

Transport Logistics

**SHARED SOLUTIONS
TO COMMON CHALLENGES**



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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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Publié en français sous le titre :
Logistique des transports
DÉFIS ET SOLUTIONS

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FOREWORD

The mission of the OECD Programme of Research on Road Transport and Intermodal Linkages (RTR) is to promote economic development in its Member countries by enhancing transport safety, efficiency and sustainability through a co-operative research programme on road and intermodal transport. To achieve this objective, the Programme recommends options for the development and implementation of effective transport policies for Members, and encourages outreach activities for non-member countries. All 30 Member countries participate in the Programme.

The Trilateral Logistics (TRILOG) Project was initiated in 1996 as part of the RTR Programme, with an aim to stimulate the exchange of approaches to and experiences with multimodal management, freight transport logistics and associated policy challenges encountered on a multi-regional and international basis. The Project was undertaken through three task forces, which have produced reports representing the Asian-Pacific, European and North American regions. Japan, the European Commission's Directorate General VII (now DG TREN) on Transport, and the United States, chaired the three task forces respectively.

This report aims to identify and address the issues common to all three regions, and hence develop policy options for co-operative action to facilitate the attainment of efficient logistics networks internationally.

ABSTRACT
ITRD N° E113826

With the increasing globalisation of economic activity and rapid development of Information and Communication Technology, businesses are seeking to develop and organise strategic, efficient and world-wide networks. These networks, which are often referred to as global logistics focus on integrating product sourcing, production and distribution.

In order to promote such global logistic networks, which are also compatible with sustainability objectives, governments need to develop and implement cohesive transport policies both individually and collectively. Hence, collaborative studies are needed to exchange approaches and experiences across regions. Three task forces, which have produced reports representing the Asian-Pacific, European and North American regions have sought to identify problems and suggest solutions in their respective regions.

This report aims to identify and incorporate issues common to all three regions and develop policy options to facilitate the development of global logistics systems on a co-operative basis.

Fields	Economics and administration, traffic and transport planning.
Field codes	10, 72.
Keywords	Demand (econ), economics, education, efficiency, financing, freight transport, government (national), harmonisation, integration (transport), intelligent transport system, intermodal transport (freight), international, logistics, policy, sustainability, transport operator.

TABLE OF CONTENTS

Foreword	3
Abstract ITRD	4
EXECUTIVE SUMMARY	7
Common findings and recommendations	8
<i>CHAPTER I: GLOBAL TRANSPORT LOGISTICS</i>	10
1.1. Development in trade networks	11
1.2. Trends in logistics	11
1.3. Policy recommendations	16
<i>CHAPTER II: INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) DEVELOPMENTS FOR SUPPORTING LOGISTICS</i>	21
2.1. Advancement of logistics in the information society.....	21
2.2. Effects of advanced information technologies and technological innovation on logistics	22
2.3. Policy recommendations.....	24
<i>CHAPTER III: INTERMODALITY AND LOGISTICS</i>	27
3.1. The need for sustainable transport	27
3.2. Characteristics of intermodal transport.....	27
3.3. Logistics and intermodal transport.....	28
3.4. Obstacles to intermodal transport	28
3.5. Policy recommendations.....	30
<i>CHAPTER IV: PROVISION OF LOGISTICS INFRASTRUCTURE</i>	35
4.1. The need for logistics infrastructure development.....	35
4.2. The need for new financing and operating schemes	35
4.3. Partnership between public and private sectors	36
4.4. Minimising costs of infrastructure projects	36
4.5. Distribution of costs	37
4.6. Regional issues	38
4.7. Policy recommendations.....	39
<i>CHAPTER V: SKILLS AND TRAINING REQUIREMENTS</i>	43
5.1. The characteristics of the labour market in the logistics industry.....	43
5.2. Changes in the logistics industry	43
5.3. Effects of changes in the logistics industry on human resources.....	44
5.4. Policy recommendations.....	45
<i>CHAPTER VI: EVALUATION OF LOGISTIC SYSTEMS – INDICATORS</i>	47
6.1. The aim of developing logistics performance indicators	47
6.2. The need for new indicators.....	47

6.3. Recommendations for developing new indicators	48
REFERENCES	50
ANNEX.....	51

EXECUTIVE SUMMARY

International business has been undergoing a period of rapid transformation. Trends towards globalisation, integrated logistics and the development of Information and Communication Technology (ICT) are all reshaping the world's trading patterns and consequently physical trade flows. Such restructuring is contributing to economic growth, better allocation of resources and more freedom of choice for consumers, as well as increased competition.

In order to be internationally competitive, businesses are organising strategic worldwide networks that can deliver an efficient and high-quality response to demand from any segment of the world market. The efficient and integrated organisation of such activities is often referred to as global logistics or supply chain management (SCM), and it has become the core of global competitive power.

Global logistics networks serve as a circulatory system for the corresponding global value-adding chain where various components in the logistics network serve different functions in an organisationally unified manner. Therefore, in order to establish a region as a key component in global logistics networks, it is necessary to create a vision of how to position the region strategically within the context of the overall global logistics networks. To achieve this objective, governments both individually and collectively will need to develop and implement systematic policies for realising the vision. The essence of this global logistics competence also applies to the private sector.

At the same time, in the midst of growing environmental concerns, efficient physical logistics are no longer independent from sustainable development objectives. Global logistical competence now requires a variety of considerations in a much broader perspective including the need for environmentally friendly logistics.

In order to establish efficient and environmentally-friendly global logistics networks in the 21st century, collaborative studies are needed to understand the current state of logistics systems in and across various regions and to identify the problems specific to each region. In these studies, the advancement of logistics needs to be assessed not only from the viewpoint of industrial or national competitiveness, but also from that of global social optimisation taking account of consumers, shippers, logistic service providers and government perspectives. Hence, a vision of desired global logistics networks based on global interests and a common framework across regions is required. Concrete policies and directions for both governments and private corporations, which will enable them to identify development paths to achieve the vision, should be advanced.

The aim of the OECD TRILOG Project has been to stimulate the exchange of approaches to and experiences with multimodal management, freight transport logistics and associated policy challenges encountered on a multi-regional and international basis. The project was initiated in 1996 as part of the OECD Programme of Research on Road Transport and Intermodal Linkages (RTR Programme).

A central theme is to identify common critical issues regionally and globally and then to compare or suggest solutions and approaches that could facilitate the development of relevant policies to promote efficient transport logistics. The solutions or suggestions should lead to policies that can

better foster private sector development, harmonisation of regulations, standardisation and use of technologies and practices that improve the overall level of integrated transport efficiency.

The TRILOG project was undertaken through three task forces, which have produced reports representing the Asian-Pacific, European and North American regions. Japan, the European Commission's Directorate General VII (now DG TREN) on Transport and the United States, chaired the three task forces respectively. In the report, the terms "(advanced) logistics" and "supply chain management" are used interchangeably. (Advanced) logistics refers to "...the concept of synchronising the activities of multiple organisations in the logistics chain and feeding back necessary information to organisations in production and/or physical distribution sectors on a real time basis, by fully utilising information technology and digital communication networks," (OECD 1992, 1996). This extends the original concept of logistics management seen as an iterative process that seeks to optimise the flow of materials and supplies through the organisation to the customer (Christopher, 1999). In Europe, the term "supply chain management" is used, whereas in North America and the Asia-pacific the term (advanced) "logistics" is generally used. Hence, logistics and supply chain management is taken to include the extension of logistics concepts to customers and suppliers, irrespective of geographical and organisational boundaries.

This plenary TRILOG report aims to identify and incorporate the issues common to all three regions, and hence develop policy options for co-operative action to facilitate the attainment of seamless transport systems internationally. There are significant shifts taking place in the way that business is being done (e.g. e-commerce), but it is not clear what developments will follow, in what direction they will move, what exactly causes the developments and how to react to or promote them. The report focuses on the common findings of the three regions and recommendations based on these findings, and hence should be considered as an overview rather than a set of definitive conclusions.

Common findings and recommendations

- The trend towards globalisation and logistics is in the process of reshaping transport activities. New strategic uses of logistics will continually alter the nature and culture of operations in companies; governments will have to match these changes. The strategic advantage of logistics is likely to be most pronounced in terms of improvements in co-ordination and planning resulting in transport efficiency gains. However, it is important for governments to fully understand concepts of logistics and to stimulate economic competitiveness to achieve positive economic development. At the same time, governments need to reduce any negative impacts, so as to achieve a more balanced approach to economic growth, including sustainable development.
- At present, the ability of governments to promote global logistics systems is limited by internal institutional and organisational constraints, as well as a lack of knowledge of logistics developments and of the effects of their policy actions. In many cases, freight transport policy reflects modal thinking without due regard being given to the need for integrated freight management as required by transport operators.
- In order to increase competitiveness by promoting the opportunities afforded by logistics and also achieving sustainable development, governments need to develop an *integrated policy framework* to achieve broader socio-economic objectives. The range of policy issues affecting the efficiency and sustainability of global logistic systems are wide and extend beyond the jurisdiction of narrowly focused government agencies charged solely with improving the performance of the transport sector. Also, since transport and logistics are

interrelated with international trade, international finance, sustainable economic development, global climate change and regional and local concerns, the policy framework should be seen in a much broader context and be co-ordinated internationally, where appropriate.

- Within this overall framework, a range of triggers and constraints need to be designed given the regional variations in “local” conditions. Countries differ in their use of logistics since they are at different stages of development with diversified cultural backgrounds. Many governments, including those in Asia, still have a very limited understanding of logistics. Several countries suffer from insufficient *specialised logistics knowledge* as well as lack of more general awareness of the importance of logistics, and are therefore unable to formulate cohesive policies to manage logistics. In addition, modern logistics concepts such as intermodal transport have not penetrated these countries yet. Nevertheless, all regions should respond to the current developments in logistics and the need for efficient and environmentally friendly transport solutions.
- The effectiveness and efficiency of policy actions could be analysed through *comparative studies*. A major difficulty encountered in this study was the lack of information available to compare and contrast different regions. Although assessments of performances of logistics systems and effectiveness of policies could be made possible by the use of appropriate performance indicators, at present indicators and data for monitoring developments in logistics are lacking. Therefore, there is a need for co-operative research to develop these indicators and identify policy relevant data requirements. It is also necessary to establish comparability of data collections through a co-ordinated statistical database in order to enable data sharing among all participants.
- The strategic use of ICT is critical for realising advanced logistics systems. On the other hand, the high pace of change in this area poses a challenge. The increasing use of ICT in logistics resulting in fast, flexible development of transport on a global scale may pose a threat to achieving sustainability unless the policy requirement is rigorously defined. Many governments are lagging behind in the development of a policy framework that could promote the effective use of ICT to the benefit of transport efficiency and sustainability.
- Although there is little sense of urgency in the international arena for sustainable mobility, it is essential that the policy tools for achieving compatibility between logistics development and sustainability be formulated. Therefore, governments need to enhance the capacity for advanced transport logistics to contribute to *sustainable transport development* in the context of increasing globalisation of economic activity.
- Logistics yields opportunities to expand *intermodal freight transport* by increasing the volume and length of flows and by taking advantage of the better planning and co-ordination possibilities offered through ICT. Thereby, logistics could contribute to the achievement of sustainability objectives by improving the level of service offered by intermodal transport to make it more attractive to shippers. However, this will require co-ordinated interventions by governments, including harmonised regulations, and standardisation of frameworks surrounding the use of technologies and infrastructures. Research on mechanisms, such as Performance Based Standards, to facilitate innovation and the introduction of new operational and infrastructure technologies through regulatory reform is required.
- *Integrated transport infrastructure networks* are prerequisites for global logistics systems. In many Asian countries, the development of freight transport infrastructure is a key issue.

Developments in Asian logistics have not kept pace with its rapid growth and lag far behind those of North America and Europe. There is an imbalance in the amount of transport infrastructure and institutional measures between different countries in Asia, which leads to gaps and inefficiencies in the logistics system.

- In both developed and developing countries, ***financial instruments*** available to governments for the development of infrastructure are still not sufficiently flexible, prevalent, or transparent to cover and serve current needs. The potential for innovative financing arrangements, including Public-Private Sector Partnerships, should be explored.
- Logistics and ICT developments necessitate changes in the demand for skills. Improved ***training and qualification systems*** are needed to respond to these developments. Human resource development in support of the freight industry should be considered both a public and a private sector responsibility. Since the level of skills differs across countries, developing countries may need assistance in establishing training courses.
- In order to achieve efficient global logistics systems, ***extensive co-operation and collaboration among private corporations, governments and international organisations*** is essential. Governments need to prepare for the framework for the development of advanced global logistics systems, where important cross-border issues such as custom clearance processes, deregulation and development and maintenance of intermodal systems should be addressed. Therefore, governments are advised to co-operate and integrate their policies at a global level by, for example, harmonising regulations, streamlining ICT-based operations in custom clearance systems, standardising new technologies in order to promote seamless operations, compatible training and qualification systems and promoting extensive information exchange among all affected stakeholders.
- Since many technologies, especially those encompassed under Intelligent Transport Systems (ITS), are still in the research phase, R&D efforts are crucial for the development of advanced logistics systems. However, due to the uncertainty of its short-term profitability, R&D in the private sector needs support. Therefore, governments need to not only foster R&D efforts in the private sector, but, in order to maximise the opportunities of technological progress, also facilitate the demonstration of technological solutions and seek productivity benefits from diffusion of information.

CHAPTER I: GLOBAL TRANSPORT LOGISTICS

1.1. Development in trade networks

One of the most obvious manifestations of logistics activities is the growth in freight transport due to the worldwide expansion of trade. In particular, the globalisation of industry, including planning, sourcing, manufacturing and marketing activities has resulted in more complex trading and much more developed transport networks.

Development of trade networks has also been facilitated by major regulatory and technical trends. Trade liberalisation, particularly within trading blocks such as the Asia-Pacific Economic Cooperation (APEC), the European Union (EU) and the North American Free Trade Agreement (NAFTA), has removed constraints on cross-border movement and has reduced related “barrier costs”. Advances in telecommunications and information technology have given companies the means to improve the efficiency of their businesses across widely dispersed geographic locations.

1.2. Trends in logistics

The development of trade networks creates various needs for value-added logistics management and gives rise to a large number of individual trends in logistics and supply chains.

1.2.1. Restructuring of logistical systems

Manufacturers are restructuring their logistics systems by concentrating production and inventory capacity in fewer locations. Concentrating production capacity enables companies to maximise economies of scale in production at the expense of making their logistics system more transport-intensive and lengthening lead-time to customers.

Inventory centralisation, which has been a long-term trend, is now occurring on a larger geographical scale. Companies have been able to enjoy the inventory cost savings, while minimising additional transport costs by geographically separating stockholding and break-bulk operations, with the former becoming more centralised while the latter remains decentralised.

Centralisation has also occurred in parcel and mail delivery systems by configuring their logistics systems to “hub-satellite” systems in which all but local traffic passes through a centralised sorting system.

1.2.2. Realignment of supply chains

Companies are realigning their supply chains. In many sectors, companies have been concentrating on core competencies and sub-contracting non-core, ancillary activities to outside

contractors. Vertical disintegration of production is adding extra links to the supply chain and increasing the transport intensity of the production process.

At the same time, companies have steadily expanded the geographical scale of their sourcing and distribution operations. Also, in order to overcome the tension between centralised production and product customisation, companies are centralising the core production of standard products, often in countries with low labour costs, and delaying their customisation until products reach their regional markets. The number of stock keeping units is minimised until the point of customisation, thus minimising inventory risk and costs, and reducing lead-times.

An example of this is the Personal Computer (PC) manufacturing industry which has reformed its activities to take advantage of the globalisation of production networks to reduce costs. In order to respond flexibly to changes in demand while avoiding increases in inventories of finished products, the industry has created a global product network in which final assembly is placed as close as possible to end markets.

In regard to delivery, direct delivery seems to be expanding for products with a higher ratio of value to weight. This reflects the growth of direct marketing, particularly through electronic media. On the other hand, in several countries in Europe, some large retailers are taking responsibility for the supply chain from their suppliers to final purchasers.

In realigning supply chains, international transport is becoming increasingly concentrated at a smaller number of hub ports and airports in order to enjoy economies of scale.

1.2.3. Rescheduling of product flow

Product flow in the supply chain is increasingly time-compressed. The lengthened supply chains are now under pressure to compress order lead-times (time elapsing from the placing of an order to the delivery of goods) in order to be competitive in a foreign market. There seems to be a variation of lead-times, which can be attributed to differences in trading practices, degree of retail concentration, level of ICT support and size of the country.

Time compression of product flow can save inventory costs, enable companies to respond more rapidly to shorter life cycles of products as well as variations in demand, and increase reliability of delivery. One way of rescheduling freight movement is by operating nominated-day delivery to customers and introducing timed-delivery at factories.

1.2.4. Refinement of transport and warehousing management

Transport and warehousing management is refined by optimal use of different transport modes and by the increasing use of Information and Communication Technology (ICT). For example, selective use of international transportation modes is now common in the personal computer industry, in which parts are transported either by air or sea, depending on the degree of added value. Items with low added values are normally carried by sea in order to reduce transportation costs, whereas key parts with higher added values are selected according to demand shifts and transported by air immediately prior to assembly. This enables manufacturers to maintain the quality of parts used in finished products, ensure consumer satisfaction, and at the same time eliminate the risk of declines in the price of product inventory.

The real cost of international freight movements has been declining. Air freight, previously seen as too expensive and complex, has emerged as a more viable option due to declining unit costs, excess capacity on some lanes, reduced international trade bureaucracy and the growth of integrators with comprehensive door-to-door services.

Developments in vehicle and handling technology also offer the potential to change the operating costs of different modes of freight transport and bring about a change in the pattern of traffic flows.

ICT will greatly impact transport and warehousing management, with electronic communication along the supply chain being set for massive growth. Automatic positioning and navigation systems as well as real time order processing, routing and scheduling systems are predicted to expand. Many transport companies have invested heavily in “track and trace” systems to identify the location of any consignment at any time, improving the visibility of the global supply chain to shippers and their customers. This has emerged as a key issue in inventory management.

1.2.5. Changes in product design

An increase in complexity and sophistication of products will lead to more value added per unit of weight, especially with final products. Increase in Internet sales is converting the direct delivery of CDs, tapes, videos and software into electronic distribution. Opportunities also lie with regard to the integration of logistics and transport implications at an early stage of product design: integrated product design. For example, the participation of the packaging industry and other supply chain actors. Standardisation and the implications for (reverse) logistics (storage, handling, transport etc.) can be taken into account. For example, this could entail the collection of clean waste (*i.e.* packaging) from retail outlets by the same vehicles used for product distribution.

1.2.6. Integration of logistics

As industrial activities extend globally, logistics will involve more material and information flows throughout a supply chain from sources to customers, which extends beyond national borders. In restructuring supply chains, logistics need to be managed as an integrated process that seeks to optimise these flows. If all firms involved in a particular supply chain optimise their logistics systems independently of other firms in that chain, the management of flows across the whole chain is likely to be sub-optimal. Integrated logistics attempts to overcome this problem.

This concept of integrated logistics extends functional management to include customers, suppliers and manufacturers. Companies can no longer afford to focus on supply-side efficiency alone, they need to use their business strategy to drive them towards integration of their demand and supply sides to build a platform for achieving a competitive advantage. This involves the complete set of activities and organisations relevant to production and distribution, as well as their connecting supply links. It suggests an underlying structure of activities operating within a process of material and product flow. Decisions made in each area impact others so that it becomes a single, interdependent system.

Different levels of integration

Integration of industrial logistics covers a wide spectrum. In a fragmented supply chain with many stakeholders involved, the integration of industrial logistics can be initiated as a functional

integration, such as the integration of different divisions within the same company responsible for sales and distribution activities. Companies at this level of logistics integration are attempting to gain functional excellence and cost advantages in their global supply chain operations of sourcing, conversion, distribution, and after sales service. Companies are removing internal barriers instead of reinforcing them, and are focusing on tactical solutions (*e.g.* rationalisation of non-value-added activities, working capital, inventories, customer services, etc). This may evolve into internal integration where different companies under the same corporate structure combine facilities, equipment, systems and personnel in more flexible modes of deployment.

The most extensive integration is market channel or external integration. This level requires that enterprises extend their internal supply chain process both upstream with suppliers of raw materials and downstream to final consumers. In this way, all companies in the supply chain are integrating their activities with those of other companies to achieve economies of joint operation. The market channel now becomes a virtual enterprise with common goals, systems, organisations, facilities and shared management. Firms at this level are working in project organisation with suppliers and customers, and investments are made jointly. Companies achieving this level of integration have the potential to realise superior levels of performance.

While relatively small groups of innovative companies have adopted logistics techniques and tools, and incorporated advanced ICT, the emphasis for most is on achieving optimal flows between two consecutive companies in a chain. Many companies are still grappling with the problems of internal integration, with respect to both physical activities and information systems.

Compared to North America, logistics are underdeveloped in Europe and Asia. In practice, the development of logistics is partly a consequence of concentration of power (through take-overs and mergers) and the subsequent exercising of that power on other supply chain members. Alternatively, it can be seen as an opportunity for smaller companies to collaborate in order to achieve supply chain economies of scale that may otherwise be denied to them individually.

Impact of integrated logistics on global business practice

The progressive integration of logistics across supply chains has had profound effects on business practices. These include the following trends, noted by Scary (1999):

- Higher interdependency between firms interlinked within the business network, which has become the new reality of industry. Performance by an individual firm affects the performance of all, and determines the ultimate performance of the network as a whole.
- A more globalised economy links the sourcing of material and product components with production and markets across national boundaries, invoking problems of time, distance, cultures and diverse market preferences. It intensifies competition and increases the complexity of supply by expanding product variety, searching for higher efficiency while responding to diverse and rapidly changing markets.
- Changing the concept of corporate enterprise. Organisations have shed peripheral activities to concentrate on core competencies that offer the promise of unique value. Greater external dependence therefore forces attention to inter-organisational relationships for co-ordinating activities and processes. In some cases, the shift towards core business has led to the creation of “virtual” organisations, where the majority of business operations have been outsourced to external parties, including third and fourth party logistics.

- Transformation of organisational structure of the corporation from a hierarchy, in which the manager dispenses knowledge and workers perform, to the point where knowledge is widely diffused throughout the organisation and workers manage their own activities. This places collaborative decisions closer to the point of action. In a logistics framework, it places a premium on inter-organisational relationships through formal and informal contact, as well as on data and information systems across organisational boundaries.
- Changing the government environment, creating both problems and opportunities. Much of the economic regulation of transport and telecommunications has been liberated, leading to new market-based combinations of service providers who offer transport combined with warehousing, telecommunications, product assembly and related services. Other forms of regulations to cover consumer protection, environment and safety are replacing the former economic restraints.

1.2.7. Outsourcing of logistics activities

The need for outsourcing

Efficient logistic activities are indispensable to effective business operations. Therefore, companies that perform these necessary functions exceptionally well are, in multiple ways, adding genuine value to the business operations.

Globalisation drives a higher level of complexity in the logistics supply network, highlighting the important role of distribution and transportation to enhance market value of products. The importance of distribution and transportation in maintaining a company's sustainable, competitive advantage further increases the sophistication of distribution and transportation operations.

As companies seek to concentrate on their core competencies, logistics activities are now being outsourced increasingly to specialist providers.

Third party logistics (3PL)

Logistics activities are often outsourced by manufacturers to Third Party Logistics operators (3PL). These operators have greater expertise, which enables increased flexibility of logistic operations to cover wider geographical areas, with lower operating costs and better quality of service.

The externalisation of logistical services has been a two dimensional process, with firms increasing both the range of services that they source externally and the volume of traffic entrusted to the third party. Companies have been increasingly demanding an integrated logistics service tailored to their requirements. The best third party providers understand the strategic importance of logistics management, and position themselves to provide more and better services that overcome their client's concerns about relinquishing control of their key competency. This places heavy emphasis on the contractor's ability to co-ordinate and customise its service.

The clients appear to be satisfied with their 3PL-service experience. The outsourcing of logistics activities is expected to increase. This trend has encouraged many global logistics service providers to expand the range and geographical coverage of their activities to developing regions, offering more customised services.

Fourth party logistics (4PL)

Today, most providers offer a range of services that complement the specific needs and capabilities of their clients. The general trend, however, is for third parties to function as full-service providers, thus ensuring that all services desired by clients can be supplied at least as completely and cost effectively outside the organisation as within. Fourth Party Logistics (4PL), a new concept in logistics outsourcing, is emerging as a path to surpass one-time operating cost reductions and asset transfer of a traditional outsourcing arrangement.

A 4PL provider is a supply chain integrator that assembles and manages the resources, capabilities, and technology of its own organisation with those of complementary service providers to deliver a comprehensive supply chain solution. Central to the 4PL's success is a "best of breed" approach, which is to integrate the client's supply chain activities and supporting technologies across alliances between the best third party service providers, technology providers and management consultants, thereby creating unique and comprehensive logistics solutions that cannot be achieved by any single provider. The development of 4PL's solutions leverage the capabilities of transport operators, technology service providers, and business process managers to deliver a comprehensive supply chain solution through a centralised point of contact.

1.3. Policy recommendations

i) Need to develop policies to stimulate the trend of globalisation and logistics

Trends towards globalisation, logistics and the development of ICT, including e-commerce, are combining to reshape the world's trading patterns and consequently physical trade flows. Such restructuring is leading to economic growth, better allocation of resources and above all greater freedom of choice for consumers. It is evident that policy measures to counteract the dynamics of logistics and globalisation are simply not an option. In contrast, by providing the underlying framework to support these developments, governments may achieve an aggregate rise in welfare, as well as a more equitable spread of welfare.

Therefore, policies for establishing each region as a key component in global logistics networks need to be developed and implemented. Key issues for establishing such policies include environmental concerns, strategic use of information technologies including the development of frameworks that ensure consistency and interoperability in the application of ICT, regulation and deregulation, customs clearance, efficient logistics pricing, promoting intermodal transport and development of human resources.

ii) Need to recognise negative impacts of globalisation and logistics

The shifts towards globalisation and logistics will be dynamic and may necessitate structural changes involving negative impacts on some regions and sectors. Companies that operate on a worldwide scale will not necessarily adhere to rules set by regional authorities, even at the EU level. Production processes have become more footloose. Since production activities, in combination with choices for certain markets, are most important in constructing supply chains, these choices determine the geographical direction of the physical flow of goods and may lead to regional imbalances.

In industry and business, procurement accounts for 50 to 60% of total turnover. Through the use of information technologies, firms can plan their production activities to better meet end-customer orders and hence synchronise procurement. In this respect, Business to Business (B2B) and Business to Consumer (B2C) are interrelated. Co-ordination between B2B and B2C is a key factor in the management of flows.

However, the growth in transport demand accompanying this development may not always lead to an efficient outcome by placing uneven pressure on infrastructure and the environment. The increasing number of freight vehicles on urban roads has been a long-term trend. Currently, freight traffic accounts for 15 to 20% of all vehicle movements in urban areas. E-commerce in its present form is based on home-delivery, which may lead to less consolidated deliveries and thus more freight traffic. This will have environmental and social impacts for society and major cost implications, as delivery efficiency could fall sharply and therefore operational costs could rise significantly. The implications of e-commerce at this level will depend on whether firms can consolidate their consignments, thereby improving vehicle load factors and reducing the number of trips.

The problem posed by consolidation of transport services, especially large transport firms such as international forwarders, requires careful monitoring by governments and, where necessary, the creation of government-sponsored task-forces involving all the players in the sector to ensure that the use of ICT does not foster the development of anti-competitive practices. Similarly, while competition policy should provide a safeguard against such developments, it should not act as a constraint to the emergence of co-operative transport arrangements between competitors.

iii) Need to develop policies based on full understanding of logistics

It is important for policy makers to understand concepts of logistics and current practices. Identification of advanced logistics thinking is important in determining best practices. Only then can the macro-impact of logistics management be fully assessed. However, policy makers should be aware of the danger of extrapolating an individual company's best practices, which occur at the micro level, into policy decisions at the macro level.

With the restructuring of supply chains, the value density of products is changing along with logistics reach. At the same time, material density is shifting towards information density. Communication and information systems for tracing and tracking the movements of freight, data processing for customs formalities and managing systems for determining inventories at warehouses and yards are required for efficient globalised logistics operations. This shift has led and will continue to lead to major shifts in distribution patterns: the number of shipments will increase while their size decreases. This, in turn, may have major impacts on the development of dedicated infrastructure.

Gaining accurate information on the deployment of logistics will identify those elements sensitive to policy reform, and enable the development of policies for securing the efficiency and reliability of freight transport associated with globalised production and logistics.

iv) Need to develop transport policies in a wider context

Since supply chains are often insensitive to transport costs, given favourable trade-offs with respect to inventory holding, labour/production and procurement costs, the total costs of transport should be analysed in the context of logistics.

As companies seek to rationalise their production, source goods from a wider area and service a larger market, they need to move their goods over greater distances. This increases the demand for freight transport, leading to transport and environmental problems. However, as planning requirements, taxation regimes, labour supply and scale economies drive decisions on the part of companies, they may not be influenced by freight transport policy. Therefore, the decisions that most affect freight transport demand are often taken without regard to freight transport policy. If governments are to be effective in reducing the transport intensity of an economy, they should address transport demand as part of a broader policy framework, which could include, among other elements, fiscal planning, labour policy, environmental policy and regional planning.

v) Need to co-operate and collaborate to develop efficient global logistics networks

As logistics networks expand to a global scale, integrated development of transport hardware, information infrastructure and systems for advancing global logistics networks require careful consideration of social factors. The range of public policy issues affecting global logistics networks is wide and extends beyond the jurisdiction of narrowly focussed government agencies charged solely with improving the performance of their own transport sector. Across countries and regions, a diversity of players involved in logistics face the challenge of how to deal with different regulations, information requirements, economic interests, market conditions and cultures. The extent to which individual governments are involved in the development of logistics networks also differs from country to country.

The Netherlands provides an example of the (future) integration of logistics and potential freight traffic flows from industrial parks in the spatial planning process of these parks from a national level down to a regional level. Until now, great differences have existed in the Netherlands in the way different city councils issue land claims to potential buyers. For instance some councils deny allocating claims to logistics providers, as they simply do not generate sufficient employment per square metre. Other councils might prefer logistics providers as they proliferate themselves as a logistical node. This often leads to sub-optimal supply chains and inadequate accessibility of the main infrastructure for industry and business. Therefore, implementation of integrated government policies on efficient supply chains not only cross border, but also between different levels of policy making within national boundaries (national, provinces and cities) could lead to more efficient freight distribution networks.

Hence, constructive co-operation and collaboration among private corporations, governments and international organisations are necessary for the development of efficient global logistics networks.

vi) Need flexible and swift approach in developing policies

There is an inadequacy in the development of policies and organisations to facilitate activities in the logistics chain. As logistics breaks down the functional barriers within companies, governments must also seek to break down the functional responsibilities of the traditional government departments and be flexible in developing their policies.

Also, it is obvious that ICT will play a key role in transforming logistics and supply chain planning. This suggests that the underlying policy framework developed by governments should be flexible and responsive to the needs of both industry and society.

vii) Need improvement in statistics

To gain a better understanding of logistics, it is vital to improve the statistical recording of freight flows. In many European countries, for example, it is almost impossible to bring together the freight data (by mode, national and international movements), the trade data and the production data. Reforming the various classification schemes of these data with a logistics perspective (based on value) would enlighten policy makers, and allow policy development to be based on more reliable information.

viii) Need to recognise the diversity between countries

Countries have diverse social and geographic features and are at different stages of economic development with widely divergent transport systems and operating structures. This needs to be recognised in developing logistics policies.

In Europe, differences in company use of logistics for single countries should not be neglected in the development of EU transport policy. The differences pose threats to countries not belonging to the core of Europe (peripheral regions and Eastern Europe).

The volume of trade in Asia has greatly increased due to export oriented policies. The region has seen acceleration towards globalisation of domestic economies, reflecting the increase in the activities of multi-national companies both in the region and beyond the region. Improvement of domestic transport in Asian countries is also an important issue for securing the reliability of freight transport associated with globalised production and logistics.

However, logistics laws and regulations are quite diverse in each Asian country (OECD, 2000). Countries also differ in their level of economic development, industrial structure, and level of infrastructure development including transportation and telecommunication. In some Asian countries, outdated operations and ineffective organisations threaten to constrain their ability to achieve efficient logistics operations and impede future development of sophisticated logistics. In most developing countries, logistic policies and logistics researchers are lacking.

Hence, in order to develop an efficient global logistics network, these diversities need to be recognised. However, it is essential that policies be directed toward minimising sources of inefficiency attributable to such differences and to standardising the operating characteristics of logistic systems to achieve seamless transport wherever possible. Otherwise, industry may by-pass those trading environments that are overly complex or costly, to the disadvantage of the country concerned.

CHAPTER II: INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) DEVELOPMENTS FOR SUPPORTING LOGISTICS

2.1. Advancement of logistics in the information society

In the 1970s and 1980s, information technologies such as LANs (Local Area Networks) and WANs (Wide Area Networks) were introduced to manage links and nodes in an isolated manner. As Just-In-Time management became prevalent in manufacturing, it called for Total Quality Management (TQM) which integrated logistics into other corporate functions. Thereby, link and node management became part of the overall management approach using innovative information network technologies. However, up to this stage, one corporation largely controlled the information networks.

In the 1990s, TQM evolved into logistics and at the same time the Internet revolution came to fruition. The need to manage door-to-door deliveries efficiently on a global scale prompted the expansion of corporate information networks to include suppliers, dealers, partners, subsidiaries and alliances in an integrated manner. The necessary integration of logistics operations across the supply chain has been made possible by the advancement of information technology.

Internet is rapidly becoming a powerful business tool because of its online commercial services and e-commerce capabilities. The net is ready to become a medium by which companies trade, make contracts, exchange data and information, discuss designs and locate components.

The application of ICT to transportation has also led to the emergence of Intelligent Transport Systems (ITS). ITS links individual transportation elements and combines them into a single system through the use of advanced information technologies. ITS integrates various technologies and institutional functions to realise efficient, safe and environmentally friendly transport systems. It offers the potential to improve the efficiency of use of transportation systems by generating additional capacity from existing physical infrastructure.

With the traditional design approach of transport infrastructure, it is inherently difficult to take into account dynamic changes associated with logistics. In order to overcome this gap, dynamic control of logistics operations is necessary. Strategic applications of innovative information such as Global Positioning System (GPS), ITS, Electronic Data Interchange (EDI) and Electronic Commerce (EC) integrated through the Internet will then become inevitable. The existence of high-performance information infrastructure will dictate the logistics competence of a country or a region. These complex and sophisticated information infrastructures will induce interactive processes in logistics activities.

2.2. Effects of advanced information technologies and technological innovation on logistics

2.2.1. Improvement in the performance of logistics

The use of ICT has improved the exchange of supply chain information, leading to the development of integrated production and logistics management systems and has thereby improved supply chain performance in many ways.

Commercial transaction flow and physical distribution are separated. Electronic Data Interchange (EDI) has dramatically changed the ways in which commercial transactions are managed. These systems use computer links instead of hard-copy paper which required extensive time to transfer and often contained errors. The advantages of these ICT-supported information exchange systems include: increased speed and reliability, increased storage capacity, increased transparency, reduced transaction costs and increased worldwide coverage.

Goods and vehicle tracking as well as real-time vehicle routing and scheduling systems have transformed logistics management. Cargo can now be identified, tracked and scheduled in real-time almost anywhere in the world.

Mechanisation and automation inside the logistics facility, quality control and warehouse management technologies have also improved.

Lead-time has been reduced by the introduction of EDI, mechanisation, automation and optimal vehicle routing systems, leading to potentially lower levels of stock surplus.

The development of the Internet provides a convenient way of gathering, organising and distributing information on products, services and trade regulations at a global level. Inter-company trade in goods over the Internet will continue to grow and will extend the globalisation of trade, increasing the average haulage distance. Several companies use the Internet as an exchange mechanism for planning the supply chain with their partners. Major freight transport service providers have resorted to creating Web pages on the Internet to provide information on their services, schedules and rates that can be easily accessed around the clock by the global market. More advanced freight transport suppliers already provide the possibility for interactive responses to cargo-tracking inquiries made by shippers and forwarders.

These developments have increased competition among logistics providers. Transportation requirements of shippers have changed due to competition as manifested by fast, frequent and reliable services, just-in-time manufacturing, warehousing and distribution, door-to-door intermodal services, cargo tracing services and other advanced information related services. The transport industry's response to shippers' requirements has brought about higher quality value-added services resulting in current trends of supply chain integration, strategic partnerships and alliances, third party logistics, equipment sharing and paperless exchange of information. Greater competition among different companies on a global scale will also increase the pace of innovation and put downward pressure on prices -- both potentially beneficial to welfare creation.

2.2.2. Enabling new supply chain structures

The rapid development of ICT has influenced not only supply chain performance but has also changed industry structures and produced new services.

Easier access to information for suppliers and actual users has enhanced direct trade. The easy availability of information to all partners in the supply chain poses a threat to parties in the chain (e.g. agents) who traditionally earn their living through their access to scarce information. Certain intermediate roles in the supply chain may become redundant. Forwarders, wholesalers and retailers will face more competition by Internet sales channels, since a large part of their business stemmed from matching supply and demand.

However, the Internet has created new non-asset type businesses. A particular service has emerged which is referred to as the “virtual logistics chain”. A virtual logistics chain is an Internet-based communication system with a centralised database, which integrates all aspects of logistics operations, and can be accessed by interested parties to check relevant logistics information and communicate in real time. An area for possible further improvement of supply chains and opportunities for intermodal transport is the separation of the marketing channel from the physical supply chain. For instance virtual auctions which are Internet-based and do not require the physical presence of products allow products to be exchanged directly from seller to buyer without unnecessary detours and transport. Value-Added Network (VAN) companies which transmit information between customers and transportation service providers serve as integrators by functioning as databanks for checking cargo location, purchase orders and other forms of information.

An example of this in Europe is PARIS (Planning And Routing Intermodal System) which simultaneously plans the hinterland transport of containers to and from ports for several shippers and several transport companies, thereby increasing transport efficiency.

In the United States, a new type of third party logistics provider, called Information Clearing House (ICH) has emerged. These service companies create Web sites which list available truck capacities of member truck companies and enable transportation arrangements to be made between the truck companies and subscribed consignors. This increases truckload efficiency and contributes to environmentally friendly transport by reducing the number of less than truckload consignments. In the near future, such services may be expanded to enable optimal transport arrangements using and/or combining different modes via bidding.

2.2.3. Contributing to modal shift and intermodal transport

Developments in logistics and transport technology have the potential to increase the competitiveness of intermodal transport.

New developments in vehicle and handling technology have the capacity to reduce the operating costs of different modes of freight transport and bring about a change in the pattern of traffic flows. For example, the introduction of fast ferries on short sea routes within Europe is opening up competition to established long-distance truck services following these routes. Similarly, rail provides shippers with the opportunity to operate a rolling inventory along key corridors using distribution points to redirect products on demand.

The application of ICT in supply chains enables information on transport orders and shipments to be made available at an early stage. This means that transit times of transport operations can be better managed, thus creating new transport opportunities, including intermodal transport, which were not feasible before.

Efficient information technology has reduced processing time and cost and created seamless links, thereby facilitating intermodal transport. Third party companies have developed services that

link the various modal systems. The use of ICT to identify and track cargo has been significantly applied to intermodal operations. Improvements in intermodal transportation through the application of ICT and ITS have promoted the concept of just-in-time inventory management and delivery. These improvements all increase the efficiency of intermodal transport.

2.2.4. Effects on the demand for freight transport

Technology will not reduce the need to transport goods. Their dematerialisation and distribution via the Internet are transforming the direct delivery of products such as videos and software. However, the net reduction in the volume of freight movement resulting from the dematerialisation and electronic distribution of “info-products” is likely to be very small and exceeded by the additional freight traffic generated by wider sourcing of supplies, a trend which will be reinforced by Internet trading.

2.3. Policy recommendations

The use of ICT along the supply chain is set for massive growth. These technologies have played, and will continue to play, a key role in transforming logistics and supply chain planning. Therefore, ICT will be an important area for the development of policies to support the performance of global logistics networks.

i) Need to promote the strategic use of ICT

Many companies are either not fully using the possibilities of ICT or are not well positioned to reap the benefits from their ICT investments. Managers often lack a framework for deciding which technologies are best for their particular company’s situation, or lack understanding of how to manage the new technology and how to adjust their work procedures. Though it is clear that sharing of information creates benefits to the supply chain as a whole, many companies start by optimising their internal processes before paying attention to their external relations.

It needs to be understood that advanced logistics systems, embracing intermodal transport, can be realised through the strategic use of ICT. Institutional re-engineering or new organisational culture, as well as new information infrastructure may be needed to realise the potential benefits of these technologies.

ii) Need to take account of rapid development of ICT in future logistics planning

ICT is characterised by a high rate of technological change, with the designed or implemented systems being increasingly viewed as a single network, but being flexible enough to be applied more easily in diverse contexts. This high pace of change within ICT poses a challenge for policy makers and users of these technologies.

E-commerce is developing rapidly. It is necessary for the continuing development of e-commerce that consignments are delivered globally within a very tight timeframe and at low cost. Therefore, patterns of distribution are likely to change both globally and locally.

The change in the characteristics of freight transport resulting from introducing advanced or innovative ICT to logistics will have important implications for future planning. Usually, innovative information technologies are introduced for advancing logistics networks only after the transport hardware infrastructure and related facilities are well developed. However, innovative ICTs are so sophisticated that they can be utilised as powerful tools to strategically redirect the pattern of logistics operations. Accordingly, the implementation of future hardware infrastructure cannot be independent of the architecture of the information infrastructure and the characteristics of information systems designed and developed for advancing strategic logistics networks.

One of the major barriers confronting companies in the uptake of advanced ICT technologies is the increasing investment risk. On the one hand, these risks result from the large investments in ICT required, and on the other hand from the long period of time required for implementation of software and systems in relation to the increasing rate of change characterising these technologies. This is an important development that imposes great uncertainties on the willingness of the private sector to invest in ICT, particularly if there is uncertainty surrounding governments' communications policy and spectrum allocation.

Hence, policy makers need to keep up with the rapid development of ICT and develop a stable communications framework that is conducive to logistics planning by the private sector.

iii) Need to prevent negative consequences of ICT

Although ICT provides opportunities to achieve advanced logistics systems, quick changes in the configuration of supply chains may also occur, in which possible negative effects are not taken into account. Here, policy intervention may be necessary. For example, e-commerce and the application of direct consumer logistics may reduce the size of shipments and increase the number of deliveries. As long as electronically purchased products are small and two-dimensional (*i.e.* fit in the letterbox), distribution systems are likely to remain much the same. However, with larger or three-dimensional packages, distribution structures will have to change.

This may have negative effects on transport efficiency and sustainability, particularly in urban areas. In order to prevent negative consequences, there is a need for policies that can promote the emergence of new logistics systems with increased capacity for consolidation and efficient distribution so that an increase in demand for transport will not necessarily lead to an increase in traffic. Hence, regulations in other sectors of the economy may need to be reformed to avoid unintended increases in transport demand.

iv) Need for harmonisation and co-operation

Since ICT and e-commerce developments are of a global nature, openness and inter-operability of information systems are vital for the penetration of services and systems. International organisations (such as the EU, OECD, WTO, ISO and UNCTAD) have a key role to play in providing governments with a co-operative framework to achieve the integration and harmonisation of policy actions for implementing infrastructure-dependent technologies. In this way, such organisations may seek to avoid the creation of technical barriers to trade and logistics efficiency.

However, the broad menu of possible applications in this technological area is so unpredictable that the menu of applications cannot be fully predetermined. Thus the trend towards standardisation will be towards broad, functional standards that can be applied more easily in diverse contexts, rather than rigid, inflexible standards.

In promoting standardisation, advanced countries should provide technical support to countries that are still in the process of modernising their information systems and developing third party logistics and virtual logistics chain systems.

v) Need for R&D

Innovations in ICT are progressive; some technologies are still in the research phase. In promoting R&D, it should be borne in mind that emerging innovations have been triggered through interactive processes between economic activities on the market side and R&D activities on the technology side. Therefore, in order to develop ICT-based logistics networks as efficient circulatory systems for logistics, it is necessary to ensure appropriate interactions and feedback between the two sides through specific organisational structures and mechanisms within corporations, as well as across various institutions, nations and regions.

In order to maximise the opportunities derived from technological progress, governments should not only support R&D efforts in the private sector, but also facilitate the demonstration of technological solutions and seek productivity benefits from diffusion of information.

CHAPTER III: INTERMODALITY AND LOGISTICS

3.1. The need for sustainable transport

In the midst of growing sustainability concerns, transport systems pose a range of environmental problems. This is especially so for road transport, which has been increasing its share of transport relative to other modes. These problems include noise and air pollution caused by traffic congestion and the increase in CO₂ and other vehicle emissions. In particular, heavy vehicles used in freight transport are considered to be the main source of these problems. Concerns for the environment and safety are the major drivers behind regulation and legislation affecting freight transport.

These concerns have created pressure to move freight off the roads. In responding to this need, most OECD countries are being confronted with the challenge of developing socio-economic reforms that strike a balance between ecological requirements and conditions conducive to economic growth compatible with sustainability objectives.

The trend towards sustainable development will have a considerable effect on the design and operation of logistics systems. In order to achieve balance between the globalisation of economic activities and development of environmentally-friendly global logistics networks, various approaches are being discussed and examined, ranging from construction of better hardware facilities to development of information structures for reorganising logistics operations to make them more sustainable. Also, introducing new concepts and technologies to logistics operations can contribute to sustainability. Typical examples are the introduction of sophisticated dispatching systems and consolidated delivery for reducing traffic volumes and costs (including externalities), and development of transport systems to support recycling of waste products.

3.2. Characteristics of intermodal transport

Governments have been grappling to stimulate intermodal transport in order to promote sustainable development, although demand for intermodal transport has shown only a modest increase due to many existing obstacles. Characteristics of intermodal transport systems differ across regions. The Asian intermodal system is characterised by a combination of traditional and modern concepts of intermodality. Since most Asian countries are composed of islands and/or archipelagos, the large distances between countries within the region are motivating the development of sea, air and intermodal transportation. In particular, the role of nodes and transport links is vital to transport and logistic systems. Any improvement in these systems will provide significantly better services, reduce travel times, and ultimately reduce costs. Since Asia has now become the export centre of industrial goods, the need for containerised cargo transport has increased, and significant logistics infrastructure development is occurring in some countries.

To be effective, intermodal transport in the EU will require a comprehensive package of measures both to increase markedly the productivity of rail freight transport and to enforce effective

safety, loading, maintenance and working regulations in road haulage (ECMT, 2001). The NAFTA region, centred on the United States of America and Canada, is characterised by extensive demand for land-based transportation with efficient road and rail systems, and a relatively limited need for cross-border documentation.

3.3. Logistics and intermodal transport

Logistics will influence the future development of intermodal transport, and yield both opportunities and challenges. Service requirements are the major challenge to intermodal transport. Logistics will lead to ever-stricter service requirements and an increasing number of small consignments (Less Than Truckloads) -- a market which intermodal transport has lost almost completely.

However, the increasing volume of freight flows, transported over longer distances, with better planning and co-ordination possibilities of logistics activities through ICT, could result in increased consolidation of consignments and improvement in the relative competitiveness of intermodal options.

Therefore, in order to comply with these strict service demands and to be able to compete with road transport, intermodal transport needs sophisticated logistics concepts, using advanced information systems.

3.4. Obstacles to intermodal transport

Since a key factor hindering the wider use of intermodal transport on shorter distances is the substantial share of transshipment costs, one important aspect in intermodal efficiency is connection at the nodal points. Facilities at nodes have to be standardised to provide efficient services, accessibility to these nodes has to be developed or improved and transportation systems have to be integrated to attain intermodality. The links which connect the nodal points to form the logistics network are most effective when they appear to be seamless, *i.e.* facilitating transport with minimum interruption, inconvenience and wasted time. Various obstacles to seamless intermodal transport exist in and between Member countries (OECD, 2001).

3.4.1. Lack of physical and information infrastructure

The lack of terminals and missing links, or lack of infrastructure interoperability, often limits transport services.

Intermodal freight transport service is provided mainly by the private sector. However, the private sector cannot provide a fully seamless intermodal freight transport service without the essential transport, ITS and telecommunications infrastructure framework supplied by governments.

In addition, to date little progress has been made in achieving compatibility for the tracking, tracing and monitoring of intermodal transport flows, despite experiments undertaken in this field. While the road transport sector continues to introduce real-time information systems that can report on the status of any consignment being shipped to clients, intermodal transport has virtually nothing comparable to offer. Punctual and reliable information is needed for intermodal operators and ultimately for shippers.

3.4.2. Lack of standardisation

There is a lack of standardisation of load units, information systems, administrative regulations and procedures.

Adopting standard pallets and containers can facilitate efficient transfer and storage of commodities. It will enhance economic and efficient interchangeability among different transport modes, thereby serving to better co-ordinate services of more than one transport mode. Intermodal co-ordinated services such as truck-rail, truck-ship, and truck-air aim to integrate the most advantageous characteristics of each mode to achieve optimal performance. However, although the standardisation of load units is essential to improve efficiency, it has proven to be difficult to achieve due to factors such as infrastructure restrictions (changing loading/truck gauges), the preferences of road hauliers and the increasing container sizes in maritime transport.

The application of advanced ICT has allowed significant improvements in the provision of seamless service through the use of EDI. However, the success of EDI depends not only on standardised data sets but also on compatible EDI systems between and among the intermodal players and governments, which needs to be improved.

National regulations and procedures concerning intermodal transport are not harmonised. For example, in Europe some countries provide exemptions to restrictions on weight and driving bans and waive certain charges, while others do not. Also, government financial support of intermodal transport differs considerably from country to country.

Customs formalities are one of the main barriers to achieving seamless changes across modes. The advantages of standardised, automated and ICT-based interfaces are well understood. However, ICT-based customs clearance has not yet been universally adopted. It is not clear how rapidly or how extensively ICT will be adopted by authorities in different countries for the smooth operation of custom formalities.

3.4.3. Lack of intermodal service information

There is a lack of marketing and door-to-door service information. Shippers lack knowledge of the existence of intermodal transport as an alternative to road transport. However, the varied and not always complementary modal systems have encouraged the development of third party logistics, offering a range of third party services to link the modal services into a seamless door-to-door operation. Third party companies have created a service in intermodal transportation by serving as integrators in filling the gaps and linking the modal systems. These companies have the best chance to develop the skills to serve the increasing demand for high quality logistics.

3.4.4. Lack of competition in the rail sector

There is a need for greater competitiveness and improved quality of service, including reliability, in the railway sector in a number of countries and regions. This would enhance the development of intermodal transport as a competitive alternative to modally based operations (ECMT, 2001).

3.5. Policy recommendations

Intermodal transport can contribute to sustainability as well as offer substantial efficiency gains for industry if constraints can be overcome. The following areas need policy action.

i) Need to improve physical and information infrastructure

Each government needs to provide the framework necessary for the development of the physical infrastructure and links essential to intermodal transport systems, including access roads to terminals and seaport channels. For example, landside congestion at ports needs to be reduced through the development of cost-effective infrastructure to improve access and the application of scheduling systems based on advanced tracking technologies in order to reduce queuing problems.

At the ports of Los Angeles and Seattle in the United States, on-dock rail facilities are being provided for American President Lines. This improvement of the physical infrastructure decreases the number of truck movements required between terminals and nearby intermodal rail terminals, and eliminates a gate barrier, always a potential cause of delay and cost. In addition, the Port of Seattle has developed an electronic data information infrastructure, known as “Linx”. The benefits of Linx include: uniform communications with all trading partners (customers, shippers, carriers, etc.); one-time data entry; reduction of paperwork; automatic reconciliation; and better market position relative to non-EDI competitors.

Since competition between port authorities may lead to sub-optimal locations of ports, some degree of consolidation may be necessary to make intermodal services cost-effective. This may require the development of a differentiated terminal location policy at the national level (for example, Japan), or at the international level (for example, at an EU level).

In addition, systems essential to information infrastructure (including global positioning systems and advanced communication systems to permit the intermodal exchange of information) need to be further developed in order to maximise the capacity of the entire intermodal transport system.

ii) Need for standardisation to provide seamless services

Intermodal systems can be improved through standardisation. Physical standardisation of equipment or vehicle dimensions and procedural standardisation of operational, documentation and information systems have to be further encouraged or promoted in order to standardise logistics systems.

Standardisation of logistics and physical distribution systems also requires standardised customs clearance in order to facilitate legitimate borderless intermodal transportation. Unnecessary and poorly co-ordinated bureaucratic practices and red tape will hamper the seamless and smooth distribution of goods. There are several ways of streamlining customs procedures across countries. However, as mandated by law, governments still require the same customs forms and other traditional procedures. Adoption of a single and standard form for the processing of papers based on the United Nations format is one means of standardisation. Another method would involve the introduction of modern customs procedures and techniques such as pre-arrival processing of data and documentation. This could include “risk assessment” in which importers or exporters with a known compliance record are exempted from physical inspections and rapid “green channel” release of goods with no or little duty to be paid, and automatic transfer of data from importers to customs authorities.

In attempting to “standardise” logistics systems, the institutional aspect of logistics and intermodal systems needs to be reformed in order to accommodate innovations in technology. Industry acknowledges the benefits brought about by innovations in technology and strongly urges legislative measures to adapt to the innovations and practices coming on stream. Without regulatory reform to accommodate innovation, any new approaches to improve the logistics system would be futile. Therefore, it is imperative that institutional measures be introduced, especially through legislation to allow industry to be responsive to new technologies, such as those available under ITS, and novations in the intermodal system. This will provide better opportunities and competitiveness in global trade.

The establishment of a single processing area for import/export EDI would further support and enhance standardisation. Several countries in the Asian region, like the Philippines, have already established a single processing area, which has significantly reduced the clearance time of goods.

iii) Need to support technology developments

New technologies are needed in order to meet shippers’ constantly higher demands for efficiency, reliability and timeliness to make intermodal freight cost and services even more competitive with road transport.

Intermodal transportation not only depends on the physical interface but also upon an electronic interface to send the information necessary for moving cargo from its origin to destination. Therefore, it is critical to invest not only in the physical links to exchange cargo between the modes but also in technology to permit the intermodal exchange of information in order to maximise the capacity of the entire intermodal transportation chain. Streamlining the movement of freight along an integrated intermodal logistic network through deployment of seamless Internet-based information systems may further improve fleet management and optimise load dispatching.

Technology development and implementation is primarily a concern for the industrial partners, but governments can stimulate developments by issuing standards and spreading knowledge about experiences from technical and commercial tests. Operators can then choose from a palette of proven technologies at reasonable prices and also benefit from experiences gained by operators of other services. Some countries, such as Australia and New Zealand, are investigating the possibility of introducing Performance Based Standards as part of their regulatory reform agenda. Variations in prescriptive regulations on mass, dimension and configuration controls within and between countries are not always soundly based, reflecting real operational differences. The development of performance-based regulations provides a framework for establishing regulations that match the environment in which they apply in a sound, verifiable manner. Performance-based regulations are designed to directly control safety, infrastructure and environmental objectives, without specifying how the objectives are to be achieved. Performance-based regulations specify what a vehicle must be able to do, instead of what it must look like (for example, its dimensional envelope).

With present transshipment techniques intermodal transport over shorter distances is often not commercially viable to shippers and logistics service providers. Hence, further research involving industry in the search for low cost innovative transshipment systems is required.

Advanced countries should provide technical support to those countries that are still in the process of modernising their information and intermodal systems. This is also true for developing and instituting third party logistics and virtual logistic chain systems in these countries.

iv) Need to influence demand for intermodal transport

Intermodal transport will never be able to compete seriously with road transport on short distances. It could however be a viable alternative for some medium- and long-distance movements currently handled by truck. Under the right conditions, intermodal transport could fulfil the demands for flexible freight transportation with high quality service and competitive prices. However, in terms of comparative advantage, the intermodal transport market is limited to distances exceeding approximately 500 kilometres. In order to have any significant impact on road transport in the future, intermodal transport must be able to compete on the vital middle distances of 200 to 500 kilometres.

However, for the most part, government policy aims at creating a level playing field for all operators and modes. It is questionable whether such an approach will lead to a considerable shift from road to intermodal transport. If a quantum shift in the trend towards road freight is really desirable in terms of environmental objectives, a more regulatory approach may be the only possible way, with commodities being regulated to rail. However, without liberalisation of rail markets, the likely efficiency implications would be severe. Although, so far, policy has put more emphasis on the supply side in terms of networks, terminals and technologies, it needs to focus more on measures impacting on the demand side of intermodal transport.

Short of regulating commodities to a certain mode of transport, all policy measures to influence the demand side would be indirect measures. Policies impacting on demand through taxation/charging regimes could mean a stimulus for intermodal transport. Policy could also focus on creating awareness in the private sector of the opportunities for intermodal transport within the scope of logistics. Analysing best practice models or developing scans to support firms in identifying opportunities relevant to their specific situation could facilitate this. Demand could also be shifted by influencing locations of terminal facilities, integrating intermodal terminal facilities into loading or dispatching centres, establishing covenants between shippers/forwarders and governments, and stimulating consumer demand for environmentally friendly products.

On the other hand, for some regions, geographical constraints are the main determinant in the choice of a certain mode. In this case, policy should not aim at modal shifts, but at increasing the efficiency of transport. Intermodal transport should be the result of intelligent and efficient logistics and should not be a goal in itself. Public policies on intermodal transport, which do not fit into market conditions, can lead to inefficient outcomes.

v) Need for co-operation and collaboration

It is clear that the task of establishing efficient global logistics networks with minimal environmental impact cannot be accomplished by one corporation or one government. For example, when considering environmental burdens, total emissions generated by the supply chain should be taken into account. The environmental improvement achieved in one country by transferring some operations elsewhere might result in transferring pollution and environmental degradation to another country.

Optimising at a higher level of organisation, co-ordination and technology is a prerequisite for logistics in general and intermodal transport in particular. This higher level of organisation will not always be established by itself in a free market.

Therefore, building efficient and environmentally friendly logistics systems requires extensive co-operation and collaboration among private corporations, governments and international

organisations in many different areas. In particular, it is extremely important to find a balanced way of completing the task so that the resulting hardware facilities and information structures and systems help developing countries realise sustainable economic and social development while they benefit developed countries by providing a better foundation for global competition.

Studies underway through APEC seek to improve and increase awareness of intermodalism in the Asia-Pacific region. For example, Japan, Singapore and Hong Kong (China) could provide insight on how to improve and enhance policies aimed at the promotion of integrated intermodal systems in the region.

vi) Need to have intermodal objectives in policy making

There are several indications that expressed political will to realise a shift from road to intermodal transport is not always translated into concrete action, especially in cases where policy measures would directly have an impact on road transport.

One example is the hesitation among a number of European governments to increase competition in the railway sector. In achieving a modal shift away from roads in Europe, cultural, management and ownership issues in non-road modes must be addressed.

Governments need to formulate a clear set of common objectives for intermodal transport, integrating transport policies influencing individual modes and non-transport policies such as spatial development, economic development and environmental issues. There is a need to monitor the progress made in achieving the objectives.

In addition, in developing policies on freight transport, policy makers should always bear in mind the objectives of promoting intermodal transport. For example, ICT is considered to be an effective tool for introducing new concepts. ITS, in particular, has potential capability to increase the safety of drivers, and the security and reliability of freight transport not only on roads but also on rail, sea and air. Future policies to introduce these new concepts in freight transport should aim to enhance intermodal objectives.

CHAPTER IV: PROVISION OF LOGISTICS INFRASTRUCTURE

4.1. The need for logistics infrastructure development

The rapid growth of e-commerce demands fast response deliveries. Increasingly, businesses seek to sustain sophisticated short-cycle and bespoke manufacturing processes to meet customer requirements directly. The internationalisation of transport activities requires co-ordinated government action if efficient logistics systems are to be achieved. However, financing transportation infrastructure is increasingly challenging for governments as private sector carriers and shippers demand improved facilities to move goods on shorter and just-in-time delivery schedules.

These trends are rapidly and continually changing supply chain functions and demands. These changes necessitate flexibility, the cost of which will need to be reflected in the cost of infrastructure provision.

Existing road, rail, air, and port infrastructures are coming under considerable pressure. Much of the European air freight fleets will require new investment in order to comply with new noise regulations. Rail networks are coming under increasing pressure to accommodate more freight on key routes at a time when passenger volume is also increasing. Parts of the European road network are reaching capacity constraints, particularly in major urban centres and on motorways. The transport sector, especially road transport, is under increasing pressure to reduce its impact on the environment.

At the same time there is a growing need to improve decision-making processes surrounding investments in transport infrastructure, with focus being given to system-wide priorities rather than priorities being determined on a modal basis only. Further, there is a need to increase investment in new ITS technologies, develop standardised systems and hence improve inter-operating efficiencies across all infrastructures.

4.2. The need for new financing and operating schemes

Traditionally, the public sector has played a vital role in the development of transportation systems. Government policies have strongly influenced the national planning, design, construction standards and requirements of infrastructure. Much of the historic and continuing provision of major infrastructure has been met through government funding rather than through private sector investment. The underlying assumption has been that infrastructure serves the public good and is therefore a government responsibility.

However, pressure is mounting within many countries to significantly reduce reliance on government borrowing by increasing private sector involvement in financing and operating of their infrastructure. A key target area for this is the provision of logistics infrastructure, because of its direct commercial relationship with businesses.

There are four key reasons contributing to the need for new schemes concerning logistics infrastructure. First, government expenditures on transport infrastructure, particularly roads, have come under increasing scrutiny from other sectors. As a result, public funds are often insufficient to meet growing demands for new logistics systems. Second, public sector financing may not be the efficient option. A weak incentive structure is apt to result in mismanagement of both resources and financial risk. Third, the public sector is rarely able to recover the full cost of providing public services from users. Fourth, the availability of new technology such as Electronic Toll Collection allows the private sector to provide services exclusively.

4.3. Partnership between public and private sectors

Various innovative funding schemes may be possible, such as independent private companies, Private Finance Initiative (PFI) including Build, Operate and Transfer (BOT), and other public-private joint ventures.

4.3.1. Independent private corporations

Private sector involvement increases the incentive to minimise costs, reduce development inefficiencies, and offer higher valued services to users. However, there are several problems that could offset the advantages of private financing. The profit objective of the private sector may tend to disregard the negative effects of the project (*e.g.* congestion, environmental degradation) in order to cut costs. The danger of monopolist pricing in a spatial context must also be considered.

For governments, because of the attractiveness of private sector involvement, there is a growing tendency to place vital infrastructure projects, programmes and services under the care of the private sector. This could lead to lesser government control and reduced management costs of public services.

One organisational strategy may be to establish public corporations. These independent agencies could serve to identify, encourage and assist in undertaking environmentally sound transportation projects with private funds. Such agencies constitute a bridge between the public and private sectors. However, a properly defined charter must be drawn up to ensure that they do not become substitutes for (other) private development.

4.3.2. Private Finance Initiative (PFI)

The concept of PFI has created new opportunities for both the public and private sectors. Private sector financing of transport infrastructure should be considered a partnership between the public and private sectors. The potential for raising private capital on both domestic and international markets can be enhanced by making policy reforms that create clear rules allowing investors to form reasonably firm expectations about cash flows generated through investment in transport infrastructure.

4.4. Minimising costs of infrastructure projects

In financing logistics infrastructure, the objective is to maximise return from investment in infrastructure while minimising cost by creating an efficient well-managed project. The returns expected from investment reflect the level of risk. The appropriate identification, allocation and

management of risk therefore become critical to creating the most cost effective and efficient financing structure.

Failure to properly identify risks may lead to underestimation of particular costs. For example, public finance seems cheaper only because the taxpayer is underwriting the associated risk.

Effective risk management is a crucial element in the creation of a fundable proposition. Whilst attempts may be made to cover every foreseeable risk in contracts, the nature of infrastructure projects is such that they are inevitably exposed to change. This is inherent in the nature of the long time scale for their planning, completion and operation. There is constructional and operational risk in that logistics infrastructure will need to change throughout both the development and operational stages of its life. Supply and demand variations, macroeconomic change, and changes in policies including threat of expropriation may also occur.

Efforts have been made to manage projects to accommodate changing circumstances. For example, policy adjustments on privatised highway projects include: *a)* rescheduling the construction programme to allow staggered construction of priority stretches first and lengthening the construction period, *b)* staging construction of carriageways, to be upgraded only if warranted by traffic demand, and *c)* deferring the construction of interchanges which have low traffic demand.

Those responsible for risk allocation need to be responsive to problems in order to maximise the speed with which they are rectified, minimise risk associated with delays and in particular identify and resolve serious problems quickly. Re-negotiation must be feasible in order to accommodate changes with minimum costs and delays. Control clearly affects renegotiations. Parties who are in control and are best positioned for efficient renegotiations should therefore provide financing.

Parties most capable of managing risk should be given incentives to do so. Incentive-based performance will ensure that proper reward is provided to the parties who make the scheme a success and manage risk. The equity partners in the project should not have their equity merely capped, but should share the benefits of success in a true public-private partnership arrangement. The extent to which returns are shared should relate to the original allocation of risk. Risks that cannot be allocated appropriately to any one partner should be spread as widely as possible.

Many transportation projects involve considerable commercial and policy risks that call for government guarantees. Government guarantees against risks are a major issue in private financing and public/private partnerships. On the one hand, if a government shoulders most of the risks, the private sector loses its incentive to minimise costs. On the other hand, if government does not share the risks, the project may appear too risky to attract private sector investment. This arrangement requires maintaining a delicate balance.

It is especially important to synchronise guarantees with major environmental protection efforts. For instance, private toll road operators should not be offered guarantees of traffic volume level that would counter competition from other modes or from public transit. This could be counter-productive as it could encourage increased use of passenger cars and create problems for public transit operations.

4.5. Distribution of costs

An equitable distribution of costs and benefits may be achieved by charging beneficiaries the full cost based on the Beneficiary Pays Principle (BPP), and by internalising external costs (*e.g.* congestion taxes) based on the Polluter Pays Principle. The BPP is justified because it is assumed that

people will pay for the use of a facility if they feel that they benefit from it (*e.g.* airport, road, port, terminal, and rail network). The Polluter Pays Principle implies a political judgement that polluters should pay for the damage they cause to the environment.

In road transport, for example, revenues based on the BPP and Polluter Pays Principle can contribute to meeting road and traffic management expenditures. This creates a direct link between those who benefit and those who pay, thereby building more transparency and accountability into the financing system. The various forms of charges levied on road users according to these principles include: charges for road capacity use (road tax and registration fees), charges for access to a certain link or network (toll fee and area license fee), charges for road distance (fuel tax), charges for road damage (vehicle weight charges and weight-distance charges), charges for road congestion (peak load pricing or congestion taxes) and charges for environmental damage (CO₂ emissions tax).

Road congestion charges have attracted much attention since their correct application could result in a net benefit to society. While some motorists could be disadvantaged, society as a whole would benefit from less congestion through more efficient use of infrastructure. Additional benefits could include less environmental pollution and more appropriate revenue distribution. However, only a few countries have actually implemented such an approach to road infrastructure management.

Other logistics infrastructures may also be used more efficiently with peak load pricing. For instance, landing and parking fees of aircraft are differentiated at congested airports.

Public acceptance of new schemes is important. Tolls, for example, are not popular in some countries, and may face strong opposition. The process of achieving consensus needs to be carefully managed.

Also, although new fees aim to better equalise distribution of costs and benefits within society, optimisation of equity would be difficult, if not impossible, to achieve. The introduction of fees may inadvertently produce other, unforeseen disparities. Compared to taxes, fees may require more complicated administration and enforcement systems, which is another potential disadvantage to full cost pricing. ITS can overcome these difficulties and provide the opportunity to implement flexible pricing schemes for road infrastructure. For example, congestion and/or parking charges could be varied relative to the level of demand.

4.6. Regional issues

The volume of both domestic and international logistics flows has increased rapidly in Asian countries in response to the expansion of global operations. Significant logistics infrastructure development is occurring in some countries in Asia. The extensive distances between countries within the region are motivating development of air, sea and intermodal transportation.

However, logistics infrastructure and institutional measures in Asia lag far behind developments in North America and Europe. Congestion on streets, at ports and at airports reduces logistics efficiency. The lack of sufficient infrastructure therefore becomes a source of bottlenecks in the performance of logistics operations and can be a barrier to economic development.

Reasons contributing to the lack of efficiency in transport logistics throughout Asia include insufficient funds for infrastructure provision, poor policy direction by governments, prioritisation of policies that favour industrial sector growth, and inability to meet the demands created by high economic growth. Transport policy is characterised by a lack of understanding of the importance of

developing efficient logistics infrastructures and places priority on passenger transportation (e.g. prohibiting trucks on roads during weekends). These disparities in policy making affect the balance between the supply of and demand for logistics infrastructure.

Another common feature in the Asia-Pacific region is the emphasis placed by governments on infrastructure improvement as a public good. However, most developing countries in the Asian region lack the necessary funds to improve the logistics infrastructure and to develop institutional solutions to logistics problems.

Since public funds are not sufficient to meet growing service-oriented demands for new and improved logistics, various private funding schemes are emerging. This could be recognised as a positive characteristic of the Asian region. Several countries are actively applying Private Financing Initiative (PFI) methods to develop civil infrastructures, including additional roads and ports. The Build-Own-Transfer approach has been adopted in some Asian countries, but with mixed results.

4.7. Policy recommendations

i) Need policies for private participation in development of logistics infrastructure

Logistics infrastructure should ultimately cater for the needs of the logistics industry, which in turn serves commercial needs. Governments need to develop innovative infrastructure financing schemes with private sector involvement, but at the same time ensure that such schemes are compatible with sustainable development objectives. Hence, policies should be devised that encompass all parties involved with the provision of advanced global logistics systems. Implementation of a successful programme depends on a number of important prerequisites: an active government role in planning the logistics system, strong commitment to private funding, steady economic growth, acceptance of some risk-sharing between private and public sectors, strong local capital markets, and an entrepreneurial private sector. The selection of a preferred form of public-private partnership and the specific form of private sector participation should be based on an analysis of the total costs and benefits of the options available.

ii) Need to maintain government control for consumer protection

Governments need to develop the framework to encourage private sector involvement in the financing and operation of infrastructure, while recognising the negative effects of infrastructure use by applying “correct” pricing policy. Agreements between governments and the private sector should encompass such aspects as pricing (for direct and indirect costs), construction and operational provisions, use of intelligent transport technologies (e.g. compatibility across the network in the application of electronic tolling), as well as safeguards against the spatial monopoly position of suppliers.

iii) Need adequate control and allocation of risk

Private sector financing of transport infrastructure must be seen as a partnership between public and private sectors. The potential for raising private capital on both domestic and international markets can be enhanced by policy reforms that establish clear guidelines, allowing investors to form reasonably firm expectations about cash flows generated from investment in infrastructure. For this, a

project needs to be well managed to minimise exposure to risk. Risks that are inherent in infrastructure projects need to be effectively managed and allocated appropriately. At the same time, the private sector should be given incentives proportionate to their risks.

Risk sharing will therefore be an important part of the management structure required for infrastructure projects. An infrastructure venture capital fund may be created to pool these high-risk equity stakes. However, although some form of risk sharing between public and private sectors is necessary, governments should not underwrite normal commercial risks.

iv) Need to re-distribute costs adequately and minimise state aid

Distribution of costs and benefits should be equitable, and based on BPP and the Polluter Pays Principle. This is necessary for more efficient use of both new and existing infrastructure. New schemes should be devised in this respect.

Public acceptance of new schemes should always be taken into account, including the generation of externalities. The consensus-making process needs to be carefully managed, and the expected distribution of costs (both direct and indirect) and benefits attributable to various groups needs to be understood and open to the public. The distribution of revenues should be determined carefully in order to reach a consensus in the decision-making process.

In general, users' fees are not sufficient to cover the total direct cost of infrastructure provision in present schemes. At a minimum, governments should base users' fees on the costs necessary to maintain and rehabilitate the existing network.

In cases where funding gaps remain, these should not be written off as part of the public sector's annual budget. Subsidies and guarantees should be kept to an absolute minimum because the use of subsidies and loan guarantees as political tools transfers costs and risks to the taxpayers. In some cases where the project currently has high direct costs, but contributes to other policy objectives, this may be justified as an exception. Even in these cases, the financing should be treated as a high-risk equity stake, and managed accordingly.

v) Need to promote private funding for balanced development

It is expected that the respective governments of developing Asian countries will further open infrastructure development projects to the private sector.

However, in less developed countries, PFI projects might not be attractive because the private sector may not be able to charge sufficiently to recover the investment. For the promotion of private sector projects, it may be necessary to prime the pump, or to provide some form of subsidy (e.g. negative tender). Developed countries cannot lend money directly to these countries in the framework of ODA (Official Development Assistance). Therefore, IFC (International Finance Corporation), the World Bank's subsidiary organisation, will need to continue to play an important role in providing loans at low rates. This effectively lowers the average loan rate, making projects more attractive, and reduces financing costs.

Another issue in Asia is the imbalance between the amount of logistics infrastructure and institutional measures between the different countries and regions. This imbalance presents disadvantages in the development of logistics systems. Therefore, greater emphasis should be placed

on developing logistics systems in regions where few logistics concepts and practices exist. Strategies should be devised to promote advanced logistics. However, it should be recognised that no uniform objective can be achieved due to significant differences among the Asian countries: each country must engineer strategies that balance its own objectives with regional objectives.

vi) Supplementary information

Whether using private funds to develop logistics physical infrastructure is appropriate or not depends on the specific conditions surrounding the type of infrastructure investment and the prevailing political/economic situation in each country.

CHAPTER V: SKILLS AND TRAINING REQUIREMENTS

5.1. The characteristics of the labour market in the logistics industry

Logistics is emerging as a key economic activity and an important source of employment. Public policies concerning working conditions and training have a direct impact on the volume and quality of manpower and on the competitiveness of the transport and logistics service market. Human resource development in support of the freight industry is considered both a public and a private sector responsibility.

The existing labour force in the logistics sector is comprised mainly of older males, raising fears that a structural labour shortage may occur.

There is already a shortage of skilled manpower in certain operational areas, particularly highly skilled drivers in some countries, *e.g.* in the United States and Australia. In EU logistics, skill levels and wages differ markedly across countries, particularly between Western European and Eastern European countries. These shortages may be linked to inferior/difficult working conditions and/or lower wage levels prevailing in the logistics sector compared to other industries.

5.2. Changes in the logistics industry

The introduction of new tools, methods and organisational forms is expected to change the structure of logistics services production.

The logistics market is expected to become more active as a result of expanding business activities. The development of Internet trade, third-party logistics and new businesses and services catering to diverse needs will serve to enlarge the market. In particular, logistics and other customer-focused distribution methods will become increasingly vital in the future.

Logistics offers an opportunity to “optimise” activities across the supply chain; outsourcing plays a crucial role in this process. Increases in hired transport and logistics suppliers, as well as declines in internal account activities, reflect the trend toward outsourcing and professional specialisation. Reductions in the number of “support jobs” (*i.e.* not related to primary activities) contribute to increased productivity and price decreases.

The more supply chains are divided among numerous service providers, subcontractors, local or global organisers, the more co-ordination they require. Specialised services focus on specific assets and know-how, which need to be inserted into a coherent framework, providing a complete integrated complex service. Closer links between partners induce stronger rigour in organisation, and diffuse an industrial type of organisation — including strict “just in time” practices — into a previously more artisan-like type of industry.

Therefore, instead of a traditional taxonomy, relying on techniques and industrial specialities, the alternative approach distinguishes operational logistics activities from mainly organisational ones, consisting of developing, selling, and controlling the operational logistics activities. The interface dimension of these activities, highly dependent on information technology, is crucial.

5.3. Effects of changes in the logistics industry on human resources

The many developments in logistics have important consequences on employment and labour. For example, in Europe, two models of logistics organisation exist, in which the status of manpower is the crucial issue. One relies on high skills, information technologies, and the contemporary standards that advanced logistics require. The other relies on low product price and competition, resulting in downward pressure on salaries and working conditions.

Both models can be implemented simultaneously inside the same organisation, even in a seemingly contradictory way, with modern organisation ruling the core logistics system while ancillary services are delegated to outside providers or produced in-house by casual workers.

Therefore, driving and warehousing activities that are subject to price pressures are often the domain of poorly trained and low paid employees, particularly in Eastern European countries. However, new technologies will require a higher level of training to operate tracking, tracing and other ICT devices now essential to transport and logistics services. In Australia, the National Road Transport Commission has reviewed several approaches to assessing the skills levels of young drivers in order to fast-track training to address the problem of skills shortage in the industry (NRTC, 1999). The conclusion of the NRTC was that the fast-tracking concept could be criticised on road safety grounds as even careful selection of fast-track candidates may be insufficient to fully compensate for the higher crash risk carried by younger, less experienced drivers of heavy vehicles. The fast-track provisions would increase exposure to risk among younger drivers.

The associated problem of engaging sub-contract drivers operating under tight financial constraints relates to the chain of responsibility in road transport. In Australia, the challenge of effective compliance and enforcement is being addressed by extending the chain of responsibility to anyone in the transport chain who contributes to unsafe on-road outcomes — including consignors and receivers. Comprehensive national compliance and enforcement provisions are being finalised by the National Road Transport Commission, in conjunction with the road transport industry, road transport authorities and enforcement agencies. Occupational Health and Safety (OH&S) agencies are also involved in the process (NRTC, 2001).

Furthermore, logistics developments lead to changes in the demands for skills and require more highly educated employees. To provide their customers with complete, tailor-made integrated distribution services, distributors must employ logistics specialists who have the necessary skills to examine the complex distribution needs of their customers, devise for them the best transportation option, and design the necessary distribution and information systems. A key factor in this process is obtaining people who have such specialised abilities.

Many developing countries suffer from lack of logistic knowledge and policies and therefore need assistance in human resources education and training. Developed countries are dispatching logistics experts to establish and develop training courses in logistics in these developing countries, which can also provide benefits to the donor countries' supply chains. For example, several Japanese companies are actively promoting the education and training of human resources, in compliance with the Standards of Training, Certification and Watchkeeping for Seafarers (STCW), in developing Asian

countries. The enactment of standard international laws and regulations in the shipping industry has also encouraged private sector involvement in education and training of human resources in developing countries.

5.4. Policy recommendations

i) Need to improve conditions in the logistics industry in order to secure adequate workforce

In order to secure an adequate workforce to meet future labour needs in the logistics industry, factors that have discouraged workers and have prevented full utilisation of the labour force must be removed. In areas such as road transport, decisive political efforts will be necessary in order to achieve greater equity between conditions of employment prevailing in transport and those in other sectors.

Advanced information technology and equipment should be introduced more rapidly in order to enhance the efficiency of older and non-skilled workers. However, the industry also needs to promote the development of skilled workers at schools, help improve job-hunting activities, and reduce labour turnover in order to avoid potential labour shortages in the future.

Industry-wide efforts to improve its image are also necessary, if the logistics industry is to compete for workers in an increasingly narrow labour market.

ii) Need training and qualification systems for responding to developments in logistics

Logistics training programmes can upgrade skills and improve the work performance of those employed in logistics systems. Technology is rapidly changing and influencing different industries. However, skilled people are needed to plan, develop and operate the most advanced automated systems. Logistics training and educational programmes can evoke awareness of the various levels within the industry. Thus training and personnel development in logistics are critical for responding to advanced technology and global business trends. It is important that both policy makers and company executives pay attention to logistics studies and practice, and make training of personnel a top priority.

In addition to training programmes, workers' skills can be improved through education/certification schemes, resulting in increased rewards to the more highly skilled workers.

iii) Need co-operation between countries, especially to assist developing countries

Developing human resources through training and education is important to both the public and the private sectors. Co-operation between countries by establishing a database covering various aspects of logistics systems in a region (*e.g.* statistics, public policies, best practices, etc), and having periodic seminars to exchange experience and new ideas would benefit this.

The lack of logistics knowledge and policies in many developing countries could lead to bottlenecks in economic development. Developed countries need to facilitate human resources training in developing countries by dispatching their logistics experts to establish and develop logistics training courses in these countries. Dispatching experts will not only benefit these countries by developing human resources but also promote the provision of important logistics facilities that could play a crucial role in the harmonisation of intermodal operations.

CHAPTER VI: EVALUATION OF LOGISTICS SYSTEMS – INDICATORS

6.1. The aim of developing logistics performance indicators

The aim of developing performance indicators for the logistics sector is to evaluate the efficiency and sustainability of logistics systems, monitor the achievement of logistics policies and explore possible improvements.

Different players in the logistics chain have different objectives, and achievement of each of these objectives needs to be evaluated. The private sector aims to achieve optimisation of the supply chain, and hence, be competitive in international markets. The public sector aims to fulfil its responsibility by applying effective policies to address the trend towards increased globalisation of economies and liberalisation of trade while achieving sustainability and social objectives. The public sector has to be able to monitor freight transportation and the performance of logistics systems to measure the effectiveness of its policies.

Therefore, it is necessary to assess the advancement of logistics not only from the viewpoint of industrial or national competitiveness, but also from the viewpoint of global, social “optimisation”. Performance indicators can be used to assess impacts of logistics by considering the major players in the logistics system, *i.e.* consumers, shippers, logistic service providers and governments.

Although a complete evaluation of logistics systems may be difficult, a relative evaluation is possible and useful by comparing the performances of logistics services in different countries using performance indicators. They can be evaluated by considering best practices as the standard evaluation criteria.

6.2. The need for new indicators

There is a trend towards highly complex webs of supply chains. In such chains, joint management by many actors and interaction with other flows in the network is necessary. The simultaneous management by many actors in a complicated supply web necessitates development of new indicators that reflect the share of and responsibility for the use of system-wide resources and assets that individual actors carry, respectively.

Traditional performance indicators for global logistics systems have relied largely on simple quantitative measurements. While such simple measurements have helped to conduct partial comparative analyses, by helping managers, customers, suppliers etc. to evaluate how well their own subsystems perform in specific dimensions, they are inadequate for comparing the efficiency of different supply chains as a whole.

The present micro and macro indicators are both inadequate for assessing the performance of supply chains. The micro indicators, however relevant for single companies, are difficult to aggregate to the supply chain level. The macro indicators reflecting the efficiency of supply chains tend to be

disjointed and focused on particular concerns in isolation, rather than on a comprehensive review of all supply chain aspects, which are of interest to policy makers.

Therefore, there is a need to develop a multi-criteria assessment system at a meso level for conducting a comparative evaluation of logistics services in different countries which will cover total logistics costs, quality of logistics services, and impacts on socio-economic factors. However, recent work by the OECD (OECD, 2002) highlighted major problems with data availability for such analysis. Key data problems include access to data that are commercially sensitive; cost of collecting, storing and releasing data; timely access to data collected by government statistical agencies; and resource constraints facing such agencies and their adoption of a “user pays” approach to collecting/managing/releasing industry specific data. In regard to the latter, many statistical collections have been dropped by such agencies as a result of lack of funding.

6.3. Recommendations for developing new indicators

i) Need to develop multi-criteria indicators to enable comprehensive evaluation

Performance indicators can be classified into two types, cost indicators and quality indicators. In the private sector, there is a need to assess the performance of logistics systems in the consumer goods market not only from the cost aspect but also from more comprehensive aspects including consumer service, quality and safety of goods.

Furthermore, when assessing overall performance, non-monetary costs such as socio-economic costs (including environmental costs) should be considered. These are often neglected by the private sector. Society as a whole, however, shoulders these costs, thereby reducing the total efficiency of the system.

By combining these cost and quality indicators or by aggregating them into regional or national average values, a more comprehensive evaluation covering total logistics costs, quality of logistics services and impact on socio-economic factors can be performed.

ii) Need to develop meso-level indicators so as to enable policy actions to develop competitive supply chains

Indicators should be developed to assist policy making, thereby enabling policy actions to be implemented in a way that supports efforts by industry to develop competitive supply chains.

The interaction between industries' responsibility to create competitive supply chains and public policy goals of improving industry efficiency through policy actions requires governments to understand the mechanisms affecting the performance of shippers, carriers and other service providers in the supply chain, not only domestically but also internationally. A comprehensive analysis of the economic and financial impact of the wide range of policy instruments in place could assist in determining the cost effectiveness and appropriateness of various policy options and this requires macro indicators.

However, the macro indicators focusing on welfare maximisation are mostly decomposed into meso level indicators focusing on welfare optimisation, under the condition of subsidiarity, for sectors

or regions, and not on supply chains. Policy makers should seek the linkage between, on the one hand, the macro and meso level indicators and, on the other, the supply-chain indicators.

iii) Need to specify and communicate the strategic policy objectives of developing indicators

For governments, it is important to establish a clear relationship between performance indicators and the transport policy objectives they are designed to support, in order to transform indicator values into relevant action and link them to past and future development.

Hence, it is necessary for governments to specify their strategic policy objectives for developing performance indicators and to communicate them to all participants involved with logistics.

iv) Need to enhance implementation of indicators by the private sector

Many companies have interests in performance measurement. The real challenge is to define indicators that are useful to improving performance and to implement them with all relevant stakeholders. It is difficult to measure performance in supply chains. Partners who are willing to look beyond their own scope will ensure their position as good supply-chain players.

v) Need to collect data and compare costs appropriately

In order to improve the basis of transport policy, data collection, obtained from logistics service providers, is essential. It is also necessary to focus on data useful for international comparisons and on indicators useful for analysis associated with transport policy objectives. Shippers, as well as transport operators, can be direct suppliers of relevant data.

To collect relevant information in a cost-effective way, it may be necessary to conduct sample surveys, complemented by information from modal statistics and traffic counts, particularly in relation to the performance of different supply chains. A special area of interest is the growing importance of the so-called 'last mile': the delivery of goods to consumers in urban areas. Due to developments and opportunities in Business-to-Consumer e-commerce and the tendency among consumers to spend less time on shopping, there is a growing need for home deliveries. This will have huge implications for supply chains and transport. An area that is often missing in research is how to replace passenger transport to and from shops by alternative environmentally-friendly means.

In making international comparisons of costs, technical issues need to be addressed such as: selection of appropriate units, international normalisation of cost/price elements, the need to consider that cost differences mainly depend on differences in labour cost, which is higher in developed countries, and that logistics costs vary depending on several factors such as regulation, distance and type of goods.

In summary, indicators need to be selected which are relevant, plausible and for which data can be obtained. They should be applied in a way that provides both industry and government with the insights necessary to determine factors contributing to inefficiencies in supply chains, and strategies/policies to lift performance.

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ANNEX

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OECD PUBLICATIONS, 2, rue André-Pascal, 75775 PARIS CEDEX 16
PRINTED IN FRANCE
(77 2002 06 1 P) ISBN 92-64-19839-3 – No. 52621 2002