INFORMATION, TRADE, AND EFFICIENCY:

AN INTERNATIONAL TRANSPORT FORUM

ROUND TABLE

ON

INFORMATION AND COMMUNICATIONS TECHNOLOGIES FOR INNOVATIVE GLOBAL FREIGHT TRANSPORT SYSTEMS

GENOA, ITALY

MARCH 8-9, 2010

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INTRODUCTION

World trade value has increased over 20-fold over the last 50 years. The increase in trade has been accompanied by increases in the size of ports, increases in the size of ships, and innovations such as containerization and the use of information technologies. Yet, there are considerable strains on the transportation network. Two common approaches to mitigate the strains from increasing volumes are to add capacity or to use existing capacity more efficiently. While in the long run,growth in trade will incite investing in additional capacity, there are still substantial benefits to be derived by a more rational use of existing transportation infrastructure.

The Joint Transport Research Centre of the International Transport Forum and the OECD has held a series of Round Tables that grapple with various options. The most recent was held in Genoa, Italy on March 8-9, 2010. In this workshop, the role of information and communication technologies (ICTs) was examined as a mechanism to improve the effective management of traffic, and, in particular, intermodal traffic, with the focus towards improving the efficiency of transportation services and the management of transport bottlenecks.

A central component of economic efficiency is that economic agents have the relevant and necessary information at the necessary time to make optimal decisions. Over the last several decades, the advent of information technologies both in terms of infrastructure and software have dramatically increased the availability of data, and reduced the costs of accessing information. Discussions of the Round Table focused on the type of information, the technologies of information, and the use of information in transportation. Indeed, better information can affect where and how goods flow. It can also make movement of goods

through the network more fluid, which may reduce both transport time and costs. Hence, better information can lead to a more efficient and effective transportation network, which can have the effect of reducing congestion, especially during periods of high-traffic volumes.

The Round Table was held at the headquarters of the Port Authority in Genoa, Italy. The Round Table, chaired by Professor George Giannopoulos, focused on the salient issues of efficient and effective transportation of goods through a supply chain with an emphasis on transport hubs and ports. It became clear that ICTs can and have improved the effective management of intermodal traffic. The development of ICT allows for better integration of the different modes of transport, which contributes towards a more efficient transport network, a reduction in congestion, and can also contribute to reducing negative environmental outcomes and meeting climate policy targets. This is a summary of the discussions of the Round Table for policy-makers to consider at the 2010 International Transport Forum on Innovation and Technology: Unleashing the Potential, to be held 26-28 May 2010, in Leipzig, Germany.

Four introductory papers and presentations were commissioned to provide the foundation for the discussion:

- Prof. Enrico Musso – University of Genoa, Italy and Dr. Alberto Cappato IIC, Italy; **Co-modality as a solution to enhance modal shift in freight transport:** *ICT applications can help.*
- Prof. Peter De Langen – University of Technology Eindhoven, Netherlands and Dr. Albert Douma – University of Twente, Netherlands; **ICT & Hinterland Transport:** *Challenges for using ICT to improve coordination in hinterland chains.*
- Mr. Franco Borasi – ElsagDatamat (Finmeccanica Group), ICT and Logistic Director; **An Approach to a Global Intermodal Transport System:** *Potentials of open access web-based services.*
- Mr. Frank Knoors – Business Development Director, Logit Systems, Belgium; **ICT Applications for Innovative Global Freight Systems:** *How to implement a global system: Standards, systems, and services that make freight management work.*

These papers and the discussion underlined that better information, information systems and the sharing of information can lead to improvement in the capacity and efficiency of transport systems. Relevant information may affect and/or enhance modal shifts, co-modality and better integration. However, the presentations and discussions also pointed to a number of obstacles and solutions that affect both the procurement of information and the adoption of ICTs. These obstacles pointed to the need to understand how businesses (and, for that matter government agencies) make decisions and the need for security in dissemination, transmission and use of information procured from agents. Further, there is also a need for ICTs to be compatible i.e., interoperable, which points to standards and related discussions of local versus global transmission of information, standards, etc. The discussion in the Round Table has provided several most enlightening insights on these issues, and recommendations for future actions. The major points are summarized below.

1. THE IMPORTANCE AND USES OF INFORMATION

Transportation supply chains involve thousands of economic agents. In a port, agents include shipping companies, freight forwarders, truck and rail companies, the port authority, buyers and sellers of products, government officials and a host of others. Transactions amongst these individuals generate an enormous amount of information which can be processed, organized and disseminated. Better information, for example by ensuring that the commercial information about the goods are in an electronic form as early as possible in the supply chain, may lead to lower costs of moving goods from one location to another. Better information should also facilitate greater levels of trade. Transport and logistics costs account for up to

about 25% of the final costs of products, and reductions in these costs can be an important factor in trade facilitation. One way to reduce costs is through the use of ICTs which can improve capacity coordination within supply chains and a better utilization of existing capacity.

Professor Musso and others noted how information can be used before and during transportation. Specifically, information (on slot availability, destination or estimated arrival time) can be provided to affect where goods flow (market) and how goods flow (modal) decisions and improve capacity utilization by better coordinating modes in intermodal movements as well as storage and terminal space. While it is clear that such information is useful, there are impediments to the procurement and dissemination of information.

2. UNDERSTANDING THE BUSINESS MODEL

A recurrent theme throughout the Round Table was the need to understand the role of information in a business model framework. Specifically, for information to be disseminated, firms must choose to provide (mostly through cooperation) information, and it was in this context where the need to understand the business models was discussed. Loosely speaking, firms choose to provide information only if it is in their business interest. If it is not in their business interest, they will opt out. Since the provision of information is central to the effectiveness of ICTs, it is important to understand this concept in designing related policies.

This was particularly clear in Professor De Langen's presentation where a number of different decision-makers in the supply chain were discussed. These include shippers, hinterland (truck, rail, barge) operators, port terminal operators, liners, freight forwarders, etc. These are interlinked through complementary activities involving several potential layers. Of

course, in many cases, their returns are interdependent and depend on the level of privacy of information. Coordination of different activities e.g., scheduled service, storage, loading, unloading, etc. depends mainly on the level and coordination of information. Strategically, different players may find it useful to withhold information. A clear consensus of the Round Table is that understanding the role of private and public information in the context of a business model was very important in evaluating the role of ICTs and ICT policy.

3. STANDARDIZATION AND COSTS OF ICTS

ICTs are, of course, costly. They involve sunk costs which are costs of investment which are not recoverable as well as costs of use. Over the last several decades, both sunk and variable costs of ICTs have fallen dramatically. Specifically, the costs of both hardware and software have fallen by sizable amounts, while performance has increased substantially. Further ICT advances e.g., WIFI, satellite communication, etc. has made accessibility to information almost ubiquitous.

Finally, at the Round Table there was some discussion on the need for standardization. While there are some standard components, operating systems, telecom protocols, etc, which have obvious advantages in lowering the costs of ICTs, there is still room for greater standardization to allow for greater interoperability between users. Such standardization could include a standardized description of transport services, in similar ways as we have seen the definition of standardized dimensions for load units earlier – container dimensions. Further, the World Customs Organization has just released trade reporting requirements for customs

and other regulatory agency. Adoption of this standards by the EU would make a significant contribution to achieving interoperability.

4. AREAS FOR ENCHANCED USE OF ICTs

Participants pointed to multiple areas where there is room for an expanded use of ICTs. They include, for instance, the expanded use of ICT at freight terminals, a more effective use of intermodal terminals within supply chains (a process labeled as ”terminalization”), and integrating IT within the container itself (“Intelligent Containers”). The terminal is a fundamental element in containerized freight distribution, with several areas in which ICT could improve performance and interoperability.

First, the interface between the modes (containership, unit train) and the stacking yard of the terminal could be improved. Large numbers of containers often have to be handled in a short amount of time so that containerships can maintain their schedule integrity. As import containers are unloaded from a vessel, they are stacked in import blocks designated by the yard manager. Unlike export containers that are segregated by vessel, destination, size, and weight, import containers are stacked in the order they arrive to the yard block. This container management may facilitate unloading operations and reduces vessel turn-around time, which is the main priority of the terminal operator, but may also inhibit the timely movement of containers.

Another issue concerns the interface between the terminal and the regional transportation system, notably gate access. Tight supply chain management and security concerns are placing pressures to quickly and reliably process container pick-ups and deliveries.

This can involve appointment systems and automated storage and retrieval systems that are likely more successful with effective use of ICTs.

A second area is that of terminalization. As trade has become more "globalized" and as shipment distances increase, there are growing quantities of containerized cargo that are in transit because of global supply chains and the extended transport distance they involve. As a result, an important part of inventory management is the consideration of "in-transit" inventory. Such a practice is made possible by ICTs, enabling to consider a container at a nearby terminal as available inventory. This helps mitigate warehousing costs, but places pressures on terminal operations.

Finally, a likely evolution of ICTs concern the container itself and an ability to provide real-time (or at frequent intervals) information about its status. This involves Global Positioning Systems (GPS) and Radio Frequency Identification (RFID) technologies that allow to monitor the location of the container as well as its temperature and integrity. This is likely to be an area of ICT growth due to the requirements of just-in-time inventory management, reliability of delivery, security, and even insurance claims.

5. GOVERNMENT ROLE AND BUSINESS MODELS

In order to make various ICT applications attractive to their users, it is important to understand and analyze the complex and sensitive business relations and working models in the various parts of the supply chain. Taking into account the legitimate interests of the business involved, and trying to overcome the inherent inertias and preference for proprietary systems, is of

paramount importance. By trying to understand and accommodate these legitimate business interests of those involved, one has to decide how this cooperation will be achieved.

This brings the questions of whether the government's role is to improve the private industries or, for example, to ensure border security while improving border clearance timeliness. Concerning the ICT applications providing Business to Government links the Round Table found support for such applications and noted promising applications and systems such as:

- The "e-Border" challenge and the Integrated Cargo System of the Australian Customs and Border Protection Service. The challenge for border management agencies concern securing the information required for border management purposes in a time frame that enables risk assessment and clearance to be concluded before goods arrive at the border. Consequently, the time available for border management response can be maximized and delays for logistics management can be minimized (Capgemini, 2008);
- The "Neutral" Platform for container transport information provision to customs and LSPs by the EU co-financed project SMART-CM, and others like Freightwise and Euridice. The Freightwise project sets up standardized framework for interfaces between the generic roles (transport user, transport service provider, transport regulator and transportation network manager (Knoors, 2010).

These systems have helped assessing risks prior to receiving the actual container. This border agency intervention should be based on intelligence-led and risk-based approaches rather than on mass screening or mandated supply chain security. Customs should take into account the extent to which risks are mitigated by shippers who demonstrate container security with track and trace capability. Border agencies could start with an attempt to get pre-information forms filed through electronic, including web-based systems, and potentially evolve into the more advanced systems of monitoring the containers the way SISTRI is used to track wastes. With container ships becoming larger, ports have to be prepared to handle large amounts of containers efficiently and efficient customs procedures can only help mitigate this problem.

There were, however, examples of lessons that could be learned from it strategies that turned out to be inefficient. They mainly imply situations where governments tried to control private interests instead of just security issues. A particular shortcoming was the failure to appropriately consider business models of transport companies, in cases such as (Langen, 2010):

- INTIS (Netherlands, aimed at setting standards)
- Barcelona Port Community System
- Dutch government single window initiatives

While there is potentially large quantities of information about the operation of freight transport systems, there are no real clear incentives for the industry to disclose it to other actors in the supply chain. This brings the question of to what extent the government should act as the facilitator for the diffusion of supply chain information? This leads to the next question of what are the current driving forces that need to be understood when implementing an ICT aimed at improving public and private efficiencies.

6. FACTORS INHIBITING ICTS AND TRANSPORTATION

When considering an ICT system in the transportation system, it is helpful to understand three forces among others that shape the diffusion and application of ICT over freight transport systems (Rodrigue, 2010).

Transport systems are the outcome of substantial capital accumulation in assets that takes place over decades and that shapes operations and additional investments. There are sunk costs within freight transport systems that future innovation cannot effectively bypass. Infrastructures have been built, modes selected and specific locations have been reinforced

through the development of intermodalism. Thus, as the level of asset accumulation increases, sunk costs incite a path dependency where innovations, or at least the options available, are increasingly limited. More than any other transport technology in history, containerization has geared global freight distribution in a **path dependency** that undermines future paradigm shifts towards new forms of distribution, but which is still significantly prone to incremental improvements. Nevertheless, ICTs still have tremendous potential to reduce the friction of containerized traffic.

Different actors have different level of access to information, which results in unequal power relations. A common pattern is that large transport firms have more information and the capacity to use it than small firms, for the simple reason that they operate a larger network and are thus able to better understand and shape the systems in which they are operating. Asymmetry is also a competitive advantage as firms will not reveal comprehensive information about their general costs and operational characteristics (e.g. capacity, scheduling) to their customers and competitors. Competitiveness tends to alleviate asymmetry since competing firms will reveal more information about their services to capture and retain customers. Still, firms are reluctant to reveal their market intelligence and operational knowledge, which are essentially their business model. This is particularly the case for their deficiencies (such as spare capacity) which would enable customers and competitors to gain a temporary advantage. While there is always a price discovery mechanism at play influenced by market forces, several freight transportation systems operate in an oligopolistic environment, particularly the international segment, so a level of obfuscation is implicitly part of business strategies. Even with ICT, asymmetry is likely to endure in global freight transport systems as it enables a better

level of information control within firms.An ICT strategy established by a firm to help take control of its management and decision making processes may be very efficient. Thus, internalization appears to be a prevalent strategy of ICT development which operates within the boundaries of the firm, but several channels / conduits can be established with partners and customers to insure proper interactions. This can reinforce asymmetry as the more internalized and ICT system is, the less likely the involved firm will share the information and the associated business practices. An example of internalization would be between a maritime shipping company and a terminal operator that would share information, particularly if they are parent companies (e.g. Maersk and APM). However, the terminal operator may reveal little information to the port authority.

There is a particular belief that ICT can help break these forces, particularly asymmetry, but it is more likely that ICT will reinforce them. Thus, the outcome will not necessarily be a harmonization of ICT systems since asymmetry and internalization of powerful forces embedded into business models, but a convergence towards better interoperability. The latter opens opportunities to establish specific information exchange schemes where the concerned players see mutual benefits; where cooperation provides more returns than competition. Port community systems appear to be such an endeavor where cooperation leads to efficiency improvements, since the maritime / land interface and its intermodalism are complementary. One of the most significant impacts of ICT on freight transport systems, concerns multiplying effects related to a better utilization of existing assets. This implies that the same asset base can provide additional capacity and reliability, therefore improving its amortization. The outcome is an improvement of the “velocity of freight” without an improvement in modal

velocity. Supply chain management is therefore improved, leading to economic benefits for producers and consumers.

7. SMALL TO MEDIUM SIZE COMPANIES

Much of the development of ICTs was done privately with substantial private investment. Hence the view of a Global ICT network may have arisen 25 years too late with respect to the developments that have already incurred. Many companies including small and medium companies have made progress and are holding their own proprietary ICT solution. The only long-term solution the industry seems to require at this point in time is indeed a kind of translation box/server that could enable the various actors to intercommunicate and cooperate in term of transport and supply chain optimization. The supply chain itself on a global and even a local level involving global trade is too complex for a top down approach to be successful. The aim of standardized solutions should not hamper development of alternative business opportunities, but instead provide standard interfaces where users' needs are leading the process.

The air cargo industry users' are being represented by 1000 – 2000 carriers and the sea and freight industry has hundreds of thousands of operators, ranging from major global players to local freight operators. There are many standards and systems available that handle or are related to freight management among the transportation industry; Enterprise Resource Planning (ERP), Traffic Management System (TMS), Waste Management System (WMS), fleet management systems, and port community systems. Besides systems from well-known vendors

there are many legacy systems developed in-house in order to support specific business processes. A global freight management system may never come true unless we are able to exchange information with such systems. Current standards in the sea and freight industry are far too vast and the size of the different players using their own systems too large. Freightwise, discussed earlier, can support this by a true unified framework of simple interoperability standards and it is currently being integrated with the Universal Business Language (UBL) initiative. It has the potential to unlock a mass market of transport services and supporting products and services that support true interoperability and integration. This is also targeted at small and medium companies that can participate through web-based open access interfaces. The same form of standardization would help in speeding up the process of border crossings at Customs. This is an area that needs some help from the Customs Authorities of the more developed nations to set a standard across their borders that could be implemented across to the other Customs offices in regards to prior information to be attached to container imports.

8. CONCLUSIONS

The last 50 years have been marked by globalization and the growth of international trade. While transportation modes and infrastructure have both quantitative and qualitative improvements, there is a clear consensus that existing assets can be better utilized. The use of Information and Communication Technologies (ICTs) offer many options to help improve the capacity, efficiency, reliability, security, safety and environmental performance of global freight transport systems. The outcome involves in better resource allocations where existing capacity has a higher level of utilization, goods flow to higher valued locations, and unnecessary

redundancies may be removed, each of which reduces transport costs and therefore facilitates trade.

There are central key issues and points identified and articulated by Professor Giannopoulous, which summarize the Round Table. The key issues are:

1. How to convert the multitude of data collected from numerous sources into useful information for each user category along the supply chain?2. What parts of this information should be "visible", and by whom, besides – that is - the parties that are the primary "owners" of it?

3. What is the scope and timing of this information (how much, and at what stage of the chain)?

4. What would be the appropriate business models for providing this information along the supply chain in a trusted and neutral way?

5. What is the suitable architectural framework and "technical standard" for providing this information ("global" vs "local" systems, standardization of messages, provision of interoperability among existing systems, etc)?

Prof. Giannopoulos also highlighted a number of insights and recommendations that can be drawn from the discussions. These are summarized by the following nine points.

POINT 1: In order to comprehend and make the various ICT applications attractive to their users, we need to understand and analyze the complex and sensitive business relations and working models in the various parts of the supply chain. Taking into account the legitimate interests of the businesses involved, and trying to overcome the inherent inertias and preference for proprietary systems is of paramount importance. By trying to understand and accommodate the legitimate business interests of those involved, it is possible to incite a wider application of ICT, but also a wider application of intermodal transport in general.

In support of this principle, a detailed layered model of the business processes in the whole supply chain was presented and discussed, and it was noted that the trend of the firms

to expand to many layers, which can be a prime incentive to them for going intermodal. Some interesting "success stories" in which ICT and business interests were harmonized and with positive impacts, include the "*PortBase*" system in the Netherlands and the "*key-rail*" infrastructure charging model.

POINT 2: "Centralized" solutions have not proven their worth and that a more decentralized but interconnected – i.e. "mixed" – approach seems promising. This is expressed characteristically by the "*Planning Apart Together*" approach that has been recently introduced in the Netherlands.

On the question of using "centralized", universal "single-window" type of solutions for information provision, versus decentralized interconnected ones, the participants noted with interest the written intervention (made through a discussion paper) of CLECAT and FIATA, which noted:

"*In logistics we only need the ability to negotiate from one end to the other seamlessly by taking successive steps, and we need efficient systems to create compatibility between different* ***interlocutors*** *and, sometimes, among multiple users who have implemented their own systems that are in principle incompatible*".

Their position seems to indicate a strong interest by the industry against establishing "universal" systems but simple and easy to implement solutions of getting "neighboring" systems to talk to one another.

POINT 3: Creating standards and perhaps more appropriately a standardized way of addressing ICT applications, the Round Table noted many efforts towards creating a global "Reference Architecture". They include the *Karen* project architecture the recent *Freightwise* -

project. It was noted that what is needed most is a framework that creates the basis for *transparent information that is available in the market for <u>all</u> users to choose from*.

Relative to this notion was a presentation of the most recent frameworks created by theresearch project Freightwise, funded by the EU. According to this framework (which is now starting "application" tests via an EU DG Enterprise funded project called *DiSCwise)*, a standard notion and notation is established for:

a. Transport service description & publishing (marketing transport services under full control of the transport service provider),
b. Transport execution planning, and
c. Transport execution status monitoring.

By creating standard types of messages for these stages between the 4 principal actors in a transport chain (e.g. the transport service provider, public authorities, the user, client) one can achieve an overall system for freight transport operation which allows for:

a. Data source aggregation
b. Data consolidation and exploitation according to the specific interests of each "party",
c. Personalized information delivery, and so on.

By making the move (and the expense) to develop "connectors" i.e. by translating customized proprietary systems, under which most of the actors operate, to the standard outlined above, effort interoperability among the various diverse systems can be achieved with relatively minimal efforts. Freightwise supports a decentralized approach and does not aim to replace existing standards.

Governments can assist towards wider proliferation of such framework systems by: a) further support their development and b) support the creation of "connectors" to proprietary systems, at least until a necessary "critical mass" of compatible and interoperable systems (via linking to this higher level architecture) is achieved.

POINT 4: A point of much discussion and deliberation was the way that ICT systems implementation (as well as modal integration and cooperation) could be made operational. There were quite a few participants who took the view that government should play a more active role. Among the possible realms of engagement, the following can be noted:

a. Enforcing regulations at all levels (speed limits, driving hours, load factors, etc);
b. Insuring that information of "public interest" is available to all (e.g. Estimated Time of Arrival);
c. Providing more "regulation" for the system's function..

Actors that have privileged links to governmental agencies (e.g. major port authorities, terminal operators or shipping companies) could also play a leading role in adopting ICT systems and thus inciting otheractors to participate.

POINT 5: There were, however, many voices too, that cautioned against reverting too easily to the state to help and insisted on a market driven approach to create value for the user.

POINT 6: Concerning the ICT applications providing Business to Government links and solutions, the Round Table was unanimous in supporting such applications and noted with interest information provided by participants about promising applications and systems such as:

- the "e-border" challenge and the Integrated Cargo System of the Australian Customs and Border protection Authority; and
- the "Neutral" Platform for container transport information provision to customs by the EU co-financed project SMART-CM, and others.

A standard electronic form for all freight to be accepted by all customs was mentioned as a very desirable and positive advance in ICT assisted "green lane" approach to passing borders.

POINT 7: On the desired level of visibility along the transport chain, it was noted that "value for money" depends on the size of the actor utilizing the information, the type of information,

among others. There is an “Asymmetry” of information provision that is evident among the various actors. Many companies (especially large multinationals) have substantial amount of information that is used to gain competitive advantage through this asymmetry. So, visibility is still an open issue.

POINT 8: Worldwide deployment of ICT for freight was another area of concern. The general view was that successful and above all fast and seamless deployment depends on a number of key factors which can be summed in the following four elements:

a. Decentralized rather than centralized systems providing flexibility of application (not “one solution to fit all”);

b. Transparency of operations;

c. Interoperability at all levels, and;

d. Adoption of a common standard at least in the form of a high level architecture to ensure common definitions, notations, and message formulation among actors.

POINT 9: Finally, the Round Table discussed ways in which ICT could achieve a higher level of usage within Small and Medium sized Enterprises (SMEs). Here the general view was that such actors have an inherent aversion to spending for ICT because they do not perceive real benefits and in many cases this is true due to the lack of the necessary “critical mass” of users that would ensure such benefits. So, there is still a lot to be done on this front and actions that could help are:

a. Inducement through ICT adoption by “champions” that are major actors and who interact with SMEs, since many are their customers. This in a way will incite SMEs to adopt ICT.

b. Support by governments or public operators for the dissemination of information, stimulus/support for developing key items such as software connecting local proprietary systems to larger and more globally oriented information systems.

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