

Article submitted on 2008. 11. 30

Examination completed on 2008. 12. 09

Publication accepted on 2008. 12. 24

## The Effects of Electronic Commerce on the Freight Transport Industry

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### I. Introduction

It is obvious that the e-commerce is transforming the way of doing business. Electronic commerce enables businesses to sell their products and services directly to each individual consumer without establishing a physical point of sale. A number of e-commerce companies have spent a tremendous amount of time and energy developing the opportunity to make transactions happen on the web. While some products, for example, newspaper, airline ticket and music, can be delivered digitally to households, most products purchased online

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ultimately must be transported in the physical world. In the e-commerce environment, an efficient and reliable delivery system is essential for gaining customer loyalty and thus obtaining profitability. In other words, structural changes originated from e-commerce would in turn affect the physical flow of goods. Therefore, performance of downstream material flow should not be underestimated when considering the impact of e-commerce. Information Communication Technology or e-commerce can affect directly as a means to reengineer and increase efficiency or indirectly under an influence of changes in other supply chain functions. It is also true that the negative effects are underestimated despite the fact that the impact could be positive or negative. The purpose of this study is to examine to what extent and how, positively or negatively, e-commerce will influence the freight transport industry.

## II. The Changing Logistics Environments under the E-Marketplace

### 1. Development of E-commerce

Until now the growth of e-commerce has been remarkable since e-commerce has become popular. It is reported that this trend will become more faster than expected (OECD, 1999). According to the survey conducted by OECD (2003), e-commerce in 1995-97 is the equivalent of 37% of US mail order catalogue shopping, 3% of US purchases using credit/debit cards, and 0.5% of the retail sales of the seven OECD economies. Moreover, it will reach the equivalent of 15% of the total retail sales of seven OECD countries until 2005.

&lt;Table 1&gt; Estimates of e-commerce sales compared to various benchmarks

	E-commerce estimates (US\$ billion)	US Catalogue sales (percentage)	US credit card purchases (percentage)	Direct marketing (percentage)	OECD-7 total retail sales (percentage)
1996/97	26	37	3	2	0.5
2001/02	330	309	24	18	5
2003/05	1000	780	54	42	15
Source: OECD (2005)					

## 2. Changing Transaction Pattern by E-commerce

In general, the possibility of very rapid exchange of information not only between people but also directly between technical systems via electronic communication networks such as the internet has contributed to increasing market efficiencies. In particular, the emergence of global marketplaces driven by e-commerce has changed business processes towards economic efficiencies. In fact, there are some driving forces for which companies are trying to participate in global marketplace.

### 1) E-market vs Traditional Market

According to the Wang<sup>1)</sup>, e-markets differ from traditional markets in three dimensions which include technology infrastructure, channel integration, and information intensity.

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1) F. Wang, "E-Tailing: An analysis of web impacts on the retail market", *Journal of Business Strategies*, Vol. 19, Issue. 1., 2002, p. 75.

&lt;Table 2&gt; A Comparison of Web and Traditional Markets

	E-market	Traditional market
Technology	is a determinant for market development and business strategies	serve as a supportive tool
Channels	integrated	separate
Market information	intensive	limited

Source: Wang, 2002

## 2) Global Reach

E-commerce gives any companies opportunity for global reach, the ability to extend reach customers anywhere there is a internet connection, and at much lower cost. It is reported that for companies selling exclusively on line, international revenues amount to one-third of total revenues.<sup>2)</sup>

## 3) Cost Benefits

Such operating costs as rent and depreciation, store personnel utilities and other expenses of a physical store can be reduced significantly in e-marketplaces. In particular, it can approach zero for digital products.<sup>3)</sup> E-procurements can dramatically reduce errors, and thereby speeding the process compared to traditional purchasing ordering which is a relatively costly, labour intensive paper based process. What is more e-procurement makes it possible to reduce inventory cost by *Build-To-Order* system.

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2) OECD (1999), *The Economic and Social Impact of Electronic Commerce: Preliminary Findings and Research Agenda*.

3) N. Dholakia *et al.*, "Electronic Commerce and the Transformation of Marketing" in *Global E-Commerce and Online TMarketing* edited by Dholakia N. *et al.*, Quorum Books, 2002, pp. 43-60

#### 4) Enabling Direct Selling

E-commerce allows companies to direct access to customers which provide companies with a competitive advantage. Sellers can understand their markets better, and consumers gain greater information about the product through direct connection to the manufacturer.<sup>4)</sup> Direct market access appeals in particular to newcomers that starts with e-commerce without physical stores.

#### 5) More Effective and Efficient Customer Service

As society become more affluent, the demand for customized products will increase. E-commerce can facilitate the use of customization which offers its customers the opportunity to configure its product or service to customer's specification because customer can self configure the desired product online. Manufacturers can provide customized products by utilizing e-commerce technology to satisfy customer needs.

Furthermore, e-commerce enables companies to interact more closely with customers. Customer Relationship Management(CRM) systems can automatically record detailed consumer activities and can be used to build consumer profiles from various tangible and intangible activities. This allows companies to better understand consumers, and thereby provide personalized service.

## 2. Evolving Logistics System under E-Marketplace

E-marketplaces lower the cost of logistics, and promote just-in-time deliveries, and reduce inventories by improving information sharing between buyers and sellers. This has enabled Cisco and its suppliers not only to reduce manufacturing cycle times and inventory but also

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4) Turban E, *et al.*, *Electronic Commerce 2004*, Pearson Education International, 2004, p. 87

to build better products.<sup>5)</sup>

E-logistics which refers to the logistics of e-commerce system has some different features compared to traditional logistics as shown in the table below. The main difference is that it involves small shipments of parcels sent to many customer's homes while the traditional one involves movement of large volume of materials to a few destination.<sup>6)</sup>

<Table 3> Traditional vs E-Logistics

Characteristic	Traditional Logistics	E-Logistics
Type	Bulk, large volume	Small, parcel
Destinations	Few, concentrated in one area	Large No, highly dispersed
Demand type	Push	Pull
Value of shipment	Very large, usually more than \$1,000	Very small, frequently less than \$100
Nature of demand	Stable, consistent	Seasonable, fragmented
Customers	Business partners (B2B), usually regular (B2C), not many	Usually unknown B2C, many
Inventory order flow	Usually unidirectional	Usually bidirectional
Accountability	One link	Through the entire supply chain
Transporter	Frequently the company, sometimes outsourced	Usually outsourced, sometimes the company
Warehouse	Common	Only very large shippers or moving companies

Source: Turban (2004)

5) Corbitt T, "Business-to-Business Electronic Commerce", *Management Services*, Vol. 46, Issue. 1, 2002, p. 33.

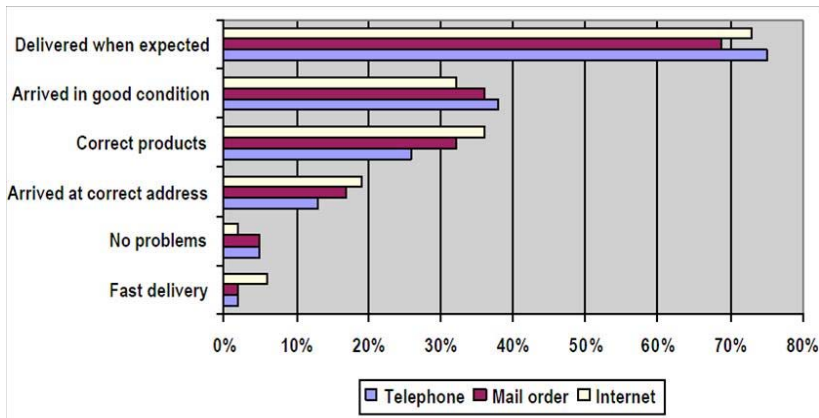
6) E. Turban, *et al.*, *Electronic Commerce 2004*, Pearson Education International, 2004, p. 535.

### III. Implications of E-commerce on Freight Transport

#### 1. Interrelationship between E-commerce and Freight Transport Service

An efficient and reliable delivery system is essential for gaining customer royalty online and consequently obtaining profitability.<sup>7)</sup> Therefore it may fairly be said that the success of e-commerce revolution depends on the issue of order fulfillment. As can be seen from the Chart 1 below, the critical issues are timeliness and the quality of the products when they arrive. However, on the other hand, it has been pointed out that existing supply chain systems were not designed for e-retailing.<sup>8)</sup> Therefore, physical process will need to be adapted to fulfill these customer's demands.

<Chart 1> Reasons for delivery satisfaction



Source: eLo Logistics of electronic business, 2002

7) Minyoung Park and Amelia Regan, *Issues in emerging home delivery operations*, Available at [www.uctc.net/papers/](http://www.uctc.net/papers/)[19<sup>th</sup> Jan, 2005], p. 2.

8) UNCTAD, *Building Confidence: Electronic Commerce and Development*, UNCTAD/SDTE/MISC.11, 2000, p. 50.

Many aspects of business practices such as globalization of trade, small batch, customized production and just-in-time distribution, which has affected by e-commerce, may bring about a number of changes in the volume and patterns of goods movements. All of these factors indicate the increased importance of effective transportation, logistics, and related technology tools.

Up to now, there is yet little empirical data on the transport impact of e-commerce. However, recent survey conducted by Morgan and Stanley has shown that increasing utilization of e-commerce by large retailers and manufactures in North America will change their freight patterns and subsequently.<sup>9)</sup> Under the situations, it might be possible to presume the implications of e-commerce on freight transport as follows

## 2. Potential Implications of E-commerce on Freight Transport Industry

### 1) Better Planning for Freight Transport

As time becomes increasingly important to manage, the importance of delivering on time to integrate with other supply chain processes, becomes greater. The increased visibility through entire logistics system supported by ICT should, over time, not only enable companies to better plan but also the demand from each participant in the chain can be more accurately forecasted, which allows having a higher degree of load utilization in the transportation vehicles<sup>10)</sup> thereby reducing the need for most emergency transportation services.<sup>11)</sup>

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9) Anonymous, Internet use will change freight patterns, *Transportation & Distribution*, Vol. 42. issue 1., 2001, p. 38

10) Jnsson Gunilla *et al.*, Transport and environment in connection with e-commerce in the *E-commerce and logistical consequence*, Hultkrants Ola and Lumsden Kenth ed., Department of Transport and Logistics at Chalmers University of Technology, 2000, pp. 51–52.

11) Anonymous, *op cit.*, p. 40.



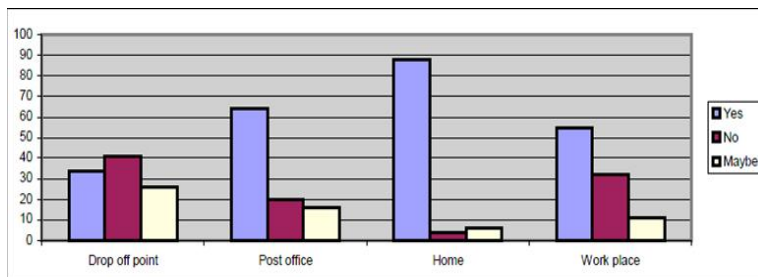
2) Integrated Transport Activity with other Supply Chain Functions

The development of e-commerce and other ICT in connection with process such as Just In Time delivery are now making it possible for monitoring flows much more accurately so that transport may be planned to operate optimally to integrate better with other supply chain.<sup>12)</sup> This means that there will be no unnecessary transports. However, on the other hands, deliveries become more frequent and smaller in size under the influence of 'Just In Time' trend in logistics<sup>13)</sup>.

3) Changes in the Freight Transport Pattern.

A shift from conventional retail store toward e-tailing entails significant changes in transport pattern. Chart 2 illustrates online consumer's attitude toward delivery points. As can be seen from the Chart 2, most consumers who order the products on the internet want to their products delivered to their homes.

<Chart 2> Attitude toward delivery to drop off points, post home and work place



Source: Jansson Gunilla *et al.* (2000)

- 12) R. Mason and C. Lalwani, Assessing the impact of B2B e-Commerce on freight transport in the *Transport in Supply Chains*, Cardiff Business School Logistics Operations Management Section, 2004, p. 68.
- 13) Romm *et al.*, *The Internet Economy and Global Warming: A Scenario of the Impact of E-commerce on Economy and the Environment*, Center for Energy and Climate Solutions, A Division of The Global Environment and Technology Foundation, 1999. Cited in Jansson Gunilla *et al.* op cit.

This implies that e-commerce generates a different need for the transportation of goods from traditional delivery practices. In general, business transactions could more frequently be carried out directly between manufacturing companies and customers to the exclusion of wholesale trade. This could lead to a larger number of orders, each with a lower volume. Under such conditions smaller, more frequent shipments becomes the consequents of e-commerce as manufacturers and distributors communicate directly with consumers although the extent to which e-commerce will affect transportation, may depend on the types of markets and products.<sup>14)</sup> The table and figure below compares the differences between traditional delivery and e-commerce delivery.

Similarly, substitution of e-tail for B&M retail entails a substitution of personal transportation for freight transportation of the package delivery. As a result, a few number of delivery firms with better position in this type of service such as UPS and FedEx have benefited from the rapid growth.<sup>15)</sup>

<Table 4> Characteristics of E-commerce Delivery

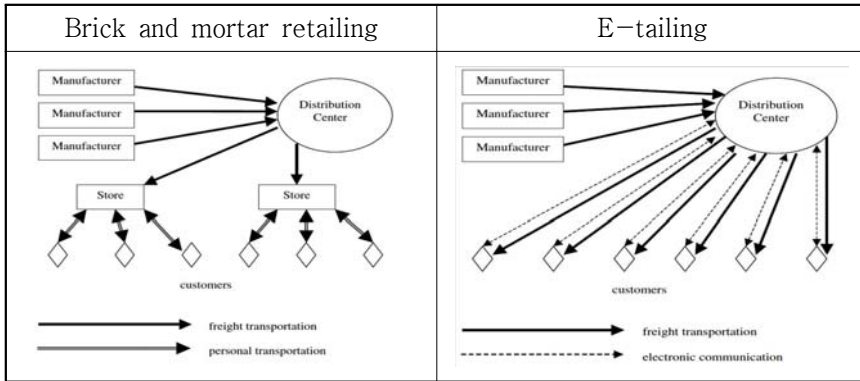
Attributes	Traditional Delivery	E-commerce Delivery
Distribution chain	Producer Wholesaler Retailer	Online retailer Customer
Shipment size	Large	Small
Shipment type	Homogeneous	Heterogeneous
No. of loads (Density)	High	Low
No. of delivery stops	One or more stops	Many stops
Delivery failure	Few	Many
Delivery frequency	Low	High
Delivery time sensitivity	Low	High
No. of vehicle required	Low	High
Vehicle size	Large	Small
Delivery cost/each load	Small	High

Source: Minyoung Park and Amelia Regan (2003)

14) Minyoung Park and Amelia Regan, *op. cit.*, p. 5.

15) W. P., Anderson, *et al.*, E-commerce, Transportation and Economic Geography, *Growth and Change*, Vol. 34 No. 4, 2003, p.423.

<Figure 1>



Source: W. P., Anderson, *et al.* (2003)

#### 4) Freight Modal Shift

Quick response to market demand stemming from real time monitoring changes could lead to more frequent and smaller size of transport.<sup>16)</sup> Simultaneously, the emergence of this trend for quick responses and flexible transport could considerably reduce the opportunities for rail and inland shipping. According to survey (Morgan and Stanley, 2001), customers of freight transport intend to ship faster, more frequent, smaller, and lighter shipments, which benefit the express/parcel carriers as well as the LTL truck load companies.<sup>17)</sup>

In fact, as shown in the table 3 below, parcel, postal and courier shipments, and the value of goods moving as air freight has increased in the U.S.<sup>18)</sup>

16) It may seem that shipping goods in small quantities directly to individual consumers should be more expensive than shipping large quantities to stores. However, the seller is able to reduce inventory carrying cost by shipping small orders. Therefore, any increase in transportation cost is in part offset by savings in inventory costs (*Ibid.*).

17) Anonymous, *op. cit.*, p. 40.

18) James S. Keebler, Changes in the U.S. Transportation of Goods, *Logistics Quarterly*, Spring, 2002, p. 10.

&lt;Table 5&gt; Domestic and Export-Bound Freight Shipments within the US

	1997 Tons	1997 % of Total Tons	1997 vs. 1993 Growth in Tons
Truck	7992	58.3%	25.2
Rail	1539	11.2%	-2.9
Pipeline	1881	13.7%	0.6
Water	1523	11.1%	3.9
PPC	25	0.2%	30.6
Other/Unk	754	5.5%	6.7
Total	13179	100.0%	14
Tons of Shipments in Millions, PPC = Parcel, postal & courier			

Source: U.S. Department of Transportation (1997)

#### 4) Growing role of Logistics Service Provider

One of the main changes in transport sector resulting from the development of e-commerce can be found in increasing role of LSPs. As discussed above demand driven by e-commerce may lead to less consolidated deliveries and thus more freight traffic which will in turn fall delivery efficiency and raise transport operational cost. However, on the other hand, it would be possible for a number of e-commerce firms to co-ordinate in consolidating their consignments and by jointly generating more flows, could cut delivery costs by utilizing logistics LSPs.<sup>19)</sup> Moreover, e-logistics providers will offer numerous services in addition to traditional delivery services such as shipment tracking, payments, handling of return flows and assistance with installation of delivered goods.

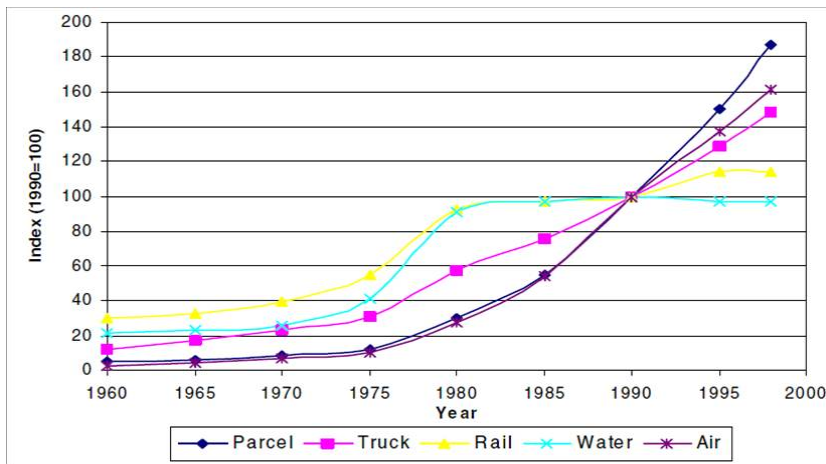
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19) OECD, *op. cit.*, p. 5.

5) Growth of the Parcel Industry

Increasing demand for quick delivery and higher service quality driven by e-commerce bring business opportunities to the couriers handling parcel delivery, delivering goods to each customer's home quickly and reliably in small batches.<sup>20)</sup> This trend is supported by recent survey<sup>21)</sup> showing that the parcel industry has been the fastest growing major segment of the freight transportation in the U.S.

<Chart 3> Growth of the parcel industry



Source: Minyoung Park and Amelia Regan (2003)

Until now this essay examined the impact of e-commerce on the freight transport industry. However, it is also true that other factors other than e-commerce could affect the freight transport industry. According to Dutch estimations (Table 4), freight transport is expected to increase until the year 2005 by 38% of all vehicle trips. Of them

20) Minyoung Park and Amelia Regan, *op. cit.*

21) Morlok *et al.*, *The Parcel Service Industry in the U.S.: Its Size and Role in Commerce*, Systems Engineering Department, School of Engineering and Applied Science, University of Pennsylvania, Philadelphia, 2000. Available at [www.seas.upenn.edu/sys/logistics/](http://www.seas.upenn.edu/sys/logistics/) [23th Jan, 2005]

17% belongs to 'new economy', 21% to 'old economy' sectors.<sup>22)</sup> Therefore, it may be hard to say that overall changes in the freight transport industry have not derived solely from e-commerce. We should not overlook the influences of the underlying structural change evolving in the whole supply chain.

<Table 6> Freight Transport Growth by 2005 in the Netherlands

Transport segments	Changes by 2005 (No. of vehicle trips) (%)
Freight transport 'old economy'	+21
Freight transport B2C	+8
Freight transport B2B	+9
Total freight traffic	+38
Passenger traffic	+10

Source: Transport en Logistiek Nederland (2000)

## IV. Case Study – Trucking Industry<sup>23)</sup>

### 1. Introduction

E-commerce is changing the competitive environment of the trucking industry, both directly in challenges to traditional freight brokers and

22) Markus Hesse, Shipping news: the implications of electronic commerce for logistics and freight transport, *Resources Conservation & Recycling*, Vol. 36, 2002, p. 223.

23) Adapted from Nagarajan *et. al.*, *E-Commerce and the Changing Term of Competition in the Trucking Industry: A Study of Firm Level Responses to Changing Industry Structure*. Presented at Berkeley Roundtable on the International Economy (BRIE), University of California at Berkeley, CA., 2000.

indirectly challenging trucking firms to transform their business services through changes in trucking company customers' needs. In addition, traditional trucking companies are under pressure to shift their businesses into providing a broader set of asset-based transportation management services. In this situation, most traditional trucking firms are investing in advanced information technologies as a means to respond to the customer demands in the forms of just-in-time distribution, package express, door-to-door delivery and same-day service. They also are exploring new opportunities in related transport industries such as home delivery and package express.

## 2. Transplace.com – Freight Information Brokerage

### 1) Background

The trucking industry is highly fragmented and geographically dispersed. According to data combined from several sources<sup>24)</sup> in 1998 there were almost 500,000 inter-state motor carriers which consist of about 30,000 for-hire carriers and 470,000 private fleets. Over 70% of the inter-state carriers operated six or fewer trucks. In this respect coordination of disparate fleets and drivers is critically important.

### 2) Introduction to the Company

Transplace.com is an industry-leading logistics and transportation management company. It was formed through the merger of the logistics divisions of six top US trucking firms. The company has 700 employees and works with more than 3,000 carriers around the world to offer customers almost unlimited transportation capacity. Transplace.com

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24) American Trucking Association (1999); Newport Communications (1999); Standard & Poor's (1999)

was formed to build a massive network of shipper freight and carrier capacity and apply world-class technology to optimize transportation. The firm has a highly efficient network and provides small-to-large-sized shippers and their supply chain partners with reduced costs, improved service and better decision-making capabilities.<sup>25)</sup>

### 3) Objective

Its corporate strategy is to exploit Web-based opportunities to enhance economic performance, including improvements in the efficiency of logistics and purchasing and load matching, in order to reach optimal levels of capacity utilization<sup>26)</sup>.

### 4) Solutions

The company uses optimization algorithms to determine the most efficient way of matching freight with its massive network of carriers to increase load ratios and minimize empty miles and detention hours. Its load-matching services provide information that matches available shipments with trucks that has available cargo space, in order to increase trailer utilization and decrease waiting times.

Transplace.com integrates three critical elements for lowering logistics and supply chain costs<sup>27)</sup>:

- Critical mass: Combines large volumes of shipper freight, carrier capacity, and supplier resources.
- Web-based systems connectivity: Reaches and integrates a vast network of shippers and carriers, provides supply chain visibility, and empowers collaborative execution.

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25) Transplace (2003), *Transplace Logistics Solution*. Available at <http://www.transplace.com/assets/media/> [20<sup>th</sup> Jan, 2005]

26) UNCTAD, ICT, The Internet and Economic Performance: Implications for Developing countries in the *E-commerce and development report*, UNCTAD/SIDTE/ECB/2003/1, p. 46

27) Transplace (2003), *op. cit.*



- Optimization technology: Utilizes systematic and highly automated methodology to unleash network synergy that reduces cost and improves service.

### 3. Arnold Logistics – asset-based transport management service

#### 1) Background

The emergence of e-commerce has created new shipment requirements for customers of the trucking industry. In response to this market situation many companies are now attempt to transform asset-based transportation management service providers rather than simply remains trucking companies. In addition, the companies provide a broad range of transportation management services covering from warehousing goods, to order taking, logistics management, and after-sales services.

#### 2) Introduction to the Company

Arnold Logistics which has long been a profitable LTL company is now transport management service provider offering one-stop order fulfillment services for e-tailers and mail-order catalog companies through combining its trucking and warehousing operations. Its service covers order processing, inventory management, and small package shipping.

#### 3) Solution

The company has transformed its business to improve its ability to fill orders quickly and precisely. The firm has turned its warehouses into logistics hubs where more than 600 people are involved in the order fulfillment process: receiving goods from manufacturers or suppliers, processing, packaging, and delivering to customers. Arnold

Logistics also provides value-added services by comparing freight rates and handling customer returns.

#### 4) Result

The traditional LTL and TL segments of Arnold Industries have gained some benefits from the new business activities, because shipments to the logistics warehouses use TL and LTL services. In addition, the company has gained substantial expansion into new transportation services that emphasize information management rather than physical handling of goods.

## V. Conclusion

Many aspects of business practices such as globalization of trade, small batch, customized production and just-in-time distribution, which has driven by e-commerce, affects their distribution strategy in many ways. As a result reduction in average shipment size, corresponding increases in shipment frequency, and an emphasis on time delivery becomes the consequents of e-commerce. At the same time quick response to market demand requires more flexible transport such as air and road freight. Smaller and more frequent shipment requirement of supply chain may cause complexity in transport operation management, potentially cause higher costs. On the other hand, the increased visibility of goods through more efficient information flow enables to achieve higher degree of load utilization thereby reducing unnecessary transportation. However, overall changes in the freight transport industry could have affected by other factors other than e-commerce. Thus, we should not overlook the influences of the underlying structural change within the whole supply chain.

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## ABSTRACT

### The Effects of Electronic Commerce on the Freight Transport Industry

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This paper investigates changing business transaction under the e-commerce environment and their implications on freight transport industry with some case studies. It shows that an efficient and reliable delivery system is essential for e-commerce as business industries are faced with the stricter and more diversified demands of customer. In addition, many aspects of business practices such as small batch, customized production and just-in-time distribution in the e-commerce environment, in turn, bring about a number of changes in the volume and service patterns of freight transport. E-commerce requires longer transport distances and often higher delivery frequencies. It also entails to a certain extent a modal shift towards truck and air freight transport modes. On the one hand, the logistical requirements of e-commerce goods may stimulate greater complexity in existing supply chain management, causing higher costs. However it is true that the increased visibility of goods through more efficient information flow allows more efficient and effective transport management in the logistics system.

Key Words : E-Commerce, Freight Transport, E-Logistics