13 The Money Lies on the Street: the Problem is How to Pick it Up?

Kees Ruijgrok, Tilburg University, TiasNimbas Business School, c.j.ruijgrok@tiasnimbas.edu

Abstract

In this contribution the reasons behind not realizing obvious improvement possibilities in logistics will be addressed. Firstly it will be indicated that the correct generalized cost definitions must be used in order to calculate the convincing Return on Investment, especially in cases of uncertain demand or supply. But more importantly, often there are so called 'soft factors' that are important to address, because they form a blocking factor to grasp the potentially available profits. Two examples of logistical innovations (hybrid networks, supply chain synchronization) that were confronted with implementation problems are reported, and conclusions are drawn with respect to the ways these promising innovations could be realized

13.1 Introduction

As more authors in this book probably indicate, Jo van Nunen often used jokes and special phrases to clarify the point he was making. The statement "the money lies on the street, it is the problem how to pick it up", is one of these phrases[1]. I do not remember when Jo used this phrase, but it struck me as very correct, because often in the world of optimizing logistics systems, one often encounters opportunities for minimizing logistics cost that theoretically seem very attractive, because they show obvious cost reductions, while maintaining or even improving service quality, but seem to be difficult to realize in practice.

Reasons for not implementing these ideas can be manifold, and vary from 'not invented here' syndromes, risk aversion, lack of thrust between partners that depend on each other, towards infeasible business models.

In this paper I will present some examples of such opportunities, some of which have been identified already by many authors on many occasions, but often their implementation is still waiting for some miracle to happen. Consequently, if the theories behind these possible improvements were right, there are profits that could be realized, if only the right ways to implement these ideas could be found. Now these profits or potential benefits remain unused, one could argue that this is a case of welfare loss, in which society as a whole suffers from this inability to act adequately. A potential solution to create a break-through, might be that some of the business risk is taken over by the society as a whole in order to stimulate innovative entrepreneurs to grasp these opportunities. This however seems to contradict the nowadays popular deregulated and privatized market organization. In some sectors of our economy, mainly in the area of sustainability, such measures seem to be acceptable and the working area of existing policy instruments could be enlarged.

I will first present the basic ideas and theoretical arguments behind some of the seemingly attractive opportunities, and then I will mention some of the reasons that might be relevant for not realizing these opportunities as yet. Finally I will suggest extending the use of some existing policy mechanisms as an instrument to avoid these stagnating innovation possibilities.

---

[1] In this case the striking phrase was combined with a joke by Jo to explain the phrase. I remember he said: "I have known this principle already since my years as student in Eindhoven. One night I had been visiting pubs with a couple of other students and we were standing outside one of these pubs, and I saw a note of 25 guilders lying on the street and I put my foot on it. My friend saw me doing that, and said: 'Do you know your are standing on a bank note?' I responded: 'Yes of course, and I am protecting it , but I do not dare to pick it up, because, when I do so, I am sure more then 25 guilders that I have spent on beer tonight, will be spilled on the street."

13.2 Logistics cost optimization with service constraints using the generalized cost concept

Logistics managers try to optimize the logistics costs as much possible, while maintaining or improving their service quality, which is determined by the requirements of their customers (Christopher, 1992). Changes in required service quality can act as a driver for changes in the organisation of logistics networks. Mass production systems that have evolved over centuries are being replaced by responsive systems that produce customized goods. Logistics and transport services support this development by new supply chain architectures.

JIT systems were only a brief stage in the development of transportation-inventory systems -- in the future, logistics and transport will be much more tightly integrated with production systems. Complex trading networks have evolved primarily to exploit labour cost differences, regional production specialization, global product differentiation opportunities and availability of raw materials in particular countries. Their development has also been facilitated by major regulatory and technological trends. Trade liberalisation, particularly within trading blocks such as the EU and NAFTA, has removed constraints on cross-border movement and has reduced related ‘barrier costs’.(Van Nunen et al , 2008) . Advances in telecommunications and information technology have given companies the means to manage the physical movement of products over long, often circuitous, routes. Many carriers have invested heavily in ‘track and trace’ systems to be able to establish the location of any consignment at any time, improving the visibility of the global supply chain to shippers and their customers. The way in which individual trends manifest themselves varies according to the geographical scale at which companies and markets are operating.

Network structures will vary according to the degree of customization and the degree of responsiveness required. In each situation, different chain configurations will be deployed to satisfy product and service demand. Typical variations between segments concern the move from European distribution, based on production to stock, towards production to order, where delivery takes place directly or through cross-docking. Also new concepts like rapid fulfilment depots (for low demand but urgent products like spare parts) and flexible order production (allowing fast switching in batch size and end-product specifications) are being introduced to allow for better responsiveness.

There are several ways to overcome the challenges that logistic managers face in order to cope with the need to minimize costs and at the same time to meet the ever increasing demands of customer service.

Out of the many possibilities 2 proposed principles will be mentioned because although interesting there is still a low level of acceptance in the logistics community: hybrid networks and network synchronisation. Before we clarify these two principles we have first to clarify the concept of integrated or general logistics costs, because in trying to optimize logistics costs with given service requirements some general unifying concepts can be identified.

The concept of Generalized Logistics Cost requires not only the incorporation of transport, handling and inventory costs but has also to include variables that try to capture the effects of economies of scale and the impact of improved transparency. Other important cost components of a realistic integrated cost concept are (see also Tavasszy et al 2010):

1. pipeline costs (including inventory costs for products in the pipe line)
2. value density (vd = V / Vol in m3), where V stands for value: for products with a higher value density inventory costs are more important than for other products
3. shipment size P : the higher the shipment size the lower the transport and handling cost per unit
4. frequency f : higher frequencies lead to lower waiting costs, and therefore more reliable lead times, lower safety stocks and also to network synergies
5. variance in demand, the higher this variance is, the higher is the demand for responsive and therefore expensive services that can meet this demand, or require to bear bigger amounts of

stocks: if the demand is stable it can be forecasted accurately and goods can be shipped far before the actual demand is realized, while using a cheaper mode of transport.

Defining Generalized Logistic Costs, we propose to take into account all of the drivers mentioned above for product i out of the set of all products, is:

$C_i = I_i + H_i + T_i$, i = 1, … , I

$I_i = I_i^{safety} + I_i^{pipeline}$

$I_i^{safety} = f(f, o, \sigma^{demand}, \sigma^{supplyl})$

f = frequency

o = order size,

σ^{demand} = standard deviation of demand

σ^{supply} = standard deviation of supply

$I_i^{pipeline} = f(TT, r, V)$

TT = Transport time,

r = interest rate also reflecting the risk for obsolescence of unsold products,

V = value of goods transported

H_i = handling costs (depending on the packaging density pd):

pd = # colli per m3)

T_i = transport costs = f (d, P, f, vd, m, s, b)

d = distance ,

P = shipment size

f = frequency = Vol / o , though the reverse relationship, when frequency is a function of the order size, might also be true

vd = value density,

m = mode

s = speed (depending on the mode of transport)

b = reliability of the mode used:

As mentioned above, we assume that rational supply chain managers try to minimize their logistic costs while maintaining a certain service level that is required for their customers. These service levels are very much correlated with the value density of the products involved (Christopher, 1992, Simchi-Levi et al, 2000) so the supply chain optimization problem can be reduced to a generalized cost minimization problem per product type. This optimization problem involves the choice of production and storage locations, the frequency of replenishment shipments, the choice of mode and the inventory policy used.

In many cases the mode choice decision is not a free choice, and normal choice models that assume an extensive set of alternatives cannot be used. We propose to use generalized cost curves that take into account the most likely choice for mode of transport.

Lammers et al (2006) found that 95% of the transport mode choice is determined by the product characteristics and the ‘as the crow flies’ distance, that for most transport flows are given and cannot be influenced. In Figure 1. below the shipment sizes and transport costs of some modes of transport are visualized. From this picture it becomes clear that huge differences between the respective modes of transport exist, both in shipment size and in average transport charges.

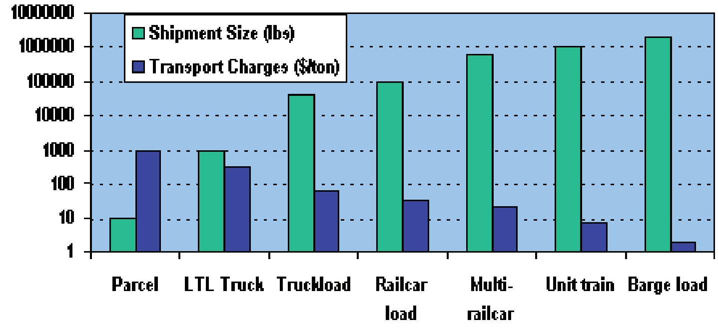


Figure 1. Differences in shipment size and transport charges for different modes of transport (Rodrigue 2006)

Because of these large differences and the limited choice flexibility, it is possible, given a limited number of exogenous factors, to specify an a-modal or mode abstract generalized logistics cost function, such as the one visualized in Figure 2 below:

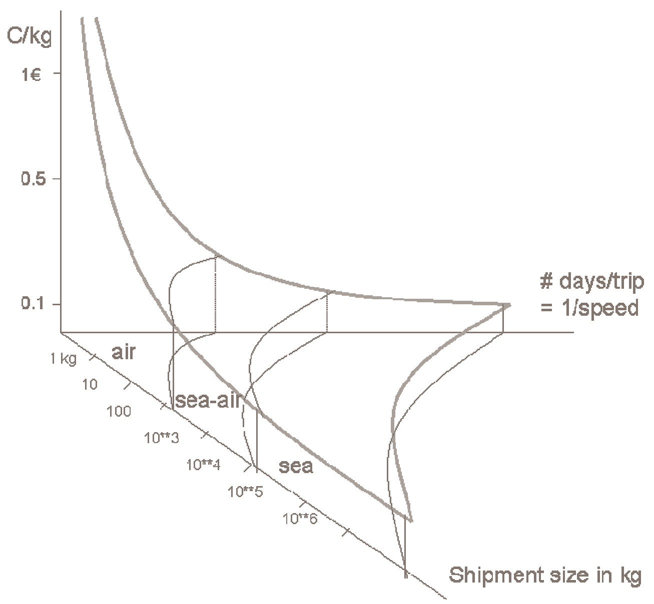


Figure 2 Transport cost per unit, as a function of speed (distance per time unit) and shipment size

This figure shows the areas for which the modes (air, road and sea transport) are dominant ones. By specifying the weight of the shipment and the required speed the mode choice and the transport cost per unit can be derived easily, if all modes are available. 100.000 tons of crude oil are transported by ship, a box of diamonds is shipped by air, unless the distance is less then 1000 km's, when road transport or express parcel transport will be used.

There will be no discussions on the mode choice decision in these circumstances, at least in densely populated developed economies, where all abovementioned modes of transport are present.

Besides shipment size and speed there are 2 other determining factors that really do have a strong influence on the modal choice and other logistic decisions, and that is the value density of the product and the level of demand uncertainty. When taking into account the value of the product and the volatility of demand also the effect of inventory costs via increased safety stocks and the effect of pipeline costs can be visualized, as is done in Figure 3.

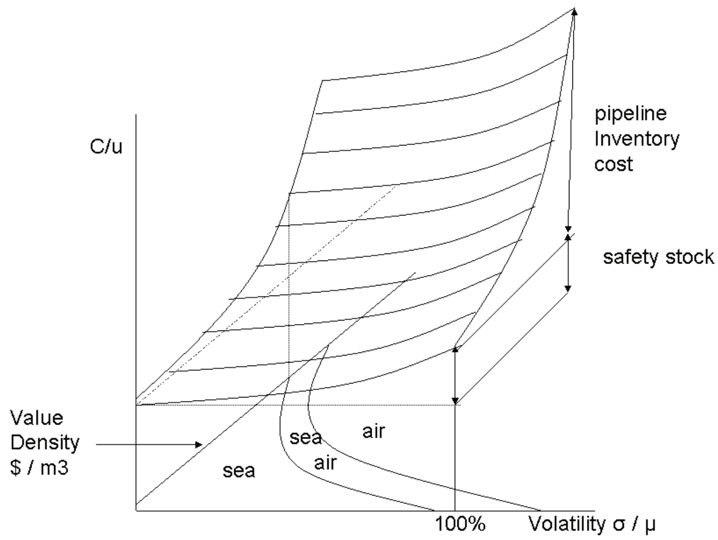


Figure 3. Logistics cost per unit as a function of value density (value per m3) and volatility (standard deviation of demand/ mean demand)

When the value density is low, pipeline costs (the inventory costs during transport) will be negligible. When the value density becomes larger, the pipeline cost becomes significant. For instance, in case of a shipment of 1 container with 1000 laptops (20 pallets of 50 laptops) with a production value of $500 per laptop, each container will have a pipeline cost of $5000 for a trip of 36 days and a capital cost of 10%. The average transport rate of this container from Asia to Europe is $ 1500, so the pipeline cost for this shipment will exceed the sea transport cost with a factor 3 and this integrated costs would be roughly the same when these products would have used the air mode (3kgs per laptop at 2$ per kg). So, although transport costs differ a lot per mode of transport; generalized costs show less variation, taking into account other logistic cost factors.

When the volatility is high, retailers and distributors do need safety stocks in order to avoid empty shelves if the demand for a product is higher then the stock and the demand during the reorder period. Safety stocks can be avoided for a great deal if fast and reliable transport options exist that can guarantee the delivery of products within the customer service requirements. So, trade offs exist between inventory costs and transport costs and the Generalized cost concept should take these trade offs into account.

Thus it can be concluded, that by taking into account a few important product and demand characteristics, a large variation in generalized logistics cost can be explained already quite well, and the optimization of generalized cost under given service requirements can be put in a standardized format.

13.3 Examples of interesting innovative concepts that seem to be difficult to realize

In this paragraph two examples of interesting innovative concepts will be mentioned, that try to apply to minimize the generalized costs as mentioned above, and although they lead theoretically to interesting cost savings, their applicability in practice seems to be hampered by some thresholds or hidden costs.

The examples that will be given relate to:

a. hybrid networks
b. supply chain synchronization

Both examples relate to the distribution of Fast Moving Consumer Goods from suppliers to retail distribution centres, and although this sector is responsible for a large part of truck transport in all the countries of the developed world, its principles can be applied to many other sectors where at least two feasible parallel supply chains can exist together (hybrid) or where the coordinated delivery (between supplier and retailer) of goods leads to a decreased delivery frequency (synchronization).

13.3.1 Hybrid networks

Through the use of hybrid networks a flexible way of quickly adapting from one supply source to another. Through using a hybrid network product flows of different shippers can be consolidated and shipped in an efficient way profiting as much as possible of possibilities to use economies of scale. The extra costs that are introduced because the products are sent through the hub network for extra handling, transportation to and from the hub, should be compensated by the economies of scale of the inter-hub transportation.

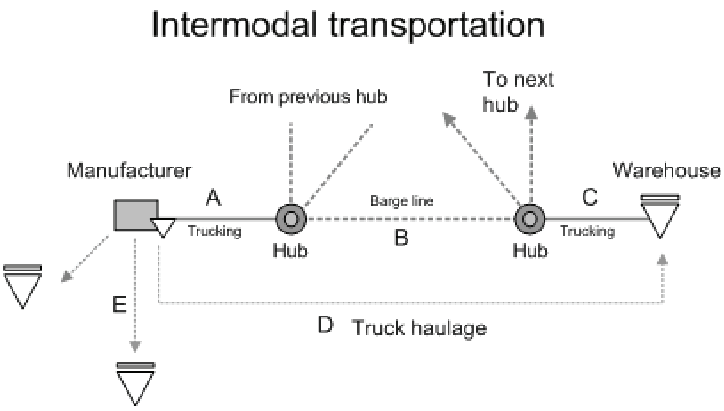


Figure 4 : The concept of an intermodal hub network

In figure 4. the concept is illustrated in more detail (based on a study reported by Groothedde et al (2005). In this figure two alternatives are illustrated; the first is direct transportation from manufacturer to the retail warehouse; the second alternative consists of shipment through the hub network making use of barges. When making use of the hub network the products are shipped from the manufacturer to the nearest hub by truck (A); the pallets are then transshipped on a dedicated pallet barge and transported from the hub near the origin to the hub near the destination (B); unloaded and finally shipped by truck to the final destination (C). As these barges have a capacity of 600 pallets (about 20 truckloads) economies of scale can be achieved on this segment of the intermodal route.

It is however essential to combine this intermodal route with direct trucking that provides logistic services for short distances and excess demand that cannot be accommodated through the hub network (D). In other words: in this concept the combination is made between the capacity of inland barges and the responsiveness and flexibility of road transport; economies of scale and scope can thus be guaranteed. The two modes operate in parallel and make it possible to accommodate the large and predictable volumes and the peaks in demand. Because the shipment time increases considerably when barges are used the order lead-time will usually be exceeded if the order is shipped after it is received. On average it takes 10-15 hours to cover 150 kilometers using these barges. To cover this same distance by truck would take approximately 2 hours. This gap (t_4-t_3, depicted in figure 5) between the shipment time via the hub network (t_4-t_1) and the order lead-time (t_3-t_1) forms a great problem, especially in the retail were lead-times of 3 hours are no exception. To avoid this problem, the shipment should be sent in advance, before the order is placed. The part that can be well forecasted can be sent through the hub network in advance, the unpredictable part of demand can be accommodated by direct trucking (see figure 5.).

The volatile part of the demand is supplied by a fast (and more expensive) network, while the stable part of demand is being delivered through the slow but cheap hub network that makes maximum use of economies of scale.

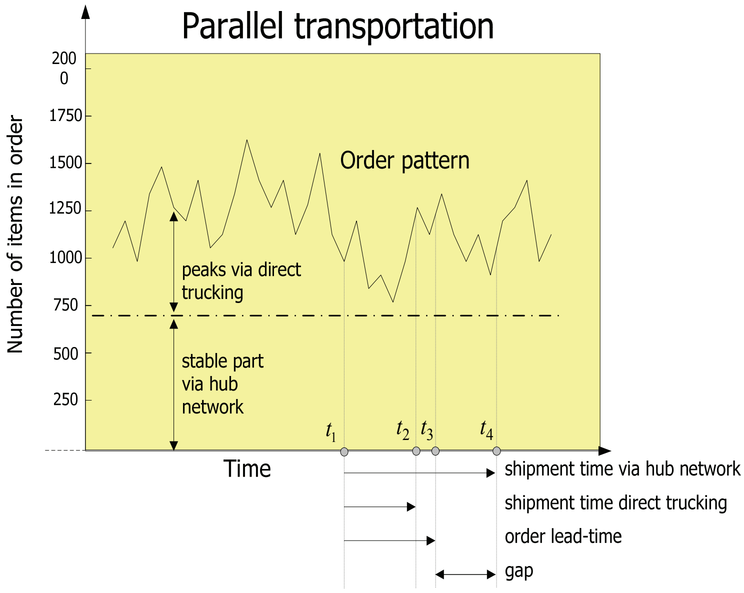


Figure 5. Being responsive by combining different networks (Groothedde et al, 2005)

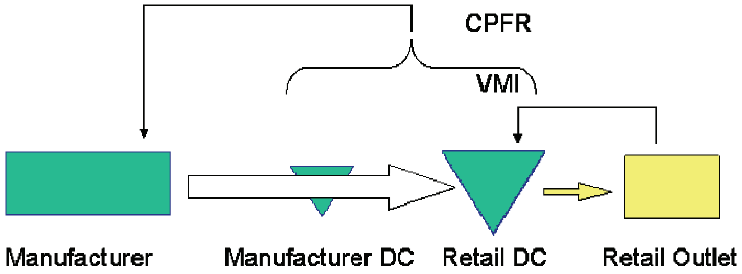
These hybrid networks are instrumental in a new stage of evolution of firms' logistics capabilities, in their search for improved services and simultaneous cost reductions.

In the example given above a cost reduction of 18% of the integrated or generalized logistics cost of fast moving consumer goods (as defined above) that can be handled is this hybrid concept is calculated to be feasible (see Groothedde 2005).

The specific reason why the practical application of this project has failed has been the subject of a number of studies (e.g. Jansen and Verver, 2008). They conclude that there are a number of reasons why projects like this are difficult to realize: the lack of trust amongst parties that have to collaborate with each other, the lack of scale in the initial phase of the project and also the lack of public support. They claim that a significant change of mindset from corporate boards and governmental departments is necessary for this type of projects. They propose that in the coming decade national and European governments should start thinking about new approaches of regulating and subsidizing logistic – community – networks and therefore initiate a change in mindset. The introduction of network - optimizing and community networks will result in economical and environmental profits incomprehensive compared to nowadays standards.

13.3.2 Supply chain synchronization

Another example of potential cost reduction can be achieved through synchronization. This principle is introduced amongst others by Andersson (2001) We give here the example that comes from the dissertation of Van der Vlist (2007) who shows that the synchronized deliveries of Fast moving consumer goods can achieve considerable savings (30 -40%) compared to the situation where the retailer optimizes the replenishment of the products in the stores and in his distribution centers without taken into account the inventory costs of his suppliers. Through the introduction of Collaborative Planning and Replenishment (CPFR) and the application of Vendor Managed Inventory Concepts (VMI) the integrated logistic costs can be reduced. This principle is visualized below in Figure 7.



1. The manufacturer has visibility of the inventory level at the retailer (VMI)
2. Based on this information the manufacturer determines the production quantity and moment
3. Immediately after production the production batch is moved down the supply chain
4. Inventory and handling costs decrease. Time pressure vanishes. Full pallets, full trucks
5. The inventory at the retailer increases, however at the expense of the manufacturer

Figure 7. The principle of Supply Chain Synchronization of Fast Moving Consumer Goods (van der Vlist 2007)

The principle of Supply Chain Synchronization has been popular in Supply Chain Magazines for several years now (see e.g. Ashcroft, 2009), but also here its success in practice is often hampered by psychological factors such as lack of trust and commitment. In a recent thesis (Visser, 2010), it is shown that subjective factors play an important role in logistics decisions regarding outsourcing even in a very rational and robust industry such as chemical logistics. These subjective factors have, amongst others, to do with resistance to change, transaction costs and lack of trust between supply chain partners. Visser has performed stated preference interviews in a careful designed survey design, in which she quantifies the effect of these ‘soft’ variables, in relation to the ‘hard’ variables such as logistics cost and service quality (see also Visser, 2009).

In fact the results from both cases (hybrid networks as well as supply chain synchronization) show that it is difficult to put together sustainable supply chain collaboration between partners that need to combine their efforts (and investments) to make the collaboration between them successful. Also if they agree on a common vision, they are in many cases unable to materialize this common vision into a successful collaboration. These conclusions are in line with the final conclusions on transition management, reached in the Transumo Programme, where Jo van Nunen has acted as scientific director. In the evaluative final report the authors (van Binsbergen et al, 2010) conclude that besides the economic rationale behind systems innovation there are a number of blocking factors that make the implementation of these plans difficult. Besides the factors indicated above they mention:

- the distribution of costs and benefits amongst consortium partners
- the establishment of enough scale to make a good start
- the fact that most parties try to avoid risks and step into new systems after the start up problems have been solved by others.

13.4 Consequences for ROI and CBA

Most investments projects that deal with the introduction of new concepts on the market have to face costs before making profits (see figure 8.). As a consequence of this, the profit pattern over time follows a so called ‘hockey stick’ model that’s reflects the fact that after the first initial investment, in the beginning the (variable) costs are higher than the revenues and that it takes a while for the full cost recovery has taken place. Companies are calculating the Return on Investments (ROI) by calculating the Net Present Value (NPV) of the differences between costs and revenues. Many companies only are interested to be involved if this NPV is positive with a time period (Pay back period, PBP) of 2 years maximum.

In Cost Benefit Analysis (CBA) on a societal level the same type of calculation takes place, but not only out of pocket costs are taken into account but also external costs and indirect costs. If a project has a good Benefit-Cost ratio, societies are willing to put tax payer's money into these investments, also if it takes a longer period before this NPV (including these societal costs) becomes positive.

Normally governments are afraid to interfere with private business affairs, because it can lead to market disruptions and also to severe risks if the costs of project failure have to be paid by governmental funds. As a consequence of this type of investment behaviour, many projects that have only profits on the long run, don't pass the stage of feasibility studies. Also the projects that have been clarified above relating hybrid networks and synchronizing supply chains often fall within this category, thus besides arguments related to scale and lack of trust, possibly also the lack of evident business cases might be one of the reasons for not realizing these projects (although they show cost reduction potential, the level of investments in equipment and IT systems could be huge), and therefore their NPV too low (or their PBP too long).

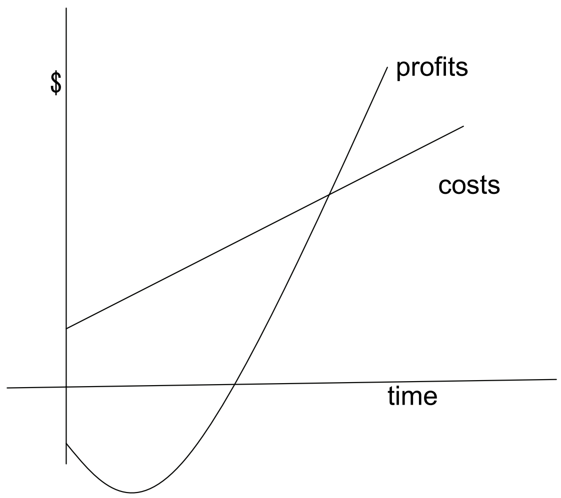


Figure 8: The hockey stick model

In the case of stimulating modal shift towards more sustainable modes of transport, many types of governmental subsidies have been put forward to overcome the problems of the non attractive business cases. A very popular one on the European level is the so-called Marco Polo instrument, which stimulates projects where the amount of CO2 reduction is considerable and companies receive a substantial amount (max 50%) of costs subsidies to make the projects attractive. In the case of Marco Polo only projects are subsidized that become profitable within 5 years after their start (see EU, DGTREN, 2009). Companies that start to make profit have to pay part of this subsidy back in order to avoid market distortion. Although this Marco Polo subsidy is only designed for stimulating modal shift, it seems that this principle could equally be relevant for other projects that are aiming for CO2 reductions on another way, such as through synchronizing the supply chain.

13.5 Conclusions and Epilogue

In this contribution that was intended to be incorporated to the Liber Amicorum of Jo van Nunen which had to be presented to him on September 3rd, 2010. I am sad not to hear his reaction, which no doubt would have begun with an appropriate joke that was associated to the one mentioned in the title of this contribution. In this contribution, I have tried to show that, notwithstanding the great effort that many logisticians (amongst which Jo van Nunen himself) have made, there is still a great deal of improvement possible in logistics, both from the point of view of shippers and carriers that put great emphasis on the importance of cost reduction and service improvement as well as from the point of view of society as a whole. We have shown that the generalized cost principle, often used to avoid sub-optimization within logistics systems, should be extended to take into account the effects of uncertainty in supply and demand. Furthermore we have indicated that decisions on innovations in logistics (as well as in other systems) can be blocked by many so-called 'soft' factors, that sometimes are of greater importance than the 'hard' costs and benefits that could be achieved if such innovations could be realized.

But even more relevant, I hope to have shown that one of the most important reasons for not achieving potentially attractive optimization possibilities has to do with lack of trust and lack of governmental support. I have indicated that widening the scope of instruments such Marco Polo could help to overcome these thresholds and lead to increased profitability, both private and from a societal point of view.

References

Anderson, D.L. and Lee, H.,(1999), Synchronised supply chain: the new frontier, Achieving Supply Chain Excellence Trough Technology, Montgomery Research Inc, 1, 12-21

Ashcroft, J. (2009), The eight dimensions of Supply Chain Synchronization, http://www.supplychainnetwork.com/eight-dimensions-of-supply-chain-synchronization/3/

Christopher, M. (1992), Logistics and Supply Chain Management, Financial Times Pitman Publishing, London

EU, DG TREN, MEMO/09/443 (2009), Marco Polo 2003-10 - Commission builds on the success of Marco Polo programme, Brussels

Groothedde, B., Ruijgrok, C.J. and Tavasszy, L.A., (2005), Towards collaborative, intermodal hub networks: a case study in the fast moving consumer market, Transportation Research, Part E, 41, 567-583

Groothedde, B., (2005), Collaborative Logistics and Transportation Networks, A Modelling Approach to Hub Network Design, Dissertation, Trail series T2005/15, Trail Research School, Delft

Henstra, D.A., Ruijgrok, C.J. en Tavasszy, L.A., (2007), Globalized trade, logistics and intermodality: European perspectives, in: Thomas R. Leinbach and Cristina Capineri (eds), Globalized Freight Transport, Edward Elgar Publishing Ltd., Cheltenham, 135-166

Jansen, B. and Verver, G.J, (2008), Distrivaart, Troubled past of a future network, Masters Thesis TU Delft

Rodrigue, J.P., (2006), Transportation and the Geographical and Functional Integration of Global Production Networks, *Growth and Change*. Vol. 37, No. 4, pp. 510-525.

Simchi-Levi, D., P. Kaminsky, E. Simchi-Levi, (2000), *Designing and Manageing the Supply Chain,* McGrawHill Higher Education,

Tavasszy, L. , C. Ruijgrok, I. Davydenko, (2010) *Incorporating logistics in freight transportation models: state of the art and research opportunities,* paper prepared for WCTR 2010, Lisbon

Van Binsbergen, A. et al., (2010), *The Assets of Transumo* (in Dutch), Transumo Zoetermeer

Van der Vlist, P. *Synchronizing the Supply Chain,* (2007), Trail Thesis, T2007/7, Trail Research School, http://repub.eur.nl/resource/pub_10418/index.html

Van Nunen, J and D. 't Hooft, UNECE, (2008) *Transport without Borders*, www.transumo.nl/Downloads/UNECE%20%20Transport%20without%20borders%20(5).pdf

Visser L.J. (2009), *Resistance to Change: a Threshold to Benefit from Logistics Collaboration,* Proceedings NOFOMA Conference Jönköping 2009, pp. 853-874.

Visser, L.J. (2010), *Thresholds in Logistics Collaboration Decisions* , Ph.D. Thesis Tilburg University.