E Business Impact on Canadian Transportation

Research conducted for the Canada Transportation Act Review

Report prepared by
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I. INTRODUCTION

1. Importance of E-Business to Canadian Transportation

The Internet is revolutionizing the way in which companies do business. It has changed the way organizations operate and conduct business by enabling the re-engineering of sourcing, production and logistics processes. It has increased the ability of firms to collaborate in the supply chain, and to adopt or adapt to new buying and selling practices. This has lowered transaction costs and improved efficiency, changed relationships with suppliers and customers, and changed industry structure. Canadian transportation is significantly impacted by the Internet because it is both a business that uses the Internet and a supplier to businesses that use the Internet. Electronic Business (E-Business) provides opportunities for transport firms to use technology to improve service, to increase productivity and to reduce cost. E-Business is a challenge as it creates new supply chain requirements and capabilities that impact the demand for transport services, and in many cases creates new demands on fulfilment. It is both a challenge and an opportunity as the Internet reinvents the marketplace through the creation of freight exchanges and online marketing of services.

There are important issues for Canadian transport to face in the near future. What type of E-Business strategies should be adopted and at what rate? Is adoption of E-Business a necessity in order to compete in the global and North American transport market? What is the role of electronic market exchanges in transportation? How must transport firms change in order to meet the transport needs of customers in the Internet age? These issues are important at all levels of government as well. How will changes in the market affect the competitive structure of the transportation industry and particularly the ability of Canadian domicile carriers to compete with U.S. carriers? How will transportation demand patterns be impacted by E-Business and what is the impact on utilization and need for transport infrastructure? Will there be significant modal shifts? How will efficiencies created by the Internet affect the demand for transportation

infrastructure? What are the subsequent impacts on the congestion, environment, safety and energy use?[1]

2. Study Objectives, Scope and Methodology

This report was prepared for the Canada Transportation Act Review Panel (CTAR) to address the following areas:

- Assess the E-Business environment in Canadian transport.
- Investigate specific E-Business directions that Canadian transportation firms may take.
- Identify how E-Business may impact the competitiveness of Canadian transport.
- Develop implications for government policy.

A framework for analyzing these areas is shown in Figure 1[2]. Electronic business can impact the demand for transport by:

- Dematerializing physical products and thereby reducing or transforming the demand for transport.
- Changing supply chain management practices that impact how and what shippers purchase from transport suppliers.
- Creating new distribution patterns and transport needs through online selling.

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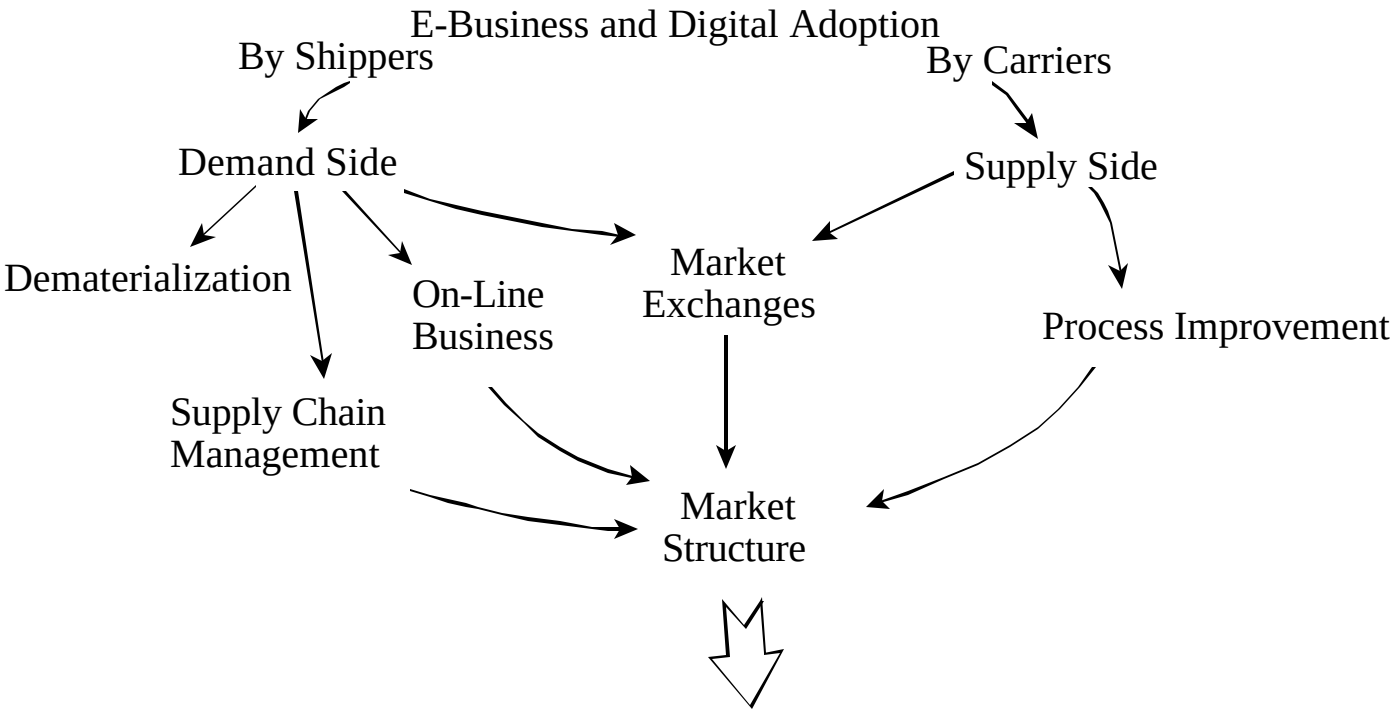
[1] For a more detailed explanation of these issues, see Chow, 2000.

[2] This framework is a condensation of a comprehensive framework summarized in Appendix A.

Figure 1
IMPACT OF E-BUSINESS ON TRANSPORTATION



E-Business can impact the supply of transport by enabling transportation firms to improve their own internal business processes, customer relationship management, procurement and supply chain coordination. The Internet enables the growth of market exchange or electronic marketplaces that provide a new medium for shippers to buy and carriers to sell transportation. All of these changes on the supply side, the demand side and on the nature of market interaction have an impact on the market structure of the transportation industry and subsequently social, environmental, safety and economic impacts on society.

The focus of this study is on the freight sector of transportation. The rail, truck and marine/port sectors of Canadian transport are specifically highlighted with regards to their use of E-Business. This report is based on an extensive search and review of academic and industry literature and the collection of primary information from industry representatives. This report utilized related studies sponsored by CTAR or Transport Canada, or conducted by the CTAR staff. These studies and their relationship to this report are summarized in Appendix B.

3. E-Business Environment and Concepts

Electronic business (E-Business) is any commercial transaction carried out, facilitated or enabled by the electronic exchange of information. Electronic exchange can be via the Internet (Web), Electronic Data Interchange (EDI), intranets, dedicated telecommunications or email. Transactions can be buying and selling, servicing customers, collaborating with business partners, or conducting transactions within a company. Transactions can be internal to a company and affect the internal supply chain process or be across firms, affecting external supply chain processes. Electronic transactions that involve the change of ownership (purchase or sale) of a product or service are formally known as electronic commerce (E-Commerce).

E-Business transactions are often classified as Business to Business (B2B), Business to Consumer (B2C), Business to Government (B2G) and Consumer to Consumer (C2C). The growth and potential magnitude of E-Business is astounding. AMR Research estimates electronic B2B activity at $5.7 trillion in 2004 or about 29 percent of all business transactions. AMR states that leading companies will move more than 80 percent of their activities to the Web. Like the B2B market, the B2C segment is undergoing rapid growth. Forrester Research estimates online consumer spending will amount to $2 trillion or one out of eight dollars of all retail transactions by the year 2003. Forrester Research also forecasts that the number of households that shop online will grow from its current 17 million to 49 million by 2004. According to the Canadian E-Business Roundtable, the value of E-Commerce in Canada was approximately $11 billion in 1999. By 2003, Canadian electronic commerce is forecasted to reach some $94 billion.

Statistics Canada found in 1999, that 52.8 percent of enterprises in the private sector use the Internet. These firms accounted for 75.4 percent of the economic activities of the private sector. Only 37.1 percent had no plans to use the Internet. Internet sales and purchasing activity of the Canadian transport, manufacturing and retailing sectors are shown in Table 1. An indication of the importance of electronic commerce in Canada's transport environment is taken from the shipper survey conducted by CTAR staff[3]. The statistics in Table 2 suggest the degree to which shippers in Canada use EDI or the Internet with transportation service suppliers. Significantly more respondents are using the Internet (57 percent) than EDI (36 percent). Furthermore, 22 percent plan to use the Internet with their transportation service providers while only 16 percent plan to do so with EDI. This reflects the greater accessibility and popularity of the Internet to shippers.

[3] Hinchcliff, 2001.

Table 1 Internet Utilization in Canadian Private Sector (1999)			
Internet Usage Characteristic	Industry Sector		
	Transport-ation and Ware-housing	Manu-facturing	Retailing
Percent of enterprises that use the Internet to sell goods or services	10.1	14.9	10.9
Percent of economic activities attributable to enterprises that use the Internet to sell	21.2	16.3	21.9
Percent of enterprises that use the Internet and use it to sell goods or services	23	23.3	27
Internet sales with or without online payment (millions)	$164.3	$900	$610.6
Internet sales as percentage of total operating revenue	0.3	0.2	0.3
Percent of enterprises that use the Internet to purchase goods or services	10.7	18.9	10.8
Percent of economic activities attributable to enterprises that use the Internet to purchase	27.8	31.8	15.7
Percent of enterprises that use the Internet and use it to purchase goods or services	24.4	29.7	26.7

Source: Bakker, 2000

Table 2 Use of Electronic Data Interchange and Internet - 2000

Use of electronic data interchange (EDI)	Use EDI	Plan EDI	DK/NA	Total responses
With product and material suppliers	35 %	21 %	44 %	110
With transportation service providers	36 %	16 %	48 %	107
Within your company	54 %	8 %	38 %	115
With business customers	50 %	13 %	37 %	120
With final consumers	21 %	14 %	65 %	100
With government	21 %	9 %	70 %	99
Use of Internet	Use Internet	Plan Internet	DK/NA	Total responses
With product and material suppliers	60 %	15 %	25 %	115
With transportation service providers	57 %	22 %	22 %	120
Within your company	72 %	5 %	22 %	129
With business customers	59 %	20 %	21 %	120
With final consumers	42 %	13 %	44 %	104
With government	37 %	12 %	52 %	104

Source: Hinchcliff, 2001

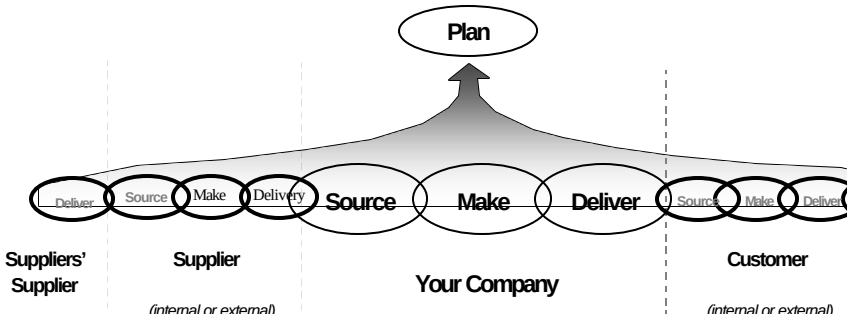
II. The Impact of E-Business on Transport Demand

1. Supply Chain Management

The supply chain is all of the firms and processes involved in producing and delivering the product to the end consumer. Supply chain processes include all of the activities required to source supplies and raw materials for production, finished goods for resale, and parts for after sales service as illustrated in Figure 2. Supply chain processes include making and producing the product or service, and the delivery of goods to each member of the supply chain, encompassing both inbound and outbound logistics as well as reverse logistics. The supply chain itself may be a single vertically integrated firm and its final customer. However, few firms are this comprehensive, instead the majority of firms operate as part of a larger supply chain, a network of suppliers and their suppliers, customers and their customers. This market based industry structure benefits from the lower costs and productivity of specialization, with different members of the supply chain adding value. It is predicted that the supply chain itself will become the trading entity, that functions as a corporate family with each member contributing a specific core competency. This form of organization will not become dominant overnight because the sharing of commercially sensitive information is foreign to the culture of many firms. However, there are real cost savings that can be gained from collaboration between supply chain partners and even between competitors and the process has already begun in a number of industries. For example a number of industries have made tremendous gains through Collaborative Planning Forecasting and Replenishment (CPFR).

The management of the supply chain involves the planning, execution and control of these processes to deliver products to end customers at the lowest cost . Information has always been critical to all three of these management tasks. Information such as forecasts of demand and future cost conditions are the foundation for optimizing decisions involving the production -

Figure 2. Supply Chain Management



distribution network and product flow, and collaboration across the supply chain. Information flow initiates transactions and enables more precise coordination across the supply chain during execution. Detailed and real time information permits close monitoring of processes, enabling agility and responsiveness to changing market conditions or out of control processes. Thus information technology has always had an important influence on the efficiency and effectiveness of the supply chain. Prominent applications of the Internet for supply chain activities are shown in Table 3.

Table 3

Application of the Internet to Supply Chain Processes

Procurement	C	Internet enabled demand planning; real time available to promise/ capable to promise and fulfillment.
	C	Other linkage of purchase, inventory, and forecasting systems with suppliers.
	C	Automated requisition to pay.
	C	Direct and indirect procurement via marketplaces, exchanges, auctions, and buyer seller matching.
Inbound logistics	C	Real time integrated scheduling, shipping, warehouse management, demand management and planning, and advanced planning and scheduling across the company and its suppliers
	C	Dissemination throughout the company of real time inbound and in-progress inventory data.
Operations (Production)	C	Integrated information exchange, scheduling, and decision making in in-house plants, contract assemblers, and component suppliers.
	C	Real time available to promise and capable to promise information available to the sales force and channels.
Outbound Logistics	C	Real time transaction of orders whether initiated by an end consumer, a sales person, or a channel partner.
	C	Automated customer specific agreements and contract terms.
	C	Customer and channel access to product development and delivery status.
	C	Collaborative integration with customer forecasting systems.
	C	Integrated channel management including information exchange, warranty claims and contract management (versioning, process control).

Source: adapted from Porter, 2001

Transportation is one of the most important and critical supply chain processes. Transportation costs account for approximately 60 percent of total logistics costs and in many fulfilment situations transportation is the largest component of the order cycle, influencing the speed and reliability of the order cycle and the quality of the customer experience. The transportation sector is an industry unto itself, composed of multiple modes and thousands of individual firms competing for the shipper's business. The services and capabilities that the transportation industry needs to provide and the means by which transport firms market and produce service are profoundly impacted by E-business. E-business influences transport demand in a number of ways:

- Electronic technology and specifically e-business technology has enabled logistics and supply chain managers to integrate and collaborate within and across firms. Integration and collaboration are consistent with management strategies such as outsourcing and engaging in partnerships and alliances. This creates demands on transportation suppliers to be able to function as partners, sharing and managing information. Higher levels of information and integration, support the use of pull systems which place new requirements on transportation firms for higher levels and different types of service, technology and other capabilities.

- E-business has been adopted in the procurement function leading to both opportunity and the necessity of carriers to connect with its customers electronically.

- E-business technology has enabled the creation of on line-businesses and that utilize different distribution networks and strategies. Changes in transport demand and carrier capabilities result from this new on line-businesses, causing modal shift. New on line-business have different logistical requirements and therefore different transportation requirements. Disintermediation of supply chain intermediaries could change distribution patterns.

- E-business may substitute digitization for physical movement, also called de-materialization or e- materialization. This is the replacement of tangible goods with virtual goods or digitization. This may reduce physical movement requirements.

2. Supply Chain Integration

Overview

Electronic technology and specifically E-Business technology has enabled logistics and supply chain managers to integrate and collaborate within and across firms. Integration and collaboration are consistent with the trend towards outsourcing and engaging in partnerships and alliances. Firms have always sought this integration to reduce cycle times, inventory and other supply chain costs, particularly in industries with high risk of inventory obsolescence or high inventory value. The impact of the Internet is that it is an incredible medium that allows supply chain activities to be carried out in a truly synchronized manner.

Internally, the Internet enables efficiency gains through the creation of Intranets that ensure that all employees have access to the same information, facilitating collaboration within firm, across sites and across divisions, and Enterprise Information Technology that allows the sharing of information between applications and different legacy systems. The latter technology includes FTP and XML which together have the capability to automatically accept XML formatted data and to output the data in this format.

The Internet enables external efficiency gains by supporting alliances with point to point links that allows information systems to interact without human intervention on routine tasks, enabling multi partner integration by providing accurate data to all members of the supply chain concurrently. This allows the possibility of supply chain optimization, reducing the bull whip effect, spiked order patterns, inventory shortages and surpluses caused by delays in information flows.

Enabling Pull Systems

Successful integration enables the supply chain to move from a push to a pull fulfillment strategy. The traditional model of a push supply chain had been to forecast demand, produce the product for stock and locate it close to the customer to meet demand. This achieved production and transportation cost efficiencies but at the expense of holding large inventories. Pull systems, such as assemble to order or build to order, result in postponing the production of the product or holding inventories as far upstream in the supply chain as possible. Pull systems are more responsive to actual customer demand and result in the movement of smaller quantities more frequently. Quick response in retailing, efficient consumer response in grocery, stockless inventory in health care, JIT in manufacturing are examples of pull strategies. Centralizing inventory in fewer locations is another form of postponement. For these systems to work, information such as supply, demand and shipment status must be shared across the supply chain. With visibility of moving or standing inventory, various participants in the supply chain can plan and synchronize their processes with demand (pull) signals.

Developments in the computer industry provide the leading example of moving away from a costly make-to-stock, push system. Dell Computer Corporation epitomizes the utilization of a pull supply chain strategy with its “Dell Direct" model and demonstrated the power of a “build-to-order”system enabled by the Internet. The Dell Direct model is based on a reconfiguration of the supply chain, a tight integration of B2B and B2C capabilities, and new approaches to dealing with customers. Consumers can choose a custom configuration at Dell’s web site, arrange purchase and payment details online, and then can track the progress of their order through every phase of production, right up until delivery. Orders go directly from the web site into Dell’s production schedule, parts are ordered from suppliers only after the order (and payment) is received, parts are kitted immediately before production and built up in cells, and the final product is tested and loaded with software before shipment. Accessories such as a printer or scanner are warehoused by the manufacturer. Merge in transit strategies are used to insure the

arrival of different components of the order at the customer's site at the same time[4]. The result is that the company carries no inventories contributing to its low costs. Every other major PC maker builds to stock and sells through resellers who carry inventory. This is an industry in which inventory has high obsolescence costs as components rapidly become technologically obsolete and the more inventory in the chain, the higher the obsolescence costs.

This type of supply chain requires transportation system that fast, reliable, flexible and information laden. Dell's distribution network to Canada starts in its primary plant in Round Rock (Austin), Texas (and more recently its new assembly plant in Memphis, Tennessee). Supplier are required to provide just in time availability of components and other raw materials. To do so, many have developed supplier hubs where they stock their products to be picked and delivered to Dell in less than 24 hours. Essentially, PC companies like Dell have transferred their inventory to the suppliers. Intercity inbound logistics is changed little as bulk shipments, usually by intercity TL, are still used to ship to these hubs (as opposed to the computer maker's plant directly). However, increase local movement from the supplier hub to the plant on a just in time basis has increased.

Outbound logistics is changed dramatically. The traditional push supply chain would produce PCs in large quantities and ship them in TL or container quantities, to a distribution location (cross dock) in Canada for immediate redistribution to retail locations where product is stocked, or to a central (but within Canada) location for distribution to retail stores on demand. Product is moved to retailers by TL, LTL and some courier service depending on urgency and whether the product is being shipped for stock or for an existing order. Consumers pick up their purchases at store locations. For PCs that move through general retail channels, the product is more likely to move in TL to a local Distribution Center and by local delivery to the stores, aggregated with other products. Although the product is of high value, the penalties for slow transportation were minimal since the products were being moved for stocking purposes, not immediate demand.

[4]See Fine and Raff, 2000 for further discussion of Dell's system.

However most retailers operate on schedules so reliability is valued. This is minimized by the frequency of deliveries to each point in the supply chain.

In contrast, Dell's pull supply chain also ships Truckloads of PCs from its U.S. plants but the product has already been sold and the ultimate destination is already known. All of the product is moved to a centrally located redistribution facility(s) that cross docks the PCs to either a LTL or parcel/courier carrier for immediate delivery to the customer. Thus there is a shift from depending on TL to move the product within pickup distance (a retailer site) of the consumer to using LTL and parcel to deliver directly to the consumer. The carriers making the final delivery must be able to deliver to residences, make inside deliveries (e.g. not just to a receiving dock), and have bar coding capability and real time shipment tracking systems that can be linked to Dell's web site. These capabilities are needed in order to provide Dell's customers with the ability to track the status of their orders accurately and deliver direct. While most parcel/courier companies have such capabilities, not all LTL carriers have these qualities.

The TL movement from the U.S. plants to distribution point in Canada requires both speed, flexibility and visibility. As noted above, the carriers must be able to provide real time shipment status (in the TL carriers case, vehicle status) information that are accessible to customers via Dell's web. In addition, Dell needs for this segment of the fulfillment chain, TL carriers with both single driver and two driver (slip seat) operations with adequate capacity inbound into Canada. Dell makes a delivery commitment to the customer with regards to the total order cycle time composed primarily of the manufacturing cycle and the delivery cycle. When the PCs are produced in a short manufacturing cycle, Dell will request a truck with a single driver but when the manufacturing cycle is long, Dell will require a truck with two drivers which gains from 24 to 36 hours in the movement from the U.S. to Canada.

Reliability is now more important in the TL segment of the movement as products are moving to a cross dock for redistribution for delivery within a limited order cycle time. In many cases, there is a time window for delivery to the redistribution point since outbound parcel and LTL

shipments move on a departure schedules on a 24 hour cycle. The need for reliability and vehicle visibility of the TL carrier is increased as Dell uses more merge in transit to consolidate components of systems not produced at the same location as the CPU unit. Reliability, in part is dependent on the available capacity that the carrier has in specific traffic lanes. Without vehicles in the vicinity of Dell's Texas plant, it would be difficult for a carrier to effectively respond to Dell's request for transportation service. This does not disadvantage Canadian domiciled carriers as it might seem initially. An analysis by the author of trucking options available to move Dell products from Texas to drop points in Canada revealed that numerous Canadian domiciled TL carriers offered comparable services, speed and flexibility as their U.S. domiciled counterparts but that their rates were lower. These Canadian carriers are already moving substantial front haul traffic into Texas or Mexico or the West Coast from Central (Ontario) Canada and possess consistent back haul capacity back to Ontario. However, vehicle tracking capability was a minimum requirement to qualify for the-business.

For better or worse, companies like Dell are creating customer expectations that are beginning to affect other industries. Consumers are increasingly also Internet consumers, and Internet consumers have come to expect that the norm in retail commerce is at least converging on custom-ordering products one day and expecting home delivery within the next week and within a reasonable but often precise time window. The appeal of this model is being explored or implemented in numerous purchasing segments in the B2C sector ranging from clothing to automobiles. This will produce demands for faster, more reliable, information rich transport options from other industries.

As other industries move towards complete pull, configurable over the web, there will be a demand for more rapid service delivery providers that can meet the demanding needs of make to order. The whole make to order and delivery process is made faster by Internet enabled techniques based on the ability of suppliers to see customer orders as soon as they are placed, reducing the historically significant delays in transmitting this information along the supply chain.

Pull and postponement systems also create demands on transportation suppliers to be able to function as partners, to produce, to share and manage information, and to provide higher levels of service in terms of speed and reliability. Pull systems inherently result in smaller quantities of products required in each stage of the supply chain but this does not necessarily mean smaller vehicle loads. Logisticians seek the right combination of consolidation and breakbulk through cross dock and traditional distribution center operations to minimize transportation costs and maximize vehicle utilization. Finally, pull systems result in fewer returns or cross facility shipments since product movement is based on actual rather than anticipated demand.

3. Improved Planning and Execution of Processes Through Collaboration

Modern supply chains operate on information, including the status of goods in transit. With this visibility of moving or standing inventory, various participants in the supply chain can plan and synchronize their processes better. This requires logistics service providers to have the capability to trace and track shipments under their control and making this information readily accessible internally and to customer or supply chain partners. For example, Federal Express developed an information system that provides real time information on product flow from order processing through handling in the distribution centers and movement in transit for Georgia Pacific Paper. This provides information for Georgia Pacific's Warehouse Management (WMS), which can better plan personnel and scheduling while knowing what products are flowing into the distribution center. The availability of up to date information about demand leads to better forecast accuracy and a clearer understanding about downstream demand. This leads to fewer rush orders which require costly expediting by premium transportation and greater consolidation possibilities.

The visibility of inventory while it is in transit also improves distribution efficiency and reduces inventories. For example, there is a demand for a product that is not in stock at a warehouse location. That location orders additional inventory even though there is inventory in transit that

would meet the need. Knowing that there is inventory in transit and whether it would arrive in time to be used can reduce the safety stock held in a specific location, reduce unnecessary inventory ordered and reduce expediting of product. Manufacturers gain significant operational benefits from information sharing and collaborative forecasting. Knowledge of actual sales and better forecasts of actual consumer sales enables the manufacturer to reduce the "bullwhip" effect, level their production of finished goods and plan their transportation requirements more accurately. This allows the shipper to pursue leveling strategies that produce a continuous flow of transport rather than surges.

ECR and CPFR

In the retail sector, Wal-Mart led the path to using collaboration to enable pull strategies. By the early 1990's Wal-Mart and some of their suppliers had designed an information logistics system to harness the Point of Sale (POS) data that it collected at each sale[5]. With compatible computer systems and the willingness to share data with suppliers, the information about what was moving over a scanner in a store could be transmitted directly to suppliers - their own distribution centers and/or manufacturers. Manufacturers could, in turn, adjust their supplies (or production lines) according to consumer demand aggregated from each store. Theoretically, by making information about sales at all retail stores available to both the retailer and their suppliers simultaneously, a continuous loop was created whereby information about sales flowed in one direction and products flowed back, just in time to match the retail demand. The concept of sharing information about sales with vendors and developing a continuous and coordinated flow of products was introduced to the rest of the retail food industry and institutionalized by a coalition of trade associations (i.e. Food Marketing Institute, Grocery Manufacturers of America) and food manufacturers and suppliers (i.e. Proctor and Gamble) and a few big chains (i.e.Kroger) under the name of Efficient Consumer Response (ECR) in 1992. It had little to do with the consumer except that its goal was to track consumer purchases at the point-of-sale and share that data with suppliers so they could tailor the delivery of goods to match the volume being sold. The goal of ECR was to have each food store/company behave like Wal-Mart; to implement

[5]The section adopted from Kinsey, 2000.

electronic data interchange (EDI) to order goods and slim down the offerings in each category in order to streamline delivery and the costs associated therewith. In 1998, 24 percent of stores responding to a survey by the Food Marketing Institute reported using EDI with at least some suppliers. Of those who did, 53 percent used a third-party, value-added network (VAN). This is a network that connects different members of a retailer's supply chain using Web-type technologies and interfaces. Only 17 percent were using the Internet and the rest used both. (FMI, 1999). A major stumbling block to adopting management practices advocated under the umbrella of ECR is that EDI requires compatible computer systems which are expensive to set up and operate. ECR suffered from a lack of what economist's call "network effects" (Belleflamme, 1998; Katz and Shapiro, 1994).

Under the ECR vision, establishing a set of individual, workable communications networks with computers at all stores that could communicate with the computers of all suppliers was asking more than the industry could deliver. The technical problems of incomparability and a cultural resistence to sharing store level data with suppliers resulted is very slow adoption. As expected, the largest chains adopted first. Large chains all had their own distribution centers so they did not have to communicate with a wholesaler standing between them and a manufacturer/vendor. Many of the large manufacturers were already part of an electronic network for ordering and replenishment with Wal-Mart so they were ready to operate in this type of business environment. Smaller retail stores were simply not willing or able to participate in electronic data interchange (EDI) necessary to participate in an efficient response relationship with suppliers. But, apparently the largest chains, already in supplier networks, believed that there was industry wide economics of scale to be gained if more retailers and suppliers could be convinced to join. In other words, they envisioned the benefits to the whole industry and themselves if more retailers and manufacturers could be enticed into the "network." In 1999 several large retailers such as H.E.Butts, Kroger and Wal-Mart went to the Uniform Code Council (UCC), who had originally negotiated the design of the bar code, and asked if they could help design an Internet platform that would allow virtually any retail store to communicate directly with their suppliers without having to invest in special hardware and software. The UCC

responded with UCCNet, a wholly owned subsidiary of the non-profit UCC. It is designed as an open format, electronic Internet interface for retailers to use to build a business to business relationship with their suppliers. It was launched in July, 2000 with 75 companies using the industry-designed, standards - based foundation for electronic commerce (Ghitelman, 2000). Although it is in its infancy, it provides access to e-commerce to small and large companies alike with its single computing language, eXtensive Markup Language (XML).

Collaborative Planning, Forecasting, and Replenishment (CPFR), again pioneered by Wal-Mart, takes the 1992 ECR vision and implements it through the use of better information technology that allows a vertical exchange of information between retailers and manufacturers. Sharing retail POS information with the food manufacturer on a daily basis provides the basic data for this system. With the historical record of consumer sales, the manufacturer and the retailer each forecast sales over some future time period, share their forecasts, and negotiate anticipated future sales if necessary. Manufacturers agree to deliver merchandise on a prearranged schedule and manage the inventory of their products in each store. This system obviously demands accurate scanning information and some Internet interface over which data can travel securely. It also demands a willingness to share data and the responsibility for the products on the shelves. An Internet connection for ordering, invoicing and communicating between retailers and suppliers does not necessarily imply a full blown CPFR program. But using an electronic network is a necessary step to establishing CPRF relationship with suppliers. “The whole intent of CPFR is to establish trust between retailers and manufactures” (Robinson, 1999) . Wal-Mart is using CPFR with more than 8 percent of these suppliers (IGD, 1999) . Shulman (2000) suggests that this system is a B2B2C system since the information truly starts with consumers’ purchases and responds to their purchases with replenishment that matches. It is a system where manufacturers produce to meet consumer demand not to meet the capacity of their plants. It is truly a new way of thinking and doing business all up and down the supply chain.

With CPFR each party faces less risk of excess inventory or stock-out in this system and sales tend to increase (Margulis, 1999). In 1999, 26 percent of retailers and 43.5 percent of whole-

salers were planning to try a CPFR system (Blair, 1999). Forester Research, Inc. projects that some form of business to business food commerce will grow from $22.5 billion to $211.1 billion by 2004 and comprise 12% of the value of transactions (Blackmon, 2000).

Those who are developing software to allow CPRF processes agree on the following trends in the supply chain technology: 1.) Integrating the optimization process to increase profits, 2.) Collaboration with trading partners to enhance efficiencies, reduce inventories and better understand the consumer, 3.) Real-time data communication, 4.) Moving from enterprise integration to advanced planning and scheduling, 5.) Co-managed inventories (Robinson, 1999). These trends will transform a fragmented and costly distribution system from a supply push to a demand pull system.

Businesses to business e-commerce network systems involve nothing short of re-engineering the business process, changing the culture, and integrating data from one place to another; from a retailer's sales floor to a decision system that involves a manufacturer, somebody's warehouse and a transportation system, and being able to evaluate and change options on the fly. But as everyones' costs decline in a large efficient network, competition will increase and new networks will arise to define unique niche markets.

The manufacturers that engage in direct store delivery are some of the most active in developing CPFR relationships with retailers. When there is an agreement with a manufacturer to replenish shelves according to the sales demand, many manufacturers choose to deliver it themselves, stockthe shelves, manage the inventory and, in some cases, retain ownership of the product until it is sold, that is, scanned upon purchase. In this case, the retailer has no cash tied up in inventory, they own fewer assets, they save on labor, and they have more cash to use between the time the item is sold and they must pay in manufacturers' invoice. Salty snacks and beverages and some bakery products are most likely to be delivered directly and handled on a "scan based trading" basis. It could be argued that this is one way for manufacturers to regain control over

their products and retrieve some of the bargaining power that flowed to retailers as they held the key to system wide inventory management, namely the scanner data.

Value Webs and Virtual Supply Chains

The combination of information technology and outsourcing philosophy has also led to the development of "Value Webs" as opposed to linear supply chains. Also referred to as virtual businesses or networked supply chains, the leading example of a Value Web is Cisco. The Cisco model is to outsource most of the manufacturing and other non core processes, leveraging the Internet to integrate closely with suppliers. The end result is that the ownership of the physical assets used in production has become unnecessary for Cisco, and irrelevant to its customers. Manufacturing is outsourced to dispersed locations and merge in transit assembly is employed to complete the production of build to order products. Real-time knowledge of both supply and demand allows Cisco's suppliers to ship components directly to customers, bypassing Cisco itself. Direct fulfillment means reduced transportation expense, faster cycle times and reduced inventories but it places a heavy premium on both service reliability and shipment visibility, which are required to enable Cisco to be responsive to customers. For example, Cisco internal systems are connected to UPS's logistics management system allowing Cisco to track product status in real-time. This allows Cisco to intercept, reroute or reconfigure orders on short notice. Cisco can defer a delivery so that it arrives just in time, not early or late.

In addition, the network feature of the Internet enables coordination across multiple members of the supply chain simultaneously rather in a sequential manner. A feature of this network is that information is not flowing sequentially from partner to partner, but rather it is continuously available to all qualified viewers. This could not have been accomplished economically or expediently with EDI. It is predicted that "Five years down the road, today's linear manufacturing chains will have broken down. In their place will be networks of manufacturing specialists, all cooperating at Internet speed to deliver products. (Radjou, 2000)

Synchronization of the supply chain was beginning in many industries, particularly among larger firms such as Cisco and situations where the number of transactions justified the investment in EDI. The lower cost and easier implementation of Internet communications has made it feasible to achieve such coordination in and with small and medium size firms as well. Internet technologies can provide many of these capabilities today at far lower cost, and small and medium size enterprises should take advantage of these easy-to-use technologies.

Large productivity and other Internet-related benefits have been cited by firms such as Cisco, GE, AT&T, and IBM. The efforts of IBM's Personal Systems Group are particularly illustrative (U.S. Department of Commerce, 1998):

> Each month, the group's marketing departments report information on how many PCs they think will be sold. The production planning departments identify manufacturing and materials capacity in each factory. Armed with inputs from across the company on demand and supply, production schedules are assigned to each factory. The procurement staff uses the same information to negotiate with suppliers. As new information comes in each week, the process is repeated and the production schedule fine-tuned.
>
> Electronic communication between factories, marketing and purchasing departments have made this quick response possible. Problems are communicated as they arise and the appropriate adjustments are made. If demand suddenly rises or if one factory cannot meet its production schedule, IBM is aware of it in time to increase production at another factory.
>
> The Personal Systems Group has been phasing in this Advanced Planning System (APS) since 1996 and already reports significant results. During the first year of APS, inventory turns increased 40 percent over the previous year, and sales volumes increased by 30 percent. The group anticipates another 50 percent increase in turns and a 20 percent increase in sales volume in 1997. By better utilizing its existing manufacturing capacity,

> IBM has avoided having to make additional investments to meet the increased volume requirements. The lower investment and operating costs due to improved inventory turns have resulted in savings of $500 million.

Ultimately, most manufacturers will want these kinds of savings. Ernst & Young predicts that inventories can be reduced by $250 billion to $350 billion across the U.S. economy. This would also significantly increase manufacturing capacity utilization.

Supply chain integration and synchronization is enabled by information sharing and collaboration between supply chain partners including transport firms and other logistics providers. The implication is that transportation firms must have the capability to share information with their shippers and increasingly to be able to do this through the Web. Many transportation or logistics service companies are providing this real time information in a personalized way to become an integral part of their customer's supply chain. This creates the opportunity to secure long-term business by embedding their processes into those of their customers and adding value beyond traditional transportation and logistics offerings. The Cisco-UPS and FedEx - Georgia Pacific Paper cases are examples.

4. Improved Procurement

The Internet has improved and enabled the re-engineering of the procurement process for many firms. Through the automation of purchasing processes via the Internet, companies have reduced procurement transaction costs, speeded up the purchase cycle and increased control. It is estimated that the average manual purchase transaction can be reduced from more than $100 to less than $10 through automation. The same automation can be used to control maverick or unauthorized spending. The Internet permits instant transmission of request for bids, quick access to available sources and prompt responses.

The GE Lighting Division began purchasing online in 1996. A process that took 7 days in the past was now accomplished in 2 hours. Labor costs in procurement decreased by 30 percent with 60 percent of the procurement staff redeployed to strategic activities rather than paperwork. Electronic handling of all documents and transactions from beginning to end reduced errors that caused reworking of 25 percent of the purchase orders in the past. The total procurement cycle from identification of supplier to award of the contract went from 18 - 23 days to 9 - 11 days.

The Internet enabled purchasing process also decreases the cost of the products themselves. The Internet facilitates global sourcing and increases the supplier base. GE Lighting now sends its RFQs around the world instantly and material costs declined from 5 to 20 percent due to the wider online supplier base. In February of 1997 alone, GE found 7 new suppliers , one with a 20 percent lower cost. Whereas GE Lighting set up their own purchasing site, firms can also participate in horizontal or vertical market places (exchanges) in which multiple buyers and sellers buy and sell products.

Logistics service providers such as transportation firms are important suppliers just as much as suppliers of physical goods. The process of purchasing transportation services can potentially be automated and better controlled through Internet based purchasing automation or E-Procurement. Transportation firms which are not Internet enabled, may not have access to customers who rely on the Internet to identify transportation suppliers and transact business. Large shippers seek automation of purchasing simply to streamline and reduce the cost of frequent purchase transactions. A Morgan Stanley Dean Witter (MSDW) survey of U.S. shippers found that manual transactions with freight transport providers, which include face to face, telephone, fax and regular mail communications, will decline from the current 67 percent to only 31 percent in the next two years (Valentine, 2001).

Firms can set up their own purchasing site or participate in horizontal or vertical market places (exchanges) in which multiple buyers and sellers buy and sell products. Both strategies will offer opportunities for aggregating orders or coordinating orders to reduce logistics and transportation

costs. Internally, orders can be consolidated and placed strategically by using information technology to gather and keep current information about supplier capabilities and performance and to use this to concentrate orders with the most efficient suppliers. Consolidation would be further increased by pooling purchasing power through consortiums enabled by the Internet. The direct impact on transport is that there will be greater pressure on profit margins. The indirect impact, is that Internet technology will promote collaboration among the members of the purchasing exchange, enabling the exchange to more efficiently consolidate orders to make larger orders with more lead time and certainty or coordinate movements to increase vehicle utilization. This will allow the assets of transportation providers to be used more effectively.

The Internet facilitates global sourcing to a wider online supplier base. The expanded geographic scope of sourcing has led to increased demand for long distance and cross border transportation movements. At the same time, shippers may seek to leverage their buying power and reduce transaction costs through supplier reduction. Shippers would seek carriers with multimodal and worldwide service coverage. Electronic procurement and the use of electronic purchasing exchanges both lead to more price competition in supply chain, which in turn lead to pressure of suppliers, including transportation, to have smaller price margins and work harder to reduce costs.

In many vertical electronic market exchanges or private online web sales site, a select set of carriers or Third Party Logistics providers are integrated into the market site by being automatically linked to transactions. For example, when purchasing a product from an online retailer, the shipment options are preselected and the costs known. The buyer has little choice in selecting alternative transportation and there is no carrier competition in the short run though there are always opportunities for a new carrier to supplant the existing “preferred carrier”. In some sites, the total delivered cost of purchasing and transporting a product is quoted with the buyer being able to choose a specific transportation option. Schneider Logistics Inc. (SLI) has formed strategic alliance with Internet market sites such as PlasticsNet.com and iMark.com. The partnerships make SLI the logistics divisions of these dot-com companies. When a customer

clicks the “Ship Now” button, the responsibility of delivering the order is transferred immediately to SLI. The customer receives a real-time point-to-point transportation rate for multiple shipment options based upon requested transit times and shipment characteristics. Internet marketplace developers do not have to download the information and then tender the load because SLI is in charge of the entire process from arranging the shipping schedule and shipping mode to offering on-line tracking.

Another benefit of the Internet in the area of long-haul shipping is that the Internet facilitates the bartering of high-transportation cost assets (such as paper or steel). A company in California may seek to purchase paper from a Quebec source and a New York company may seek to purchase the same kind of paper from a British Columbia source. If it was possible to switch buyers, instead of shipping cross-continent twice, the net result would be two relatively short trips. Paperexchange.com is fostering exactly this type of efficiency gain. Product market exchanges can be linked to transportation exchanges to help maximize the efficiency of both.

5. Online Retailing

Online Retailing Demand and Disintermediation

The Internet has provided a direct line of communication between sellers and consumers that previously was dominated by mail and telephone order-based catalogue channels. The B2C sector is composed of both pure online retailers such as Amazon.com and traditional “bricks and mortar” firms who have set up online sales channels. In Canada, examples of traditional retailers who have set up online sales are Canadian Tire, Sears Canada, Hudson Bay, Chapters and Staples. Pure online retailers in Canada include several home grocery firms, such as Grocerygateway and Megadepot, which became Onvia.com and moved to the U.S. Recent failures, amalgamations and pull backs of pure online retailers have not slowed the growth of Internet retailing as traditional retailers have expanded their online offering.

Direct online sales to consumers or B2C is small compared to B2B transactions. In 1999, 11 percent of Canadian retailers used the Internet to sell $610.6 million of products, accounting for only .3 percent of total operating revenue. Few doubt however that Internet shopping will not increase, albeit at a slower rate. Factors leading to this increase include:

> On line proficiency of consumers will increase
>
> Internet infrastructure continues to develop. Government believes that information technology and electronic commerce are catalysts for economic growth. Thus governments are actively working to increase digital commerce. The US government supports Internet expansion through promotional and development programs, consumer education programs, etc.
>
> Technology will continue to develop that will enhance the online experience, enabling easy and more rapid customization, navigation and ordering. Site infrastructure will become more sophisticated, connection speed will increase ad encruption and payment security will become more standardized and accepted.
>
> The increasing number of Web ready computers and potentially Web enabled television will enhance consumer comfort levels online and help convert the percentage of the population still hesitant to enter the virtual world.
>
> Internet information assistants will enhance Web maneuverability, price comparison abilities, and shopping convenience. (Rosen and Howard, 2000)

The top retail goods that are sold online as ranked by estimated sales in 2002, are computers, food, books, apparel, gifts and Music. Much of online sales is merely a transfer of catalogue sales from telephone to the web. Catalog sales that has been transferred to Internet sales represents a significant portion of Internet sales with approximately 40 percent of catalogue sales

($42 billion) accounting for 36 percent of estimated e-retail revenues by 2003. The top 12 catalogue firms all have electronic commerce operations. (Rosen and Howard, 2000).

An Ernst and Young study found that 51 percent of online shoppers lived in towns with populations less than 50,000, compared with only 2 percent of Internet consumers live in major metropolitan areas. This reflects the limited shopping opportunities in the smaller communities. (Rosen and Howard, 2000). Canada is one of the leading countries in Internet usage, perhaps reflecting the low population density affect. At the same time, the development of pure on line retailers in Canada has been slow and certainly behind the growth in the U.S. overall. This may be due to scale or availability of venture capital. This has implications for the flow of goods with possible shifts from domestic origins to transborder origins.

Online Retailing Impacts

Online sales generally requires a different logistics system and network. Products are now picked and delivered in consumer units rather than cases or pallet loads. Customer deliveries must be in residential areas which were not originally designed for large volume of commercial truck traffic. Residential areas may not have the density of delivery activity. Customers may want deliveries in evenings and weekends as well as the convenience of time windows and quick delivery. These are all new challenges for the online company, particularly with regards to efficient transportation and for many online ventures, logistics costs are a barrier to online retailing. "E commerce ventures must pay more attention to what has often proved their weakest link: fulfillment and distribution" (Economist, Feb. 26, 2000).

As evidenced by the catalogue industry, the major deterrent to at-home shopping is the cost of delivery, particularly for small ticket items which are most comfortably ordered online. Online transactions still involve a human component and physical cost. In a retail store, the customer locates the product and effectively "ships" the product home. In the online store, the employee must locate the good and the company must bear the burden of delivery. Delivery density to residential locations and the small size of many online deliveries raises the final delivery cost.

Online retailing can result in disinter mediation of participants in the supply chain. The Internet and other information technologies have produced greater flows of information with customers so as to reduce the value of middlemen or other participants who do not add value to the chain. The roles of intermediate warehouses and middlemen in both industrial and consumer markets will diminish. Thus Dell and many other companies have eliminated retailers, selling online and delivering directly to customers. The majority of online retailers compete on the basis of price and reduce their costs by stocking and delivering from a centralized stocking point rather than from stocks located in every local market (the retail store model). This distribution strategy has increased the demand for long distance delivery of small packages to residential locations, 7 days a week and in the evenings. This represents a shift from transporting larger TL shipments to warehouses and LTL shipments to stores where the customers traditionally picked up the goods themselves. In addition, these deliveries tend to be time sensitive, requiring reliability and increased speed. A manufacturer in Saskatchewan who used to ship a truckload to a distributor in California now may sell 90 percent of his products over the Internet directly to the customer and ships each unit to its final destination. That company no longer has truckloads to be managed by carriers but individual shipments sent by “couriers” (IBI, 2001). Similar trends have and will continue to occur in B2B markets where distributors and wholesalers are losing market share. An example is the Canadian pharmaceutical market where manufacturers have sought to sell and deliver directly to hospitals, bypassing traditional distributors.

The changing demand pattern may mean shifts in the market share of different types of carriers (e.g an increase for parcel companies and a decrease for TL and LTL carriers). In turn, this has implications for infrastructure development that supports the operations of different modes. Will an increase in next-day and second-day deliveries require more airport landing capacity? Will airline terminal capacity be adequate or will small package providers have to use less efficient off site facilities. What is the impact of increased residential deliveries on municipal road capacity and traffic?

The impact very much depends on the product and fulfilment system used by the online retailers. In the case of online grocery retailers, grocery products still need to be stocked locally so inbound transportation of products to distribution centers will change minimally. However, the products are no longer moved to retail stores but are picked and packed for delivery to consumers at the distribution center. There will be a reduction in local truck movement to retail stores and consumer shopping trips to these stores offset by an increase in truck deliveries to consumers.

In contrast, online book retailers like Amazon and Chapter.com stock their products at centralized, national distribution centers to minimize inventory, and use long distance transportation to deliver the products directly to customers. The traditional retail chain transports books in bulk from plants to national warehouses, then to regional warehouses and finally to stores where consumers purchase and pick up the product. The online book retailer typically substitutes air freight or ground parcel freight for truckload movement over long distances and substitutes truck delivery for consumer auto shopping trips over short distances. A by-product of an online "pull" system is that the traditional 35 percent of books returned from retailers back to national warehouses by truck is reduced substantially.

Hendrickson et al (2000) develops a model comparing costs of a traditional retailing of books versus e-commerce retailing of books. They model a traditional book supply chain is printer to National warehouse to regional warehouse by truck, to regional warehouse (of retailer or publisher) by truck, and to retailer store by truck, picked up by consumer using auto. They assume that 35 percent of the books are returned from retailer back to national warehouse by truck from the retailers regional warehouse. With an E-commerce supply chain, books move from the printer to National warehouse by truck, to an e-commerce hub by truck, to regional center by air freight, delivered to customer via ground parcel company from regional center. This centralization of inventory essentially reduces the risk that books are geographically places in the wrong market. Simulating the sales of $1 million or 286,000 copies of a best seller book, they find:

> Total costs including transportation, packaging, returns production costs and retailing cost favor the e- commerce supply when return book cost are considered, total costs between the two systems are about equal when returns are not considered.
>
> Total transportation costs (including the cost of returns) is $646,000 for the e-commerce chain versus $693,000 for the traditional chain, with the substitution of air freight for truck over long distances(about equal) , and truck delivery for consumer automobile movement over short distances (lower).
>
> When translated into transport and environmental impacte commerce has lower environmental impact as the elimination of auto trips more than offsets the higher fuel use of air versus truck.

They conclude that based on their assumptions:

> E- commerce can lower transportation costs by shifting transport from costly consumer and TL to less TL and air.
>
> By selling by e-commerce, inventory is in essence postponed and kept further upstream in the supply chain until demanded. This eliminates the return costs which are significant.

The latter is borne out by anecdotal evidence that online sellers appear to have lower returns, thus demonstrating a typical feature of the Internet, the ability to minimize waste.

The direction of traffic shifts due to B2C online retailing is certain but the magnitude and ultimate impacts are largely unknown. There will be continued growth in B2C online sales but pure online retailing is continuing to rationalize. Webvan, the largest and most ambitious

grocery online retailer recently went bankrupt. Chapters.com is scaling back its product offerings over the Web. At the same time, traditional brick and motor retailers are cautiously entering the online market. At this time, we do not know which e-commerce model will ultimately win in the marketplace and how efficient existing retailers are in their own transportation system. In the case of products delivered over a long distance, such as books, for instance, online purchases may allow drop-shipping directly from a primary distributor to a consumer, whereas traditional shopping would mean that the book might first travel from the distributor to the traditional bookstore's warehouse and then to the bookstore where the consumer buys it. While the net impact in this case is probably still an increase in business transportation energy, the ultimate impact is much more difficult to calculate.

More importantly, it is still largely conjecture as to whether online delivery of products to homes reduces the number of trips and kilometers travelled of private automobiles used by consumers. "Efficient package delivery by truck may replace at least in part inefficient personal driving to malls, supermarkets, bookstores and the like. This will be particularly true if most of the packages are delivered by the Post Office, which already passes virtually every home in the country daily"(Romm 2000).

There will clearly be an increase in business transportation, but the degree will probably depend on how much of the final deliveries become bundled. If a variety of different trucks all show up at the same house or in the same neighborhood over the course of a week, each making individual deliveries, that will increase transportation movement. But many companies recognize delivery costs as a barrier to online buying and are seeking to bundle deliveries by increasing the variety of products that it sells online. This was essentially Webvan's strategy but it ran out of money before it reach the scale and density of volume to lower distribution cost to competitive levels. Others envision bundling a very broad range of products and services for direct delivery to customers' homes including "groceries, prepared meals, pet food and supplies, postage stamps, dry-cleaning, video and video game rentals, film processing, bottled water and cooler, as well as package pickup and delivery." In the long-term, consumers may not require

overnight delivery of many items they purchase regularly (pet food, home office supplies, vitamins and health care products, and so on). What they will need is reliable delivery at regular intervals, which in theory should allow an efficient system to be set up.

Another great unknown question is whether or not a significant fraction of Americans will change their driving habits over the next few years once it is possible to make a critical mass of cyber-trips on the Internet (Romm, 2000). Research has only begun on this tradeoff and years ofresearch on the impact of online retailing's closest relative, teleshopping, provides few answers[6].

Online Retailing and Transportation

The greatest beneficiary of online retailing has been the forms of transport that inherently move products quickly and in small shipment sizes. Couriers and parcel carriers such as UPS, FedEx and Purolator as well as the postal systems are being used for direct to consumer delivery that bypasses the traditional retail store. Local delivery carriers have also benefited to the degree the distribution system continues to stock products locally. In addition, new transportation or e-fulfilment companies are being created to meet the demand for fast, reliable movement of parcel size shipments from online companies. These include TPL firms which provide or coordinate all the processes required in fulfilment of online orders and virtual companies which non asset information management firms leveraging the assets of existing transportation companies. Sameday.com and NextJet are examples of such firms..

Dematerialization will impact selected carriers but no where is this impact more relevant than the postal carriers. However, the Post Office can participate heavily in the growth of online sales, since they already have the infrastructure in place for home deliveries. The postal system of most countries go to virtually every home on a daily basis, so piggybacking delivery of online sales on the existing delivery system should be relatively efficient. Major online companies like

[6]See Marker and Goulias, 2000 for an analysis of the potential trip impacts of teleshopping.

Amazon.com already send 65 percent of its goods through the U.S. Postal Service. The Postal Service will, however, face fierce competition from major shipping companies, like UPS and FedEx who have specifically targeted home delivery for online retailers as growth opportunities. For such companies, energy is significant cost of doing business, so there is a great incentive to maximize efficiency; these companies are already early adopters of alternative-fueled vehicles and many plan to be early adopters of advanced efficiency vehicles. Also, for such companies, a 10 percent increase in package delivery might only mean a 5 percent increase in vehicle miles traveled, because of their sophisticated use of information technology to optimize delivery routes and times.

6. E - Materialization

De-Materialization is a long-standing trend in the economy, as producers seek to reduce the size and weight of products. The Internet accelerates the trend towards a weightless world by transporting products that have been converted from atoms to bits. This is called E-Materialization and will have a tremendous impact on the demand for transportation in certain product sectors. Paper consumption is one of the likeliest target for E-Materialization. Although the long-heralded “paperless office" promised by the computer revolution has not occurred, the Internet and digitization are reducing the need for paper in a number of traditional uses. While there may not be a paperless future, paper consumption per dollar of GDP will drop significantly. One analysis projects that by 2003, the Internet will reduce the demand for paper by 2.7 million tons, compared to what it would have been without the Internet (some 30 million tons across several categories of paper), even with increases in some paper uses (Boston Consulting Group, 1999). One of the reasons for this slowing is that the United States is further along in Internet use. Americans, who once routinely printed out their emails, do far less often, and have become more comfortable reading text in electronic form than even a few years ago.

Many businesses have cut paper consumption using the Internet and computer technology to reduce costs. AT&T has cut paper consumption by more than 400 tons. Their strategy has included (Romm et al, 2000):

- Shifting the AT&T personnel guide from a 1500-page paper document (copied and distributed at least 20,000 times a year) to an online resource. A number of other corporate directories were similarly e-materialized.
- Putting the Environment, Health & Safety organization online, including their monthly newsletter (which by itself saved 1.8 million pieces of paper).
- Enabling online requests for supplies via the Internet.
- Putting nearly 400 corporate forms online, so they can be printed only when needed.
- Distributing *AT&T Today* online, eliminating 10,000 daily copies, and saving 24 million pieces of paper.

Other companies adopt paperless transactions in purchasing, human resource management and in sales, reducing the need for forms using paper. IBM reports that its Internet-based supply chain management system has cut paper consumption by 5 million sheets. Digitization of documents which can be printed only when needed, also has the benefit of eliminating surplus documents.

Just as the CD ROM caused a remarkable decline in printed encyclopedias, the Internet is poised to have a similar impact on newspapers, magazines, catalogs, directories, direct mail, information-based books and the like. Instead of having paper versions transported, they are relayed over the Internet. Other areas for E-Materialization are in software, music and film. Manufacturing of software on disks and CDs (delivered by plane and/or truck) continues to shift toward purely electronic files delivered over the Internet. Ironically, two of the products that can be e- materialized, books and music, are the leading products that are sold online. This may offset some of the increase in long distance movement of small parcels. Substantial evidence indicates that the volume of physical mail per capita will decrease as more and more people gain

access to the Internet. As email and online billing grow, the threat to postal delivery will increase.

Another form of e- materialization emanates from the reduction in facility capacity that results from improved supply chain management. Companies that have been able to implement pull systems have reduced inventories and the need for space to store that inventory. For example, improving the frequency of inventory "turns" (number of times inventory in existing warehouse or store space is sold or used for production each year) reduces inventory-related interest, handling and storage cost. A doubling of inventory turns reduces the storage space required in half. This reduces the need for warehouse facilities, which in turn reduces the demand for construction materials and the need to transport these materials.

Similar reductions in facility construction can occur for retail space as inventory is centralized by online operations, for commercial office space as more persons perform their job at home via the Internet, and for manufacturing space due to Internet enabled manufacturing efficiency. When manufacturers are better able to produce just what is needed and make fewer mistakes in manufacturing, they will need fewer raw materials (and fewer new manufacturing plants) per dollar of GDP. Given that raw materials are among the heaviest goods that are transported, even a very small savings here will have a very large impact on transportation ton miles. And if e-commerce does reduce the amount of construction per dollar of GDP, that too will have a significant impact, since construction is very transportation intensive. The construction of commercial buildings (and manufacturing plants) in particular relies on a great deal of steel and cement, two of the heaviest items to transport.

The impact on transportation of E-Materialization is that the demand for physical movement of product will be decreased. This is particularly significant for Canadian transport firms which move paper and raw or in-process materials used in the production of paper (e.g. pulp, logs, chemicals). Paper demand may still rise but will be lower per capita than without the Internet. E-Materialization is also significant for postal companies and couriers which move paper and other

products that can be digitized. Transportation modes and carriers that are dependent on raw materials for production and construction materials should also expect a decline in demand relative to GDP.

7. Canadian Experience

A study of the impact of E-commerce on Canadian general merchandise and pharmaceutical retailing demonstrates the impacts of E-business (White, 2000). The study included field surveys 7 large firms in retail and wholesale. The study found:

> All of the general merchandise firms have embraced e-commerce for their B2B operations for both EDI and Internet technologies. Each organization began its e-commerce system based on proprietary EDI technology and to some extent were migrating to Internet-based systems.
>
> The pharmaceutical retailing industry is largely using EDI to receive and order supplies with the exception in BC where the Internet is used by a BC Cooperative to receive orders from its associate stores. Some pharmaceutical suppliers are beginning to sell products directly over the Internet to pharmacies.
>
> The Internet is used to exchange critical product information between themselves and suppliers and/or consumers, allowing collaboration on product forecasts and product flow decisions. The communication of demand information from retailers to suppliers allow shorter lead times, optimized production and lower inventory.
>
> The Internet also permits customers to more easily custom order their products based in individual needs and preferences. Retailers can present thousands of choices but through the medium of electronic communications, the individual choices of many thousands of customers can be aggregated into batch orders to suppliers.

The relationship with suppliers is strengthened through the use of Internet to improve the flow of information between the parties, which in turn encourages collaborative decision making.

The CTAR shipper survey suggests that these supply chain impacts are occurring[7]. As summarized in Table 4, more than 25 percent of shippers in the survey (and more than 50 percent of the shippers answering the question) indicate that E-Commerce enabled a new distribution strategy with suppliers, transportation service providers and with business customers.

Table 4 Does use of E-Commerce enable new distribution strategies?

With	Yes	No	DK/NA	Total Responses	No Response
product and material suppliers	51 %	29 %	20 %	100 %	55 %
transportation service providers	54 %	27 %	19 %	100 %	53 %
within your company	45 %	36 %	19 %	100 %	52 %
business customers	57 %	29 %	14 %	100 %	51 %
final consumers	37 %	29 %	34 %	100 %	61 %
government	24 %	36 %	40 %	100 %	60 %
Source: Hinchcliff, 2001					

This is corroborated by a mid-2000 survey of 250 major U.S. shippers by Morgan Stanley Dean Witter (MSDW). The survey found that 70 percent of respondents expected their freight transport needs to change as a result of E-Commerce, and 44 percent said that a freight transport provider must have E-Commerce connectivity in order to bid for their business. The most highly prized features of carrier web sites were real time tracking and tracing. A shift to parcel and express services was noted by 65 percent of the shippers questioned, reflecting a broader trend in the industry. Other major changes highlighted by the survey include an increase in the use of local trucking or courier services (Valentine, 2001).

[7]Hinchcliff , 2001.

Similarly, KPMG found the following ranking of the relevance of carrier Internet offerings by shippers: shipment tracking, customer self help, shipment visibility to all supply chain partners, posting information, customer online communication, invoicing and billing information, customer transactional capabilities. The least important though still significant, were auction unfilled space at discounted rates, online ordering, collaborative planning, just-in-time inventory management and pricing.

8. Implications of Internet Enabled Demand Changes for Transportation

The Internet enables integrative and collaborative supply chain strategies reflected in pull systems, logistical and manufacturing process improvement, centralized inventory and electronic procurement. The Internet is the medium by which online retailing, disintermediation and E-Materialization occur. Table 5 summarizes the major impacts on transportation with respect to transport demand, potential modal shifts and carrier capabilities.

Table 5

E Business Enabled Supply Chain Change and Implications for Transportation

Supply Chain Impact	Implications for Carriers
Internet enabled collaboration and integration	Carriers need to be able to participate in partnerships
Smaller, more frequent shipments	Modal shift towards small package carriers; Need for more consolidation capability; Need cross docking capability
Shipment visibility	Requires real time tracking and tracing Web enabled; Information sharing capability
Reliability and speed	Modal shift to inherently more reliable modes; Improved service required of existing modes

Fewer emergency shipments	Modal shift from faster modes and carriers to slower but reliable modes and carriers, Better equipment utilization
Less wasted movement, fewer returns/fewer repositioning movements	Reduced demand for transport overall
Improved loading/levelling of demand	Better equipment utilization
Direct shipping to customer	Consolidation capability needed Need cross docking capability
Deliver direct to consumer	Delivery systems to residential destinations Deliveries after normal work hours and on weekends
Share demand information	Better equipment utilization
Load consolidation	Modal shift
Increased bartering	Reduced demand
Global sourcing	Demand for global service capability Modal demand shift from domestic modes to international modes; multi modal package
Leverage purchasing power	Pressure on profit margins
Electronic procurement, automate and streamline procurement processes	Web enabled Participation in electronic exchanges expanded market opportunities
Bidding, auctions, Market exchanges	Improved capacity utilization Expanded market opportunities Increased price competition
E materialization	Reduced transport demand for end products and intermediate or raw materials movement

Transport demand changes include:

- **$** E-Materialization reduces the demand for the transport of products that are digitized, particularly paper products that contain information. Thus, transporters of paper products and all materials in the paper supply chain, including postal services, are directly impacted. Indirectly, supply chain efficiency and changed work patterns can reduce the amount of construction materials required for the building of manufacturing, warehousing, retail and work space and therefore the transportation of construction materials.
- **$** Online retailing and supply chain management effectiveness enabled by the Internet result in the postponement of downstream inventory, reduce the risk of products being returned or repositioned and subsequently reduce transportation demand. Transport demand is also decreased by supply chain management process improvements such as direct shipping and leveling of shipments.
- **$** E-Procurement reduces transport demand by facilitating the trading or bartering of goods rather than moving products.
- **$** Electronic procurement which facilitates global sourcing may increase transportation demand by lengthening the distance from which products are sourced.
- **$** The Internet has continued the trend of substituting transportation for inventory in pull supply chain systems, increasing the demand for fast and reliable transport.
- **$** The Internet has facilitated optimization and planning that enables shipment movements to be reduced or planned better. Freight may be tendered in larger, consolidated lots as shippers have access to more opportunities to consolidate both internal freight and freight across shippers. Transport demand may be smoothed by production leveling enabled by JIT and quick response strategies which are heavily dependent on information transfer.

Transport service requirement changes include:

- **$** Online retailing and supply chain management strategies that pull products instead of pushing them up the supply chain increase the demand for delivery in smaller quantities more frequently. Generally such deliveries have high degrees of reliability and speed.
- **$** Online retailing also changes the destination of these deliveries to residences at times other than normal working days.
- **$** On the other hand, E-Procurement and better logistical planning can result in greater consolidation by shippers and thus supply chain process improvement results in better advanced planning. This can lead to less expedited transportation and larger shipments.
- **$** Pull systems and online retailing are demand responsive so speed, reliability and flexibility are valued logistics systems requirements. Many carriers will be chosen for their ability to provide these aspects of service (small shipment, fast, reliable) and to minimize costs through consolidation and cross docking of freight.
- **$** Transportation inputs may be substituted for inventory inputs in the logistics system by using faster and more reliable transport (to reduce safety stocks) or more long distance transport (to centralize inventory and reduce stock).

Transport capability changes include:

- **$** In order to participate in supply chains that achieve these results, carriers need new capabilities with respect to information technology. The ability to provide and share information on shipment and equipment visibility in real time to many supply chain partners are becoming more important and for many shippers a basic carrier selection criteria. Connectivity and information visibility are characteristics of transportation that are increasingly considered minimum capabilities to compete for a shipper’s business in the E-Business environment.

- In order to participate in Web-enabled supply chains, carriers must be web-enabled as well to share information and perform transactions such as selling online or providing shipment status information.
- Carriers increasingly need to be able to participate in partnerships which share sensitive information to support supply chain collaboration and integration.
- As shipments get smaller and are pulled directly to consumption, the ability to consolidation and breakbulk through the use of cross docking is increasingly needed to efficiently move freight.

Potential mode shifts changes are:

- Pull supply chain strategies, centralization of inventory, online retailing and disintermediation generally result in shifting large shipment movements over long distances to smaller shipment movements, shifting freight movement from rail and TL and LTL to TL, LTL and parcel/courier.
- These same forces place a premium on transport modes that are inherently more reliable and fast. Again this shifts transport demand towards parcel/courier from LTL or towards TL from rail.
- Online retailing generally substitutes local truck delivery of multiple shipments for multiple shopping trips in passenger vehicles.
- Electronic procurement could shift freight from parcel/courier to LTL and LTL to TL due to better consolidation and planning. Global sourcing will shift traffic from domestic to international carriers.
- As shippers gain control over their supply chain processes, they plan better and have fewer emergencies, shifting freight from higher cost modes and carriers to slower but less costly modes and carriers.

Competitive and productivity impacts on carriers are:

- The utilization of electronic market exchanges and online buying will increase pricing pressure on carriers.
- Online purchasing of transportation will increase the access of Web enabled carriers to shippers.
- The Internet is allowing shippers to share information with carriers that will help the carriers utilize their equipment better.

The general direction of the use of the Internet and its impact on the transportation market and industry are identified by numerous surveys but the direction and the magnitude of these Internet impacts on transportation vary by market, industry and individual customers. Carriers will have to meet changes in their customers' needs as they utilize E-Business. By analyzing how the Internet is going to influence their customer's supply chain decisions, retail channel strategies and fundamental demand, carriers can anticipate and plan their own service offering, capabilities and E-Business strategy.

Transportation planners face the very difficult challenge of aggregating these estimates to determine the net impact on transportation infrastructure needs. For example, just-in-time delivery models and other pull systems, born of business to business e-commerce and information sharing, have their own time constraints. The physical infrastructure, such as highways that are congested, and unpredictable demands due to weather emergencies, make lean, efficient delivery systems vulnerable to default. For example, the two hour inventory of seats and other car parts preferred at Ford Motor Co. plants has been increased to a four hour inventory to ensure that they have enough inputs to run the plant continuously. Trucks running late due to a variety of infrastructure problems make this change necessary. It has forced some manufacturers to resort to air freight and to keep loading docks open through the night so trucks can arrive during low traffic times. At the other end of the supply chain, the costs of running out of stock at a retail store are born first by the consumer and then by the retailer who lost sales. Documenting these costs is just beginning. What is clear, is that efficiency in the logistics of the supply chain

and the speed of Internet communications can not compensate for existing infrastructure constraints and costs created by automated, nonhuman decisions.

III. Adoption and Utilization of E-Business in the Transport Sector[8]

1. Overview

Electronic Business (E-business) is both a challenge and an opportunity for transportation. It is a challenge as it creates new supply chain requirements and capabilities that impact the demand for transport services, in many cases creating new demands on fulfilment. These were reviewed in Section II. E Business is also an opportunity for transport firms to use technology to improve service, increase productivity and reduce cost. It is both a challenge and opportunity as the Internet reinvents the marketplace through the creation of freight exchanges. The ability to meet these challenges and opportunities is especially important to Canadian shippers. As a predominantly trading nation, Canada's transport capabilities in part determine its competitiveness in the global market for goods and services. Canadian domicile transport firms also face the challenge of competing with well situated and large U.S.-based competitors. This section is an overview of the transport industry's adoption and utilization of e-business technology with a focus on Canadian carriers where possible.

The Internet is an enabling technology–a powerful set of tools that can be used, wisely or unwisely, in almost any industry and as part of almost any strategy (Porter, 2001). The Internet tends to alter industry structures, dampen overall profitability, and reduce the ability of any company to establish an operational advantage that can be sustained. The key question is not

[8]A more detailed treatment can be found in Chow, 2001b upon which this section is abstracted. Specific application to Canadian transport sectors is treated in Section IV.

whether to deploy Internet technology–companies have no choice if they want to stay competitive–but how to deploy it.

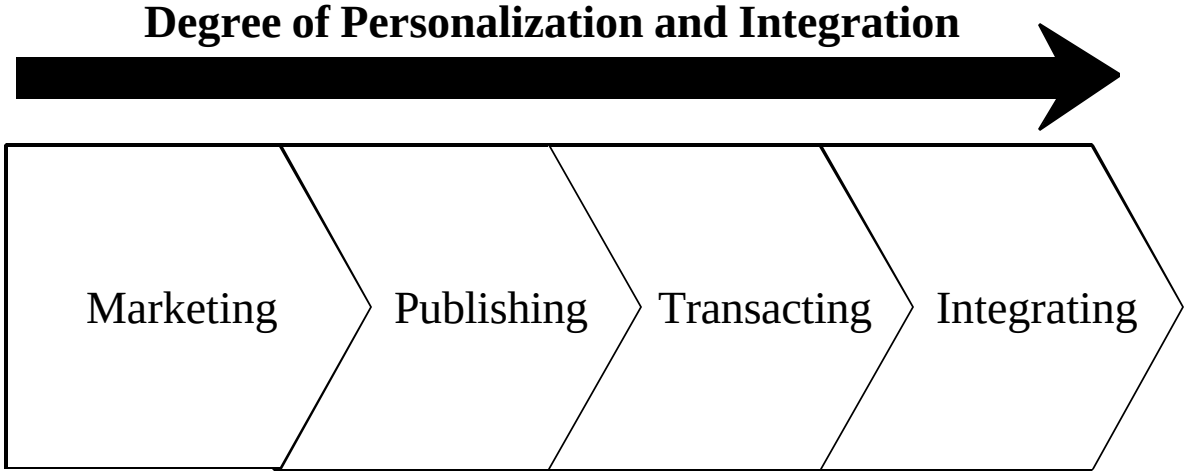
2. Online Transportation Competency

Products may be sold electronically but the products (unless it is information) must still be physically delivered to (or picked up by) the customer. This process is now commonly labelled e-fulfillment (or simply fulfillment) and transportation is an integral participant in the fulfillment process along with warehouse companies, third party logistics (TPL) providers, application service providers (ASP), supply chain software vendors, and market exchanges. As more and more products are sold online, changes will occur in the types and quality of services demanded. In both B2B and B2C online-business, customers expect a level of performance, speed, and precision for e-fulfillment that is significantly beyond their performance expectations for more traditional business. Perhaps just as important is the demand for new services that facilitate the total transportation transaction and support integration across the supply chain.

KPMG has developed the e-business maturity model shown in Figure 3 (KPMG, 2000). The model describes the stages of development in utilization of the Internet by transportation companies. The higher the degree of maturity, the greater the degree the-business (carrier) has personalized its service and integrated its processes with its customers.

> In Stage 1, the marketing stage, the objective is to build brand awareness. A carrier is using the Internet as a billboard to broadcast basic company information, such as name, brand, products, and locations. Examples include posting information about locations, executives, products, and company history.

Figure 3
E-BUSINESS MATURITY MODEL



Source: KPMG (2000)

In Stage 2, the publishing stage, the objective is to provide decision making business information to customers. The carrier is using the Internet to reduce the costs of publishing specific company information to customers, partners, and the workforce. Communication remains one way and typically involves a company's private Intranet. Users can download attachments such as:

- Pricing information
- HR benefits manuals
- Invoice information
- Annual reports

In Stage 3, called the transactional stage, the objective is to conduct and manage an account electronically. The carrier is using the Internet to create two-way information flows, allowing a small number of business transactions with customers or partners. For example, customers have the ability not only to access information about their shipments,

but also to place and change orders. This could include some level of integration with back-office and legacy systems, but often serves only as a front-facing connection and involve limited process or technology redesign. Capabilities include:

- Online order placement
- Supplies purchasing
- Shipment tracking
- Time and expense reporting
- Online communication
- Stock purchase
- Freight bill payment

Finally there is a stage 4, the integration stage, which is the interactive or process coordination level of maturity. Here carriers use the Internet to conduct all business transactions and information sharing with customers, employees, and partners. Technology enables visibility across information sources to help maximize efficiencies from supplier to consumer. This includes a totally paperless business platform and extremely tight integration of back-office, front-office, and customer/partner systems. Integrated capabilities include:

- Real-time shipment visibility
- Customer order management
- Collaborative planning
- Employee field communications

An example of a carrier with some aspects of stage 3 maturity is Mullen Transportation which has a one to one electronic commerce relationship with Lafarge where a web-based system automates communications between the two firms. This will give Lafarge more control over its shipments by providing visibility from plant to customer (Transport Topics, 2000). Roadway Express began its Web evolution in 1995 when it set up its first web site and established a web team. By 1996 it had advanced from merely providing information to allowing shipment release

and tracking and in 1999, it established my.roadway.com. This comprehensive site provides One-Stop shopping convenience for all Roadway services, is flexible and customizable for individual customers, works in real-time with respect to transactions and supports business processes from order to post-delivery. According to Roadway, it had more than 10,000 users in first nine months (Puglia, 2001)[9]. The CN is representative of the situation characterizing many of the Class I railroads in North America. The CN established a web presence that focused on broadcasting marketing information for a minimum investment starting in 1996 (Stages 1 and 2 in the maturity model). This was expanded beginning in 1997 to provide interactions such as basic queries, personalization and linking of sites advancing the railroad toward stage 3 in the maturity model. In 1998, true Stage 3 transaction oriented features such as customer self service, supply chain planning and links to supply chain communities were being developed for completion in 2003. Finally CN began a program to bring its E-Commerce capability to Stage 4, the interactive level, in 2000. Features that CN was developing included CRM applications, supply chain optimization, real time ATP, and advanced personalization (Clarke, 2000 and Henderson, 2000).

KPMG surveyed large transportation and large shippers using this framework in October 1999 (KPMG, 2000). The survey found that shippers want carriers to be at the interactive stage but that most of the carriers were only at the transactional stage of Internet maturity. The same survey indicated that carriers, shippers and analysts all agree that the planned e-business investments will not drive carriers to meet carrier or shipper expectations with respect to collaboration, instead carriers and customers seem to be building independent rather than interdependent technology solutions. Indeed, there seems to be a major opportunity or window for competitive advantage, perhaps from the technology suppliers themselves.

Carriers who reach the Stage 4 level of maturity will be able to embed their people, processes, and technologies inside their customers own processes and will capture market share and raise

[9]Please see Inbound Logistics (2000) for further detailed examples of motor carrier Internet offerings.

switching costs, potentially locking out carriers unable to reach stage 4 or reach it too slowly. While there is no excuse for laggards, small carriers may be at an inherent disadvantage, being forced to be "subcontractors" providing capacity to the carriers who own the relationship with the customer.

Forty-one percent of the carriers in the KPMG survey indicated that they were ahead of the competition today (1999) versus 83 percent in 2 years. Most of the carriers believe that they would be making great strides, advancing from the transactional stage to an interactive stage in the next six months. Analysts and shipper felt it would take two years. In either case, this indicates that most large carriers should be approaching the transactional stage today.
KPMG also measured the depth and direction of Internet usage by asking the carriers what Internet activities they had in place and planned. Summarized in Tables 6 and 7, the majority of the carriers were investing in customers focused initiatives, with supplier, employee and investor focussed initiatives far behind. More important, when the 282 planned initiatives are plotted against the maturity model, the carriers would be placed in an advanced transactional stage rather than the Interactive stage of maturity they expected to be.

Table 6. Initiatives in Place and Planned, by Percent of Carriers and by Number of Initiatives

Stakeholders Addressed	Current Internet Initiatives		Planned Internet Initiatives	
	% of Carriers	Number of Initiatives	% of Carriers	Number of Initiatives
Customers	100%	177	95%	142
Suppliers	68	49	68	90
Employees	82	46	68	40
Investors	59	18	32	10
Totals		290		282
Source: KPMG (2000)				

Table 7. Partial Listing of Current and Planned Activities		
Activities by Stakeholders	**Percent of Respondents Mentioning Activies**	
	Current	***Planned***
Customers:		
Posting information	95%	23%
Shipment tracking	95	36
Pricing information	73	32
Online order placement	73	45
Customer self help	73	55
Customer transaction capabilities	73	68
Collaborative planning	23	64
Suppliers/Operations:		
Purchasing	36%	45%
Maintenance/repair purchasing	23	55
Customer order management	23	55
Paying invoices	23	64
Employees:		
Field communications	68%	27%
Recruiting	64	36
HR benefits	45	64
Time & expense reports	32	36
Investors:		
Posting information	55%	14%
Self service	23	23
Transactional	5	9
Source: KPMG (2000)		

Another approach to assessing whether carriers are meeting the needs of shippers is to match the carrier initiatives with the Internet offerings most valued by shippers. Table 8 shows the ratings

for 12 Internet enabled activities which were considered important (e.g., had a ranking above 2.5). When these capabilities are compared with Internet initiatives of the carriers, only 5 of 12 capabilities were in alignment between the two groups. Activities in alignment were: posting information, online ordering, shipment tracking, customer self help and customer transactional capabilities. These activities are characteristic of the transactional stage of Internet maturity, while the activities not in alignment are characteristic of the Interactive level. The survey found that 40 percent of the shippers felt that carriers were meeting their expectations with only 13 percent indicating that carriers exceed expectations and 47 percent indicating that carriers were not meeting expectations. Specific capabilities that shippers want carriers to improve the most were integrating the Internet and company processes, adopting common standards and effectively conducting track and trace. Said one shipper, "There is no common language for tools–no industry standards" (KPMG, 2000).

It should be noted however that the majority of shippers are not Internet sophisticated either and over half are not currently making use of Internet to manage their supply chains, and most are only demanding stage three capabilities, eg. transactional (rather than interactive). 43 percent of shippers currently made significant use of Internet to manage supply chains but 100 percent plan to do so in 2 years.

Table 8

Relevance of Carrier Internet Offerings - Shipper Perspectives

Activity	Rating
shipment tracking	3.8
customer self help	3.7
shipment visibility to all	3.6
supply chain partners posting information	3.5
customers' online communication	3.5
invoicing and billing information	3.3
customer transactional capabilities	3.3
auction unfilled space at discounted rates	3.1
online ordering	3.1
collaborative planning	3.1
just in time inventory management	3.0
pricing	3.0

Source: KPMG, 2000

3. Carrier Internet Participation

Most of the applications require that the carrier not simply have access to the Internet but that the carrier has a web site that can be accessed by customers, employees and other partners internally or across the supply chain. A 1999 Statistics Canada survey found that only 17.6 percent of the transportation and warehouse-businesses had web sites, though these firms account for 51.1 percent of economic activity in the sector (Bakker, 2000). See Table 9 for related statistics.

A Transport Canada survey of carriers and related transportation businesses conducted in the Summer 2000 is summarized in Table 10. Since the Transport Canada population frame only includes the larger firms, the higher but still minority presence of web sites in the transport sector shown in the table are likely to be reasonable. This survey also evaluated whether the web site was merely a billboard for information (Level 1 or L1) or used for transactions and tracking (Level 2 or L2). The statistics suggest that the larger carriers in both the truck but especially the rail sectors are Web enabled at the transactional stage of Internet maturity while ports and port authorities are far from transactional capability.

Table 9
Industry Usage of Internet

Internet Usage Characteristic	Industry Sector			
	Transportat-ion and Warehousing	Manufactur-ing	Retailing	All Private Sector
% of enterprises that use Internet	43.8	63.7	40.5	52.8
% of enterprises with no plans to use Internet	51.2	24.4	43.5	37.1
% of economic activity attributable to those who use the Internet	79.5	na	na	75.4
% of employees with access to PC, workstation or terminal	40.6	42.7	53.4	55.6
% of employees with access to Internet	17.9	20.4	13.1	28.4
% of enterprises with a Web site	17.6	31.7	16	21.7
% of economic activity attributable to those who have a Web site	51.1	55.4	32.3	44.8

% of enterprises that use Internet and have a Web site	40.3	49.8	39.5	41.1
% of enterprises that use Internet to sell goods or services	10.1	14.9	10.9	10.1
% of economic activity attributable to enterprises that use the Internet to sell	21.1	16.3	21.9	17
% of enterprises that use Internet and use it to sell goods or services	23	23.3	27	19.1
Internet sales with or without on line payment (millions)	$164.3	$900	$610.6	4179.7
Internet sales as percentage of total operating revenue	0.3	0.2	0.3	0.2
% of enterprises that use Internet to purchase goods or services	10.7	18.9	10.8	13.8
% of economic activity attributable to enterprises that use the Internet to purchase	27.8	31.8	15.7	25.1
% of enterprises that use Internet and use it to purchase goods or services	24.4	29.7	26.7	26.2
Non Internet users				
Goods and services we produce do not lend themselves to concluding transactions over the Internet	36.3, 11.6	34.2,21	24.3, 16.5	35.3, 15.8
Prefer to maintain current face to face-business model	31.5, 20.3	35, 29.6	35.9, 30.8	32.9, 22.7)
Security concerns	15.8, 16.1	25, 27.5	20.2, 28.5	21.3, 18.2)
Internet users				
Goods and services we produce do not lend themselves to concluding transactions over the Internet	14.9, 7.1	17.8, 18.6	15.8, 12	21.9, 9.5
Prefer to maintain current face to face-business model	26.5, 11.3	35.8, 24.1	39.4, 15.2	31.7, 14.3
Security concerns	10.2, 5.4	13.1, 18.3	16.7, 14.4	11.8, 11.6)
Source: Bakker (2000)				

Table 10 Transport Canada Web Site Presence Survey					
	N/A	web site	Total	L1	L2
Trucks	77%	23%	100%	54%	26%
Rail	40%	60%	100%	55%	38%
Buses	66%	34%	100%	71%	25%
Airlines	15%	85%	100%	55%	12%
Airports	94%	6%	100%	71%	0%
Ports	78%	22%	100%	100%	0%
Port Authorities	39%	61%	100%	82%	18%
Source: Transport Canada,2000					

A survey on the use of electronic commerce technologies at intermodal transfer points was conducted by Levelton et al (2000). The 44 respondents were service providers and stakeholders involved with either the Port of Vancouver or the Port of Halifax. Some of the key findings of the survey were:

- **$** Software support for business and e-commerce requirements - virtually all organizations surveyed indicated that their software applications provided a high level of support for their business requirements, with the possible exception of human resource management. In many organizations, this is still a paper driven file system. On the other hand, the organizations surveyed did not generally believe that their existing systems provided much support for their electronic commerce requirements. Generally, the more sophisticated organizations with ERP systems felt that their systems could support their electronic commerce initiatives.
- **$** E-commerce as a critical success factor – many of the organizations surveyed believed that e-commerce is a critical factor to their current and/or future success. Some respondents, including trucking companies, freight forwarders and shipping agents, were not completely convinced that e-commerce was a critical success factor. Many of these respondents are smaller organizations and appear to have a shorter-term view of their business.

- **$** Web site availability and functionality – with the exception of the trucking companies surveyed, more than 70 percent of the companies in each sector had a web site. The two major uses of the web sites were:
  - Posting of information about the company (service description).
  - Provision of e-mail capability to facilitate customer service.

  While there is some use of company web sites for rate quotes, booking freight, tracking/tracing and reporting, these functions are not extensively implemented or used.
- **$** Commercial interfaces – paper transactions significantly dominate the commercial interfaces between the various parties in the port community. While traffic data sharing, event notification and shipment tracing all have significant volumes of electronic transactions, many of these are undertaken through the use of EDI or e-mail.

UPS and FedEx were most frequently mentioned by carriers and shippers alike as forerunners in using the Internet for business gain. This is consistent with the Morgan Dean Stanley Whitter shipper survey that identifies UPS and FedEx cited as the leading edge firms in the application of E-Commerce in transport (Transportation & Distribution, 2001). UPS and FedEx have always been technology adopters with a business model that is supported and enabled by IT. However, their model may be not applicable to everyone.

A sampling of web sites of large and leading carriers were examined by Salomon Smith Barney (Anonymous, 2001a). Major web site offerings can be classified into those features that facilitate the exchange transaction (buying and selling freight service) and those that facilitate the physical movement. The emphasize of the majority of these web sites is on the former with real-time tracking and tracing being the predominated feature. Online rate quotes and online rate tariffs are features that enable buy and sell transactions.

The larger carriers in all modes of transport have the capability or are in the process of being able to make service and pricing information available, to register customers and to subsequently perform buying transactions online. The rail, ocean and air/parcel sectors tend to be more

concentrated resulting in greater availability of Web-based services to users of these modes. The trucking sectors are more fragmented, with relatively more carriers not web-enabled.
Parcel and courier carriers with scheduled service sell significant quantities of freight service on a transaction-by-transaction basis. Many customers are individuals or small businesses which have traditionally purchased a standard, well-defined service over the telephone. Transferring this process to the Internet was simple. Shippers can view rates and service of UPS and FedEx, order a pick up and delivery and track shipments online in minutes.

4. Online Transportation

Overview

Electronic business has opened new channels for conducting transactions between transportation suppliers and customers and has created new industry structures in transportation by changing the relationships between shippers and logistics service providers. In addition to connecting carriers with customers electronically, the Internet has led to the growth of electronic market exchanges and in turn new forms of logistics service providers. Electronic transport marketplaces present both challenges and opportunities to transport companies.

Transport services like physical goods can be sold electronically. According to Forrester Research, shipping and warehouse services have a good product fit and industry readiness for E-Commerce. However, there are a number of paths upon which transport services can be sold electronically. Carriers must choose between directly transacting with its customers, participating in an exchange or having an intermediary to sell its service.

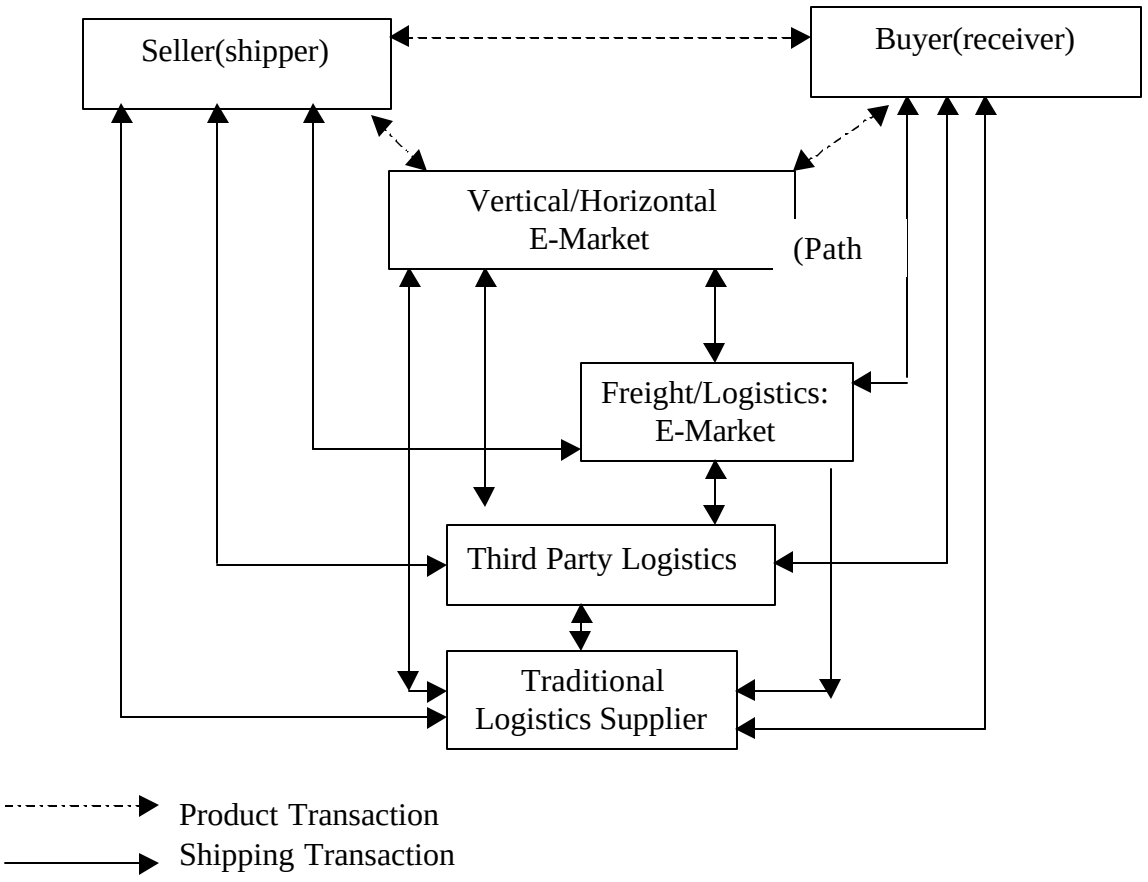
The traditional channel of commerce was either a direct, one-to-one relationship between a carrier and a shipper, or an indirect channel through an intermediary such as a Third Party Logistics company, freight forwarder, broker or transportation management service. A carrier could choose either the direct or indirect marketing channel as its primary sales channel or use both. Historically, railroads dealt directly with shippers of carload and bulk traffic while there

was a greater tendency to depend on sales intermediaries for intermodal traffic and less than carload freight. This was especially true for U.S. railroads and less so for Canada's two Class I railroads who traditionally sold through direct channels. The ocean shipping sector is also characterized by a mix of direct sales and the use of ocean freight forwarders. The air and parcel sectors are dominated by direct sales, particularly by UPS, Federal Express and DHL. Most LTL truck movement is through direct sales while TL could be both direct and indirect.

Freight forwarders typically consolidate freight to take advantage of lower rates for large size shipments or to utilize transport capacity that they purchased in advance. As the practice of logistics outsourcing expand, TPL providers and Transportation Management Services have increased the share of transportation movement that they control. The TPL may make the carrier selection decision and manage the transportation supplier relationship for the shipper. TPLs add value by managing as well as executing logistics processes such as transportation. Freight brokers have always been the purest form of intermediary, providing a mechanism for matching carrier capacity with shipper needs. This has been particularly true in the truckload sector where brokers and load matching services would be contacted by vehicle drivers or carriers seeking return backhauls.

The Internet has enabled carriers to market to customers through online sales channels including company web sites and marketplaces. This has expanded entry paths to the customer as illustrated in Figure 4. On one hand, this presents new means and opportunities for carriers to access customers that were previously unaccessible or to provide better contact via closer relationships with the customer. On the other hand, there is potential intermediation by virtual and physical middlemen who may own the customer relationship.

Figure 4 WEB -ENABLED TRANSPORTATION MARKETING CHANNELS



Direct contact and sales with the shippers on the Internet.

A carrier (traditional logistics supplier) can transact directly with sellers or buyers depending on who controls the freight movement (path 1). Any carrier can respond online to a Request for Quotations or Bids (RFQ) issued by shippers online. Carriers may also offer and sell services through their company web site (path 1). Major web site offerings can be classified into those features that facilitate the exchange transaction (buying and selling freight service) and those that facilitate the physical movement. The emphasize of the majority of the current web sites is on the former with real-time tracking and tracing being the predominate feature. Online rate quotes and online rate tariffs are features that enable buy and sell transactions, stage 2 in the KPMG maturity model.

The larger carriers in all modes of transport have the capability or are in the process of being able to make service and pricing information available, to register customers and to subsequently perform buying transactions online, stage III in the KPMG maturity model. The rail, ocean and air/parcel sectors tend to be more concentrated resulting in greater availability of Web-based services to users of these modes. The trucking sectors are more fragmented, with relatively more carriers not web-enabled. Parcel and courier carriers with scheduled service sell significant quantities of freight service on a transaction-by-transaction basis. Many customers are individuals or small businesses which have traditionally purchased a standard, well-defined service over the telephone. Transferring this process to the Internet was simple. Shippers can view rates and service of UPS and FedEx, order a pick up and delivery and track shipments online in minutes.

Participation in the Electronic marketplace as a transport supplier

A carrier can may participate in a vertical or horizontal electronic marketplace as a supplier of transport services (Path 2). The vertical or horizontal marketplace is concerned with the purchase or sale of goods which require transportation. In some cases, the carrier is the preferred if not the only supplier of logistics services to complete the transaction. The electronic marketplace may qualify the transport suppliers as a service to the buyers and sellers resulting in

less adverse selection risks for the participants in buying transport services . For example, E-Chemical is a neutral online marketplace that allows registered buyers and sellers to select a product, get a price, and order or track small chemical shipments online through its web site. It uses Yellow Freight system as its primary transportation provider. Many B2C online companies have preselected transportation options using specified carriers to provide different levels of service at set prices.

Contractor to an Internet-Enabled TPL

A carrier may also be a service contractor to a TPL or intermediary who subcontracts or selects core transportation carriers for its clients. The transport service may be purchased online or offline. In turn, the TPL may be selling a logistics service directly to shippers/receivers (Path 3) or to a Vertical/Horizontal Electronic market exchange (Path 4). Examples include: C.H. Robinson is the TPL that is linked to Paperexchange.com. When a customer makes a purchase, C.H. Robinson provides the transportation alternatives based on the capabilities of its subcontracted carriers. Schneider Logistics is the transportation service provider for the online plastics exchange, PlasticsNet.com. When a sale is transacted on the exchange, Schneider provides the traders with instant rate information on transportation alternatives and later with cargo tracking and billing services online. In this case the TPL, Schneider Logistics, intermediates between the carrier and the shipper.

5. Transportation Participation in Market Exchanges[10]

Overview

An "exchange" or "virtual marketplace" is the forum where buyers and sellers can meet, exchange information and perform transactions. An electronic marketplace or exchange has the purpose of bringing together previously fragmented buyers and sellers into one community, through a many-to-many electronic platform. Through the web, both suppliers have access to

[10] This section adapted from Chow (2001b) **Market Exchanges and Their Impact on the Transport Industry.**

more buyers and shippers to more sellers. The most direct path is to transact directly with sellers or buyers (depending on who controls the freight movement) through their company web site. Shippers can view rates and services of UPS and FedEx, order a pick up and delivery, and track shipments online. Carriers, particularly larger competitors in the truck, rail and marine sectors, have similar capabilities. Carriers can implement online auctions to sell transport capacity. Alternatively, carriers can access the web sites or receive electronic communications from shippers about their transport needs and bid for those freight movements. Both of these paths are relatively efficient for either the buyer or the seller but not for both. For example, a carrier's web site offerings may be accessed by many potential shippers reducing marketing and sales costs of the carrier and providing access to a broader market. However, each shipper has to access multiple carrier sites to achieve the same benefits from a sourcing perspective. Similarly, a shipper's web site would provide access to a broader supply of carriers, but each carrier has to access multiple shipper sites to broaden its market access. This is confirmed by a survey by Salomon Smith Barney who found the primary reasons that shippers use auction sites for obtaining transportation service were: to obtain pricing leverage, to gain flexibility in carrier choice, and to obtain transport capacity not available from existing carriers used (Anonymous, 2001a). Other benefits of participating in online marketplaces for both carriers and shippers are summarized in Table 11. Small shippers generally save the most from participating in exchanges. They are less likely to have negotiated favorable contract terms and pay the highest margins. The Internet provide smaller shippers with access to a much wider range of service providers.

Table 11

Online Marketplace Benefits

Shipper Benefits	Carrier Benefits
Increased price transparency	Increased price transparency
Automatic procurement processing	Increased asset utilization
Greater access to service providers	Greater exposure to large shipping base
Lower procurement costs	Confidentiality
Greater visibility	Reduced sales and marketing overhead
Confidentiality	Greater breadth of payment services
Automated payment processing	Data mining capabilities
Data mining capabilities	Asset optimization services
Supply chain optimization	

Source: Banc of America Securities (Coleman et al, 2000).

A carrier may participate in an electronic transport exchange as one of many direct suppliers of transport services or indirectly through a Third Party Logistics (TPL) company. The term transport exchange is typically used interchangeably with freight or logistics exchange though the latter may denote additional value-added logistics services. The buyers in the transport exchange are either buyers and sellers of the products who need their products transported or another Vertical/Horizontal electronic exchange. For example, FreightQuote.com is reported to have negotiated exclusive contracts with more than 70 vertical exchanges (Alling, 2000).

Bear Stearns (Alling, 2000) conducted a detailed review of 54 horizontal freight transport exchanges during the first half of 2000. Some of their observations were:

- 74 percent offered transportation procurement services for only one mode with the remainder providing service for two or more modes. Only 5 sites served all four modes (only 2 in the U.S.) while four sites served 3 modes.
- The modal coverage by the transport exchanges was: trucking (61%), ocean

shipping (43%), air cargo (31%), rail (11%) and container (6%). Trucking and rail appear to reflect the relative amount spent on these modes while air cargo and ocean shipping are over represented relative to freight expenditures for these modes in the U.S.

Trucking

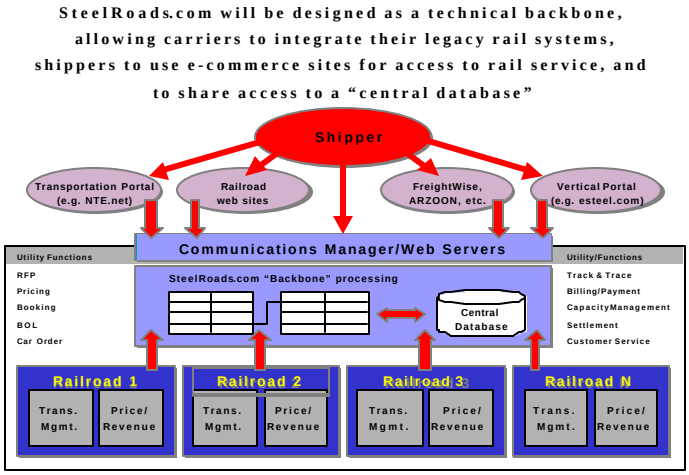
Trucking, both TL and LTL, dominate among service offerings of online procurement sites which reflect the fragmentation and low concentration of this industry segment. The majority of the online exchanges facilitating the sale of trucking services focus exclusively on trucking. At the same time, nearly all multi modal transport exchanges included truck services. The exchanges were offered by third party logistics firms, carriers, shippers, and software vendors as well as new startups. There are only a few carrier-centric sites for selling trucking services. Of the three well-known carrier-centric, horizontal sites that started up, only Transporation.com and Transplace remain. Transportation.com is a subsidary of Yellow Freight, financed jointly with venture capital partners. This public marketplace concentrated on load matching for TL shipping capacity for small to mid-sized shippers and initially set up freight auction service aimed at both the spot and construction markets as well as a vertical marketplace for trucking equipment, such as tires and trailers. The site has expanded to provide broad-based, customer-centric transportation services including load matching, shipment management, auctions, load tendering, load building and dispatching. The variety of services beyond merely facilitating buying and selling had made it a virtual TPL service (see below). The online transport provider is integrating full supply-chain services over time. "We also believe that since many shippers place high value on logistics services that deliver operational improvements and save hard dollars, you will see Internet companies revamp their business models to include more traditional contract logistics" states the president of Transportation.com.

Rail

A small number of sites offer rail service online and none offer rail exclusively. The railroad industry is highly concentrated with only 6 major Class I railroads in North America competing

continentally. Most rail traffic is moved under contract rates. Only two rail market exchanges have arisen in this sector of which one has ceased operation and the other has very little rail traffic. Arzoon is supported by a shipper focused desktop software suite for shippers or traffic managers. The decision support tools are used to manage their workflow and more effectively procure, execute, monitor and reconcile freight services by improving inbound freight visibility and tracking across different transportation modes. It provides the means for business rule and routing guide compliance leading to better synchronization of data flow with product movement. The benefits are not necessarily from better purchasing leverage but from transportation cost reduction through operational and administrative efficiencies. Arzoon seeks to provide one-stop transportation management services across all modes and across all borders, allowing each shipper to map out the best system for its needs and to purchase and follow through the service as a means of auditing how it is being executed. NS, UP, CSX and CP were the initial railroad investors. Arzoon has already developed contracts to manage freight for several large shippers, such as McKesson HBOC's pharmaceutical and beauty product suppliers, but this involves non-rail modes. As of Jan 2001, no rail contracts had been signed and railroads such as the CPR have not sold significant freight volumes. At the very least, such a site exposes shippers, who ship by both truck and rail, information of rail capabilities that they were not aware of previously. BN and CN were not asked to participate, probably because they were part of FreightWise, a competing industry freight exchange that ceased operations. The viability of Arzoon is still unknown, but it does have the advantage of having four major railroads as investing members and active participants. Each member has to determine whether to tender rail capacity to its internal online sites or to Arzoon. More importantly, Arzoon's business model is not necessarily to auction off and to utilize excess capacity of the railroads, instead it is to provide the shipper with the tools and capability to manage the transport requirements better. The exchange is what has been termed, a Virtual TPL dot.com that provides a one-stop site to access multiple transportation and logistics services from multiple suppliers with extensive decision support provided as an Applications Service Provider. Arzoon competed more with Logistics.com than FreightWise.

Figure 5. End to End Proactive Management



Source: Bell 2000

The common objective of all railroads is to be able to offer seamless service. Since freight must often be interchanged between railroads, information exchange on car status is critical to the E-

Commerce efforts of all railroads with respect to providing both shipment and equipment visibility. Steelroads.com is a Railinc (AAR information technology unit) site that serves as an information exchange for the industry. The exchange connects all Class I and 300 regionals and short lines, enabling customers to electronically set up and track freight shipments across all of these lines. The ultimate goal would be for customers to identify the most efficient route for shipment, to specify equipment required and to determine if that equipment is available along the entire route as well as track and trace through Steelroads. At the time of this writing, shippers can request railcars and trailers for loading, find out about rail equipment characteristics, issue shipping instructions, order service, monitor a shipment's progress, and contact a railroad through the site (www.steelroads.com). Both the CNR and CPR are members. The CPR believes that Steelroads can be the technical backbone that allows carriers to integrate legacy rail systems and to share information with shippers as illustrated in Figure 5.

Ocean Freight

The ocean shipping transport sector includes segments that are concentrated (container shipping) and unconcentrated (tramp shipping), with significant amounts of freight moving at low margins. Major carriers in this transport segment have online web sites that facilitate basic transactions such as booking and shipment tracking, but most freight service is sold off line on a contractual basis. However, next to trucking, ocean carrier service is the second most frequently offered service by electronic transportation exchanges. This sector has not seen any carrier initiatives to set up pure online freight exchanges, which could erode already-low carrier margins and undermine existing contractual rate structures. Shippers have generally initiated the creation of neutral sites such as LevelSeas or FreightTraders to charter ships and buy cargo space. Some have been moderately successful because the shippers, backing the creation of the electronic marketplace, bring core freight into the exchange at the very beginning.

Carriers have formed online portals which essentially seek to reduce transaction costs for both shippers and carriers. These portals essentially put existing online sites of each carrier onto a common platform, which can provide visibility across shipping lines and standardize shipping transactions among carriers and with shippers. The two ocean portal sites with multiple carriers, INTTRA and GTN will both facilitate common transactions such as booking, tracking and tracing. INTTRA initially will not be involved in freight rates and contracts while GTN is looking into it. GTN seems to be heading towards offering freight management and other value-added logistics services. Neither site as of early 2001 were operational. A third site, CargoSmart, is operational but only has one carrier member, who is its founder, OOCL. That site is basically an expanded version of the carriers' site which is put on a neutral platform to include other carriers.

At this early stage in electronic marketplace development in the ocean carrier sector, there is substantial uncertainty as to the direction and eventual impact of electronic market places on shippers and carriers.

Third Party Logistics and ASPs

The trend in electronic transportation exchanges is towards providing a broader set of logistical services. As a consequence, transportation exchanges are becoming virtual TPL providers or TPL dot.coms. These are one-stop sites for accessing multiple transportation and logistics services from multiple suppliers with extensive decision support provided as an Applications Service Provider (ASP). With ASP, software applications are hosted over the Internet so clients can avoid installation and maintenance cost.

Logistics.com is a representative example. It offers its extensive array of shipper bidding tools, transportation management, routing and motor carrier schedule optimization software. They are used to create a comprehensive marketplace and to provide decision support as an ASP that covers all key decisions by carriers and shippers at a strategic level (e.g., core carrier selection), tactical level (e.g., shipper transportation management) and operational level (e.g., shipper spot market selections, carrier dispatch optimization). Logistics.com seeks to create a Digital Transportation Marketplace (DTM) where it performs many services that TPLs currently perform offline but does not perform any actual transportation, handling and storage of product. The dot.com basically arranges for these processes to be completed by the chosen carriers and other logistics providers. Other virtual TPL sites also take advantage of new web-based capabilities and provide decision tools to automated shipper processes that manage ordering, tracking and transportation workflow.

The virtual TPL competes directly with Third Party logistics providers who in turn can expand their service offering as an online provider as well. For example, Schneider Logistics recently announced that it would deliver a version of its Summit Suite of supply chain applications over the Web (Wilson and Delaney, 2001). More importantly, TPLs have always performed the aggregation function when it sources multiple carriers for multiple clients. This is particularly true for non-asset based TPLs such as C.H. Robinson.

Collaborative and Private Exchanges

Collaborative exchanges do not focus on transportation procurement but rather on reducing cost in the whole supply chain. As freight exchanges move towards providing logistics management solutions rather than just transportation purchasing, collaborative exchanges become more important. The best known example is the freight buying exchange based on the Nistevo software platform. This was initially set up by an alliance of five major shippers in the consumer package goods business. The exchange's main purpose is not to leverage their buying power, but to collaborate among each other and with carriers with the objective of achieving cost reductions. Cost reductions can be achieved by coordinating shipping lanes of the five buying members to fill backhauls and achieve higher carrier asset utilization. The carriers participating in the exchange are already transportation suppliers with long-run contracts with the shippers. Thus, the focus is on contracted freight rather than spot trading, combining contract buying practices with modern exchange technologies. Essentially, the freight movements of the shipper members are put into one data base, increasing the opportunities for improved equipment utilization. To date this is one of the most successful Internet-based marketplaces as 7 more major shippers have joined the exchange. Nistevo leverages existing relationships and brings benefits to both carriers and shippers through increased productivity and collaboration. This is not to imply that the collaboration in Nistevo was easy. Clear and firm rules govern what information is shared and how shipments and capacity are matched. As noted in the section on supply chain integration, sharing commercial information is a new paradigm in North American business practice. All of the participating carriers are truckload carriers. It is still unclear whether such a model would be successful in the railroad sector.

These collaborative transport exchanges also tend to be private exchanges. Collaboration, at least as practiced today, is best achieved through close relationships and these are not inherently scalable to a multitude of participants. Collaboration involves sharing of commercially sensitive information that requires control achieved by limiting the number of parties that have access to it.

Competitive Trends and Shipper Usage of Market Exchanges

Growth and profitability of the pure horizontal exchange have not met expectations. Statistics Canada found that transportation sold online (by exchanges or simply online) in Canada is a very small percentage of transportation revenues. Numerous U.S. shipper surveys indicated that most U.S. shippers transacted very little of their transportation shipments electronically, and much less used online auction sites and many had no intention of doing so in the near future. A Salomon Smith Barney survey reports that 75 percent of the respondents contracted less than 5 percent of their transportation shipments electronically (Anonymous, 2001a). Only 10.7 percent of the respondents contracted over 40 percent of their transportation shipments over the Internet.

The Salomon Smith Barney survey also found that 62 percent of the respondents do not use online auction sites and have no intention of doing so in the near future. Another 31 percent were not using Internet auction sites but exploring this channel as an option. Only 5 percent reported moderate use of auction sites and 2 percent reported extensive use of auction sites to secure shipping capacity. Similarly, Lazard Freres reports that the dot.com share of the logistics market is less than 3 percent. In fact some early adopters of certain E-Logistics services are reviewing their decisions or returning to traditional vendors.

The survey of Canadian shippers by the CTAR research staff (Hinchcliff, 2001) found that only 11 percent of the shippers (who responded to the question) actually use freight or transportation exchanges to obtain transportation. The percentage drops to less than 8 percent if the total survey response size is considered. As evident in Table 12, marketplace exchange are used considerably more to obtain truck or courier/parcel transport service in Canada.

Table 12
Transportation or Freight Exchange Used to meet Transportation Requirements

	Yes	No	Planning to	Investi-gating	Dk/Na	Total responses	No response	Total
Rail	11%	70%	2%	0%	16%	100%	30%	100%
Trucking	36%	52%	0%	0%	12%	100%	25%	100%
Marine	15%	63%	1%	0%	22%	100%	33%	100%
Air	14%	65%	1%	0%	21%	100%	35%	100%
Courier/Small Parcel Express	22%	59%	1%	0%	18%	100%	32%	100%

Source: Hinchcliff (2001)

There are many explanations for the low utilization of the Internet for transport purchasing and in particular auction services but the frequently cited are:

> The majority of transport purchases are under contract from carriers with whom the shippers have developed a trusted relationship. Much of this has to do with trust and risks if there is failure. Most shippers are not going to do business with someone they are not familiar with for the sourcing of a mission-critical function which cannot tolerate disruption. This is especially true in the rail sector and in the global transportation marketplace where ship and air cargo carriers compete. Estimates of freight moved under contract range from 80 to 90 percent. A customized contract covers more than price, it includes service criteria. The transport purchases most susceptible to online exchanges are spot purchases which represent less than 20 (10) percent of total traffic.
>
> Freight exchange sites are attempting to handle all the intricacies of a customized contract negotiation. Otherwise they are only suitable for commodity type and standardized products and services.
>
> Shippers continue to want quality and capacity. Many shippers want to know that their suppliers own or control the assets so customers can be guaranteed capacity during peak

periods.

Sectors such as ocean shipping and rail are not as fragmented on the supplier side, resulting in less benefit to shippers with respect to reducing supply side complexity. For example, the top 19 container lines held 81percent of market share in 1998-99.

Shippers are waiting to see what online exchanges exist and are dubious about claimed benefits.

Shippers not ready to participate due to the non-functionality or incompatibility of their legacy information management systems.

Carriers will not commit anything other than excess capacity to transportation exchanges due to the low margins in this aspect of the E-Business (price pressure). Online exchanges could reduce already low margins. Participating in an exchange may also result in pricing transparency that may undermine the pricing strategy of the carrier. For example, lower prices sold online may undermine the contract prices.

Carriers perceive freight exchanges as another intermediary between them and the customer and therefore there could be a loss of customer relationships to dot.coms. The exchange essentially markets its own brand and carriers could lose their brand identity to the exchange. Customers will become the customers of the online exchange not the carrier.

Carriers do not want to commoditize their services. Carriers tend to shy away from participation as it treats transportation service as a commodity. They focus on price and therefore reduce carrier profit margins.

Carriers are better off pursuing their own internal online offering.

> Efficiency gains for railroad and shipper partners who already have EDI in place are marginal.

The electronic transportation marketplaces in North America are still in development and evolving. Practically all transportation freight exchanges were launched in 1999 or after and are under two years old. One industry expert estimated that “More than 200 online firms targeting transportation were launched in 2000" (Sowinski, 2001). Throughout 2000 and the beginning of 2001, numerous mergers, acquisitions and exits have occurred and are forecasted to continue. Many of the carrier-centric and neutral exchanges began as pure horizontal exchange sites, facilitating the buying and selling of transport services under the auction format. The premise was that transportation service is basically a commodity that can be easily sold on a transactions basis or that freight volume could be aggregated from enough shippers to leverage the exchanges’ buying power into reduced prices. Most of these models expanded the shipper’s choice and accessibility to transport providers, which enables and reverses auction transactions as well as improves carrier productivity by selling unused or under utilized capacity. It was believed that globalization would overpower existing relationships as companies access different suppliers, procure new items and drive down prices.

The general industry trend towards outsourcing means that carriers need to find ways of either maintaining the customer relationship (branding) or being a trusted supplier and partner with the intermediaries that have taken over the outsourcing. All of the examples above are virtual exchange, dot.coms. The trend towards outsourcing may place the shipping decisions in the hands of non-virtual intermediaries such as TPLs who may or may not be Internet-enabled. For example, C. H. Robinson Worldwide is a non-asset TPL providing trucking, intermodal and multimodal service through service contracts with the actual transportation providers. Railroads, such as BCR, seek to ensure that the growing number of 3PLs, E-Marketplaces and dot.coms will consider rail transport as an option and that it (the BCR) can integrate with the new breed of Internet-enabled TPLs.

Not only has there been substantial turnover of these exchanges but many have changed their value proposition in order to survive while more recent entrants have avoided the pure exchange model altogether. Many transportation exchanges are becoming transportation (or freight or logistics) management exchanges with additional services to help manage the transportation and logistics process. Arzoon, for example, is now promoted as a shipper-focused desktop suite for shippers or traffic managers, managing their workflow and enabling customers and suppliers to procure, execute, monitor and reconcile freight services. Each shipper can map out the best system for its needs and purchase and follow through the service as a means of auditing how it is being executed. NTE has added shipment and logistics optimization services. These services are typically provided as ASPs.

In addition, numerous transportation exchanges are seeking to enable collaboration as the primary end result of using the exchange. "If you look at these exchanges, a lot of them are migrating to collaborative logistics networks...The focus is moving away from a spot exchange to providing the infrastructure for companies to collaborate with their existing transportation partners." (Cooke, 2001). As noted above, this strategy frequently coincides with a shift from public auction-type exchanges to private exchanges that run exclusively for a specific shipper and its core carriers.

In summary, all of these developments reflect a movement away from facilitating transactions to driving efficiencies through business processes. They all reflect a trend in B2B exchanges where offerings that reduce transactions costs will win over those that actually handle transactions. Companies are less interested in finding new models on which to base their transaction behavior than on solutions, which drive efficiency throughout their business processes. Over time, technology will prove to be a commodity, while real-world supply-chain experience will prove to be an invaluable resource. The companies that have that experience are currently the traditional brick-and-mortar transport, warehousing and TPL companies rather than Internet-based dot.coms.

Summary

In summary, TL transportation, being the most fragmented transport sector, is most frequently represented in transport exchanges. Rail and ocean shipping have been slower to adapt while intermodal is the least developed. The latter can be explained by the need to bundle cost and service information for each participant in the intermodal chain. Not only is it more difficult to pull all of this information together, for many intermodal lanes, the information is not available. This is particularly true for the drayage component of intermodal.

The overview of the use of market exchanges indicates that transportation market exchanges are in their infancy. The online share of the freight market is still small and for the near future, traditional channels for selling transportation will continue to dominate. This includes third party logistics companies as well as pure transport firms. For the moment, the most successful transportation marketplace exchanges will continue to be shipper-centric and semi-private exchanges, such as Nistevo, where a limited number of shippers and their contracted carriers participate. These exchanges promote collaboration between competitors as well as partners in a supply chain to increase productivity for all involved parties. These exchanges overcome much of the uncertainty about the quality and capacity of the carrier on the other end of the transaction and encourage participation by carriers since the objective is to increase efficiency rather than rate reduction.

6. Business Process Improvement

Overview

Successful transport firms have always adopted new technology which enabled them to increase productivity, reduce costs and serve their customers better. E-business is simply another step in the long path to seamlessly connecting every process in the transportation operation to integrate operations better. Whether by the web, EDI, satellite communications or cell phone, information that is available in real time and in advance allows synchronization of operations and advanced planning. The Web's impact however is changing competitive relationships. For example, smaller trucking firms frequently cannot afford to invest in EDI, but the threshold cost of entry

into the Web is relatively inexpensive and can be rapidly implemented. Access is nearly universal. Internet kiosks at truck stops provide drivers on the road with access to Internet without having to own a PC. The growth of Applications Service Providers (ASP) make sophisticated supply chain software more accessible to small as well as large companies. Users basically rent the software and hardware. The software itself need not reside on the customer's premises, and users can access it via the Internet. A carrier for example could contract to use a Transportation Management software package or a routing and dispatching model under a monthly fee. The threshold cost of adopting modern technology is lowered encouraging adoption of technology and again, there is easier access to technology to smaller shippers and carriers, increasing their competitiveness with larger competitors. Challenger Motor Freight, for example uses Logistics.com's transportation management software to manage and analyze its truckload operations. The ASP model allows the Canadian carrier to access the software modules on a monthly subscription fee basis, minimizing information technology costs and implementation time while getting the benefit of the latest updates (Eyefortransport.com, 2001).

E-business has provided new or improved methods for transport firms to interact and serve customers at lower cost or with improved service. How has Canadian transportation taken advantage of this? A 1999 Statistics Canada survey (Bakker, 2000) found that only 43.8 percent of transportation and warehousing enterprises use the Internet compared to 63.7 percent of the manufacturing sector. However, these enterprises account for 79.5 percent of economic activity in transport and warehousing, indicating that the larger firms have embraced the Internet more readily than small and medium size enterprises. Additionally 5 percent of the transportation and warehousing firms planned to use the Internet but 51.2 percent have no plans to do so. Canadian transportation firms appear to be lagging behind manufacturers with respect to Internet usage but slightly ahead of retailing as shown by the figures in Table 5.

Purchasing on the Internet

Transportation companies can reduce the price of supplies by participating in online market exchange sites for supplies and equipment as transports firms themselves, purchase large quantities of equipment and materials, repair and operating (MRO) materials. These include

tires, wheels, fuel and vehicle parts. Electronic purchasing can lead to significant reductions in the cost of the purchasing process, control the purchasing process better and improve purchasing decisions. Through the Internet, companies can communicate with more suppliers more quickly. Automation of purchasing through e-procurement is an area that is just as easily justified for transport firms as they are for manufacturers. Class I railroads are large enough to develop internal e procurement solutions. CN implemented Internet procurement in 2000, using software developed by Ariba Inc. and BCE Emergis to create supply chain efficiencies for CN and its suppliers. The set of services would include online ordering processing, invoicing, dynamic pricing auctioning and electronic payment. The procurement system will be integrated with the SAP system at CN.

Transportation companies can also rationalize the process and reduce the price of supplies by participating in online market exchange sites for supplies and equipment. Railnet.com is a subscription-based web site offering marketing, bidding and communications capabilities to railroads and its suppliers, contractors and service providers. The site was developed by Norfolk Southern. Bidding for example would be conducted through this portal. 1Rail.com is another online marketplace for railroads to procure equipment, materials and supplies globally. 1Rail.com is a consortium of GATX, Capital/Mercer/Oracle/Sabre/Xelus, has a number of suppliers and international carriers, is a broad industry exchange/backbone focused on cost sides. The creation of RailMarketplace.com (RMP) was announced on Jan. 17, 2001. Five Class I railroads (CN, CP, UP, NS and BNSF) are providing slightly less than half the equity in the new company. The five railroads combine to have $15 billion in purchasing power. RMP would be a neutral, global exchange for rail goods and services. Member carriers have initially indicated that the percent of their purchases going to RMP could be very small to half of their annual purchases. In contrast to the rail sector, the trucking industry is highly fragmented and few trucking firms have the same buying power as the railroads. This is especially true in the TL sector versus the LTL segment of trucking. Therefore, numerous market exchanges exist for the purchase of supplies and equipment in the trucking sector and it is more likely that trucking firms participate in an on line buying exchange. An example is TruckXChange.com.

The 1999 Statistics Canada survey depicts the degree to which Canadian transport has adopted electronic procurement (see Table 5). We compare transport use of the Internet for purchasing with manufacturing to obtain a perspective. The survey found that:

- The percent of transport and warehousing enterprises that use Internet to purchase goods or services was 10.7 versus 18.9 in the manufacturing sector.
- The percent of economic activity attributable to transport and warehousing enterprises that use the Internet to purchase was 27.8 versus 31.8 in the manufacturing sector.
- The percent of transportation and warehousing enterprises that use Internet and use it to purchase goods or services was 24.4 versus 29.7 in manufacturing.

While the percentages most likely have increased since 1999, there appears to be substantial opportunity for further productivity gain and cost reduction in the purchasing process as a relatively small percent of enterprises use the Internet to purchase goods or services.

Internet Impact on the performance of transportation operations/Internet enablement of supply chain integration

Transport firms, like other members of the supply chain can utilize the Internet to improve service performance, productivity and reduce cost. Successful transport firms have always adopted new technology and the adoption of electronic commerce technologies is no exception. As with any information technology, the web has enabled transport firms to re engineer procurement, operations, marketing and administrative processes. The use of e procurement has already been discussed.

A popular human resource application of the Internet is to enable employees to access human resources' information and perform human resource transactions via self service Web sites. This is particularly beneficial to transportation companies with a large percentage of its employees working in the field and with minimum access to the corporate or administrative office of the carrier. For example Maverick Transportation, a TL carrier with 700 drivers working across 48 states, and Viking, a trucking company with 5000 employees in 66 centers in the western U.S.,

both have its employees update benefits' information, monitor health benefits and manage retirement plans on the Web. This releases HR resources to get out and visit drivers personally (Infinium, 2001). Many Class I railroads use the Web for similar reasons.

The Internet enhances the communications capabilities both within the carrier and between the carrier and shipper. Using the Internet is simply another step in the long path to seamlessly connecting every process in the transportation operation to integrate operations better. Whether by the web, EDI, satellite communications or cell phone, information that is available in real time and in advance allows synchronization of operations and advanced planning. The Web's impact however is changing competitive relationships. For example, smaller trucking firms frequently cannot afford to invest in EDI, but the threshold cost of entry into the Web is relatively inexpensive and can be rapidly implemented and access is nearly universal. For example, Park 'N View offers truckers access to the Internet and their email anywhere for the price of a phone call. A driver is connected either in the cab or via 800 truck stops and would access to many information sources and company information (Hickey, 1999a).

Electronic technology includes many information and communications technology applications that have been in development in the transport field and particularly the trucking sector, for over a decade under the grouping of Intelligent Transport Systems (ITS). Intelligent Transportation Systems (ITS) can be defined as the application of advanced information processing, communications, sensing and control technologies to improve the way in which ground transportation systems are designed, built, managed and operated (Sabounghi, 1999). E-Commerce is considered one of the ITS applications within the motor carrier industry. Major ITS systems include Advanced Traffic Management Systems, Commercial Vehicle Operations and Advanced Vehicle Control & Safety Systems. E-Commerce technologies can enhance and enable the application of several ITS applications by reducing the cost of communications and information sharing across the transportation system.

Most railroads have always been major users of information technology to plan and control operations. For example, the BN developed the Transportation Control System (TCS) which

was also adopted by CN to control train operations. Both railroads are in the process of converting their IT platforms to enable E-Commerce applications on these systems. Most of the E-Commerce applications are to provide a means of interaction between the railroad and customers, rather than improve rail operating efficiency. Both the CN and CP have also installed SAP, an Economic Resource Planning (ERP) software package to provide an enterprise wide data warehouse to support purchasing, human resources and financial decision making. Traditionally, companies brought software solutions and necessary hardware and implemented these solutions on-site. Transportation Management Systems (TMS) can be expensive, and a high end carrier selection system often runs more than half a million dollars. Increasingly, customers are buying or leasing these solutions and having they hosted offsite at the software supplier's headquarters or with the supplier's infrastructure provider. For these hosted solutions, the upfront cost is a small fraction of the costs to buy software and has it installed on site. Users basically rent the software and access it via the Internet. In some ways, TMS is among the best applications for remote hosting. TMS requires collaboration with many external parties, including carriers, freight forwarders, and brokers and there are many shipping locations. Application hosting also allows the service firm to become the information hub where everyone connects. Access to technology via application service providers (ASP) makes sophisticated supply chain software more accessible to small as well as large companies. The threshold cost of adopting modern technology is lowered encouraging adoption of technology and again, there is easier access to technology to smaller shippers and carriers, increasing their competitiveness with larger competitors. This is more applicable to trucking than to rails, despite the existence of smaller short lines in the later transport segment.

The seamless connection of shippers with carriers combined with the carriers access to decision support software and effective control of transport operations, allows carriers to plan and optimize shipment and vehicle flows dynamically. Load matching and utilization of excess capacity is facilitated by the Internet. Through freight and logistics exchanges, empty miles can be reduced by auctioning temporarily excess capacity. Visibility and communications for collaboration between carriers or between shippers to reduce empty backhauls or better utilize equipment.

Internet Impact on the Customer Management Relationship and Service Offering

The interface between the transportation firm and the customer is critical as transportation process starts with the customer's inquiry or search for service and ends with payment upon confirmation of delivery. Parcel companies such as UPS, Federal Express and Purolator are highly E-Commerce enabled. A customer can determine the service it needs, its availability and price and tender a shipment in seconds with these carriers. Other processes such as shipment tracking and payment are also highly electronic and fast. Trucking firms are less electronically enabled. The process of a shipper finding the right service, determining the price and tendering a load may take minutes. Depending on the carrier, loads are easily tracked, and invoices and payments may be made electronically. The railroads are the least electronically enabled. Railroads may take days to respond to service and price inquiries and the ordering and confirmation of equipment requires additional days. Most railroads send BOLs and get ETAs electronically and depending on the railroad, may also send out invoices and receive payments electronically.

North American railroads are in the process of re engineering and aligning their operations processes to achieve the best in class speed and responsiveness of competing modes. These include:

Immediate rate and service retrieval to find service and price for customers in seconds. Buy transportation in one step, immediate commitment of pickup and delivery to tender shipment in seconds.

Shipment tracking and notification using customer identities to track and confirm shipments in seconds.

Automatic triggers payment after proof of delivery, effectively combining invoicing and payment processes.

Similar value added services are offered by trucking firms. J.B. Hunt recently installed its Dashboard CRM tool that allows a customer to request and schedule service via multiple modes of communication including the Web, and allows J.B. Hunts customer service agents to address all customer interactions with the tools, information and flexibility required. Noted one customer "The ability to request and receive P.O.D.s via J.B. Hunt's web site has reduced the number of phone calls our claims department has to make and has improved our process time" (J.B. Hunt, 2001). The automation of order transaction processes will have the "bigger impact on carriers that have smaller shipments and process more transactions by using some kind of web interface and thus don't have to have call centers and face to face transactional processing" (Hickey, 1999b). The developments of customized interfaces that connect the customer and carrier often create firm specific assets or processes and skills that create a penalty when the shipper decides to use another carrier. For example the British Columbia Railway has implemented a customized shipment ordering and bill payment system that reduces the order processing costs of the shipper. When the shipper choses to purchase transportation from a competing carrier, the benefits that are embedded in the automated purchasing are lost to the shipper. UPS is integrating its online self-help shipping tools with Office XP, Microsoft's suite of office applications. This will allow the Microsoft office suite user to automatically connect with UPS and initiate transportation processes such as checking the status of an order (Transport Topics, 2001). This makes it more convenient to use UPS over a competing carrier without similar linkages.

In summary, transportation companies are driven to adopt these process improvements to stay competitive. Web technology in contrast to EDI is scalable, cheaper and has a lower threshold cost of entry. The Web is the medium by which firms can use software provided by ASP. While all carriers can take advantage of the Web, smaller transport companies will be able to access and use the same technology available to large carriers.

IV. Adoption and Utilization of E-Business in Canadian Transport

E-Business has provided new or improved methods for transport firms to interact and serve

customers at lower cost or with improved service. This section reviews the status of E-Business in Canadian transport with a particular focus on the railroad, trucking and maritime sectors.

1. Maritime

The marine sector is composed of shipping lines, ports, service providers at the ports and connecting surface or air transportation service providers. As a predominately trading nation, Canada is highly dependent on efficient and effective international transportation. Canadian ports and the port "community" compete vigorously with U.S. ports for this traffic. Large and small participants at Canada's major ports were surveyed to access the status of E-Business in this sector[11].

The majority of the participants in the marine sector at Canada's major ports believe that E-Commerce is a critical factor to their current and/or future success. Shipping lines are beginning to adopt E-Business technologies and expect ports to do so as well. The shipping lines see E-Business as a means to improve productivity and reduce the cost of their operations. Canadian ports feel shipping lines will favor ports that provide E-Business capabilities. Ports can use E-Business to enable early resource and equipment preparation prior to the docking of a vessel, improving turnaround time, berth utilization and container yard productivity. Transmission of cargo information for pre-clearance reduces shipment time and results in more efficient Customs operations. The port can provide advanced information on weather, berth and tide conditions that facilitate operations planning by the ship lines. Ports can use E-Business in day-to-day transactions to reduce paperwork and administrative costs. The benefits of E-Business are

[11] **Information Technology & E-Commerce in the Canadian Maritime Industry** prepared by Christopher Wright (March 2001), **E-Commerce and Canadian Ports** prepared by John McDonald and Sylvie Robitaille (March 2001), **Survey on Use of Electronic Commerce Technologies at Intermodal Transfer Points** prepared by Levelton et al for Transport Canada (July 2000).

particularly significant at ports with container traffic as it enables shippers or shipping lines to track container movements. E-Business solutions are also being implemented to solve critical truck congestion problems at some ports.

While many ports have an EDI legacy, the Internet presents significant improvements. The port is often identified as the best "community" for the collection and dissemination of information that is used by multiple members of the international supply chain. Instead of having to make numerous one-to-one contacts, a participant can get all of the information from a single portal. The Web has made information more accessible to small and medium size stakeholders who could not afford investment in EDI. Canadian ports, particularly those in direct competition with U.S. ports have taken many initiatives in E-Business. The Port of Seattle recently adopted the Portnet system developed by the Port of Singapore. The Port of Vancouver has numerous "community" type initiatives using the Internet including vessel tracking, container terminal scheduling, vessel arrival and turnaround management. In contrast, some trucking companies, freight forwarders and shipping agents are not completely convinced that E-Commerce is a critical success factor. Many of these companies are smaller organizations and may have a shorter-term view of their business or lack of resources to increase their information technology.

Major international carriers, domiciled offshore but serving Canadian ports, have highly-developed Internet portals (Web sites) to interact with customers. Maersk-Sealand for example, has developed a web site where a shipper can become a customer, receives Bill of Ladings, track cargo, book shipments, view schedules and see a variety of statistics online. The use of E-Business by Canadian shipping lines varies from virtually no involvement to sophisticated customer interface and ship management systems. Canadian ship lines have virtually no involvement in E-Commerce with shippers except one container line using EDI to track containers. At present, this information is not accessible to customers online. Overall, there appears to be some resistance from the workforce that lacks computer skills to using the Internet. Some Canadian ship lines have advanced onboard ship information systems that link ships to each other and to head office. This would manage equipment maintenance, materials requisitioning, voyage information, payroll and personnel. These for on board management

systems require real time availability of information such as weather charts, ice information and water levels to be effective. Like their port colleagues, Canadian-based carriers are not standing still. One Canadian carrier has completed its development of its Enterprise Resource Planning information backbone. The carrier is now in the process of integrating its end-to-end processes, from estimating to chartering to voyage planning, voyage management and completion of transactions as well as performance monitoring. This includes E-Commerce capabilities and an enhanced interactive web site.

Individual firms in the maritime community often cannot justify the investment in Internet technology and applications. The major barriers to using E-Business in the maritime sector are:

- **$** Some firms cannot quantify the benefits of E-Business but clearly see expenses and resources required for implementation. There is lack of awareness of the longer-term benefits of E-Commerce and a tendency to think short-term, only viewing E-Commerce as a tool to solve immediate problems.
- **$** The legacy EDI systems reduce the commercial rationale for investing in new E-Commerce technology.
- **$** Some view E-Business as complex and new. There is a fear of the unknown.
- **$** There is a concern over security of this information that is shared in E-Business applications.
- **$** The appropriate technology meeting a company's needs may not be in the market.
- **$** There is a lack of special skills and technical training, especially among smaller firms or firms that encounter resistance from the workforce who lacks computer skills. Some companies do not trust their employees' abilities to use E-Business appropriately.
- **$** The marine industry adheres to traditional practices, based heavily in paper documentation. When coupled with a general dearth of technically-skilled workers, this represents the greatest internal impediments to acceptance of E-Commerce.

Some of the above barriers are created or worsen by the lack of participation, coordination and collaboration among the stakeholders in the marine-based supply chain. The weakest

information link in the supply chain can create a gap in the chain of information. Stakeholders include customers who may not have the capability to utilize E-Commerce offerings of the carrier. There may be an inability to use a common protocol and platform amongst trading partners. Many players in the transportation industry want to grow their business from within rather than rely heavily on partnerships and alliances. Some feel that this fragmented approach could be detrimental to expansion of E-Commerce in the maritime industry. Internet-based ship management systems require government sourced information such as weather charts, ice information and water levels that are not always available in real time. Economies and effectiveness on ship applications are limited by the cost of airtime and limited bandwidth. Government departments contribute to the lack of common or standard protocols by not utilizing a single standard themselves.

About 25 percent of Canadian shippers using marine transport also use E-Commerce with its marine carriers[12]. The majority of these shippers (68 percent) are satisfied with their ability to conduct transactions over the Internet with marine carriers for container traffic with bulk cargo shippers being slightly less satisfied. Slightly more than a third of marine shippers using E-Commerce saw improvements over the last 5 years.

Large non-Canadian domiciled shipping lines are offering applications that most Canadian domiciled carriers are just now developing. But Internet applications provided by both Canadian and non Canadian shipping lines that stop at Canadian ports benefit the Canadian shipper. Canadian shippers are for the most part satisfied with maritime performance with respect to using the Internet but only a small number of maritime shippers actually use the Internet with their shipping lines. Shippers for the most part are not demanding E-Commerce capabilities from the shipping industry so E-Business initiatives must often be justified by operational savings. This is most likely to occur in port and landside operations where inefficiencies arise from the lack of coordination between the many participants of the port supply chain. Canadian ports are driven

[12]**Special Tabulations from Survey of Shippers for the Canada Transportation Act Review** prepared by Richard Hinchcliff (Feb. 2001).

to use the Internet to improve port asset utilization, to provide a better turnaround for ships and to facilitate the flow of information needed by participants in the international supply chain. Ports are in the best position to collect and disseminate shared information among the port community. Larger Canadian ports such as the Port of Vancouver, are in the process of developing "community portals" to match initiatives taken by competing U.S. ports. Their success will depend on how they overcome barriers such as the diversity of large and small businesses, legacy systems, information security concerns, and traditional workforce and practices.

2. Trucking

Almost every logistics operation utilizes truck transportation. The Canadian motor carrier industry is fragmented and composed of mainly small and medium size firms with a few large carriers. These carriers compete among themselves, with U.S. carriers and with other modes. Thirty-nine Canadian trucking firms were surveyed to access the status of E-Business in this sector[13].

There is a clear consensus about the importance of E-Commerce in maintaining a competitive edge in the future and there are widespread movement and planning to adopting E-Commerce tools. Increased efficiency and improved customer satisfaction are cited as the most significant benefits of the current E-Commerce applications for trucking. The full benefits of E-Commerce have not been realized and that there is room for improvement in all areas of potential benefits. The level of E-Commerce knowledge may be somewhat lower in medium and small size trucking firms than in large carriers. This trend suggests a need to target small to medium sized firms with educational and training initiatives.

The overwhelming majority of trucking firms are using some form of E-Commerce to conduct

[13] **E-Commerce and the Canadian Trucking Industry: Needs Assessment Report** prepared for Transport Canada by IBI Consulting (draft, Jan. 2001).

business operations. This included electronic means such as the Internet, email, fax and EDI. However, email and fax account for a large portion of E-Commerce applications in the trucking industry. The explosive growth of the Web over the past five years has given virtually any firm the ability to have an online presence. Therefore, it is not surprising that 87 percent of respondents have Web presence. The most common function of the site was to advertise/promote company information. The second most common function was that of a Web portal (an Internet starting point), followed by performing business transactions. The majority of firms in trucking do not appear to be using the Web to its full potential as a more efficient method of performing business transactions.

The penetration of E-Commerce into day-to-day business process of Canadian trucking firms is still quite low. The E-Business functions that utilized E-Commerce the most are advertising, order processing, and pick-up/dispatch. Carriers use E-Commerce minimally for procurement, shipment consolidation and vehicle registration. With the exception of vehicle registration, the cause may be due to customer readiness. The lack of automation in vehicle registration suggests a need for development of better E-Government service–the utilization of the Internet by government. While EDI and the Web showed a presence in all business functions, they had yet to dominate anyone area. This highlights that even where advanced technologies have begun to be used, their full potential has not been realized. The most likely cause of the slow adoption of EDI and the Web in the Canadian trucking industry is customer readiness in utilizing these technologies, regardless of availability.

Trucking firms have a clear intention to move their E-Commerce implementation plans along quickly, despite potential barriers that may arise. Areas showing the most room for improvement using E-Commerce include order processing (including remittance and invoicing) and registration of vehicles with government agencies. Areas that appear to have less potential for improvement include advertising, materials procurement and shipment consolidation.

Many of the areas where trucking can improve their productivity through the use of the Internet

are identical to the areas of improvement sought by ITS[14]. Many of the barriers to ITS deployment are the same as for E-business deployment.

While a number of factors may be slowing the adoption rate of E-Commerce in the Canadian trucking industry, the lack of customer readiness is the greatest obstacle. Cost considerations were seen as the second largest obstacle. Security issues and limitations of technology (both the technology itself and in-house expertise/infrastructure) were also seen as significant barriers by some carriers.

Since ITS and E-Commerce are closely related, the barriers to ITS deployment across the Canadian trucking industry are also relevant. In an exhaustive review of ITS in Canada it was concluded that carriers were generally aware of the benefits that ITS technologies can bring to their operations but a number of impediments to broader deployment of ITS prevented implementation (Sabounghi et al, 1999). These barriers were:

- **$** Cost of Investment in Technology - products become outdated quickly with the advancement of the technologies. As a result, products must be sold at prices high enough to cover development costs, which may be a deterrent to some.
- **$** Knowledge of ITS - the lack of knowledge about ITS also impedes investment, and Canada currently lacks the outreach programs which might aid in increasing awareness.
- **$** Privacy Issue - trucking companies are concerned about the storage of private and confidential commercial information.
- **$** Commercial Issue - suppliers of ITS technology are concerned about protecting their intellectual property rights as well as their market share.
- **$** Resistance to Change - workers often perceive automation as a potential loss of jobs, and do not wish to change the way they do business.

[14] A complete review of ITS applications within the Canadian trucking industry can be found in Sabounghi et al, 1999

- **$** Standardization - the lack of standardization and the proprietary nature of some of the technologies and products have made it difficult, if possible, for the industry to integrate their company's systems with the in-vehicle devices. Similarly, operational policy and strategies are often developed with little consultation, resulting in individual institutions having similarly but different requirements.

The CTAR survey indicates a high level of satisfaction in the ability of the shipper to contact, to request information or service, or to purchase either TL (64 percent) or LTL (71 percent) trucking services[15]. Truck performance with respect to meeting shipper expectations of Internet readiness improved substantially from 1995, with more than 55 percent of the shipper respondents for every category of service indicating that their satisfactions with their ability to conduct transactions improve between 1995 and 2000. Almost no shippers indicated any deterioration.

There is a clear consensus about the importance of E-Commerce in maintaining a competitive edge in the trucking industry. Firms appear to be testing the waters on an individual basis, investing in areas where potential near term benefits may be achieved. The cautious approach is due to the nature of the trucking industry, which is fragmented, fiercely competitive and operating on very low margins. The trucking industry does not have the luxury of throwing billions of dollars at testing E-Commerce applications or being first to market. This is particularly true for carriers in the truckload sector which had one of the lowest Internet satisfaction ratings across modes and services. The risk to exposure is more sensitive to the trucking firms operating at very low margins. The E-Commerce revolution in the trucking industry will be slow but could accelerate as customers themselves re-tool so as to be able to take full advantage of the carriers E-Business capabilities.

3. Railroads

[15] **Special Tabulations from Survey of Shippers for the Canada Transportation Act Review** prepared by Richard Hinchcliff (Feb. 2001).

The Canadian railroad industry is highly concentrated with only two major Class I, several regional and many short line railroads. A review of the E-Business environment of the CNR, CPR and BCR along with short lines as a group adequately covers the industry[16].

Canadian railroads recognize the importance of the Internet and E-Commerce but they also recognize that the main priority of railroads is to increase reliability and speed of service. Failing to do so will either lose traffic or direct control of whom their customers are. The CNR has generally developed E-Business applications internally and is the first in the market with E-Business innovations in the rail industry. The CPR has generally adopted the best of breed applications developed by other railroads and are proponents of marketplace and industry solutions. Regional railroads such as the BCR do not have the resources to pursue all E-Commerce opportunities internally. They seek to leverage upon industry initiatives where possible or focus their efforts on a few initiatives customized to the railroad's situation. The BCR for example is developing customized E-Commerce packages for selected customers but this will cover almost 80 percent of its business. The short line railroads have the least resources or ability to implement a cohesive E-Commerce strategy and have minimal Internet capabilities. Customer integration and ease of doing business are a common theme among most of the major railroads. Customers historically view rail customer service processes as time consuming, unresponsive and inefficient. With the Internet and its ability to quickly convey information to multiple participants in the railroad or in the supply chain, railroads are able to re-engineer processes. The BCR, CNR and CPR all have re-engineered procedures and processes that support customer transactions with the railroads. The Internet-based services offered by Canadian and U.S. railroads are:

- **$** generating and transmitting equipment requests
- **$** creating and transmitting bill of lading
- **$** viewing and paying bills

[16]**E-Commerce and the Canadian Railroad Industry** prepared by Garland Chow (June 2001).

- $ the shipper's transit information versus telephoning agent or account manager transit times and ETAs
- $ customer driven tracking and tracing
- $ proactive and escalating alerts of shipment status
- $ online lane performance information

Canada's two national carriers appear to be well poised to take advantage of E-Procurement options. Both CP and CN already have implemented ERP systems and CN (along with BNSP) is considered ahead of the industry with respect to internal E-Procurement initiatives. The CPR is not developing a standalone E-Purchasing solution but utilizes the Global Rail eXchange. Both CN and CP are participating in the industry consortium, Rail Marketplace Exchange (RMP). The BCR did not feel it had the buying power to benefit from a standalone internal E-Procurement option. It is investigating the merits of joining the long anticipated but recently announced RMP. An electronic market exchange has the purpose of bringing together previously fragmented buyers and sellers into one community, through a many-to-many electronic platform. Through the web, suppliers have access to more buyers and vice versa. Railroads participate in several types of market exchanges. A railroad can be linked (via their Web sites) to vertical and horizontal market exchanges of products or as supplier participant in a transportation market exchange. At this time, sales of railroad services via market exchanges are a very small part of railroad revenues and are generally confined to spot market sales of excess capacity. Most predict that virtual markets supported by Internet technology will be a significant factor in the future but it is simply too early to tell when the future will arrive. For individual railroads, the current issue is to decide the balance in selling its service directly versus using freight exchanges and other web-enabled intermediaries.

The CTAR shipper survey responses indicate a high level of satisfaction in the ability of the shipper to contact, request information or service, or purchase either intermodal (91 percent) or

carload (81 percent) service[17]. Satisfaction is higher for intermodal, which is the more competitive arena. Railroad performance with respect to meeting shipper expectations of Internet readiness improved substantially from 1995, with more than 60 percent of the shipper respondents indicating that their satisfaction with their ability to conduct transactions improved between 1995 and 2000. Almost no shippers indicated any deterioration.

Most North American Class I railroads have ongoing initiatives to fully harness the power of the Internet. No one railroad appears to have a substantial lead on others. In fact, both the CP and CN have implemented ERP systems, something that is not apparent in the US. Based on observations of both the CNR and CPR, we conclude that the major Canadian trunklines are competitive with their US counterparts in adopting and utilizing E-Commerce. Based on the CTAR survey results, it appears that the transcontinental Canadian railroads are meeting expectations of the Canadian shipper and that Canadian railroads have been quick to adopt E-Commerce over the last five years.

Short lines are not large, not technologically sophisticated and do not have the scale and volume to adopt information technologies that require large up front investment of funds or time. The majority of short lines, if they have a web site, use it to tell potential customers who they are and that they exist. The nature of the short line operation is simplicity. They do not have the complexity in number of origin and destinations, connections, multiple product and equipment types or hubbing, which long haul, mainline railroads must manage. Electronic technology could be overkilled for many of these operations. The key area where E-Commerce technology is valuable is in car or shipment visibility. Short lines may be critical parts of the long haul networks of the Class I's. Larger mainlines may work closely with specific short lines, in some cases providing assistance. Other railroads encourage short lines to participate in the NetRedi program on Steelroad. In general, short lines are still seeking to determine the level of Internet maturity that it needs. Regional railroads like the BCR also recognize the value and challenge of

[17] **Special Tabulations from Survey of Shippers for the Canada Transportation Act Review** prepared by Richard Hinchcliff (Feb. 2001).

E-Commerce. They have strategies but also have fewer options due to size and resources. These railroads showed that they can cope, however, by participating in and leveraging industry wide exchanges or being very focused in their E-Commerce initiatives.

A number of barriers to railroads successfully adopting E-Commerce were identified. These included:

- **$** Customers and suppliers are not ready for Internet-based innovations and cannot take advantage of the railroad initiatives. One customer is the U.S. Federal government who has been slow to re-engineer customs procedures to uniformly take advantage of the Internet technology across all ports of entry.
- **$** One or more carriers in the supply chain are not Internet enabled resulting in "black holes" in the shipment information. Visibility of freight and cars across the Class I rail network has largely been solved by industry cooperation with Rail Inc. and its Steelroads program. However, car visibility is still the suspect for traffic moving to smaller railroads and short lines, who have not developed the EDI technology to transmit rail car status information effectively. The Internet presents an opportunity to remedy this gap with the low cost of entry using the Internet.
- **$** One or more supply chain participants (carriers or customers) do not see the benefit in replacing existing legacy systems, which reduces the seamlessness of transportation information across the supply chain.
- **$** Different railroads have different views on interoperatability of Internet applications. Standardized procedures and data formats increase the ability of shippers to move from one railroad to another and increase competitive pressure on individual railroads. Railroads will have to decide individually and collectively what industry wide, compatible Internet applications should be created. A reasonable criterion would be for programs that increase railroad competitiveness for intermodal traffic to receive industry wide attention and cooperation in developing common approaches and formats. Otherwise, the creation of multiple platforms may lead to inability to coordinate across

railroads to achieve the goal of seamless transport service to shippers, particularly in the intermodal market.

- Collaboration between railroads remains foreign to the culture of many railroads, particularly if it involves potentially sensitive commercial data. The railroads are still in the process of developing the trust required to share information between themselves and with customer supply chain partners.
- Many railroads are concerned with information security. The industry still needs to consider what specific data should be made accessible to partners and how the data should be used. This is complicated by the number of participants that use or generate information. Different levels of details in the information poses reconciliation problems. The security issues make access difficult with different party names and identifiers.
- The North American railroad industry has recognized the need to become Internet-enabled and are acting accordingly. Canadian shippers are for the most part satisfied with Canadian railroad performance with respect to using the Internet; impressive gains in satisfaction are observed along with very proactive programs to use the Internet on the part of the Canadian carriers. The Canadian railroads are in some cases in the forefront of Internet application and overall do not appear to be competitively disadvantaged relative to U.S. domiciled competitors. Perhaps the primary concern should be how railroads can compete with trucking. This dictates cooperation and collaboration in order to achieve the seamless and reliable transportation service that is needed to make railroads competitive. But despite all of the potential gains that the Internet may bring to the rail industry, in the end its service performance counts, irrespective of the sophistication of the Web. Railroads must have operational excellence, safe operations, a scheduled service plan that customers can depend on, resulting in on-time delivery and ability to meet customer commitments (reliability). Keeping Internet adoption focused on those objectives will keep the railroads on track in the future.

4. Modal Comparisons

UPS and FedEx were most frequently mentioned by carriers and shippers alike as forerunners in using the Internet for business gain. This is consistent with the Morgan Dean Stanley Witter shipper survey that identifies UPS and FedEx as leading edge firms in application of E-Commerce in transport. UPS and FedEx have always been technology adopters with a business model that is supported and enabled by IT. However, their models are not applicable to everyone. Both UPS and FedEx are highly integrated, asset-based firms that internalize cooperation problems, such as barriers to Internet implementation in the port and maritime sector. Both of these firms have long left paper-based transactions systems and have progressive workforces accustom to using leading technology. They also compete in higher value shipment markets that generate both the margin and the scale that are lacking in the trucking industry. Furthermore, the larger parcel and courier customers are Internet-enabled and ready to benefit from Internet innovations by these two firms. While railroads are both large and can internalize a significant amount of its operational challenges (more for bulk, less for intermodal), railroads operate a far more complex transportation network than either UPS or FedEx. It is significant that Canadian railroads perform so well relative to other modes regarding shipper satisfaction through their ability to conduct transactions over the Internet. This is confirmed by the higher percentage of railroads with Web sites and that a higher percentage of these sites have transactional functionality when compared to both trucking and ports.

The survey of Canadian shippers by the CTAR research staff (Hinchcliff, 2001) assesses their satisfaction with their ability to conduct transactions over the Internet with Canadian transportation, e.g., ease of doing business. The question therefore addressed the customer facing aspects of railroad processes that appear to the focus of carrier initiatives. Tables 13 to 15 summarize the shipper responses for four modes providing 8 types of service (e.g. LTL verus TL, etc.)

Table 13 Satisfaction with Ability to Conduct Transactions over the Internet				
	Satisfactory	Unsatisfactory	Total responses	Total responses
Rail intermodal	91%	9%	100%	33
Rail carload	81%	19%	100%	54
Truckload	64%	36%	100%	91
Less-Than-Truckload	71%	29%	100%	76
Courier/Small Parcel Express	89%	11%	100%	72
Containerized cargo	68%	32%	100%	53
Other general cargo	79%	21%	100%	19
Bulk cargo	57%	43%	100%	14

Source: Hinchcliff (2001)

Table 14 Ability to Conduct Transactions over the Internet Comparison Between 2000 and 1995						
	Major Improvement	Minor Improvement	No Change	Minor Deterioration	Major Deterioration	
Rail intermodal	28%	38%	34%	0%	0%	100%
Rail carload	28%	35%	35%	2%	0%	100%
Truckload	27%	30%	42%	1%	0%	100%
Less-Than-Truckload	33%	27%	36%	3%	1%	100%
Courier/Small Parcel Express	49%	25%	25%	2%	0%	100%
Containerized cargo	15%	24%	59%	2%	0%	100%
Other general cargo	6%	25%	69%	0%	0%	100%
Bulk cargo	7%	27%	67%	0%	0%	100%
Source: Hinchcliff, 2001						

Table 15 Ability to Conduct Transactions over the Internet Comparison Between 2000 and 1995			
	Better	Same	Worse
Rail intermodal	66%	34%	0%
Rail carload	63%	35%	2%
Truckload	57%	42%	1%
Less-Than-Truckload	60%	36%	4%
Courier/Small Parcel Express	74%	25%	2%
Containerized cargo	39%	59%	2%
Other general cargo	31%	69%	0%
Bulk cargo	33%	67%	0%
Source: Hinchcliff, 2001			

For rail, the survey responses indicate a high level of satisfaction in the ability of the shipper to contact, request information or service, or purchase either intermodal (91%) or carload (81%) service. Satisfaction is higher for intermodal which is the more competitive arena. Railroad performance with respect to meeting shipper expectations of Internet readiness improved substantially from 1995 more than 60% of the shipper respondents indicating that their satisfactions with their ability to conduct transactions improve between 1995 and 2000. Almost no shippers indicated any deterioration. This is expected since widespread B2B Internet applications were only beginning in the mid 1990s for most industries. It should be noted however, only 33 intermodal and 54 carload users, out of 74 total rail users responded. This indicates that at the very least, 73% of the rail shippers (54/74) utilize the Internet in dealing with the Canadian railroads.

For trucking and courier/small parcel express, the survey responses indicate a high level of satisfaction in the ability of the shipper to contact, request information or service, or purchase either TL (64%), LTL (81%) or courier (89%) service. Interestingly, these percentages are not superior to rail satisfaction percentages. Satisfaction is higher for courier/parcels where integrated carriers such as UPS and FedEx compete. Truck and courier performance with respect to meeting shipper expectations of Internet readiness improved substantially from 1995 with more than 55% of the shipper respondents for every category of service indicating that their

satisfactions with their ability to conduct transactions improve between 1995 and 2000. As with rail, almost no shippers indicated any deterioration. This is expected since widespread B2B Internet applications were only beginning in the mid 1990s for most industries. It should be noted that a substantially larger number of shippers use the Internet to transact with truck and couriers than with the rails. There were 91 TL, 76 LTL and 72 parcel respondents versus only 33 intermodal and 54 carload users out of the total response sample of 179.

The maritime service responses also indicate a high level of satisfaction in the ability of the shipper to contact, request information or service, or purchase for container (68%) and Other General Cargo (79%). Internet service for Bulk cargo lagged behind all shipment categories at 57%, though it has the fewer shippers using this service. Maritime performance with respect to meeting shipper expectations of Internet readiness improved from 1995 with more than 31% of the shipper respondents for every category of marine service indicating that their satisfactions with their ability to conduct transactions improve between 1995 and 2000. However this progress is substantially less than was achieved in the rail, truck and parcel segments. As with rail and truck, almost no shippers indicated any deterioration. It should be noted that a substantially smaller number of shippers use the Internet to transact with maritime than with either trucks or couriers but usage is about equal with the rails. There were 53 containerized cargo respondents, 19 other general cargo and only 14 bulk cargo respondents of the total shipper sample of 179.

Summary

The transportation industry is using e business to:

- **$** improve internal operations,
- **$** streamline and leverage purchasing,
- **$** manage customer relationships and transactions more effectively,
- **$** provide new services and additional quality to the transport product and,
- **$** market their services through new online channels.

The transportation industry has recognized the need to become Internet enabled and are acting accordingly. Canadian shippers are for the most part satisfied with Canadian the performance of all the trucking, rail and marine modes of transport with respect to using the Internet and impressive gains in satisfaction are observed along with very proactive programs to use the Internet on the part of the Canadian carriers.

The evidence indicates there is considerable potential for internal efficiency improvement through the utilization of e business technologies and strategies. These have generally provided the impetus for e business initiatives in many transport firms. The market has demanded easier interfaces with carriers and value-added services including shipment visibility and transaction capabilities. The market has stated that they want collaborative capabilities from carriers but carriers have generally developed this capability slowly and incrementally due to the lack of response from customers. This is most evident in the use of electronic market exchanges by shippers to purchase transportation services. The statistics indicate while there is considerable potential for transport firms to use freight and transport market exchanges, transportation market exchanges are in their infancy. At this time on line sales of transport services is a very small part of revenues of any transport segment and generally confined to spot market sales of excess capacity. This is consistent with most B2B markets. A major exception appears to be exchanges which are primarily collaborative in nature and seek productivity gains through this collaboration. The leading example is the NISTEVO exchange involving nearly all of the major grocery product manufacturers. However this exchange is a private exchange between shippers and carriers that have already developed a close relationship over the years and had existing transportation contracts.

Most predict that virtual markets supported by Internet technology will be a significant factor in the future but it is simply to early to tell when the future will arrive. For individual transportation firms, this is an issue of deciding the balance in selling its service directly versus using freight exchanges and other web enabled intermediaries. For government policy, the direction will have a great impact on the structure of the industry and policies toward mergers. Carriers in general realize that they must have operational excellence, safe operations and reliable service that the

customers can depend on. Keeping Internet adoption focused on these objectives will the trucking firm on the road, the railroad on track and the shipping line above water.

V. Government Policy, E Business and Transportation

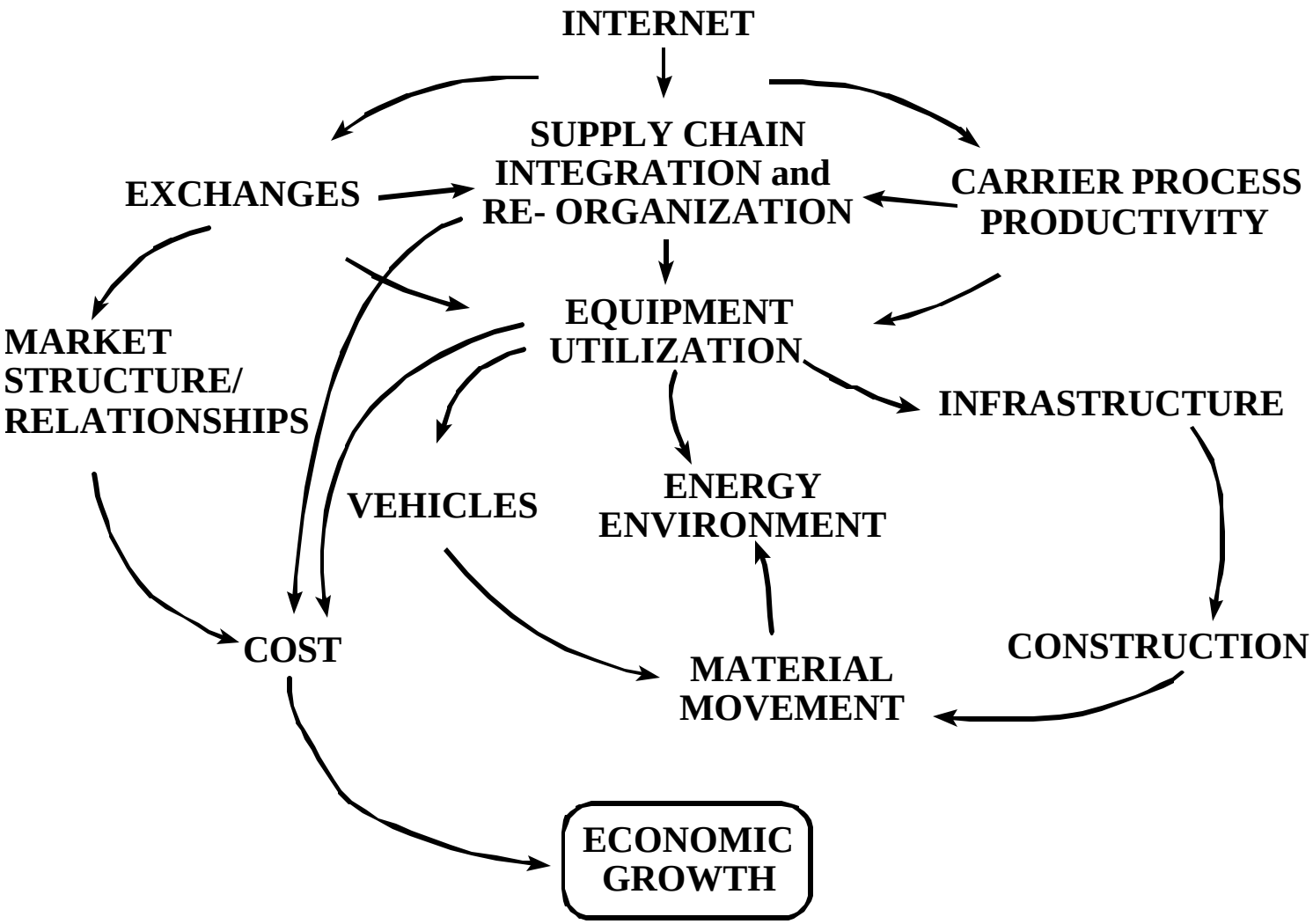
1. Government's Stake in the E-Business Impact on Transportation

Government has an important interest in E-Business and transportation. As illustrated in Figure 1, the adoption and implementation of E-Business by shippers and carriers ultimately have an impact on the market structure of the transport industry, on energy, on the environment, on safety and on the economic development.

Government is responsible for basic transport infrastructure that must be able to adapt to the requirements of a rapidly changing and growing economy. Transportation systems will have to continuously adapt and seek to avoid creating transportation-based bottlenecks to the growth of business and E-Commerce. Government can encourage a transportation system that will promote, rather than constrain, the growth of E-Commerce. At the same time, government must understand and anticipate changes in freight demand, modal shifts, distribution and location patterns to avoid or mitigate the negative effects to society of these changes to transportation patterns. There is a need for research that will help determine policy and investment decisions at all levels of government including at the global scale.

Figure 6 illustrates how the Internet can ultimately impact safety, the environment, energy and economic growth through improved equipment utilization. Section II described how the Internet is enabling firms to re-engineer their logistical processes and operate them more effectively.

Figure 6


INTERNET
SUPPLY CHAIN INTEGRATION and RE- ORGANIZATION
EXCHANGES
CARRIER PROCESS PRODUCTIVITY
EQUIPMENT UTILIZATION
MARKET STRUCTURE/ RELATIONSHIPS
INFRASTRUCTURE
VEHICLES
ENERGY ENVIRONMENT
COST
CONSTRUCTION
MATERIAL MOVEMENT
ECONOMIC GROWTH

Section III demonstrated how the Internet can be used by transportation companies to improve their operations. Section III-4 described how Internet-based market exchanges are used to connect buyers and sellers in a transport marketplace. In each of these areas the Internet enabled improved planning, coordination and collaboration, which result in improved load factors, larger loads, reduced empty backhaul, less circuitry and the elimination of non-value added vehicle trips. This increased vehicle utilization reduces the number of trips and vehicle kilometers traveled, energy used, air pollutants emitted and direct operating cost. Ultimately fewer vehicles and less infrastructure is needed, further reducing energy and environmental impacts by reducing the need to build additional vehicles or infrastructure that require raw material transportation.

Improved vehicle productivity is a direct reduction in the cost of producing and delivering a product to the end consumer. The Internet also impacts cost by providing transportation firms with the means to improve their service and costs to shippers who in turn re-organize their logistical processes to lower costs. There is substantial evidence showing that this indirect benefit is significant and provides a rationale for encouraging transport firms to adopt new information technology[18]. Finally, market exchanges reduce cost by facilitating competition.

All of these cost reductions encourage economic growth in the industries served by transport. If transport innovation is made in the U.S. and not in Canada, than intra U.S. movement is more efficient leading to migration of industry and economic activity to U.S. from Canada. If government believes that information technology such as electronic commerce are catalysts for economic growth, government must actively work to increase digital commerce in core sectors such as transport because of both direct and indirect cost impacts described above.

Government also has an interest in the viability and competitiveness of basic industries such as transport. Canadian domiciled transport firms (including ports) compete with U.S. domiciled transport firms in the transborder and international markets. Healthy competition between

[18]HLB Decision Economics Inc. (April 2001)

carriers ensures long-run allocative and technical efficiency in the supply of transport to Canadian shippers.

For example, the Internet makes virtual and market-based organization more feasible. The example of Cisco outsourcing many aspects of its business is an example of how a manufacturing firm can manage a networked production system. Can transport services be provided without asset ownership? One view is that non-asset logistics service providers are the ideal virtual competitors, as they do not need to own hard assets. Their value proposition is their ability to use the Internet and information technology to plan and co-ordinate movement and track goods across all modes, globally. These virtual carriers can leverage the assets of all transportation companies, and the value that they add is information management. Another view is that asset ownership or control is critical. The rationale is that the needs for coordination will involve sufficiently complicated interactions among the firms that alliances will only provide partial solutions. Business acquisitions are required in order to undertake the substantial changes that Internet based business will require. Major transport firms such as UPS, Federal Express, CNF Transportation, USFreightways and CRST International have developed portfolios of asset based transportation management services through mergers and acquisition. Mergers and acquisitions in the railroad industry produced massive rail enterprises that are comparable. The Internet enables these firms to effectively manage and coordinate these multiple resources in order to provide one-stop shopping of multiple services. Both forms of market organization bring forth questions of how to regulate firms with respect to competition policy: what are the boundaries of a market and how transport industries are defined.

2. Barriers to E-Business Adoption in the Canadian Transport Sector

Specific barriers to E-Business adoption in the Canadian marine, truck and rail sectors were identified in Section IV. Barriers common to more than one of these sectors include:

> Costs can prevent any firm from adopting Internet technology more extensively but it is especially true in the marine and trucking sectors. It is easy to identify costs but harder to

estimate benefits, making the return on these information technology investments difficult to quantify. The low margins and size of many of the participants in the marine and truck industries make it difficult to expend limited resources on risky projects. Resource constraints were also constraining in short lines and regional railroads.

Many marine and rail industry participants already have EDI and other legacy information systems in place, which reduce the commercial benefits of adopting more accessible Internet-based information systems. Many of the EDI applications are with the carrier's largest customers so the benefits must come from new customers not currently linked by EDI.

Much of the uncertainty or lack of benefits arises from the lack of customer readiness to utilize Internet-based innovations offered carriers. This is the dominant barrier to trucking firms but still important for marine and rail.

Lack of participation by all stakeholders in the supply chain is also an issue in the rail and marine sectors. This is a natural barrier given that multiple firms are typically involved in the transportation of goods in each of these modes. Railroads must work with other railroads, intermodal truck and customs. Ocean movements require the cooperation of shipping lines, ports, truck, forwarders, customs and rail. The weakest link can create a gap in the chain of information. Slow adoption by other members in the supply chain reduce the benefits of adopting quickly.

Interoperability between logistics providers is a problem in the marine and rail sectors. The creation of multiple information platforms and lack of common protocols prevent carriers from sharing information seamlessly. It is natural for carriers, particularly in the rail and marine markets, to develop carrier specific solutions that are unique to that carrier. This may make it harder for the carrier's customers to move to a competitor but at the same time reduces the ability to seamlessly transfer information with other carriers.

In contrast, the lack of interoperability also arises from the demands of shippers for specific formats and methods of communication. The cost of complying with a different format for each different shipper limits doing this for a few high volume customers. This is a problem for all modes and for trucking in particular.

Inadequate technical skills or training were barriers among the smaller firms in the marine industry and in the trucking which generally is composed of smaller firms as well.

Security and access to commercially sensitive information is also a universal concern across all three modes, especially when the information is shared with potential competitors.

Finally, culture and adherence to traditional practices, both within the carrier and with its partners, are key thresholds to overcome when proposing or implementing new technology may change how the business is done. Internally, there is often resistance to any form of automation; externally, collaboration is often a concept foreign to business. Changing the mindset is critical in successful implementation of Internet-based innovation.

3. Potential Government Initiatives

Government can help the private sector to overcome many of the internal and industry barriers to E-Business in the maritime, truck and rail industries.

Information Provider

The government can enhance the awareness of the benefits of E-Business through education and information programs. This is particularly useful in the truck and maritime sectors where there is a diversity of participants in the supply chain and collaboration between different participants is essential. Some of the challenges to implementing and using E-Commerce are lack of knowledge about what it is and lack of appreciation of the benefits. Government's role, in part,

could thus be to provide the information required by industry to be able to make informed decisions about the appropriate role of E-Commerce in their business. Transport Canada is already supporting an assessment and information package for the trucking industry and it is recommended that a similar program be instituted for the maritime sector. With respect to market exchanges, the electronic transportation marketplace is constantly changing and it is difficult for smaller carriers to be aware of, much less understand the long run implications of this change. While all carriers need not be Web enabled, the future growth in B2B and B2C product exchanges suggests that a larger percentage of carriers will have to be Web enabled in order to compete in the future.

Support Education

Education and skills training required for E-Business applications should be given to both technical personnel who implement E-Business applications and to the web-enabled workforce for utilizing the application. One of the challenges being faced by all industries is the availability of trained technical staff to implement the technology behind E-Commerce. Provision of funding to develop and expand technology programs could provide a stimulus for Canadian industry to keep up with or lead the world in the adoption of E-Commerce in transport and other sectors. At the same time, web-enabled workforce and industry will have a significant competitive advantage by rapidly accepting and being able to use new technology at the operating level. The government could promote and support common licensing or standardization of computer literacy and technological skills that set the goals of such training program. The government should also consider tax credits or breaks for individuals achieving a computer skills literacy certificate or retraining bonuses when skills are upgraded for employees. These human resource initiatives are rightly within Human Resources Development Canada since they are not industry specific. However, transport agencies should consider specialized training initiatives that are customized to specific transport segments.

Catalyst and Facilitator

Equipment utilization could be improved by the use of freight exchanges to aggregate freight. Both the auction exchanges for spot markets or collaborative exchanges for contract markets

should be encouraged. This would be most appropriate for the trucking market as well as the intermodal market where empty containers or trailers could be better utilized. An assessment should be made about the extent to which freight exchanges exist in Canadian trucking markerts and the degree to which they are improving vehicle utilization. An effective freight exchange may require an industry effort that brings together shippers and carriers. The Government of Canada in its role as the facilitator of transportation and trade could serve as a focal point to bring together the stakeholders and coordinate the development of an industry strategy on E-Commerce in this area. This is less likely to be needed in the rail industry but is much needed in the maritime and truck sectors, which are much more fragmented and composed of a mix of small and large companies. The government should at least initiate the process because it can approach this initiative as a neutral party who can bring the shippers into the process as well. This is critical since customer utilization of E-Commerce programs is key to the success of E-Commerce. The government of Canada representatives should include Industry Canada and Transport Canada.

Several barriers to the adoption of the Internet have to do with the lack of cooperation across members of the transportation industry. This would be the case in the rail sector where shipment visibility, service times and reliability depends on the ability of all railroads participating in a movement to be online. Seamless transportation has always been the goal of railroads and participants in intermodal movement. This is particularly a problem at port interfaces where rail, ship, forwarders, trucking, customs and terminal operators all contribute to the movement of goods. The greater the number of disparate participants, the more obstacles there are to cooperation. Ironically, the Internet is the tool that can facilitate effective coordination between transport partners. Therefore, it is the recommendation of this report that the first step for the Federal government would be to define and begin its role as a focal point in order to bring together the stakeholders as well as to coordinate the development of an industry strategy on E-Commerce.

Government as a Role Model

Government can facilitate the growth and acceptance of E-Commerce by developing an E-Government as an example for the industry. Federal regulatory functions such as vehicle registration, human relations compliance and border clearance are attractive benefits to firms wishing to adopt E-Commerce. Up until now, E-Government in the trucking industry has been left in the hands of provincial governments, and as such is subject to a diverse range in policies and resources which impedes the effectiveness and penetration of such efforts on a nation wide scale. The federal government may be able to provide more effective leadership in enabling E-Government in this area as it has done so with E-Filing of taxes. Part of this leadership would be to coordinate government activities using E-Business. Transport Canada, Canada Customs and Revenue Agency, Industry Canada and other government agencies need to get together and work together on an E-Commerce strategy that meets their respective needs and is available to the users of the system through one window. Government can encourage standardization and common protocols by adopting common standards across government departments.

Other

Other government initiatives identified by respondents to this and related research were:

> The government should ensure that there is real-time access to government produced information such as weather charts, ice information and water levels so that advanced ship management systems can be used effectively.
>
> Ensure that bandwidth is available for maritime use at a reasonable cost.
>
> Provide tax incentives for capital invested in E-Business initiatives.

Industry Role

Industry should not wait for government to begin the process. Industry should increase communication and coordination with supply chain partners to develop an integrated strategy for E-Commerce. Carriers should consider how proactive provision of shipment status/location information via the Internet, for example, can significantly reduce the volume of customer

queries and complaints, reducing the number of staff required to deal with this matter. Carriers should seriously consider the benefits of E-Commerce and make changes to business models and develop workforce that are enabled by E-Commerce. If industry is to adopt an E-Commerce strategy, knowledge of what this is all about is critical. Employees must have the knowledge and training to be able to function in a changed business model. Finally, the security of commercially sensitive data that is shared is a concern expressed frequently across all modes. Industry associations should take the lead in this area.

Ultimately, the customers provide incentives for carriers to deploy Internet technology and implement applications. Carriers have little incentive to provide the capacities that customers say they want but do not use. There is every indication that there is a growing number of shippers who use or want to use the Internet in their relationship with their transportation service providers, even if they are not capable at the present to take advantage of all of the capabilities currently offered.

Concluding Remark

This paper identified a number of barriers to implementation of the Internet in the transport industry as well a number of recommendations to reduce these barriers. Since there is every expectation that more and more B2B and B2C transactions will become Internet based in the future, there are every expectation that leading transportation firms will themselves use the Internet to manage these transactions and supply transportation efficiently. Ultimately every carrier must consider its specific situation and how this impacts the potential rate of return on an investment in e business. A trucking company with significant empty miles could benefit substantially by joining a transportation marketplace that offers load matching services. A railroad that operates nationwide would benefit from decentralizing human resource activity via the Web. One role of government is to ensure that private enterprise is not impeded by unnecessary government rules and regulations. Our examination of the barriers to increased Internet use in the transport sector indicates that such impedances are scarce.

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APPENDIX A

A Framework for Research on E-Business and Transportation

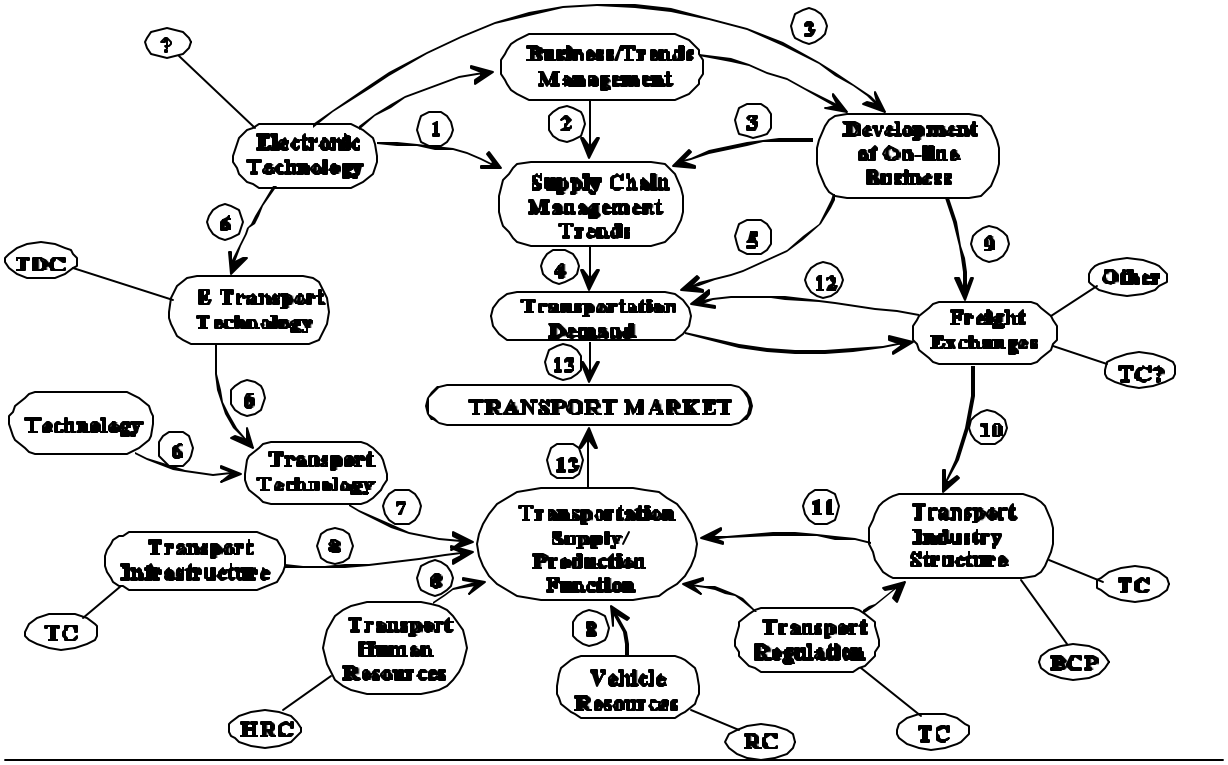
The ultimate interest of transport public policy is to enable and support the efficient and effective supply of transport to industry and consumers. Efficient transport involves low cost, high productivity, efficient allocation of resources, and sustainability in the production and sale of transport services. Effectiveness is the production of the transport service that is needed by shippers in a safe manner.

Electronic commerce impacts the demand for transport, the means by which transport is produced and the means of exchanging services. The interrelationship between these impacts, the potential influence of government policy and ultimate consequences for transport market structure are the pillars of the research framework illustrated in Figure A1. This framework defines the relationships between technology, business, supply chain and transport trends, and government policies impacting transport. The significant linkages (indicated by Lxx) are:

E Business Impact on Demand Side:

- L1 - Electronic technology and specifically e business technology has enabled logistics and supply chain managers to integrate and collaborate.
- L2 - Logistics and supply chain processes have changed under pressure to reduce inventories. Management strategies such as outsourcing, alliances and collaboration have also enabled integration and collaboration.
- L3 - E business technology has enabled the creation of on line businesses and that has influenced supply chain management practices or created new transport demands.
- L4 - New supply chain management practices place new requirements on transportation firms for levels and types of service.

Figure A1 A Framework for Research on E-Business and Transportation



- L5 - New on line business have different logistical requirements and therefore different transportation requirements.

E Business Impact on Supply Side:

- L6 - E business technology can be adopted by transport firms or adapted for use by transport firms and used in combination with other technologies. The type of technology and its availability in Canada would influence the ability of Canadian transport firms to adopt e business technologies.
- L7 - The rate of adoption can affect the efficiency and effectiveness of Canadian transport providers.
- L 8 - Technology is however only one of many inputs used in the transportation production process. In addition to technology, the transport infrastructure, human resources and vehicle resources are inputs into the production or supply function. There may be synergistic effects where development, adoption or improvement in more than one area is required to attain the full benefits of new technology.

A transport firm does not adopt technology in isolation from the utilization of other inputs. The simplest relationship is the capital (technology is a capital input) to labor ratio. Other interdependencies could be how the transport network and technology interact.

E Business Impact on Market Structure:

- L9 - Transport or freight exchanges are a specific type of on line business that has arisen because of e business technology.
- L10 - Freight exchanges are creating new industry structures in transport by potentially changing the relationships between shippers and logistics services providers such as transport firms, creating new forms of logistics service providers,

changing the relative efficiency of large versus small carriers, reducing the need for assets, and affecting the value proposition of Third Party Logistics firms.

- L11 - The supply of transport is impacted by the industry structure.
- L12 - Freight exchanges directly impact transport demand, for example expanding markets for suppliers of transport services or providing more information for shippers.
- L13 - The market structure of transport is both the supply and the demand for transport services impacted by e business. Ultimately we are interested in the efficiency and effectiveness of the suppliers in this market.

Government policies have potential impacts in all of these potential E business impacts. The small ovals in Figure A1 identify administrative arms of the Federal government which potentially influence the intensity and nature of the E business impact. Government agencies with potential impact include: Transport Canada (TC), the Bureau of Competition Policy (BCP), Revenue Canada (RC), Human Resources Canada (HRC) and the Transportation Development Centre (TDC).

Source: Garland Chow (2000) “A Framework for Research on E-Business and Transportation” Centre for Transportation Studies, Supply Chain Research Program, mimeo

APPENDIX B
An Integrated Program of Research on E Business and Its Impact on Canadian Transportation

The Canada Transportation Act Review panel has commissioned an integrated program of research to investigate E Business issues relevant to Canadian transport. The research program was coordinated with studies conducted or supported by other agencies as well as the research conducted by the CTAR staff. The major components of this research program are:

E-Commerce and the Canadian Trucking Industry: Needs Assessment Report. This report was prepared for Transport Canada by IBI Consulting to produce a toolkit and information package to assist the trucking industry in developing and implementing e-commerce applications to retain the competitive edge in the trucking market. To accomplish this objective, the study evaluated the current strengths in the industry by identifying best practices in e-commerce, and also determining barriers that may be preventing its adoption.

E-Commerce and Canadian Ports. This report was prepared by John McDonald and Sylvie Robitaille of the Canada Transportation Act Review staff to identify best practices in e-commerce in the maritime sector, and also determining barriers that may be preventing its adoption. The study evaluated whether Canadian ports were at a disadvantage with US-based competitors with respect to E-Commerce capabilities.

Information Technology & E-Commerce in the Canadian Maritime Industry. This report was prepared by Chris Wright (Mariport) for Canada Transportation Act Review to identify whether Canadian maritime carriers were up to date on their information technologies relative to global shipping competitors and what barriers existed in the adoption of new technologies.

Survey on Use of Electronic Commerce Technologies at Intermodal Transfer Points. This study was prepared by Paul Levelton, John Cowan and Scott Sears (KPMG) for Transport Canada to identify the use of electronic technologies by participants in the international intermodal supply chain. The study also identified barriers to the utilization of these technologies.

E-Commerce and the Canadian Railroad Industry. This report was prepared by Professor Garland Chow for the Canada Transportation Act Review to identify best practices in e-commerce in the railroad sector, and also determine barriers that may be preventing its adoption. The study evaluated whether Canadian railroads were at a disadvantage with US-based competitors with respect to E-Commerce capabilities.

Special Tabulations from Survey of Shippers for the Canada Transportation Act Review Panel. These tabulations were prepared by Richard Hinchcliff of the Canada Transportation Act Review staff. E Business related questions were added to the CTAR shipper survey which collected primary information on the usage and performance of Canadian transportation with respect to E-Commerce.

Market Exchanges and Their Impact on the Transport Industry. This report was prepared by Professor Garland Chow Canada for the Transportation Act Review. The study examined a specific phenomenon enabled by the Internet, the use of market exchange or electronic marketplaces. The focus of this study is on transportation as a supplier in such exchanges or marketplaces. Freight exchanges are creating new industry structures in transport by potentially changing the relationships between shippers and logistics services providers such as transport firms, creating new forms of logistics service providers, changing the relative efficiency of large versus small carriers, reducing the need for assets, and affecting the value of Third Party Logistics firms. This coverage of this study was multi modal and implications for Canadian carrier participation are highlighted.

Adoption and Utilization of E Business in the Transport Sector: Overview of the Transport Industry. This report was prepared by Professor Garland Chow for the Canada Transportation Act Review panel. The report consolidates the findings of the rail, marine and truck studies along with original contributions to provide a comprehensive overview of how the transport industries can and have utilized e business technology.

Relationship between e-business, Advanced Transportation Logistics, and Canadian Industrial Performance. This report was prepared **by** HLB Decision Economics Inc. for the Canada Transportation Act Review panel. The report explores the relationship between e-business,
advanced transportation logistics and growth in industrial productivity. This provides a framework for measuring the impact of transportation improvements on the economy, due to the adoption of information technology.

E-Business Impact on Canadian Transportation. This report was prepared by Professor Garland Chow for the Canada Transportation Act Review panel. This study provides an overview and summarization of the complete research program, findings and conclusions. The study presents original research on the E Business phenomenon and examines how E Business affects the demand for transportation (e.g. dematerializes physical products, enables new supply chain management practices and creates new distribution patterns through on line selling). All of these will change the nature of the transport services required with respect to what, how much, when and where. The study consolidates the findings of other studies on the use of E Business by various modes, the potential impact of electronic transportation marketplaces and how transportation productivity improvement might affect economic development. This study identifies barriers to E business adoption in the Canadian transportation industry and suggests strategies for government. The coverage of this study is multi modal and identifies scenarios for infrastructure requirements and modal capabilities required in the new e business environment.