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The Internet as a system for transporting goods

Abstract. *The author considers the Internet as a system for transporting goods. The influence of the Internet on the transportation of goods is also considered. The delivery of digital goods (books, music, video) to customers is described. The main purpose of the article is to present the consequences of the advent of 3D printers which would allow for the delivery of material goods to the end-consumer (or retailer/end-producer). The author thinks that it is possible to dematerialize material objects with the help of a 3D scanner and 'ship' them via the Internet to the end-consumer (end-producer or retailer), who could then reconstitute those objects with the help of a 3D printer at the destination. Finally, it is obvious from these hypotheses that Internet traffic volumes are likely to grow.*

Keywords: *Economics, Internet, 3D printer, transport, production, freight, delivery, digital, objects, shipment.*

The influence of the Internet on the transport of goods

The Internet has promoted interpersonal communication, especially between producers and consumers of goods. Producers and end-consumers today are more directly connected; at the very least, they are connected in a way that has shortened the supply chain from the producer to the end-consumer. This change is crucial to the system of goods transport.

In the pre-Internet world, goods made a long journey from the producer to the end-consumer. Traditionally, products were first shipped by the producer to the wholesaler; then from the wholesaler to the retailer,or even from one wholesaler to another wholesaler and then to the retailer; and finally, from the retailer to the consumer. By establishing direct links between the different players, the Internet has created new market relations (without completely destroying existing ones). Wholesale brands now sell goods directly to the end-consumer[1] via the Internet as do producers who sell online. In other words, the producer-consumer chain is shortened.

These trends are irreversible and are clearly the result of the profitability of e-commerce. First of all, Internet stores are cheaper than bricks-and-mortar stores. Indeed, shipping products to the end-consumer directly from the warehouse and not from a bricks-and-mortar store reduces a range of costs for producers/resellers that sell via the Internet.

Warehouses do not need to be in the immediate proximity to the end-consumer, and as a consequence they can be located in the cheapest possible premises. Internet vendors require fewer or cheaper staff: the workforce for an Internet 'shop' can be recruited from the cheapest world labor markets since they communicate with clients not face-to-face but through the Web. They also require less equipment because their shelves are virtual. Finally, Internet sellers operate with smaller inventories because their clients do not acquire the desired products immediately as they would in a traditional bricks-and-mortar shop; this allows the seller the opportunity to actually obtain the desired item from the producer/wholesaler.

Furthermore, buying online saves consumers time – time which they would otherwise have spent visiting a traditional store. Finally, given the fact that the producer/end-consumer chain is shortened and some of the intermediaries (wholesalers or retailers) are eliminated from the supply chain, the price for the consumer is consequently lower.

Nevertheless, despite the advantages of online sales and their economic profitability, there are some shortcomings also: packaging, shipping costs, and ex-

[1] Kurt Salmon, Going Direct. The Journey from Wholesale Brand to Direct-to-Consumer Retailer, www.kurtsalmon.com/.../DTC%20%20130513

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tended delivery time (at least for non-digitized or material goods). And yet, even the packaging and shipping costs that are paid for by the Internet customer (or the producer/seller which offers free shipping) are not discourage when weighed up against all the advantages of e-commerce (except in the case of the cheapest products). In other terms, it is still profitable for both the customer and the seller to trade via the Internet. E-commerce drawbacks such as delivery time should be considered in light of the shortcomings of traditional retail, such as the necessity for the customer to visit a bricks-and-mortar store to buy a given item. Admittedly, this sort of activity may take less time than the time required to deliver a product purchased online.

E-commerce will grow because it is more profitable than traditional retail. Nevertheless, some aspects of traditional retail will withstand this phenomenon and therefore will not be replaced completely by e-commerce. Traditional retail outlets that will survive the growth of e-commerce are those which trade in items which are cheap, perishable, or distinctive (non-regulated or partially regulated goods), e.g. food items. This can be explained by the fact that their purchase involves a personal choice which demands the customer's physical presence.

Psychological and sociological reasons also need to be considered. Indeed, traditional retail shops (as well as cafés) will resist online ones because face-to-face trade fosters social relationships. The need for social ties will continue to grow as individualization and social isolation in the modern world increases for a variety of reasons; because of this, traditional retail will continue at least in some areas.

The growth of e-commerce has brought about change to the traditional producer/wholesaler/retailer trade paradigm and this has impacted on the system of goods transport. The major trend here is home or office delivery of the product to the customer – a consequence of the online store replacing the traditional local store. Indeed, the disappearance of the local store renders the traditional mode of shopping – Joe Customer visiting his local store – impossible. If there is no local store from which the customer can purchase a desired item, it is not the customer-goes-to-product (local store) system but the product-goes-to-customer (by being delivered to the office or home) system that will dominate retail. Individual-centered shipment (delivery) services will therefore supersede the traditional system of transporting goods.

In the traditional retail system, goods transport is realized with relatively large volumes: goods are shipped from the producer to the wholesaler and from the wholesaler to the retailer; only then does the customer obtain the item. There are few single-package delivery services, if any. Such a system can be described as a *freight-centered transport system*because the number of products transported from A to B is relatively large. Consequently, the means by which this system operates have been adapted for its realization.

The disappearance of the traditional local store, caused by the advent of e-commerce, has ushered in a new *individual-centered transport system* which operates alongside the traditional transport system already described. These changes in the transport system can be demonstrated through the examples of e-commerce giants such as Amazon and eBay. Indeed, these businesses are centered on business-to-customer and customer-to-customer trade relationshipsrespectively. All these relationships focus on the end-consumer. The vendors assume that the traded products will be consumed on an individual level and thus they ship the items individually and not by freight methods.

Nevertheless, it would wrong to conclude that postal services (individual-centered goods transport) or small package delivery services would take over freight or transportation of large quantities of products.

First of all, the complete replacement of freight by an individual-centered shipment system suggests the removal of middlemen between the producer and the end-consumer: transport of large quantities often necessitates a wholesaler. But even in that case there would still be a need for freight, at least in situations where the producer owns his own distribution system or operates as part of a franchise system. Another reason why freight is unlikely to be abandoned is that an individual-centered shipment system will always be less attractive economically than freight because the greater the volume of freight transported, the cheaper it is (in general). Transport of large quantities of goods is usually undertaken by cheaper methods (sea and rail, for example[2]) and needs less packaging. Conversely, individual-oriented shipments are more expensive because they are time-oriented and therefore utilize more expensive means of transport, such as air transport. Finally, due to the large quantities involved, the transportation of raw materials will always necessitate freight.

On the whole, freight will not be replaced by a system of individual-oriented, small-package shipments. Moreover, due to the GATT/WTO reduction of tariffs and other trade barriers and preferences, as well as the global division of labor and consumption patterns, more and more products are consumed somewhere

[2] E.g. A. Bhatnagar, Textbook of Supply Chain Management, Sanbun Publishers,p. 13.

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other than at their point of production. Production now takes place wherever it is cheapest. It has become cheaper to produce goods in one part of the world – where labor is cheap –and then ship them to the consumer's residence than to produce them near the end-consumer. The development of transport technologies has reduced shipping costs, resulting in shipment being economically viable. In other words, the growth of freight will take place not because of the growing demand for it, but because of structural changes in the production-consumption chain, whereas individual-oriented transport growth will occur due to newly-created market relations and growing demand.

In conclusion, changes to the traditional transportation system have come about due to the robust development of the individual-oriented transport sector (transport of small packages). This development has been accompanied by other phenomena: changes in the retail chain (i.e. the demise of traditional local shops) and a reduction of the need for middlemen in the trading process.

Transport of digitized goods via the Internet

The Internet is essentiallya digitized data exchange system because it comprises links between computers and servers with a digital functioning form. Indeed, the Internet is not a transport system akin to a pipeline or, to be precise, a Pneumatic Transport Tube which allows for the transport of material goods. The Internet provides conveyance of digital dataonly, and therefore only goods that can take a digital form can be moved via the Internet, i.e. digital goods. In other words, as opposed to other transportation systems, such as rail, sea, or air, the Internet does not permit transport of material/physical goods, but only of digital goods or commercialized data.

Nevertheless, this limitation of the Internet has hampered neither the development of the digitization of some products, nor the development of their commercialization via the Internet; on the contrary, it has stimulated the development of their shipment to the end-consumer via the Internet. The latter is the real reason for the trend of digitizing physical goods. Indeed, the commercial advantages of moving goods via the Internet in digitized form are huge: instantaneity and zero cost[3] (i.e. cost effectiveness). It is undeniable that the carriage of digitized goods via the Internet is cheaper than any form of transporting any material product (given the absence of packaging and shipping costs). It is also more appealing for customers to receive the product instantly and without needing to visit a bricks-and-mortar store.

Digital transport of goods is not only more profitable – the main reason for the digitization of some products – but the digital form of the product itself is more attractive. Indeed, "soon everything that gets printed will exist in computer form, and filing will be more efficient in the electronic than in manual form. With electronic publishing there are also writings that in the Gutenberg sense will never be printed at all. Texts entered on one processor without ever being printed…"[4] In other words, it is more efficient to publish and store some products in digital form without materializing the product at all (in this case, without actually printing the book) because it removes the need for a range of manufacturing processes.

The fact that more and more products today are digitized is evidence that the immaterial aspect of the Internet is not an impediment to the development of the conveyance of digital goods via the Internet. Indeed, music, books, movies, newspapers and other products and services are being offered more and more to customers in digital form whereas only recently they were being distributed and consumed in material form.

This trend is also being stimulated by the emergence of new devices. More precisely, the growth in the consumption of digitized products – due to their being cheaper than materialized goods as well as their free shipping and other advantages – has encouraged the creation of devices that have provided for the consumption of such products in a manner which is more comfortable and cheaper for the consumer. Indeed, the advent of devices such as portable media players, tablets, and e-book readers has been concomitant with the spread of digitized products. These devices have been created because it is now possible to consume books, music, and video without needing to use material data storage devices (e.g. CDs, DVDs). This makes such products cheaper: there is no need to produce any material devices (books, DVDs, etc.) or to ship them to the retailer (or customer). The economic profitability of such products has brought about some changes in the production and transportation chain and has also changed consumer habits.

Portable media players, such as the iPod, have allowed consumers to enjoy music and video in a more comfortable manner: the consumer does not have to carry different data storage devices and can keep all

[3] The highly cost-effective character of electronic transport has been emphasized. See A. Bhatnagar, op. cit.

[3] Ithiel de Sola Pool, Technologies of Freedom, 1983, Harvard University Press, p.42.

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the data on the one device. Tablets and e-book readers imitate the traditional product form – the book – and aim to replace it. Indeed, e-book readers are made to replace the traditional product and therefore imitate its characteristics in both size and the use of E Ink displays. In addition to providing consumers with more comfortable consumption of digital products, digital devices have other important advantages. Practically any number of items can be stored and consumed on the same device while the shipment of those items is free of charge and instant. This explains why such devices are rapidly replacing traditional products.

Indeed, the consumption of music, video, books and other "digitizable" products in digital form has been driven by the emergence of these new devices. Moreover, in the future such products will be consumed almost exclusively in this form because this form is more profitable (cheaper) for both sellers and buyers, and because only this form offers free and instant shipment of the product to the customer. As a consequence, the only alternatives for end-consumer institutions such as libraries and book stores may be to become museums and centers for social and cultural events.

This will have a huge impact on the transport system. To be sure, unlike the development of the small-package transport system which does not compete with freight but exists as an extension of the current individual-oriented transport system, the transport of digital goods via the Internet has simply removedfrom the traditional transport system a part of the market previously held by its operators. It is true that digital transportation of goods has reduced the market for individual-oriented transport of such goods as well as for the freight of these goods. Indeed, there is a lack of any physical product and therefore there is no need to transport any physical items (whether raw materials or finished products). As a consequence, the traditional transport system is deprived of a portion of the market that previously corresponded to the now- digitized products (books, music, video).

3D printers and the transportation of material goods via the Internet

Not all products are useful to the customer in a virtual or dematerialized form. Indeed, although clothes, toothbrushes, tables, chairs and other material objects can be digitized (via a 3D scanning process), they can be used only in their material form. Such products *apriori* cannot be sent to the customer over the Internet because it is capable of transmitting only digital data and excludes any possibility of transporting material goods. In other terms, if the Internet can be used as a goods transport system,those goods can take only digital form. Nevertheless, the advent of some new technologies, and especially the 3D printer, has led to the notion of the Internet as a transport system for material objects, or potentially materializable digital products, also.

At first glance, transport of material goods over the Internet seems to be pure science fiction. Indeed, the possibility of material objects being transported via the Internet is no different to phenomena such as teleportation, ideas which can be found only in the realm of science fiction and not in the real world. After all, it is physically impossible to transport material objects (goods) via cables or wirelessly through radio waves (e.g. Wi-Fi). Nonetheless, the advent of devices such as 3D printers seems to make less fantastic the concept of transporting material (or potentially materializable) goods over the Internet.

The method of transporting material goods over the Internet with the advent of devices such as 3D printers can be considered as digitized teleportation of material goods, despite some restrictions. On the face of it, the word *teleportation* is wholly applicable to this way of transporting material objects since their transportation is disembodied and allows reconstitution of the product at the destination. But at the same time, the digitization of material goods and their reconstitution with the help of a 3D printer also give rise to mass production and customized production and not merely to the simple reconstitution of the *same* object.

At the outset, such a process presupposes the digitization of material goods with the help of a computer and a 3D scanner or their direct creation in digital form (the scanning process and digitization of material goods or the design of a virtual object by an operator on a computer). Only then can the material product be "shipped" to the customer over the Internet in a disembodied or digital form. Finally, once the customer receives the material product in digital form, he/she can reconstruct it with the aid of a 3D printer. This scenario, referred to as quantum teleportation (entanglement and teleportation) and once conceived only in sci-fi films such as *Star Trek*, is considered unrealistic even today[4] But is it still the case given that 3D printers allow for the reconstitution of some scanned/digitized material objects? Even if the word *teleportation* is not perfectly applicable to such transport of material goods over the Internet, the method of transport as described above is now possible.

[4] E. W. Davis, Teleportation Physics Study, 2004, https://www.fas.org/sgp/eprint/teleport.pdf

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The advantages of transporting material goods in this manner are huge. First of all, there are no transport costs; this would make material goods shipped in digitized form over the Internet cheaper than traditionally shipped items. The only material substance required by customers and/or operators of 3D printers would be the printing material for the printer itself. However, the recycling of products created on a 3D printer with the help of the same hardware could reduce the need for traditional goods transport (printing material). Secondly, virtual transportation of material (or more correctly "materializable") goods does not require packaging, warehouses, or any logistic operations that burden the seller and, as a consequence, the customer. Electronic transport of material goods is therefore cheaper than traditional transport. Finally, the producer/wholesaler/retailer/end-consumer chain would be shortened to a simple producer-end-customer chain, just as it is in relation to digital products at the moment (books, newspapers, music, movies). The trade chain would be shorter due to the removal of at least one middleman – wholesaler or retailer – that exists today in the case of e-commerce with material goods (though this actor is already absent in the case of digital goods), which would also make the products cheaper.

As a consequence, it seems that the transport of material goods over the Internet is more profitable than traditional transport and therefore will replace the latter when some technical problems are resolved. Before we can use the Internet to transport material goods or, more precisely, to transport material goods in disembodied (virtual or digital) form, we would need to overcome a number of difficulties. Therefore the significance of the traditional transport system will not be undermined at least for some time.

First of all, the use of the Internet as atransport system of material goods in disembodied form presupposes the widespread use of 3D printers on a personal level. This is inconceivable, given today's 3D printer prices and some of the technical obstacles of these devices (e.g. printing time). Nevertheless, technological progress, as well as the usual price reduction caused by the rapid uptake of mass-market consumer devices, do lead to the conclusion that 3D printers will be found in almost every house or officein the future, and this situation will be concomitant with pressure from the Internet on established transport systems.

Secondly, not every product can be transported via the Internet; that is, not every product can be reconstructed by a 3D printer. The technical restrictions of 3D printers do not allow us to conceive the possibility of transporting food, energy, or human beings, even in the near future. Indeed, the use of the Internet as a transport system can be developed only in a limited way, and will deal only with digitizable goods that can be reconstituted with the help of a 3D printer: the limitations here are mostly those of 3D printers themselves. Nevertheless, technologies are developing very quickly. Indeed, it was not too long ago that 3D printer technology was limited to the use of plastics, while today these printers can reproduce products made of metals, glass, and ceramics.[5] In the end, the range of objects potentially transportable over the Internet will be limited only by the abilities of the 3D printers themselves: those devices preclude the digitized transport of living things and biologically and chemically complex structures (food, plants, animals), and even composite objects. Nevertheless, it is conceivable that in future it would be possible to print some of the composite objects: it will take some time for us to be able to download a new pair of shoes and print them on our desktop 3D printer. Although the range of material products able to be printed will keep growing, there will always be some limitations due to the basic physics and devices used.

The limitations of 3D printer technologies – long printing times and a narrow range of printable products and printing materials – will be overcome as the technology develops. Indeed, the development of 3D printers and printing materials is certain because the advantages of 3D printer technology are incomparable: the production of goods by the customer or somewhere close to the customer (e.g. at a special 3D printer center nearby) because shipment is virtual; the possibility of customizing products; and lower transport costs because the only traditional transport methods involved in the process would be those required to deliver consumables to the 3D printer. This process excludes (or almost excludes) the transport of the end-products and places clear boundaries on the necessity for the traditional transport system. In other words, competition between the two systems of transportation – traditional postal services and freight on the one hand and the Internet on the other – is likely to grow.

While it is not likely that every home or office would be equipped with such devices, it is conceivable that local firms could develop 3D printer services for the use of end-consumers. Another hypothesis is also conceivable: 3D printers could be used as a distribution system or a system for the materialization of end-products by specialized firms at the local level. This would

[5] http://www.dw.de/customized-mass-production-using-3d/a-16468396

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bring the end production closer to the consumer. In this case, the individual-centered transport system would not be substantially harmed by 3D printer technologiesor by the development of Internet-based transport of material goods (because locally made products would still need to be delivered to the end-consumer), whereas the role of large-volume freight transport would be reduced and freight would shrink to providing shipment of raw materials and expendable materials. In other terms, in this scenario traditional freight transport would be deprived of a large part of the end-products transport market and would be limited to the transport of raw and expendable materials.

Finally, it is obvious from these hypotheses that Internet traffic volumes are likely to grow. Indeed, the use of the Internet as a means to transport material goods is likely to result in the important growth of information transmitted online.

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