Freight Transportation in Malaysia: Technological and Organizational Issues from an ITS Perspective

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Introduction
The inception report has a broader perspective than the previous one, which focused mainly on the maritime industry\(^1\). It aims to present in a coherent way, the salient characteristics of the freight transportation industry as it currently operates in Malaysia. It identifies the major challenges, the existing planning and potential policy steps that would help to enhance the level of service of the sector. This report will serve as a background for the evolution of specifically focused research projects to address the problems identified.

It should be noted that this report has been conducted with the cooperation of Malaysian students in the MUST Transportation Program; their help certainly improved the quality of the document.\(^2\)

Structure
The first section sets the stage by identifying the importance of the freight sector, the characteristics of the Malaysian economy and its implications for the nature of the cargoes shipped. The major transportation nodes, and a cargo breakdown are presented. It concludes with some observations on the interactions with the rest of the Malaysian economy and the situation in the global markets. In the second part the current trends in logistics and freight transportation globally are presented.

The second section examines the freight transportation policy currently followed in Malaysia. The problems and characteristics of the Malaysian freight transportation industry are identified as well as the interrelationships and general issues in the region.

The third section introduces the concept of Commercial Vehicle Operations (CVO) as part of an overarching Intelligent Transportation Systems (ITS) plan drawn from the US and international experience. It presents major types of CVO applications and their observed effectiveness and costs.

The fourth section deals with specific recommendations in creating an efficient ITS CVO component in Malaysia from an organizational perspective. The possible goals, the architecture and implementation strategies are discussed.

Finally, the fifth section compiles a set of recommendations either previously raised in the text or autonomous, concerning issues of general transportation coordination from an overarching perspective and in conjunction with their anticipated environmental and economic impacts on Malaysia.

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\(^1\) Sgouridis [2003]
\(^2\) Of course, any inconsistencies and/or mistakes are attributed entirely to the author.
1. Background Overview

Freight transportation is one of the backbones of any industrial system either for the transport of commodities and raw materials to be processed or for transport of the end products to the local and international markets. This is a stepped process represented by the concept of the supply chain and it creates in itself other second order loops that alternate the position of producer and consumer for the same entity; farmers for example need equipment and fertilizers that need to be transported to them. These interactions dictate the examination of the economic status of any studied region, its industrial geography and the projected plans for future economic development to be taken into account for any assessment of the freight transportation.

1.1 A Brief Discussion of Logistics Policy

It is now well understood that reliable and efficient transportation is critical for the successful implementation of the recent trends in production with just-in-time manufacturing (JIT) and inventory management practices. In the effort to reduce total logistics costs, the shippers are optimizing their decisions over transportation, inventory, handling, loss and damage. Inverse logistics have also started to play an increasingly important role for retailers. As a result a fast and reliable transportation is replacing large inventory and the focus has shifted to intermodalism as opposed to multimodalism\(^3\).

The classic graphical overview of the supply chain can be seen in Fig.1. The direction of the arrows can always be imagined to be inversed when the customers take their place as producers (and the manufacturers of the consumer)\(^4\). The flow of the information represented by the two-pointed arrow is essential in the integration of the chain.

![Figure 1: A view of the Supply Chain (Source ESCAP [2001])]()

This concept of the supply chain focuses on the customer’s perspective from the point of supply through to the end user. The objective of this process is to deliver higher end value at the minimum cost. Partnerships, third party facilitators, the adoption of client-specific solutions, technological innovation and systems integration, all play a role in excelling.

\(^3\) In this report we define intermodalism as the transport of goods on more than one mode in the same integrated form from origin to destination (mainly using containers) as opposed to multimodalism that requires the transfer from one mode to another in small cargo batches.

\(^4\) This idea has lead to a conception of logistics as not a chain but as continually interacting gears with cogs representing the separate tasks for each general category (e.g. the line haul transportation represented as the central link in Fig. 1 would be a gear with cogs like rating, routing, tracing and tracking, sourcing, auditing and payment). For more information on this approach see: TransporGistics Team [2001].
Although, the supply chain is holistic in terms of service delivery and operation, it does not take into account external to the system costs. Therefore government regulation and planning is still needed to ensure that transportation services (i) operate safely, (ii) operate equitably, and (iii) incur minimized environmental costs. Sustainable transport, as a concept, has been introduced comparatively recently. For freight transportation, it attempts to take into account the externality costs of freight moves and has been included in the latest policy statement for freight transport of the U.S. DOT [2001] (pg. 8). On the other hand, when freight movements are impeded by unnecessary barriers, either organizational or technical, governments need to remove them and thus increase the efficiency of the system.

Specifically for the transportation part the important parameters are: high reliability, cost, efficiency, low transit time, and damage minimization. These parameters can be ranked in various ways but each influences the choices of modes by shippers.

1.2 The Malaysian Economy (Macro perspective)

The background on which decisions on the freight transport and logistics development of Malaysia should be based is the economy that fuels it. The structure of the industry, the growth of the service sector, and the expansion of raw material production are the parameters that will influence freight transportation planning.

From the analysis of the major export and import products and trade partners, shown in Figure 2, two basic inferences can be made:

(i) The major revenue generating transported products are electric and electronic (more than 50% of the total) and secondly bulk products (with a combined share surpassing 10%), and
(ii) Malaysia’s major trade partners are the ASEAN countries combined and then the US market overseas.⁵

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⁵ Singapore and Thailand only if combined exceed the U.S. share.
From the perspective of the future industrial development in Malaysia four of the “Five Strategic Thrusts” in the second Industrial Master Plan (IMP2)\(^6\) are indicative:

- Global orientation - adapt and respond to the changing global environment;
- Enhancing competitiveness - focus on cluster development through the deepening and broadening of industrial linkages and productivity enhancement;
- Nurturing Malaysian manufacturers - increased participation of Malaysian owned companies in the broad range of manufacturing and related activities specifically in the clusters that have been identified to be of strategic importance; and
- Information-intensive and knowledge-driven processes - in manufacturing and related activities such as in R&D, product design, marketing, distribution and procurement.

Additionally, along with Malaysia’s 2020 goal for obtaining a developed nation status an expansion to the service sector is expected. This development does not diminish the importance of freight transportation but instead an increase in demand for parcel and less-than-truckload (LTL) services.

The above perspectives underscore the need for a two-tiered approach to cover the demand for high value/low volume and bulk shipments. The demand for the former is fueled by the state-of-the-art manufacturing concepts like just-in-time (JIT).

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manufacturing and inventory management, the advent of e-trading, and the expanded needs of the service sector in on-time delivery. Of course, bulk commodities, like grains, ores, oil, wood products, and chemicals will continue to comprise the majority of the freight by volume. The demands posed by the two tiers are quite different and in essence call for an effective transport network that utilizes trucks, reliable freight trains and domestic shipping services to cover the needs of the high-end manufacturers and cost-efficient alternatives for the bulk commodities.

Another area that is stressed is the global orientation of the Malaysian economy. Taking into account that the SE Asia region and the US are the major trade partners, efficient border clearance for the former and secure yet time sensitive procedures for the latter are necessary for increasing the productivity of the sector.

Finally, the last thrust states the need for information intensive distribution, where the products are constantly tracked and the feedback can be utilized for adjustments by the end recipients as well as for evaluating the effectiveness of the supply chain.

1.3 The Kuala Lumpur Metropolitan Area

The final part of the overview presents the major pole for generation and attraction of freight loads in Malaysia. The Kuala Lumpur Metropolitan area has a population of around 4 million, includes Port Klang, the designated load center for freight, the KL International Airport, utilized for air freight transportation, four inland container depots and a variety of industrial facilities.

![Figure 3: Schematic Organizational Representation of the Kuala Lumpur Area](image7)

Note: KL and Putrajaya are Federal Territories while the rest are Municipalities with one state capital in Petaling.

Adapted from Hall et al. [2003].
Figure 3 offers a schematic presentation of the regional organizational structure and the connecting corridors that face the highest demand.

2. Characteristics and Challenges for freight transport in Malaysia

This section establishes the current situation of freight transportation in Malaysia, the challenges identified for the region and the problems that need to be resolved in order to prepare the sector for an efficient and adequate coverage of future Malaysia needs in terms of freight transport.

2.1 Identification of challenges

A study conducted under the auspices of the Economic and Social Commission for Asia and the Pacific (ESCAP) identified the major problems faced by the freight transport community in the region ESCAP [2001]. This list, tabulated and expanded is presented in Table 2, where the third column examines the relevancy of the identified problems to Malaysia.

<table>
<thead>
<tr>
<th>Problem</th>
<th>Possible Reasons</th>
<th>Relevance to Malaysia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excessive dwell times for freight at ports or inland border checkpoints, resulting either from, or combination of the above</td>
<td>Slow customs inspection, slow document transmission, intermodal transfer delays, operational delays</td>
<td>Existing8</td>
</tr>
<tr>
<td>Congestion of the land transport accesses to ports</td>
<td>Retention in ports of certain container handling/processing activities, such as container stuffing/stripping and customs inspection</td>
<td>Existing and could be increased</td>
</tr>
<tr>
<td>Poor rail (and sometimes road) accesses to ports</td>
<td>Inadequate infrastructure</td>
<td>Not very relevant9</td>
</tr>
<tr>
<td>Poor coordination of rail and road loading/unloading activities in ports</td>
<td>Different authorities, different priorities of the organizations involved, competitive attitude</td>
<td>Existing</td>
</tr>
<tr>
<td>Blockages to the free flow of transit vehicles and cargo in the hinterland (i.e. between borders)</td>
<td>Institutional issues, incompatible/conflicting legislation, poor coordination</td>
<td>Maybe relevant</td>
</tr>
<tr>
<td>Incompatible customs and immigration procedures on either side of land borders</td>
<td>Same as above</td>
<td>Not very relevant</td>
</tr>
<tr>
<td>Inefficient and costly methods for</td>
<td>Inadequate infrastructure</td>
<td>Maybe</td>
</tr>
</tbody>
</table>

8 Lakshmanan and Anderson (2002) compiled the following comparison table of port dwelling time for international for developing countries:

<table>
<thead>
<tr>
<th>Country</th>
<th>Dwelling Time In Ports</th>
<th>Customs Clearance</th>
<th>Physical Inspection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>4/5 days</td>
<td>3 hours</td>
<td>30%</td>
</tr>
<tr>
<td>Cameroon</td>
<td>22 days</td>
<td>48-72 hours</td>
<td>80%</td>
</tr>
<tr>
<td>China</td>
<td>20 days</td>
<td>72-120 hours</td>
<td>10%</td>
</tr>
<tr>
<td>India</td>
<td>10-25 days</td>
<td>48-120 hours</td>
<td>100%</td>
</tr>
<tr>
<td>Malaysia</td>
<td>15 days</td>
<td>120 hours</td>
<td>80%</td>
</tr>
</tbody>
</table>

9 All major Malaysian ports have both road and rail access but the quality of the connectors can be improved especially if congestion problems are experienced.
<table>
<thead>
<tr>
<th>Problem Description</th>
<th>Relevant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transshipping containers or cargoes between different railway gauges</td>
<td></td>
</tr>
<tr>
<td>Lack of a single transport authority document for door-to-door consignments involving more than one mode</td>
<td>Relevant</td>
</tr>
<tr>
<td>Fragmented tariff-setting to railway in international transport corridors, putting rail at a competitive disadvantage</td>
<td>Relevant</td>
</tr>
</tbody>
</table>

The above list involves the transport policy planning on the one hand and administrative and custom organization on the other. This combination underscores the need for a coordinated action across organizational as well as international borders for solving this kind of problems. As indicated in the same study, several steps forward have been taken and the governments in Asia, despite their relatively new introduction to the concept, have shown a realization of the fact that logistics can indeed operate as a value-creating business tool. The Malaysian government has shown that is focused on the improvement of the management and efficiency of the transport sector, although the major focus remains on the building of new infrastructure.\(^\text{10}\)

In the same study, a list of questions is provided to be used as a starting point for an assessment of the freight transport situation and consequently as basis for developing an integrated plan for Governments and industry. These are adapted to Malaysia and a set of preliminary answers is provided but more information is needed to expand each question in Box 1.

\(^{10}\) See Chapter 10 in MEPU [2001]
Box 1: Initial Questions as Basis for Freight Transport Assessment [adapted for Malaysia from ESCAP (2000)]

<table>
<thead>
<tr>
<th>Q: Does the government understand the dynamics of today’s marketplace?</th>
<th>Preliminary Answer (P.A.): In some extent. The 8th Malaysian Plan indicates a market driven approach.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is there adequate practical and commercial knowledge in the bureaucracy?</td>
<td>P.A: Adopted by major industries.</td>
</tr>
<tr>
<td>Q: How developed is the concept of modern logistics in industry?</td>
<td>P.A: Adopted by major industries.</td>
</tr>
<tr>
<td>Q: Is there an integrated reform agenda with targets and measures that support a common vision?</td>
<td>P.A: Integration and performance measure use is still preliminary.</td>
</tr>
<tr>
<td>Q: Is the investment in infrastructure adequate to support growth and reforms?</td>
<td>Preliminary Answer (P.A.): Infrastructure investment is significant but there is a lag in organizational improvements.</td>
</tr>
<tr>
<td>Q: Is infrastructure investment based on appropriate economic considerations?</td>
<td>P.A: The evaluation methods used may be obsolete.</td>
</tr>
<tr>
<td>Q: Are safety and environmental considerations adequate in logistics planning?</td>
<td>Preliminary Answer (P.A.): The safety component has been given priority contrary to the environmental.</td>
</tr>
<tr>
<td>Q: Is the regulatory environment stimulating the desired outcome?</td>
<td>Preliminary Answer (P.A.): Changes are needed.</td>
</tr>
<tr>
<td>Q: Do modes complement the shared vision, rather than simply compete?</td>
<td>Preliminary Answer (P.A.): There is competition but it is not intensive.</td>
</tr>
<tr>
<td>Q: Are taxes and charges being used to stimulate efficiency?</td>
<td>Preliminary Answer (P.A.): Probably not, they are used as revenue generating tools.</td>
</tr>
<tr>
<td>Q: Are efficiency targets in place for government departments?</td>
<td>Preliminary Answer (P.A.): Unknown, some steps may have been taken.</td>
</tr>
<tr>
<td>Q: Is there an adequate consultation process with industry?</td>
<td>Preliminary Answer (P.A.): Industry may influence some decisions.</td>
</tr>
<tr>
<td>Q: Do economic development strategies adequately consider logistics issues?</td>
<td>Preliminary Answer (P.A.): The 8th Malaysian plan gives some consideration to logistics but mostly on infrastructure.</td>
</tr>
<tr>
<td>Q: Does appropriate education exist across the logistics industry?</td>
<td>Preliminary Answer (P.A.): Steps to the right direction are taken.</td>
</tr>
</tbody>
</table>

2.2. Current Situation, Problems, and Future Projections

Building on the generic problems discussed in Section 2.1, we examine and analyze some of the specific problems that freight transport in Malaysia faces. Some of the issues discussed are specific to the freight transportation while others involve areas like congestion and environmental impact.
The Federal Government’s decision to assign Port Klang as the load center for Malaysia had repercussions both in an increase of economic activity in the area as well as the freight handled by the port. The port infrastructure and handling techniques are currently adequate to service the demand but problems have arisen in the landside handling of the freight, with delays in the delivery of the goods to and from the port. Some of the potential reasons for this situation can be traced to the combination of the following factors:

(i) The majority of the freight transported to and from Port Klang (95%) is carried by trucks with rail carrying only 3.5%.

(ii) The use of EDI and electronic tracking by the haulage firms is still limited.

(iii) Even if EDI is used, there is a need for additional paper documents like bill of lading, insurance certificate, invoice, delivery order, packing list, detail packing list etc, required for custom clearance.

(iv) Company operation requires permit approvals and additional paperwork that may reduce the operating efficiency of both the private and the public sector and increase the transaction costs.

(v) There is congestion on the main corridors that delay the delivery of goods and reduce truck fleet utilization. Port generated truck traffic contributes to the problem.

(vi) Railway performance is not adequate for drawing a significant share of truck traffic.

These problems can also adversely affect the recently established air-freight linkage through the KL International Airport (KLIA). Although, the total transported tonnage is relatively small, 650 thousand tons currently projected to double by 2020, it is constituted of high value goods and can be a critical link for certain applications.

From the perspective of enforcement, a significant portion of the trucks are overweight, increasing both the wear and tear of the road surface and the probability of accidents.

Finally from an environmental perspective, truck freight transport is responsible for 86% of total emissions including non-methane hydrocarbons, CO, NOx and SOx, while it is also a major contributor to the generation of particulate matter. Taking into account that

11 See also Sgouridis [2003], Section 6.2.
12 The remaining 1.5% is transported by pipelines. Sgouridis [2003], Section 6.1.
13 Shin Yin [2003].
14 In terms of permit approvals, separate applications are filed to the Ministry of International Trade (MITI). Every paper application should be backed up with the companies’ production details and the usage of the amount permitted by the previous permit. For items subjected to tax exemption another set of documents is needed to be file to other departments, to allow for tax exemption. Multiple sets of each application are needed (3 to 6 sets). As a consequence unnecessary increases in transaction and administrative costs and possible delays in clearing respective shipments may be expected. Shin Yin [2003].
15 It is estimated that on an average day 6,000 truck trips to and from Port Klang are generated contributing to congestion; numbers can triple on high demand days (Sgouridis [2003]).
16 From the KTMB website average container train speed is only 15.1 km per hour. See also the next section.
the climatic condition and geographic location of KL in the Klang Valley, the lengthening of smog episodes can be anticipated in the near future.\textsuperscript{17}

### 2.3 Past Proposed Measures

Some of these issues, were already identified in the National Economic Recovery Plan (NEAC [1997]). Specifically in Chapter 7, the recommendations addressed to the various relevant authorities like the Road Transport Department, the Commercial Vehicles Licensing Board and PUSPAKOM\textsuperscript{18} included the following suggestions:

1. Simplification of licensing and inspection procedures for permit authorization.
2. Review of smoke test measurements and implementation of a two-tiers Hartridge Smoke Meter Unit (HSU) System for old and newer engine trucks.
3. Upgrading the loading limits for selected trucks such as double axle semi-trailers.
5. Liberalization of the land-side container transportation so that existing freight truck operators can freely enter this market.

Specifically for the improvement of container haulage the following measures were recommended:

1. Provide incentives for import of prime movers in the form of tax rebates.
2. Improve and shorten the inspection procedure of prime movers and trailers by PUSPAKOM so that equipment utilization could be increased.
3. Exempt new trailers from annual inspection for a specified period.
4. Make the approval process for operation of inland container depots more scrutinizing to ensure better quality.
5. Increase the co-ordination among the JKR, the police, the Road Transport Department and Licensing Board, in relation to the issuance of licenses and enforcement.

For the freight sector of the rail operator (KTMB) the following measures were proposed:

1. Resolve funding and equipment upgrade issues.
2. ERL should convert to meter gauge line instead of the present standard gauge.
3. Reduction of surplus staff of 1,800 out of total 6,000.
4. Consideration of freight rate increases.

Regarding the Freight Forwarding\textsuperscript{19} industry, NEAC [1997] reports that it was characterized by a great number of individual companies, divided into agents and custom

\textsuperscript{17} Also indicated by Choudhury et al. [2003].
\textsuperscript{18} Pusat Pemeriksaan Kendaraan Berkomputer Sdn Bhd: Malaysia’s comprehensive vehicle inspection facility.
\textsuperscript{19} Freight forwarders, also known as third party logistics (3PL) providers, “act on behalf of exporters and importers in arranging services such loading and unloading of goods, obtaining payment on behalf of customers, booking of space, and customs clearance for air cargo, sea cargo, land transportation, rail freight, custom agency services, intermodalism, door-to-door pickup and delivery services. Their role through the development of intermodal transport operations is important to increase efficiency in exports and imports of goods, which is a critical component in the quest of improving our total export competitiveness. Their earnings consist of commissions paid for their services and are reflected under the ‘Other Services’ item in the Balance on Services Account” (NEAC [1997]).
brokers, that operate in a very competitive environment. The major problems faced by the sector are “a fragmented structure, inefficiency of related services, high operating costs, and low volume” that result in a low growth potential. The reasons that lead to the low growth potential are identified specifically as: (i) national freight forwarders rely on other related services and use substantial foreign exchange in the procurement of services, bookings for cargo space and chartering of shipping lines, airlines or railways, (ii) low level of professionalism regarding the competition, (iii) a non-uniform tariff structure (iv) high staff turnover, (v) the poor quality of some available transportation services, (vi) the insufficient use of information technologies (EDI and the Internet)\textsuperscript{20}, and (vii) the add-on costs by the administration and customs procedures. The proposed efforts to alter this picture included:

1. Review and amendment of the Customs Act to meet the commercial requirements of the forwarding industry.
2. Conglomeration of the companies that would increase the organizational efficiency.
3. Introduction of performance based criteria to evaluate and control the various freight forwarding companies.
4. Establishment of a uniform tariff structure for the freight forwarding industry.
5. Promotion of professionalism through training and minimum educational requirements.
6. Encouragement of freight forwarders to utilize intermodal connections offering efficient door-to-door services.
7. The Government should introduce incentive schemes to encourage freight forwarders to intensively promote shipping arrangements in exporting CIF and importing FOB.
8. Increasing the utilization of the national carriers and terminal facilities
9. Increased utilization of the free commercial and industrial zones in the country for value-added and transshipment activities, especially for industries under licensed manufacturing warehouse.
10. Upgrading the information technology applications especially electronic data interchange (EDI) and expand it to support especially the inland infrastructure components such as inland depots and rail terminals.
11. Establish a container leasing company to address the shortage of empty containers.
12. Combat corruption and unnecessary bureaucratic obstacles.

\textbf{2.4 Modal Split and Intermodalism}

In Sgouridis [2003] we dealt with the specifics of the shipping and port industry but also considered issues of intermodalism and the freight connections that exist by the ports. All major ports, we have noted, were connected by adequate infrastructure to both the road and railroad networks, and Ports Klang, Penang, and PTP potentially have access to air freight transport. The rail currently transports 5% of all freight transported on a national level, with trucking covering the rest.

\textsuperscript{20} There are great margins of improvement for the use of these services, for example when this study was written (1998) the EDI approval process required 12 to 18 hours in Port Klang.
The railroad company, Keretapi Tanah Melayu (KTM) Berhad, has invested in upgrading its container carrying capacity with main view towards offering connection to Thailand industries. They operate inland container depots in several points of the country as well as short distance connection in Kuantan carrying petrochemicals. Although price is slightly higher than truck (mainly due to the short distance of the drayage) the higher safety margins offered by rail prevent potential hazmat spillage (Sgouridis [2003]). The subsidiary Malaysian Rail Corporation maintains the rolling stock, and the Railway Assets Corporation maintains the track without notable problems. Another subsidiary, Property SBU is responsible for land development, which has become a significant aspect of the railway business in Malaysia. This branch currently accounts for 21% of KTMB’s operating revenues; it is growing faster than all other sources of income and is expected to surpass the transportation business. This business model may hinder KTMB efforts to raise the current service level offered to freight transportation and may indicate the need for policy action.

3. Commercial Vehicle Operations – How it can help?
Applications, Costs and Benefits

This section introduces the concept of commercial vehicle operations (CVO). CVO are freight specific applications derived from the general Intelligent Transportation Systems concept. We propose the incorporation of CVO planning in the introduction of ITS architecture as a useful tool not only for addressing a number of the technical challenges and problems for increased efficiency discussed in Section 2 but also as a means to bring about desirable organizational change, aiming towards more adequate institutional structure and better intercommunication.

3.1 An ITS Overview

ITS Areas

What ITS technology can provide to the transportation is the capability to create an “information-intensive transportation system” (ITE [2000], pg. 27-6). This leads to a better utilization of the existing infrastructure by allowing more efficient use of the system. Although, ITS was mainly developed for highway applications, it has evolved to include both railroad and maritime applications. The traditional ITS areas are shown in Box 2.

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22 For a comprehensive general introduction on ITS see Sussman [2000].
Other information system applications that cross the border of road transportation but can still be considered as ITS technologies include the following (adapted from Choudhury et al. [2003]):

- **Data Exchange Technologies** – Electronic Data Interchange (EDI) enables the transfer of cargo data and business information from one mode to the next in standard electronic formats called transaction sets. EDI enables capabilities such as automation of billing procedures, routine data transfers between databases, freight tracking functions, viewing of bills of lading prior to actual physical delivery, and obtaining estimated freight arrival times. EDI is planned for the freight transportation system from Port Klang to the rest of the country, but the information sharing is initially limited.

- **Terminal Freight and Equipment Tracking** – It is possible to utilize modern cargo handling and equipment tracking technologies to improve efficiency and create additional capacity. These various technological solutions present the capability to track, identify, and monitor cargo and equipment in real time. Real-time equipment and cargo visibility allows for more efficient and reliable operations. Manpower and equipment utilization can be scheduled and deployed in relatively short order. Automated Equipment Identification (AEI) technologies are being used in terminal yards to identify and track equipment and loads. AEI technologies include radio frequency (RF) tags, smart cards, and satellite-based equipment/cargo tracking.

- **Port Management Information Systems** – A Port Management Information System (PMIS) is an overall system suite integrating various software subsystems that performs all the information gathering, manipulation, storage, retrieval and

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**Box 2: Traditional ITS areas**

| **Advanced Transportation Management Systems (ATMS)** | This area involves the management of the road and/or rail network through incident management (location and identification of incidents for real-time information to travelers and quick removal of the problem), traffic light control, electronic toll collection, and congestion reducing practices. |
| **Advanced Traveler Information Systems (ATIS)** | The provision of information to the users of the system whether it is public transportation or highway is the realm of ATIS. Information can be provided either before or during the intended trip. |
| **Advanced Vehicle Control Systems (AVCS)** | Involve electronic systems that are built into the vehicles and increase the vehicle’s interaction with the driver aiming to increased safety. These systems can range from collision warning systems to automatically navigated vehicles. |
| **Advanced Public Transportation Systems (APTS)** | APTS focus on the public transportation side and aim to enhance the effectiveness and attractiveness of these means. Fare collection, improved transfer between systems, scheduling, and provision of information to passengers are the applications that are included in APTS. |
| **Advanced Rural Transportation Systems (ARTS)** | These systems emphasize the safety enhancement of travelers rather than congestion reduction and are more relied on AVCS and ATIS applications. |
| **Commercial Vehicle Operations (CVO)** | Involves the use of ITS technologies by the operators of commercial fleets (trucks, taxis and others) to achieve better utilization of the fleet capacity, performance monitoring, and increased safety for the driver, vehicle and cargo. Optimization of administrative procedures and compliance monitoring are also part of CVO. |
transmission to decision makers all data needed to manage terminal operations. This is accomplished through electronically generated information reports that are integrated from data gathered from the various storage databases.

- **Electronic Toll Collection** for trucks – A measure that expedites freight movements on the infrastructure.
- **Train Traffic Management System (TTMS) and Vessel Traffic Management Systems (VTMS)** – These are computer-based systems that manage traffic in congested railways and waterways. The systems reduce the need of manual intervention and improve traffic flow. Routine functions are performed automatically: tagging of vehicle number, monitoring vehicle position, comparing actual position & current timetable, automatic route setting.
- **Logistics Warehouse and Container Freight Stations Applications** – The cargoes at these locations are transferred to smaller pickups or trucks that enter the metropolitan areas. The consolidation of freight to similar destinations and cargo transport efficiency are facilitated by these information systems.

**ITS Enabling Technologies**

ITS applications have become possible because of certain technological advancements. These enabling technologies can be categorized into four main areas:

1. **Sensing** of vehicle or cargo position and type either through roadside infrastructure or through a combination of Global Positioning Systems (GPS) and wireless data transmittance.
2. **Real-time communication** using digital media transmittance and a variety of data interchanging technologies ranging from the Internet and cellular phones to direct satellite links.
3. **Data processing capacity** through the rapid evolution and miniaturization of computer processors. This capacity allows the collection and interpretation of vast amounts of information either in a centralized common system or in private ones.
4. **Efficient use** of the above through the development of adaptable algorithms and mathematical models. This means a reduced need for human intervention and increased optimization potential.

**ITS Architecture**

An overarching framework created as an integration tool for all ITS projects is the ITS Architecture. More specifically, the ITS Architecture describes the interactions of the ITS component projects, their operation within the transportation system, what each component does and what type of information is exchanged among the components. Figure 4 is a visual representation of the key elements that should be incorporated in an ITS architecture. The development of a national (and regional) ITS architecture should stem from a vision statement that outlines several potential scenarios for ITS development over a long timeframe. In the case of freight transportation it should describe, for example, how shippers, logistics service providers and government branches will be able to use and benefit from CVO technologies and identify their service requirements.
From the vision statement stems the *logical architecture*, which describes the processes (i.e., functions) and data flows that are required to meet the user service requirements. Care should be taken to ensure that the logical architecture is designed to be *independent* of institutions and technology.

![Diagram of ITS Architecture](image_url)

**Figure 4:** Key Elements of an ITS Architecture (Source: Hall et al. [2003])

The *physical architecture* provides a framework that depicts how the components or subsystems link together to form an ITS. The physical architecture should have three layers - the institutional layer (describing the institutions and the relationships between them), the transportation layer (describing the transportation elements and their integration requirements), and the communication layer (defined by four communication channels; wide-area broadcast, roadside-to-vehicle, vehicle-to-vehicle, and wireless).

Once formulated, the logical and physical architectures are used to develop standard requirements that will guide ITS technology deployment. In addition, the two architecture components should be used while establishing the implementation strategy that defines key milestones and sets out ITS deployment objectives. We will elaborate on this process in Section 4.2 describing a possible approach for the development of the Freight module.25

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25 The discussion of the Architecture concept was based on Hall et al. [2003].
3.2 Commercial Vehicle Operations

As mentioned in the definition in Box 2, the CVO applications range among a variety of areas. The underlying objectives of CVO are (i) to enhance intermodal freight efficiency and effectiveness and (ii) to enable supply chain integration while (iii) maintaining a high level of compliance to regulations.

Current State-of-the-art CVO

The current state-of-the-art of the CVO projects include applications that can be divided into the following typical categories:

Electronic Credentialing: This application automates regulatory functions and enhances data communications capabilities of state agencies to enable paperless transactions between motor carriers and agencies (automatic purchase of credentials). Commercial Vehicle Information Systems And Networks (CVISN) that refer to the ITS information system elements that support CVO belong to this area. CVISN includes information systems owned and operated by governments, carriers, and other stakeholders but excludes the roadside sensors.26

Electronic Screening (at fixed weigh stations, ports of entry, and mobile sites): Enables the screening of commercial vehicles for safety, size/weight, and credential compliance at mainline speeds. Also known as Electronic Clearance Systems (ECS).

Safety Information Exchange: Improves targeting of high-risk operators for inspection through roadside access to current safety data; automates safety inspection activities; and supports deployment of in-vehicle safety technologies. These systems are complementary to Electronic Screening since they allow for targeted enforcement. The Hazardous Material Management Systems (HMMS) that facilitate adequate hazmat incident response are also included in this category.

Safety Improvement: Improves monitoring of safety aspects of the vehicle and the driver and can be materialized through the Roadside Safety Inspection Systems (RSIS) and on-board safety equipment. They aim for improving the safety of the drivers, other highway users and freight.

Motor Carrier Operations: The Freight and Fleet Management Systems (FFMS), as they are called, enhance the motor carrier safety and efficiencies through more timely and accurate information to fleet managers and accelerate development and adoption of emerging tracking and real-time communication technologies. These systems also provide options for online freight monitoring.

The specific technologies that enable and complement the above systems to operate include27:

- Automatic Identification Technologies (AIT): allows trucks to bypass checkpoints at border crossings using electronic clearance technology;
- Automated roadside safety inspections (e.g., weigh-in-motion scales): provides information to authorities on vehicle characteristics, reducing the need for trucks to “stop-and-go”;

26 Appendix II describes the current non-automated process for credential administration which shows how complicated it can be and the help that an electronic system can offer.

Electronic Placarding and Bill of Lading: reduces the time spent on administrative requirements and enhances the monitoring of the movements of hazardous materials;

Automatic Toll Collection (ATC): reduces the need to “stop-and-go”;

Automatic Vehicle Location (AVL) Systems: improves fleet management and - if combined with information on the type and quantity of freight - facilitates the emergency response to accidents involving hazardous materials;

On-board safety monitoring: provides information to drivers and commercial vehicle operators on the integrity of the vehicle (e.g., engine temperature, oil pressure, etc.) and status of freight (failure of on-board refrigeration unit, etc.); and

Long Range Communication Technologies: enables real-time management and response to accidents or problems.

Figure 5 provides a visual overview of the CVO systems described above and how they can be integrated into a complete ITS system.

Figure 5: Interactions of a fully deployed CVO System (Source: Byeon and Ahn [1999])

From EDI to ILIS – a Discussion

Finally, the Electronic Data Interchange (EDI) system should also be considered as an integral part of the general CVO infrastructure for the facilitation to freight transport it can provide. Byeon and Ahn [1999] propose the upgrading of the EDI to an Integrated Logistics Information System (ILIS). They argue that the main disadvantages of the current EDI deployment in general are that it (i) is not intermodally and regionally compatible, (ii) does not cover all activities, and as a consequence (iii) it is not utilized by the majority of shippers. An ILIS as proposed for South Korea is a system that includes CVO technologies in its design and provides a uniform medium for their use. More specifically the envisioned ILIS would include: Intermodal services, Integrated Database (IDB) services, and CVO services. The additional benefits of the ILIS are better and more

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28 Details on this technology can be found in Appendix I.
effective monitoring of national and international cargo transport, decreased operation
time for authorizations and clearances, and encouragement of the use of tracking
 technologies by the smaller haulage companies or logistics providers.

An ILIS system would support the needs of the supply chain in all the phases of the
commercial trade; Precontractual, Contractual, Logistic and Post Delivery\textsuperscript{29}. Additionally, in order to take the full advantage of adequate utilization of intermodal
means and achieve total transportation management the following data would need to be
integrated into the system:

- Logistics plan—routing plan, co-loading, load dock status, location of handoff, time
  of handoff;
- Cargo information—container identification, container condition;
- Bill of lading—cargo value, charges for transport, conditions for carriage and
  liability;
- Regulatory information—cargo permits, trip permits, credentials, certification;
- Customs information—spot, port identification, date and time of crossing, vehicle
  identification, vehicle profile, driver identification, driver visa, driver travel log,
  driver medical certificate, customs fees;
- In-transit information—routing management, time in/out, time/location, ETA, route
  change, location change, time of handoff change, status; and
- Destination information—delivery acceptance. (TRB [1998])

Integration of CVO Applications
From the above description, it is made apparent that CVO applications can be
implemented on various levels. Obviously some projects that directly affect the
individual company’s profitability, for example AVL or on-board safety monitoring, are
to be implemented directly on the firm level. On the other hand applications like one-
stop-shops for licenses and Weight-in-Motion stations rely mostly on governmental
initiatives. The interconnecting character of ITS technologies though creates a large
middle area where the potential gains for the two levels are enhanced by cooperation, as
for example could be the case for a combination of an AVL system connected on real
time with the Hazmat monitoring center, the Automatic Toll Collection, and the
Electronic Screening Stations. Such a synergistic system would create a win-win situation
by facilitating (i) the trucking company to manage its fleet while reducing the time spent
on tolls and weight inspection facilities, (ii) the society to keep closer track of hazmat
cargo, (iii) the highway operator to reduce operating costs, and (iv) the government to
ensure road safety. As a result the boundaries of CVO public and private projects can be
fuzzy and there is a gamut of policy incentives\textsuperscript{30} that can be used to promote them on
both levels.

\textsuperscript{29} These are defined by TRB (1998) as: • Precontractual, when requirements are determined, sources are
discovered, offers are made, and negotiation takes place; • Contractual, when purchase orders are issued
and other conditions are agreed upon; • Logistic, when transportation and distribution details are planned
and executed; and • Post-delivery, when invoicing, settlement, and reporting to industry associations and
government are completed.

\textsuperscript{30} Some incentives are presented in the Recommendations (Section 5).
On the level of the firm the use of ITS technologies can be categorized into three distinct levels of integration or operational sophistication that have different requirements from the so-called three “I” s (Information, Infrastructure, Interface) as identified by Jacobs (2000). These levels are:

**Level 1: Initial Automation** - Phone calls are replaced and routing and dispatching are facilitated by signal systems. Productivity and customer service are improved. Data in simple format are exchanged with shippers (e.g., estimated time of arrival).

**Level 2: Company Integration** - Vehicle information, such as fuel consumption, drivers’ logs, and data needed by the regulatory authorities, is sent to the operation center where, it is integrated to the company’s Management Information System (MIS). Route planning is optimized automatically, loads and drivers are assigned to trucks, trailers are assigned to tractors, maintenance activities are scheduled based on actual usage of tractors and trailers, and pricing reflects costs.

**Level 3: Inter-modal Integration** - Carriers use their communications systems to exchange various kinds of data with shippers, terminals, or intermodal transfer points. The data are more than routine information as in Levels 1 and 2 consisting of description of the consignment, bills of lading, freight payment data, and so on. Use of electronic data interchange (EDI) or the Internet is necessary. The information received at each end is used by the receiving company’s MIS.

In order for Integration Level 3 to be achieved, the systems adopted by the various companies to give them competitive advantage should conform to a certain standard of interoperability or at least trans-system communication and compatibility. ITS Architecture adherence is important when it comes to integrating those systems.

### 3.3 Current CVO Applications in Malaysia

In general the ITS concept has taken root in Malaysian transportation policies. The recent efforts to integrate the Electronic Toll Collection systems as well as the creation of a National ITS Architecture beginning from the initiative of the Road Engineering Association of Malaysia (REAM) which published with help from ITS Canada an ITS Strategic Plan that underscored this need (Lynn [2001]).

The ITS projects that have been as yet implemented have all been limited to passenger and transit applications. According to Dr. C.H. Leong (Shin Yin [2003]), CVO was given a lower priority in the survey carried out by the KL City Hall. This somewhat contradicts the Malaysian dedication to adopting Information Technology objectives and does not give incentives to the private sector to improve their operations. The current introduction of an Architecture may help to reorient efforts toward freight applications.

### 3.4 Anticipated benefits, costs and challenges from CVO Implementation

As noted in the previous section, implementing CVO requires a concerted effort of both the private and public sector but for both, the main driver behind it are the expected benefits from the use of these systems and the competitive advantage they could give to the Malaysian economy by offering more productive transportation. This section
discusses the challenges, potential benefits, and implementation costs to be anticipated if these system become widespread in Malaysia.

**Challenges**
The main challenges that would be faced are the costs needed for the installation of the necessary infrastructure and more importantly for the continuous operation of these systems, as well as the institutional issues that will inevitably arise from such overarching scope. Challenges of a smaller scale but still capable of impeding the implementation, are: (i) human resources i.e. the need of training professionals capable of operating and maintaining the systems, (ii) acceptance by the affected parties (e.g. drivers and privacy), (iii) interoperability and openness of the systems to accommodate diverse needs.

**Potential Benefits**

**Motor Carrier Operations (Tracking and Communications):**
In the realm of benefits, the fact that these have direct economic impact to competitive companies had made the ITS/CVO to be considered as a potential “early winner” in the ITS process and this has largely been proven true. For example, the Motor Carrier Operations that utilize tracking and direct communications have proven to be very popular among various small- to large-scale operations. Several system providers compete in this area and the US market has been penetrated substantially by these systems.

The trucking industry achieves increased effectiveness through freight tracking by:
- (i) promoting interconnection and en-route consolidation of cargo;\(^\text{31}\)
- (ii) reducing empty and idle time;
- (iii) optimizing routes; and
- (iv) congestion avoidance.

The increased efficiency and transparency can result in improved customer service and customer satisfaction with on-time delivery, improved reliability and reduced en-route delays or accidents. The companies that operate with trailer to tractor ratios close to one get immediate benefits from the system since the increase of equipment utilization is direct (they do not rely on leaving empty trailers at the shippers’ facilities to be filled up and picked up later).

Additional observed benefits in terms of cost savings and improved service are:
- (i) the elimination of long distance phone and reduction of phone bills;
- (ii) gaining competitive advantage by offering advanced communications services to their clients;
- (iii) small firms can continue expanding without abandoning the customization and personal touch in their services;
- (iv) drivers waste less time waiting at pay phones and receive clear instructions;
- (v) driver accountability is increased since drivers know they are observed;
- (vi) increased safety and immediate accident response; and
- (vii) Vehicle maintenance costs are reduced when engine is monitored.

\(^{31}\) Various consolidation methods are shown in Appendix III.
Knowing the exact position of the vehicles in a fleet allows for informed routing decisions. Software applications have been developed to automate the decision making process. The algorithms take into account the generation of loads actual and statistically projected, the relative position of the vehicles, route data if available (congestion and estimated travel time), and the possible combinations for consolidating freight. This type of software is now also available off-the-shelf reducing the cost of a non-customized application from $100,000 to $20,000 (US$ in 2000 rates) or less.

**Enforcement**
Freight tracking and the streamlining of administrative procedures as well as enforcement of compliance with government regulations appear to be synergistic. The data gathered from the on-vehicle sensors or the tags can be used for the calculation of fees and speed or weight control. The same is true for the electronic clearance, since it reduces the requirements and labor costs from the government perspective as well as allowing for expedited passage of compliant vehicles through the checking points.

**Security**
An additional important issue covered by CVO applications is the tracking and monitoring of containerized freight; this has received great attention lately due to the help this technology can provide to shield the supply chain from being used for malevolent purposes. Participation in the US-led Container Security Initiative (CSI) may be greatly facilitated, if there is action to adopt or even perhaps co-develop a standardized system. While such a system would facilitate Malaysian freight needs it would also comply to the CSI requirements and give headway to the ports operations. The systems that are currently considered in the US are electronic container seals and tags. These can be sensed by roadside equipment and/or transmit data of unauthorized tampering through satellite or cell phone network. Examples of these systems are given in the US DOT [2000] report.

**Cost-Benefit Ratios**
From several studies that have been conducted in the U.S. and EU the return on investment from implementing CVO applications have been shown to be substantial for the majority of them. Table 3 shows a compilation of some of the results.

<table>
<thead>
<tr>
<th>Technology or Procedure</th>
<th>Estimated Benefit Cost Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer-Aided Routing and Dispatching</td>
<td>3.3:1 to 9.4:1</td>
</tr>
<tr>
<td>Mobile Communications</td>
<td>4.4:1 to 6.3:1</td>
</tr>
<tr>
<td>Systems On-Board Computers (e-logbook)</td>
<td>0.3:1 to 6.6:1</td>
</tr>
<tr>
<td>Maintenance Support Systems</td>
<td>0.7:1 to 2.4:1</td>
</tr>
<tr>
<td>Electronic Data Interchange/Internet</td>
<td>2.7:1 to 11.7:1</td>
</tr>
<tr>
<td>CVISN</td>
<td>1:1 to 19.8:1</td>
</tr>
<tr>
<td>Electronic Clearance</td>
<td>1.9:1 to 7.4:1</td>
</tr>
</tbody>
</table>

32 The variance in the B/C ratio estimation is mainly due to the different assumptions used and also reflects differences in the size of the firms that were examined.
Overview
To summarize, from an economic perspective, CVO technologies enable commercial vehicle operators to increase vehicle utilization, which can lower the cost of goods and/or increase the range over which freight can be transported for the same price. From an environmental perspective, CVO technologies reduce energy usage and emissions related to “stop-and-go” traffic and reduce network delays caused by vehicle breakdowns (which become less frequent due to on-board monitoring systems). Additionally, they allow, given the political will, through Automatic Toll Collection (ATC) to attribute the externalities generated by trucks according to the level of usage. Finally, from a social perspective, CVO technologies hold the potential to reduce the number of dangerous and overweight trucks on the highways, lowering the number of truck-related highway fatalities. In conclusion the benefits to be expected from a successful deployment of CVO applications would be an expedited, more effective supply chain with reduced demand on common resources of road networks and clean air.

4. Steps Towards a Successful CVO Implementation
Having presented the benefits from CVO implementation and given that CVO is only in its first stages in Malaysia, we present one roadmap compiled from the collective experience of existing efforts in the US and elsewhere that could be utilized as a guiding or comparison tool for informed decision making while developing the Malaysian national freight policy. The importance of bringing the major stakeholders into the process early as well as the need for constant progress evaluation cannot be overstated.

4.1 Architecture Development
The complicated nature of ITS and the need for interoperable, upgradeable, and focused ITS projects lead the US and other countries to create an Architecture as the basis of their future ITS development. As it is briefly described in Section 3.1, the Architecture is a policy neutral tool for ensuring the above tools. It could either be developed from scratch for Malaysia, or just be adapted to the Malaysian needs from the already existing Architectures (e.g. U.S., Canada, Japan, and S. Korea).

4.1.1 Policy Vision
The first priority for the Architecture use should be the creation of a Regional ITS Architecture for the Kuala Lumpur Metropolitan area, and then for the other major population and industrial centers in Malaysia. The development of a Regional Architecture is not a policy-neutral process; instead it has to take into account the political vision regarding the future characteristics of the region. Key drivers in Malaysia that could potentially shape this vision are the stated interest into economic growth, privatization, and information technology.

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Sections 4.1 and 4.2 have been based on Hall et al. [2003].
In 1991, Malaysia announced its intention to become a developed nation by 2020 in a policy document entitled ‘Vision 2020.’ To achieve this goal the nation’s economy must transition from being an industrial economy to a service economy. The result of such a transition would not necessarily mean the gradual movement of heavy manufacturing facilities to overseas locations, since Malaysia’s substantial physical resources and geopolitical situation are significant, but it should set the stage for a knowledge-based economy and society. The industry and the export-based economy will still be the engine of growth and, as a consequence, a freight transportation focus is essential.

In the recent ‘Eighth Malaysian Plan 2001-2005,’ the first phase of the government’s broader ‘Third Outline Perspective Plan 2001-2010’ (OPP3) to implement Vision 2020 was described. Both the Eighth Malaysian Plan and OPP3 emphasis the government’s desire to transition towards a service economy, by highlighting the importance of high-value service-orientated business.

In an effort to operationalize Malaysia’s transition to an emerging global information society and economy, the government is investing heavily in information and communications technologies (ICTs). For example, fiber optics, high-speed data access, and wireless communications are currently being used to upgrade networks in the Klang Valley region. In addition, the new Multimedia Supercorridor (MSC), located in the Sepang district of Selangor, is being developed as a test bed for ICT. It is hoped that the MSC will be the first region in Malaysia to contain only service oriented business.

As Malaysian society moves gradually into the information era, the service orientation of the economy is likely to raise customer expectations for a broader range of performance and service options. These customer expectations will not be constrained to the business sector. For this reason, it is essential that the transportation sector be prepared to offer the information services that travelers and freight companies are likely to require. Therefore, the first key driver behind the development of an ITS architecture for the KL region is the need to align the development of the transportation system with that of the government’s desire to develop a service oriented economy.

A second major strategy in the Eighth Malaysian Plan is the government’s desire to support the privatization of many public services. The result of this strategy is that the total amount of available funds for public infrastructure projects is reduced significantly. Therefore, a second key driver for the development of an ITS architecture for the KL region, is that the lower cost of ITS technology will significantly reduce the government’s expenditure on the transportation system while supporting the notion of privatization. In addition, ITS technology will also enable private transportation companies to provide more efficient services and give them an enhanced ability to extract revenue from their paying customers.

4.1.2 Institutional Foundation

Materializing such a policy vision requires a solid support structure, which will act as a backbone for the entire ITS concept – both passenger and freight. One possible
institutional structure and a roadmap for establishing such a structure are presented in this section. The focus of this approach is on a single overarching organization that should supervise all aspects of ITS implementation, from Architecture creation to individual projects. The very different attributes and priorities of freight and passenger transport, though, dictate an internal separation of jurisdictions. Our roadmap recommends dividing the process of development and implementation of each into separated but communicating groups under a common umbrella entity.

This organization should be given the needed political strength to bring about the desired changes; having first consulted and educated the various stakeholders and taking into consideration their respective interests. It is envisioned that an autonomous quasi-public sector agency, that would have decision-makers from the public and private sectors, be established in Malaysia for implementation and subsequent operations of the Kuala Lumpur Regional ITS architecture. This would be in line with the structure of public-private partnerships needed to make implementation of a regional ITS architecture successful. It would also conform to the broader pro-privatization goals of the Malaysian Federal government. This agency could be created with equal participation from the Malaysian Federal Government and the City Hall of the Federal Territory of Kuala Lumpur and a name that could describe its identity is *Malaysia Intelligent Transportation Systems Agency (MITSA)*. The figure in Appendix IV shows one possible structure.

*Transportation System Goal*

Aligned with the economic-growth driver is the **development of a transportation system compatible with a service-oriented economy but capable of accommodating the needs of the industrial economic backbone**.

*Task 1: Creation of the National Architecture*

The first main task of MITSA will be to create (or adapt) an ITS National Architecture that integrates public and private transportation services, which is in line with this goal. Furthermore, the envisioned MITSA conforms to the government’s strategy of *increased support for privatization*. It is more difficult for a public sector undertaking to establish efficient working relationships with the private sector due to the purported difference in their goals and cultures. In addition, there is potential for conflict arising from profit-making motives of the private sector and public service goals of the public sector. By establishing an institution with stakeholders from both sectors, the relationship would be a stronger partnership toward a common vision. Other implications are that it would help create a policy-neutral architecture, as MITSA would not primarily be a government agency but a public-private collaborative. The stakeholders shown in Table 4 could be asked for consultations during the creation of the National Architecture but only a small core of transportation and communication professionals under the guidance of MITSA are needed to complete this task.

Finally, an integral part of the creation of an ITS Architecture is the setting of standards that would ensure interoperability among ITS applications and non-interference with other users of the spectrum.
**Task 2: Creation of the KL Regional Architecture**

The second and more critical step for MITSA would be the creation and deployment of the Regional KL Architecture. MITSA would establish the KL regional ITS architecture in accordance with regional needs and characteristics – including financial, political, societal and economic conditions, transportation system goals and objectives, and regional ITS user services.

The freight transportation Regional Architecture development and consequent deployment supervision, being part of the overall Regional Architecture, is proposed to be undertaken by a public-private collaborative. As shown in Figure 6, it will be independent from the passenger and transit teams but still allow for overlap and be supervised by MITSA in order to avoid conflicting mandates and cooperate in areas of mutual interest like the Advanced Traffic Management Systems. Table 4 shows a first draft of the stakeholders and their main responsibilities that should be considered for participation during the Regional Architecture development process.

![Figure 6: A view of a Possible Organizational Scheme](image)

Rodriguez and Sussman (1997) explain how most ITS deployment is constrained by jurisdictional, institutional, financial, political, and regulatory factors. So the interlocking structure of MITSA as shown in Figure 6 should facilitate the resolving of conflicts between the various stakeholders. In addition, MITSA should have high-level authority, across jurisdictions, to decide, and oversee the implementation of the ITS projects that are established through the multi-stakeholder collaborative process.
Table 4: Stakeholder Map Draft for Participating in the KL Regional Architecture Development Process (adapted from Choudhury et al. [2003]).

*Note:* The stakeholders that have major freight transport and CVO roles are underlined.

<table>
<thead>
<tr>
<th>STAKEHOLDERS</th>
<th>ROLES AND RESPONSIBILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PUBLIC AGENCIES</strong></td>
<td></td>
</tr>
<tr>
<td>Ministry of Local Government and Housing</td>
<td>The region proposed encompasses six administrative districts in the Selangor State and eleven urban centers(^{34}). There are effectively ten local government jurisdictions(^{35}) that manage the transportation facilities in the area and are governed by the rules and regulations set by this ministry.</td>
</tr>
<tr>
<td>Ministry of Transport</td>
<td>Determines overall transportation policies and the formal planning authority for the transport sector. Jurisdiction over rail and road sectors,</td>
</tr>
<tr>
<td>Ministry of Works</td>
<td>Has jurisdiction over all affairs regarding roads and highways. Important divisions are the Malaysian Highway Authority (toll administration), Highway Planning Unit (highway and facility construction) and Public Works Department (construction and maintenance of roads)</td>
</tr>
<tr>
<td>Commercial Vehicle Licensing Board, Ministry of Entrepreneur Development</td>
<td>Regulates the fares, schedules and routes for commercial vehicles (public transport and freight) for the nation.</td>
</tr>
<tr>
<td>Ministry of Information</td>
<td>Regulates public and private radio and television broadcasts.</td>
</tr>
<tr>
<td>Economic Planning Unit</td>
<td>Strategic national development planning. Secretariat to the National Development Planning Committee, the most politically and strategically powerful body in the country. EPU is also the coordinator of the InterAgency Planning Group which brings together public and private stakeholders into the decision making process.</td>
</tr>
<tr>
<td>Customs Authority</td>
<td>Oversees custom clearance.</td>
</tr>
<tr>
<td>Federal Territory Development and Klang Valley Planning Division</td>
<td>Plans for the Klang Valley region. It is however at present not very effective as a planner.</td>
</tr>
<tr>
<td>Ministry of Energy, Communications and Multimedia</td>
<td>Regulates the telecommunications industry.</td>
</tr>
<tr>
<td>Ministry of Science, Technology and Environment</td>
<td>The Department of Environment (DOE) regulates environmental matters pertaining to all transportation activities.</td>
</tr>
<tr>
<td>Fire and Rescue Department</td>
<td>Provides fire and rescue services.</td>
</tr>
<tr>
<td>Public Hospitals</td>
<td>Provides medical emergency services</td>
</tr>
<tr>
<td>Royal Malaysian Police</td>
<td>Enforces Traffic rules</td>
</tr>
<tr>
<td>Port Klang Authority</td>
<td>Regulates port activities</td>
</tr>
<tr>
<td>Department of Standards</td>
<td>Sets industrial standards</td>
</tr>
<tr>
<td><strong>PRIVATE AGENCIES</strong></td>
<td></td>
</tr>
<tr>
<td>KTMB</td>
<td>Freight and inland depot as well as long-distance rail passenger service provider.</td>
</tr>
</tbody>
</table>

\(^{34}\) Kuala Lumpur, Shah Alam, Petaling Jaya, Subang Jaya, Klang, Selayang, Bangi, Kajang, Ampang Jaya, Putrajaya, and Cyberjaya.

\(^{35}\) Majlis Perbandaran Shah Alam (MPSA), Majlis Perbandaran Petaling Jaya (MPPJ), Majlis Perbandaran Subang Jaya (MPSJ), Majlis Perbandaran Klang (MPK), Majlis Perbandaran Selayang (MPS), Majlis Daerah Kuala Langat, Majlis Perbandaran Kajang (MPKa), Majlis Perbandaran Ampang Jaya (MPAJ), Majlis Daerah Sepang.
<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rail Transit Operators (PUTRA, STAR, Monorail, ERL, Commuter)</td>
<td>Provide transit rail services</td>
</tr>
<tr>
<td>Bus operators – feeder and trunk (Intrakota, Cityliner, Len Seng etc.)</td>
<td>Provide bus services</td>
</tr>
<tr>
<td>Highway and expressway toll private operators (e.g. PLUS, ELITE, LITRAK, KESAS)</td>
<td>Provide highway services</td>
</tr>
<tr>
<td>Shipping Companies (Maersk/Sealand, MISC, OOCL, etc.)</td>
<td>High-throughput international companies could co-operate into the implementation of tracking systems</td>
</tr>
<tr>
<td>Third Party Logistics Providers and Shipping Agents Association</td>
<td>Providers of intermodal freight services.</td>
</tr>
<tr>
<td>Truck Haulage Operators (Kontena Nasional, Konsortium Perkapalan, MISC Haulage Services, etc.)</td>
<td>Provide freight truck haulage.</td>
</tr>
<tr>
<td>Port Operators (Northport (Malaysia) Bhd (NMB), Kelang Multi Terminal S/B Bhd (KMT) Westport)</td>
<td>Provide port services</td>
</tr>
<tr>
<td>Multimedia Development Corporation</td>
<td>Overseeing development of MSC with fiscal authority, reports directly to the federal government. Currently responsible for ITS project in Cyberjaya.</td>
</tr>
<tr>
<td>Putrajaya Corporation</td>
<td>Overseeing development of Putrajaya. Currently responsible for ITS project in Putrajaya.</td>
</tr>
<tr>
<td>Private medical emergency services (ambulances)</td>
<td>Provide medical emergency services.</td>
</tr>
<tr>
<td>Internet Service Providers</td>
<td>Telecommunications service providers</td>
</tr>
<tr>
<td>Other ICT service providers</td>
<td>Telecommunications service providers</td>
</tr>
<tr>
<td>Telecommunication and high-tech equipment manufacturers</td>
<td>Have the potential of researching and providing infrastructure and vehicle equipment manufactured totally or partially in Malaysia.</td>
</tr>
</tbody>
</table>

**Users:** Trucker Associations, Community councils, driver and passenger surveys, etc.

It is understood that bringing about radical institutional changes will probably have to overcome obstacles from conflicting interests, overlapping jurisdictions and plain organizational inertia, all of which may incur political costs. Although, the process is expected to be arduous and would require a lot of fine-tuning while it is being implemented, we believe that the end results of the concerted effort will be positive for the future of freight transportation in Malaysia.

### 4.2 Freight Transportation Architecture Implementation

Task 2 of the previous section, that is the development of the freight and CVO part of the Regional Architecture and its deployment, could follow the step-by-step method presented in this section. It is based on the FHWA recommendations and a series of
existing applications\textsuperscript{36}. It is intended mainly as an orientation tool and not as a set of instructions.

After the creation of the National Architecture, the Freight Transport Collaborative (FTC) should select and adapt elements, standards, and market packages\textsuperscript{37} of the National Architecture to suit the KL region. The following text describes how the FTC could develop the Commercial Vehicle Operations part of the Regional Architecture using a methodological approach, rather than presenting a specific solution per se. To help visualize the methodology, Figure 7 was created to highlight the critical stages.

**Methodology Outline:**

(1) Create an Open Vision

As a first step, MITSA creates a vision as a blueprint where the shared vision will be built upon. It will of course be open to change by feedback from the next steps but it is needed as an initial promotion line for attracting the stakeholders. A major focus area could be the creation of a seamless intermodal supply chain environment, with (i) reduced demand on highways, (ii) improved safety, location, and identification of HAZMAT, (iii) reduction of law violation incidents (increased compliance) with less physical interventions and (iv) reduced energy consumption and environmental impact. The vision and the consequent steps should be initiated by a task force within MITSA that will play a leading role in the first phases of the collaborative.

(2) Initiate the CVO Collaborative

2.1. *Stakeholder Identification:* The creation of the CVO collaborative needs to start from a comprehensive stakeholder map. From the comprehensive map of Table the most important players would be the following:

(i) Government representatives from the;
    Ministry of Transport,
    Ministry of Entrepreneur Development (as the CV licensing Authority),
    Municipalities more heavily affected by truck traffic,
    Police and Emergency Response Squads, and
    Port Klang Authority.

(ii) Transport industry representatives from the;
    Port Operators (Northport and Westport),
    Railway Operators (KTMB),
    Toll road operators, and
    Truck Haulage Companies (either members of the association or directly from big companies like Kontena Nasional, Konsortium Perkapalan, MISC, etc.).

\textsuperscript{36} Sadek, et al. (2000) as well as guidelines found in Parsons (2000).

\textsuperscript{37} For a definitions of these terms as used in the U.S. Architecture see
(iii) Industry and major (high quantity/high value) shippers. In this step a more project specific definition of the region may be needed; for example some residential areas might not be included in the stakeholder list whereas some industrial areas outside the officially designated region as seen in Figure 3 might be asked to participate.

(iv) The stronger advocates of the need for a change in the public sector participants and the big private sector participants should be recruited as *champions* that will firmly support the effort during the inevitable political oscillations. This step may look not important but has been identified repeatedly in the relevant literature as a key issue.

2.2. *Shared Vision Creation:* Initiate discussions with all members individually to enable them to present their needs and to give feedback on the vision so that it includes all players.

2.3. *Funding:* Establish funding sources and the participation level of each member, ensuring both short and long term support.

2.4. *Conflict Resolution:* Establish a conflict resolution policy within the collaborative. The highly competitive nature of the truck haulage companies may require specific attention in order not to delay efforts.

(3) Definition of Goals and Objectives

3.1. *Initial assessment:* It is essential to begin with an accurate perception of the current Malaysian freight network. Data will be needed to:

(i) Define the major truck generator and attraction poles (like Port Klang, large industrial areas, consumer centers and outlet stores, container depots, railway stations, and the industrial or raw material resource regions outside KL) and the major types of freight (containerized, bulk, liquid, hazmat -independent of type-, etc).

(ii) Define the major corridors that are used by truck traffic, and their existing conditions (i.e. peak hour traffic, average speeds, major problems, percentage of trucks in traffic flow, and bottlenecks).

(iii) Identify possible alternative routes (including railway and coastal and Short Sea Shipping), their current usage and their future potential based on existing infrastructure, and the freights that can use these alternatives without compromising the current level of service (LOS).

(iv) Describe the existing administrative processes for issuing credentials and the methods of enforcing the freight regulations.
3.2. **Problem Identification**: Identify the major freight transportation problems of the region and their interrelationship with the Regional Architecture as a whole.

3.3. **Goal Definition**: Goals that address the problems and are consistent with the current picture of freight transport in Malaysia can be identified, using the information from the previous steps. The goals can be set on three levels: individual firm, operator facilities, and region as a whole, and these may address issues from the following general areas: efficiency, congestion, environment, safety, and security.

3.4. **Performance Measures Setting**: Tangible measures should be set to be used for the evaluation of the progress in implementation and performance of the Regional Architecture projects. The initial step in setting the performance measure is identifying those that are better suited for evaluating the project. The second step involves the setting of the desired level of performance – different levels can be set for different progress stages. Specific performance measures can be: the number of projects actually deployed; the stakeholder and public participation; and the effectiveness of the projects as measured by reduced service times, reduced operating costs, increased fleet utilization, reduced time for issuing certificates, increased compliance, percentage of trucks at peak hours, reduction of truck involving incidents etc.

3.5. **Timeline Setting**: Finally, a roadmap should be put in place that will indicate the timeline by which the identified above goals should be achieved along with short-term, mid-term and long-term milestones.

(4) Core Regional Architecture Development

In this step, the Regional Architecture itself is structured using the identified goals and the areas where ITS applications are needed. The regional architecture uses the relevant national architecture building blocks; that is Market Packages (MPs) from the ATMS, CVO and EMS groups.

4.1. **Mapping MPs**: All MPs from the relevant groups should be checked on their efficiency towards the specified goals as well as on their ability to address the specified problems.

4.2. **MP interrelationship and implementability**: The MPs that were considered effective from the previous step should be screened for costs, availability of technology, proven benefits (from implementation to other countries) and private sector commitment.

4.3. **MP final selection, functional capability definition, and prioritization**: Those of the MPs that have passed the previous screening are prioritized for short-, medium-, and long-term deployment so that the anticipated milestones set in 3.5 can be met. In addition their functional specifications are defined to reflect the KL needs.
4.4. **Project definition:** To strengthen the MPs that were finally selected, the working team should focus their attention on specific projects in KL. For example, the increased efficiency goals could be achieved by deploying tracking and fleet management systems by the individual trucking firms, by integrating the ETC system, or by streamlining and putting on-line the credential administration by the government. These concepts should start to materialize in a tangible project format.

4.5. **Regional Architecture Interconnections:** This step completes the formation of the Architecture and all projects are integrated into the Regional Architecture. It defines the desirable user services, the physical architecture, and completes the interconnections between the Architecture elements. At this stage, the transportation experts of the collaborative should do most of the work. The process can be greatly facilitated by the use of specific software like the Turbo Architecture that allows different groups to work in parallel towards the development of project architectures that will be integrated into the regional architecture in a later stage. When this step is completed, all the existing and planned interconnections among the elements of the architecture, and not just the CVO part, will be shown.

(5) Development of a strategic deployment plan

This is the final step prior the actual physical deployment of ITS projects. A consolidation of the funding resources, identified benefits, necessary infrastructure applications, and member commitment needs to be undertaken to construct the roadmap that will guide the deployment of freight ITS during the following decades. Critical centers like the Traffic Management and Emergency Coordination Center, or independent fleet management projects, will be weighed and finalized.

Following the architecture development, the collaborative’s role will change to become a body for monitoring and evaluating member performance as well as resolving the disputes that may arise.

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38 In practice some projects would already be deployed before the Architecture is finished. This does not diminish the importance of the Strategic Deployment plan. Instead, it helps for incorporating the existing projects into the Architecture context.
Figure 7: Visual Representation of the FTC’s Approach to Developing the Regional ITS Architecture for KL
5. Recommendations

Based on the issues laid out in the previous sections, a compilation of all implied recommendations and the needs for further research is presented here.

5.1 Proposed Goals

As emphasized in Section 4, the improvement of the LOS of freight transportation is a task that requires a coordinated approach between the private and public sector. From the higher freight policy level, one of the best ways to engage the private sector in an effort for substantial improvements is to follow a two-tiered approach:

(i) provide the infrastructure and the organizational flexibility in the public sector to accommodate the needs for a more efficient transport sector, and
(ii) showcase the substantial gains to be expected from the implementation of new technologies and organizational structures. On the planning level, the inclusion of the private sector can be achieved via the public-private collaborative described Section 4.2.

The broader goals of such a planning effort follow.

5.1.1 On the level of the firm

(i.1) Reverse the fragmentation of the drayage companies by favoring consolidation and merging. *Reasoning*: few bigger firms have advantages from economies of scale in implementing new technologies and operating freight stations and depots.

(i.2) Encourage port and rail operators, and drayage companies to have specific focus on their respective business and not vie for becoming a third party logistics (3PL) provider unless they do so by independent subsidiaries. *Reasoning*: 3PL providers need not be tied to mother companies in order to ensure the best and most cost efficient service for their clients.

(i.3) Provide incentives for the use of information technologies for authorizing and declaring cargoes (EDI/Internet) as well as electronic log keeping by enhancing their advantages with substantial time and effort benefits and maybe reduction of the nominal transaction costs. The ultimate goal would be to transform the EDI system into an ILIS as described in Section 3.2 reaching a Level 3 intermodal integration.

(i.4) Gradually mandate the use of tracking for hazardous materials aiming to increased safety and security but also as a showcase of the advantages of freight tracking and AVL in general. Additionally, incentives for the increase in use of fleet management and online tracking systems could be perhaps provided through the port operators (that face problems of inadequate LOS in peak times) by offering price reductions to providers that use these technologies.

(i.5) Following (i.4), port operators can encourage a rationalization of the freight truck demand by offering yard operations 24/7, scheduling pick ups and giving incentives for using the non-peak hours. *Reasoning*: Efficiency of operations on both ends (port and truck) is increased and the demand posed by freight traffic on highways is dispersed.
(i.6) Encourage the creation of electronic marketplaces for transportation services\(^{39}\). It is complimentary to the transformation of society around information technologies.

5.1.2 On the Level of Policy and Planning

(ii.1) Promote the use of alternatives to trucking for domestic freight by better utilizing existing intermodal facilities like ports and rail terminals. ITS can help Short Sea Shipping and rail-sea solutions to become more effective and thus reduce the congestion on the highways caused by truck traffic. Another solution, highway lanes dedicated specifically to trucks, seems difficult to implement in the intensive land use areas of the KL region. Further benefits from removing part of the truck traffic from the road network are: reductions in pollutant emissions; increases in the reliability of the trucks that actually remain on the highway; and an enhancement of bus public transit.

(ii.2) Consider the possibility of creating a second pole of development in Johor, to take advantage of the PTP potential. This would decrease the pressure on the KL metropolitan area and insure that PTP does not rely entirely on transshipment cargo.

(ii.3) Prioritize the CVO and CVISN at least on the same level as passenger ITS applications and consider the creation of a central agency to plan and overview the implementation (similar to MITSA described in Section 4). A branch of MITSA or a separate organization should also be specifically authorized to oversee issues of intermodalism.

(ii.4) Support human resource training with the continuous education of current and future workers, in general transportation planning and logistics, as well as in the operation and maintenance of ITS infrastructure. Additionally, the public sector needs to hire or contract personnel with knowledge in the new transportation technologies in order to facilitate informed decision-making and smooth out the transition from an infrastructure centered institutional mentality to an information-based one.

(ii.5) Bringing the recommendation (i.4) one step further, the goal would be to obtain a total tracking capacity that would work towards the conformance with the Container Security Initiatives (CSI) security standards\(^{40}\) pioneered by the U.S. Given that the US is the single largest export partner for Malaysia\(^{41}\), achieving an early compliance could offer the authorized Malaysian ports a competitive advantage in the region that could also be transferred to the Malaysian products too.

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\(^{39}\) There are five categories of possible electronic relationships and offering of transport services:
(i) Electronic retailers that offer business to consumer (B2C) facilitation, (ii) Services and Catalogs: Intermediaries between business and the consumer of a service that provide common forums where products and services can be advertised. (iii) Exchanges: Forums where exchanges can be made. (iv) Procurement and Collaboration hubs, and (v) Auctions.


\(^{41}\) See Section 1.1.
(ii.6) Rationalize the land use patterns, separating to the extent possible commercial uses with highly intensive transportation needs and housing, so that the respective traffic does not intermingle impeding each other. The integration of existing Geographic Information Systems (GIS) in a nationwide scale that includes land uses, transportation needs, environmental quality etc. would be of significant help for this effort.

(ii.7) Promote industrial integration investments that would reduce the need for exporting and re-importing processed goods in the manufacturing cycle, as proposed in NEAC (1997). Beyond the obvious benefits to the national economy, it would relieve some of the pressure from the transportation sector for JIT logistics.

5.1.3 On the legislative level

(iii.1) Building on recommendation (i.3), it is necessary to optimize and streamline the administrative procedures connected to freight transport, in concert with the CVISN effort, to make it attractive to the private sector (one stop shopping for trucks).

(iii.2) Adapt legislation for the use of electronic enforcement and checking using Weigh In Motion (WIM) sensors and other equipment.

(iii.3) Rationalize and optimize truck weight regulations to reflect modern capacity by increasing weight limits for modern 6-axle trucks that reduce pavement pressure and increase safety by improving turn stability.

(iii.4) In order to achieve greater efficiency from recommendation (ii.1) the cabotage restrictions should be reconsidered for other ports beyond PTP so that a network of domestic connections covering all of Malaysia can be competitively created. These ports could be Penang, Kemaman, Bintulu, Kota Kinabalu and perhaps Kota Bahru.

(iii.5) Work towards standardization of technologies, especially those with widespread implications like tags for container tracking and communications systems frequencies. Taking into account that the U.S. will soon set relevant standards, this would ease the CSI compliance cited in recommendation (ii.5).

5.2 Performance Indicators

Depending on the goals that are set, it is imperative to establish appropriate evaluation procedures and performance measures to track the progress made as discussed in Section 4.2 point 3.4. In addition to those, the following indicators of the freight transport system status could be used as measures of successful or not implementation of the changes:

- The percentage of firms that use electronic methods (EDI/Internet) for conducting and declaring their transactions reaches 60% of the total.
- The cost of commodity transportation does not increase beyond the marginal transportation cost.\(^{42}\)

\(^{42}\) Calculating the marginal cost of transport – especially for decreasing-cost industries like rail - can be controversial. An approximate comparison tool can be derived by adjusting the existing rates in other countries.
The flow of critical commodities is expedited.
The utilization of equipment is increased.
The number of truck trips in the Kuala Lumpur and secondly in the rest of Malaysia tends to remain at least constant by transferring the increased transportation demands to other modes and increasing the productivity of the trucking industry. If this is not achievable then at least the relative contribution of intermodal transport should show upward trends. This way the contribution of freight traffic to congestion and emissions decreases with time as the total motor vehicle traffic increases. Rail increases its percentage of freight handling from 5% to 20% of the total cargo shipped internally and Short Sea Shipping is utilized as a viable alternative to truck haulage beginning to attract a significant percentage of the freight.
The deployment of CVO applications and the rest of the ITS program is firmly based and supported by an adequate Architecture. There is a continuation in the scope and interoperability among the projects.
The need for distant trips of commodities, or even exporting and re-importing in the production cycle, is reduced and more of these needs are covered internally.

5.3 Funding
Finally, as in all other public projects, the key to an efficient and effective intermodal transportation system that utilizes ITS applications lies in the ability to fund it. The government will be compelled to use flexible means to fund capital-intensive projects that complement the transportation, environmental and economic development objectives set previously.

The proposed MITSA or its equivalent should come up with viable funding solutions that would most probably include a variety of the so-called innovative funding measures. The basics of such an approach rely on encouraging public-private partnerships. The governmental dedication to this objective needs to be shown with the creation of a comprehensive ITS/CVO Intermodal Masterplan. The financing of the ensuing projects could follow one of the three standard concession practices Built-Operate-Transfer, BOO, BTO. Some projects can be designed to be self-financed.

Conclusions
This inception report assesses the general situation of freight transportation in Malaysia and brings forward the potential of Intelligent Transportation Systems applications and more specifically Commercial Vehicle Operations for providing a way of improving the offered level of service.

Malaysia’s vision of attaining developed nation status by 2020, is based on expansion towards a service and information economy, but this is only possible by increasing the productivity of the industry. A major parameter towards a competitive industry is the efficient transportation of freight, since it is calculated that this sector comprises at least

43 See Appendix V for more details on the various public-private partnership types.
10% of the value of products. Domestic and international supply chains rely on the high utilization of equipment and infrastructure, as well as the coordination of a series of private and public administrative procedures.

In order for the transportation industry to increase its productivity, changes in the customary way of conduct of both private and public agents are needed. One way to achieve a coordinated change is to initiate a new organization with the participation of the private sector that will oversee the Architecture development, outline policy orientation, and coordinate the implementation efforts. Although, it may be a politically difficult decision, the end results from the coordination level that can be achieved and the stakeholder involvement can be significant.

The other main recommendations made, are directed on three levels: individual firm, transportation policy and legislative. The streamlining of administrative procedures and their electronic facilitation, the consolidation of the very small carriers, the active support of private initiatives for installation of freight tracking and fleet management systems, the support of intermodal solutions and increase of the utilization of the rail and waterways for domestic and short distance international trade, are some of the more important ones.

All these measures have as end goal to facilitate the creation of an efficient supply chain. More specifically they can:

- Support efficient landside haulage and logistics services (the motivating problem for this report);
- Improve the traffic conditions and emissions in congested areas like Kuala Lumpur;
- Increase the security level so that it complies with the CSI requirements and give the Malaysian shipping and port industry a competitive advantage;
- Promote road safety and reduce the impacts or prevent incidents that involve hazardous materials;
- Streamline civil and private transportation services;
- Encourage the use of new technologies, which is convergent with Malaysia’s stated goal of the promotion of knowledge-based economy; and
- Give incentive to local manufacturers to enter new technology markets of sensing, monitoring, sealing and other electronic equipment.
References


Parsons, R. “Chapter 19 - Issues in Developing and Implementing the National ITS Architecture. Intelligent Transportation Primer, Institute of Transportation Engineers (ITE), Washington, D.C., 2000.


Shin Yin, Katherine Chan, personal communication via email, Spring 2003.


Appendices

**Appendix I – Container Tracking Tags**

The first steps to be made, if the deployment of an Automatic Vehicle Location (AVL) or Freight Tracking system is to be successful and organized, should include the following:

- A careful analysis of the costs and expected benefits;
- A comprehensive investigation that would map the users/customers of the system as well as (or even more important in our case) the demands of their clients/consignors;
- Identification of the potential for private interest and co-sponsorship giving special attention to the electronics industry; and
- Implementation of pilot projects to test the feasibility and adaptation to the Malaysian characteristics (driver behavior, employee culture etc.).
- Promotion of Fleet Management Systems to Malaysian logistics and haulage companies. If there is reluctance of the sector to follow, incentives to the first user companies like tax exemption of the investment or priority to public contracts could be given.

It would be helpful if the above were part of a National ITS Masterplan that would adopt an incremental and open architecture approach.

Prior to the finalization of the systems that would be implemented, the inter-operability of the systems inside and outside the national borders should be of concern. For example, some consideration should be given to Thailand’s intentions to adopt a similar system. If Thailand has also plans for a similar system, then effort is needed to ensure the compatibility of the two systems. In addition, special attention should be given to the meeting of the CSI requirements. Finally, two other important considerations should be (i) the ease of expansion that the systems exhibit and (ii) their technological characteristics, so as not to be obsolete at the time of deployment.

The currently available technologies that can be used for AVL are summarized in the following table.

<p>| Comparison of Technologies (Source: Wolfe [2003]) |
|---------------------------------|---------------------------------|---------------------------------|
| <strong>RFID</strong> | <strong>Positives</strong> | <strong>Concerns</strong> |
| | • Broad array of capabilities | • Lack of standards, but this is being addressed |
| | • Passive can be very low cost | • Lack of global frequencies, especially in regard to active RFID |
| | • Active can be high capability and moderate cost | |
| | • Can take person out of the inspection loop | |
| | • Movement on standards | |</p>
<table>
<thead>
<tr>
<th>Infrared</th>
<th>• Clearly effective at short ranges</th>
<th>• Lack of clarity on strengths and shortcomings -- contradictory information</th>
</tr>
</thead>
</table>
| Contact and Near Contact | • Some are highly reliable in harsh environments  
• Demands human involvement in seal inspection | • Contact “keys” subject to loss and misuse  
• Demands human involvement in seal inspection |
| Remote | • Potential for immediate identification of problems  
• Potential global coverage | • High cost  
• Usually requires significant outbound power |
| All | • Potential to improve efficiency along with security | • Risks of increasing complexity, opening new avenues of attack, and generating false confidence  
• Need for independent assessment of vendor claims  
• Need to assess operational impacts as well as technical performance  
• Requirement to manage and sift increased data flow, identify false positives, and act on true positives |

**Appendix II – Conventional Credential Administration in the US**

**Current US Credentials administration:**

Commercial Vehicle Credentials:
- Vehicle registration [interstate registration plan (IRP) or intrastate],
- title,
- oversize/overweight permit
- Carrier registration (including insurance verification and hazardous materials authority),
- interstate fuel tax (IFTA),
- HazMat permit
- Driver licensing

The typical process for credentialing today is:
1. Applicant requests paper form from state via phone; or state mails renewal form to applicant
2. Applicant fills in entire form and submits in person at the appropriate county-based credential facility
3. State personnel review the form in real time and ask applicant for supporting documentation, corrections, and clarification, and compute fees due.
4. Applicant pays fee via check, cash, or credit card.
5. In some cases, applicant departs with credentials (driver's license, temporary license plate, oversize/overweight permit, HazMat permit). In other cases, applicant departs with receipt, but no credential, pending further processing and checks.

6. Application information is entered into computer system in the appropriate credential office. The information is uploaded to a central site for that credential administration, and checked to see if the credential should be granted. Some checks are automated, some are manual. In most cases, the entry-check-response process takes ~5 working days. If the application is approved, in most cases, credentials are printed and mailed once a week. If the application isn't approved, the applicant is contacted either by phone or mail, depending on the nature of the problem.

**Appendix III – Freight Consolidation Methods**

Various methods for bundling freight flows are shown in the following figure from TRB (1998). AVL can facilitate these functions.

![Freight Consolidation Methods Diagram](image)

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<td>E</td>
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**LEGEND:**
- node for rail-road or barge-road exchange
- node for rail-rail or barge-barge exchange
Appendix IV – Proposed Organizational Structure for MITSA

**Figure 3. Organizational Structure of Malaysia ITS Agency (MITSA)**

1. NPC sets up MITSA.
   - Nomination of CEO and Board of Directors

2. MITSA creates guidelines for a National Architecture.
   - Adapts from existing worldwide models or formulates its own model.
   - Hires technical experts.

3. MITSA brings together groups of public and private actors for freight and passenger transport, to form public-private collaboratives.
   - Facilitates decision-making between operators and policy makers.

4. MITSA, along with collaboratives established above, creates Regional KL Architecture.
   - Identifies problems in different sub-systems of transport – passenger and freight.
   - Establishes a vision for ITS Architecture – decides on system ‘attributes’ required.
   - Decides on system ‘aspects’ and specific operational and user services.
   - Establishes ATMS guidelines, resolving areas of overlap between subsystems – such as in cases of Incident Management and Emergency response.
   - Fixes performance measures.

5. MITSA manages procurement process.
   - Floats tenders for various software, hardware requirements, technical and management consultancy.

**Key**

- National Planning Council (NPC)
- MITSA [Malaysia ITS Agency]
- MITSA Board of Directors
- Government: Part of the PM's Cabinet
- New quasi-public sector agency
- Chairman [Chief Secy. to Federal Govt. from PM’s Dept.]
- For linkage with NPC and for enforcement
- Head of Operations and decision-making
- Chief Executive Officer [‘ITS Champion’, nominated by MITSA Board of Directors]
- Representatives from Federal Government
- Representatives from State Secretariat and Federal Territory of KL
- Private Technical Experts
- Public-Private Collaborative: Govt. Officials and Private Sector Operators
- Technical and Management Consultants [public/private]
Appendix V – Types of Public-Private Partnerships

TRB (1998) summarizes the various types of public-private partnerships as following:

“Generally [] it is easier for the private than for the public partners to disengage from an unsuccessful project, since the latter partners are tied to a specific geographic point and have a more difficult (if not an impossible) time in defaulting or declaring bankruptcy. By and large, public partners have a longer time horizon, are more exposed to public scrutiny, are required to take a broader perspective, have deeper pockets (because of combined regulatory and taxing powers), and have more staying power (in large part because they are stuck where they are).

Planners have a great deal of latitude when it comes to teaming up public and private participants, but there are three basic models for public-private partnerships:

• **Build-operate-transfer (BOT)**—Under this approach, a private firm designs and constructs the facility with or without public-sector financing assistance. The private firm then assumes responsibility for operating and maintaining the facility for a period, usually 20 to 40 years, after which title is transferred to the host governmental jurisdiction. The costs of construction and operating are generally recovered through charges imposed on users. In this situation, the private developer, unless indemnified by the host government, accepts tort liability because private ownership is retained during the period of operation specified in the development agreement. Also, by private ownership it may be subject to taxes. (An example of this type of public-private partnership in the transportation area is the Dulles Greenway toll road project in Virginia.)

• **Build-transfer-operate (BTO)**—BTO differs from BOT in that when construction of the facility is complete, ownership of the project immediately passes to the public sector. The public jurisdiction then contracts with the private developer to operate the facility for a period specified in the development agreement. As with BOT, construction and maintenance costs are recovered through user charges. Major differences center on the issues of liability and taxes. Because the public sector holds title to the facility, the developer is significantly more insulated from liability risk. (An example of this type of public-private partnership is the State Route 91 tolled high-occupancy-vehicle lane in California.)

• **Build-own-operate (BOO)**—Under this approach, a private firm or consortium operates and maintains the facility indefinitely because the development agreement contains no transfer provisions. The BOO model is related to the concept of a concession or a “perpetual franchise.” Design, construction, operation, and maintenance are private-sector responsibilities, with the public sector assuming only a regulatory role. (An example of a BOO project is the Ambassador Bridge in Michigan, which is owned by the Central Cartage Company.)”