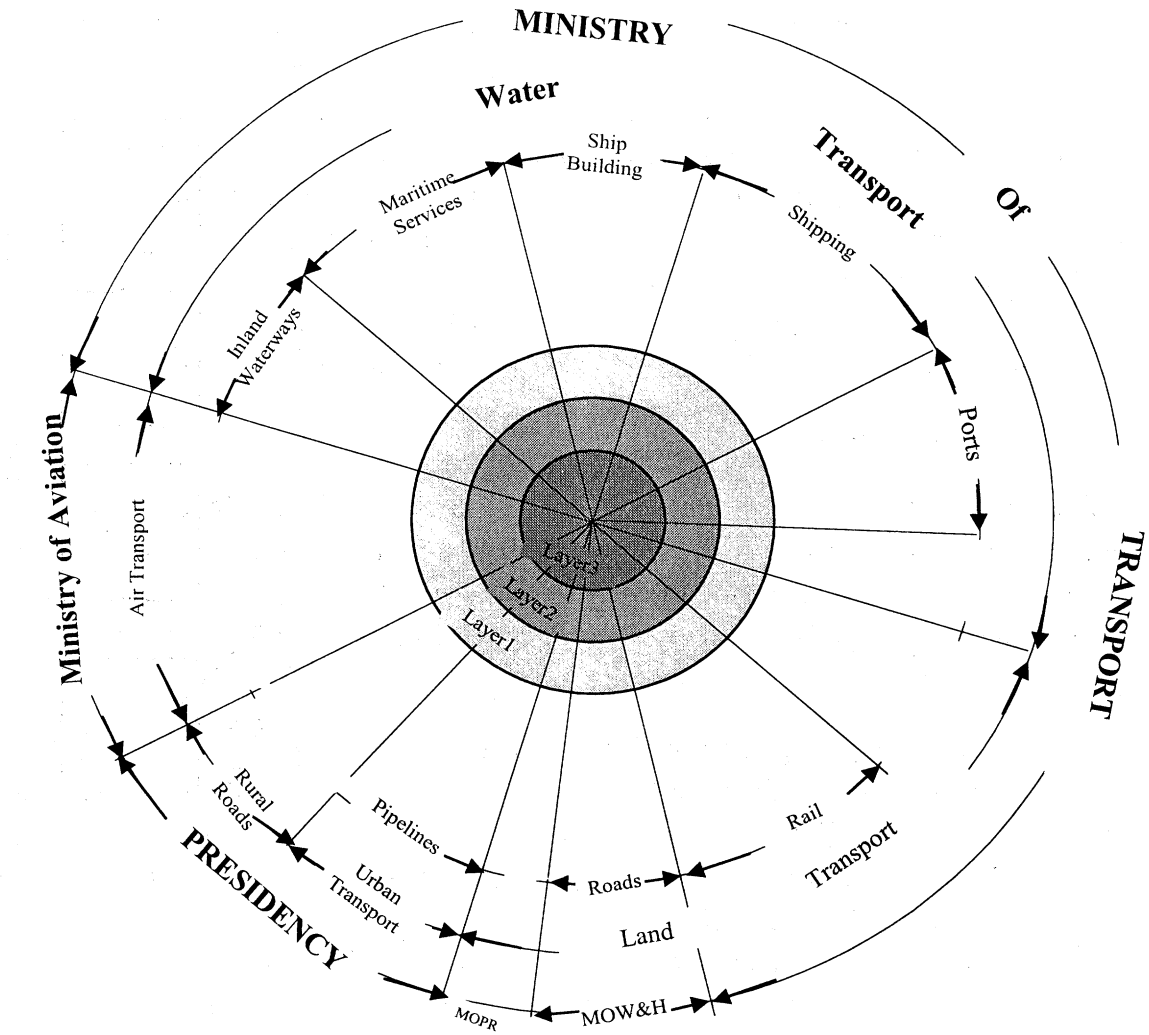
Legend:

NTIS= National Transport Information System

NIS= National Information System

MOT= Ministry of Transport

Fig. (1): Proposed Internal & External Relations of the NTIS



Layer 1= Operational (Data/ Applications)
For the daily operations of the Transport agency

Layer 2 = Managerial (Data /Applications)
Management information system (MIS)

} Reside in the respective department of the Transport agency

Layer 3 = Transport Policy & Planning (Data/ Applications)
Decision Support system (DSS) for the

} Reside in the PRS department of the MOT

Fig. (2): Scope and coverage of the different layers of an Integrated Transport Sector information system

As a first priority, the inner core of the system has to be automated. The outer and middle layers of the sectors normally do currently exist in some form irrespective of whether this form is organized or not, comprehensive or not. They might currently be also automated or manual (as is the case with the majority of the situation). Automation of such layers should follow a certain prioritization scheme. If the information of the outer and middle layers are computerized then a link must be established with the inner core. If this information was manual, then some regular flow of information from these layers towards the center should be effected. This set up, thus, does not hinder any agency of the transport sector from establishing and expanding its own enterprise system so long as it is integrated with the core national system in a predetermined way.

3. The Regional Goal: A Top-Down Approach

While the normative picture of the envisaged system adopts a bottom-up idealistic approach, it is believed that a regional system based on the aggregation of national elements will be unrealistic and time consuming. From a pragmatic point of view, ITSAM-IS should start by setting a regional model that is eventually compatible with the national ones. This model should satisfy, inter alia, the following requirements:

- Serve as a pilot goal for national models;
- Serve as a depositary for the influx of data and information obtained by ESCWA Secretariat from national sources.
- Provide a consistent and reliable reference base for ESCWA studies and projects in the field of transport;
- Provide a framework to identify and resolve any data conflicts; and
- Serve as a source for future publishing of regional maps and statistics in transport.

4. Towards Implementation: Prerequisite Considerations

4.1 A Regional Zoning System

It is clear that a zoning system will be the logical first prerequisite for ITSAM-IS. A multiple level hierarchical system might be adopted. The first such level will evidently be the national boundaries of the ESCWA countries. Other zones might be added for the outer world, e.g. Europe, Asia, Africa,... etc. The subsequent levels of the national zones should adopt the administrative classification of the country concerned.

4.2 Standardization

At this early stage of developing ITSAM-IS, there is an excellent chance to lay the foundation for harmonized system since no previous commitments are currently imposed. Two desirable characteristics are of prime importance namely; homogeneity of data and compatibility with the applicable international trends.

The main tool to achieve homogeneity is standardization. Standardization applies for the statistics definitions, nomenclatures, classifications, and codes. Compatibility with global trends prevailing for the statistics of a given mode is the other major requirement. It facilitates cross-references and comparison issues with other countries.

For instance, air transport data should be along the same lines recommended by ICAO. These requirements could be found in ICAO bulletins published annually containing annual as well as monthly statistics of civil aviation fleets and traffic of ICAO countries. The classification, coding systems as well as source data reporting forms and filling instructions are given in these bulletins.

An appropriate reference for port statistics is the United Nations "Manual on a Uniform System of Port Statistics and Performance Indicators". The manual is prepared by the former shipping division of UNCTAD. The schemes presented in this manual were extensively discussed both with the World Bank staff and the United Nations Statistical Office. Both organizations gave their support to the proposed schemes.

The manual provides a statistics scheme on the port's level that allows the derivation of two sets of indicators, PRIMARY INDICATORS and SECONDARY INDICATORS. The first set allows the port's management to monitor performance while the second provides further information on such aspects as "why","when" and "how" pertinent to the results of the primary indicators if they are required.

The manual provides also a satisfactory coding system made up of the following components:

- Catalogue of ship type;
- Catalogue of handling code;
- Catalogue of packaging;
- Catalogue of delay causes;
- Catalogue of type of service;
- Catalogue of conferences operating in the study region;
- Catalogue of type of trade;
- Catalogue of countries;
- Catalogue of ship movements; and
- Catalogue of pre-berthing and sailing delay causes.

The data sources for such system are the port's documents as well as the physical field data collection operations by designated authority according to prescribed data collection forms. Data is then manipulated in certain ways (collation, regrouping, aggregation, ...etc.) and processed to develop the required indicators from each certain call of a certain ship to the port under consideration. Eventually overall port performance indicators are worked out for the port over the prescribed time span which is usually one year. The general scheme of the manual is shown in fig.3). It should be noted here that due to the special nature of container traffic, special data

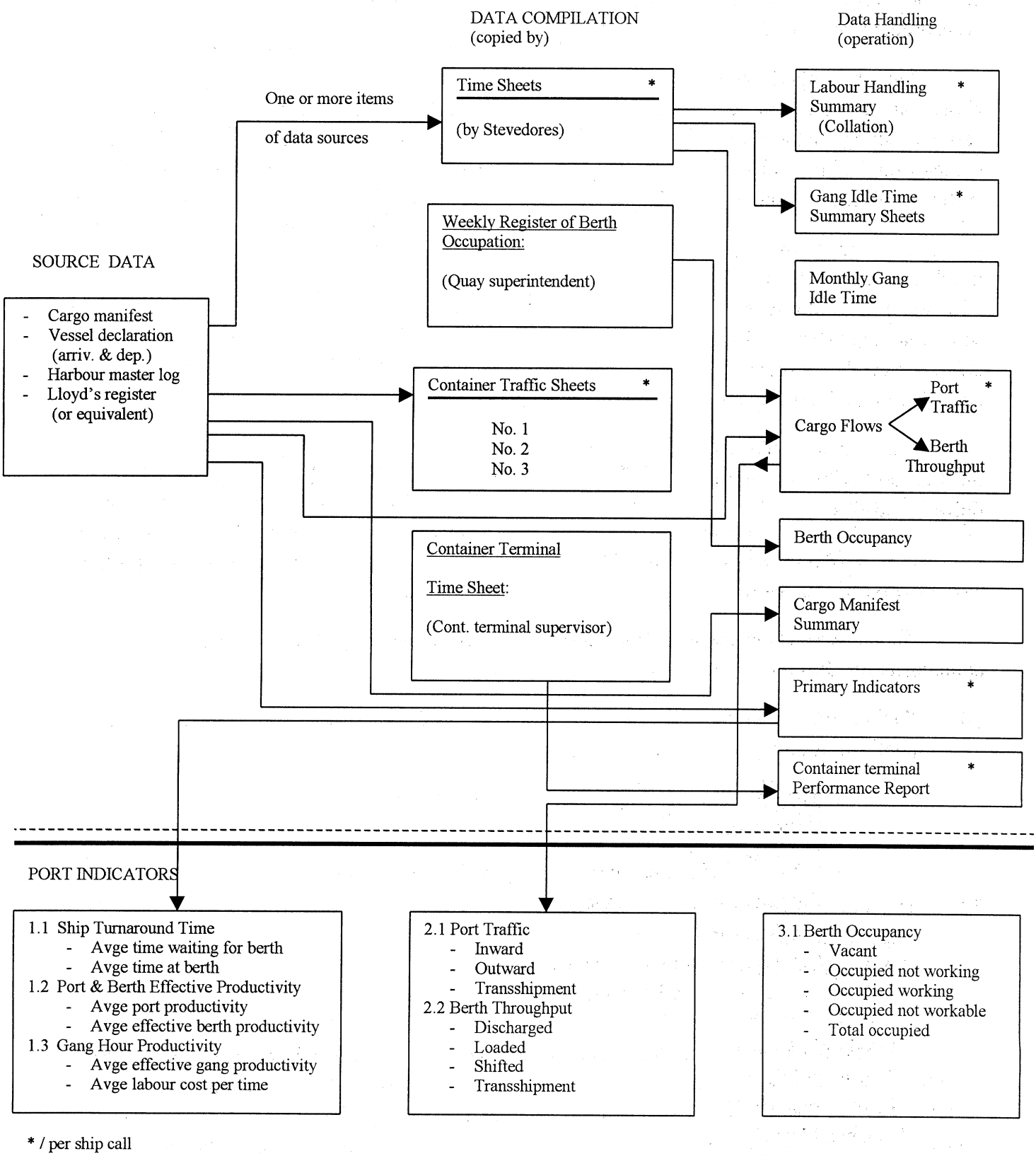


Fig. (3) General scheme for computing port performance indicators

collection forms are designed for such traffic and a separate container terminal performance report is accordingly produced.

On the other, the United Nations Maritime Transport Statistics adopts the (MTC) classification system for commodities. It is a 5-digit code that classifies cargo according to their cargo handling method where each commodity could be easily identified. It gives also a cross comparison list for correspondence with other trade classification systems such as the (SITC) system. It gives also other codes suitable for shipping statistics such as coastal area classifications.

In road transport, the work conducted in the World Bank in connection with the development of the Highway Design and maintenance standards Model (HDM) provides an adequate frame of reference for road data, both gravel and paved. This frame of reference might be somewhat sophisticated. However, it serves as a good normative goal towards which data collection efforts may be directed in a phased strategy according to a certain priority scheme. The classifications adopted by the model would be appropriate for the roads sector.

For railways, the statistical publications of the International Railways Union together with the transport statistics of the United Nations Statistical Office(UNSO) provides a signpost for railway statistics.

Annex (A) of this report is an attempt to put under one list, the main prerequisites for the envisaged NTIS. The list should be regarded as tentative and not in any way exhaustive.

Therefore, it is recommended that international statistical publications be reviewed to decide upon this issue. In summary the following list is recommended:

(a) Publications of the United Nations Statistical Office, New York particularly their publications on:

- The International Standard Definitions for Transport statistics;
- Bulletin of transport statistics; and
- The United Nations Maritime Transport Statistics.

(b) The International Civil Aviation Organization (ICAO), especially ICAO series designated "Digests of Statistics", "Statistical Yearbook", and "Manuals on Air Transport Statistics". ICAO digests series cover:

- "Traffic, Commercial Air Carriers" (annual)
- "ON-Flight Origin and Destination" (quarterly)
- "Traffic by Flight Stage" (annual)
- "Fleet-Personnel, Commercial Air Carriers" (annual)
- "Financial Data" (annual)
- "Airport Traffic" (annual)
- "Airport and Route Facilities" (annual)

(c) United Nations " Manual on a Uniform System of Port Statistics and Performance Indicators"

5. The Data Base Structure: Data, Entities & Attributes

One of the primary considerations in designing a meaningful information system is to have the size and level of sophistication of its data structure commensurate with the immediate and progressive needs of the potential users and their capacity to evaluate raw data and interpret outcome results.

Another consideration in identifying and classifying data structure items is to minimize data redundancy as well as to ensure the highest degree of modularity that would permit future expansion of the database against the increased demand imposed-on its applications.

Moreover, the objective uses of a national transport database should also be clearly defined at the outset. This definition will largely determine the general configurations and main features of the data structure. Moreover, it would help deciding the level of aggregation in the data system and consequently would shape future plans for data base expansion schemes. The structure suggested here will mainly serve decision support for transport policy and planning purposes.

In ITSAM-IS, it is recommended to adopt a data structure which is more inclined towards a modal classification. This is believed to be more appropriate to the needs of the users. For, on one hand, the trends prevailing in one mode could be easily applied to the respective modal section of the database. On the other hand, any possible derived statistical publications will adopt a modal approach. Moreover, modal classifications will be more commensurate with the institutional set-up of the transport sector on the national and regional levels.

To this end, two terms are introduced here namely; data ENTITIES and data ATTRIBUTES. Entities are classified into 9 modal groups and 7 non-modal groups as shown in table (1). The modal groups come under 3 modes of transport; land, water, and air. It could be noticed in table (1) that river transport is separated from inland waterways. At present sea-going vessels navigating inland are classified under maritime transport. The distinction between river and inland waterway transport could be made according to the sailing craft characteristics (sea-going vessels or river crafts). Rural roads are singled out in one group due to their special nature. Similarly is the case with urban transport. Inland border points are included as an entity since they are significant for border crossing and transport facilitation issues. Sea ports though not a mode of transport, are included under the overall water transport mode.

Each modal entity group is divided whenever applicable, into individual entities as shown in table (2). Entity groups and individual entities may be given a 3-digit code for each. Therefore, the traffic entity of the road transport will, for example, have the code (005.300)...etc.

Attributes on the other hand are particular pieces of information pertinent to a particular entity. For instance, the entity " road transport traffic" might have the following attributes:

- ton. kms, total network;
- tons transported, total network;
- passengers. kms, total network; and
- passengers traveled, total network.

...etc.

Attributes might alternatively be called DATA ELEMENTS while the particular value of such elements might be called DATA ITEMS.

No effort should be spared to establish a comprehensive data elements structure. However, data availability will unavoidably impose vacant or empty gaps in this structure.

Table (1): Classification Groups of Transport Data Entities

A - MODAL GROUPS:

	CODE
LAND:	000
ROAD TRANSPORT	005
RAIL TRANSPORT	010
PIPELINE TRANSPORT	015
WATER:	100
RIVER TRANSPORT	105
INLAND WATERWAYS TRANSPORT	110
NATIONAL SHIPPING	115
COASTAL SHIPPING	120
SEA PORTS	125
AIR:	200
AIR TRANSPORT	205
AIR PORTS	210

B- NON-MODAL GROUPS: 300

MULTIMODAL TRANSPORT	305
URBAN TRANSPORT	310
RURAL-ROADS	315
STORAGE	320
TRANSPORT INSTITUTIONS	325
INLAND BORDER POINTS	330
SOCIOECONOMIC	335

Table (2): Individual Entities of Each Modal Group

	CODE
Network	000
Infrastructure	100
Mobile Units	200
Traffic	300
Enterprises	400
Financial	500
Staff	600
Projects	700
Fuel & Energy	800
Safety	900
Performance Indicators	(no code)

6. Source, Collection, and Collation

To effect a harmonious data collection scheme, data sources should be well identified against the data elements structure pointed out in the previous section. The global statistical publications mentioned earlier specify usually the forms used to collect source data. Collation and processing operations will largely be decided by the output format. It is believed that it is too early to decide on these features in the time being.

Special attention should be given however to field collected data. These are: (a) traffic counts, (b) origin destination surveys and, (c) infrastructure inventory. These data collection scheme have to be conducted on a regular basis and carefully phased between countries of the region.

7. A Phased Strategy: The starting point

The development of the full-fledged data elements structure for the envisaged system will follow a staged strategy according to a prescribed priority scheme. To embark on this strategy it might be feasible to start with the regional network and infrastructure entities of the road and rail aspects of the land modal group as identified in table (1). Sea and Air ports are possible candidates also at this stage.

The already identified respective networks of the published map of ITSAM will perfectly serve this purpose.

ANNEX (A)

Prerequisite Classification & Unification Measures for the Envisaged NTIS

Prerequisite Classification & Unification Measures for the Envisaged NTIS:

A - CLASSIFICATION SYSTEMS FOR:

I- Maritime Transport 1/:

- Ship types
- Cargo handling in ports
- Packaging of Cargo
- Causes of ship delay in
- Shipping Services
- Conferences
- Type of Trade
- Countries
- Ship Movements in Port
- Pre-berthing and Sailing Delay Causes
- Sea-borne Commodities

II - Road Transport: 2/

- City codes.
- Road class
- Paved Road Surface Type
- Paved Road Base Type
- Unpaved Road Compaction Type
- Resealing Types
- Overlay Types
- Vehicle Types
- Axle Types
- Road Maintenance Operations

- Road Construction Operation

- Road maintenance standards 3/

- Road Construction standards 3/

III- Railway Transport:4/

- Railway Gauges

- Railway Lines

- Railway Tracks

- Rail Weights

- Sleepers

- Locomotives

- Coaches

- Wagons

- Signaling

B- UNIFIED SYSTEMS & NOMENCLATURE FOR:

- Zoning of the Country

- Notes and Symbols of statistical publication

- Legend (key) of transport maps

- Stages of transport project cycle

- Operating cost itemization for each mode

- Construction cost itemization for each mode

- Project benefits itemization for each mode

- Project exogenous costs itemization for each mode

- Project exogenous benefits itemization for each mode

1/ This section is along the lines adopted by UNCTAD's Manual

2/ This section is along the lines adopted in HDM

3/ A definition will be required

4/ This section is along the lines adopted by the International Railway Union.