Many studies on mode choice focus on determining which attributes play a role in mode choice and what their weights and elasticities are.

A framework of organizational and behavioural mode choice processes

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SUMMARY

As part of a European research project on mode choice (CEDR,2017), KennisDC Logistiek Gelderland, the logistics research group of HAN University of Applied Sciences, developed a framework of organizational and behavioural mode choice processes. Many studies on mode choice focus on determining which attributes play a role in mode choice and what their weights and elasticities are. In this report we take another perspective and look at mode choice from a process perspective at both the strategic and the operational level. In the end, it is a person (e.g. a transport planner, or supply chain manager) who works inside an organization with a certain strategy and goals, who makes or influences the mode choice. Therefore, a framework of organizational and behavioural mode choice processes is developed, based on literature from psychology, management and logistics. The framework combines both the individual perspective and organizational perspective and builds on two theories. The first one is the theory of planned behaviour, which explains how a indivdual forms an intention and how an intention leads or does not lead to a behaviour. The second one is policy deployment, which explains how

an organizational strategy can effectively be translated to department and personal goals. The framework is then applied to seven cases. These case studies involved in-depth interviews with logistic and general managers and planners from both shippers and logistic service providers (LSPs). The report ends with a conclusion on how organizations can stimulate sustainable mode choices at both the strategic and the operational level and how policy makers can support them.

Literature review: Mode choice processes

Rational decision making and utility theory

The theory of rational behaviour is a framework for understanding the social behaviour, that consistently pursuing some well-defined goals and pursuing them according to a set of preferences The theory of rational behaviour assumes that an individual has preferences among the available choice alternatives that allow them to state which option they prefer (Harsanyi 1977).

Figure 1 rational decision process

The rational decision process is depicted in the above figure. This rational choice process can be modelled using discrete choice models in which the goal is specified as a weighted sum product of choice attributes. The previous sections used (notions of) these models and as such gave valuable insights in attributes, thier weights and elasticities. The following sections add to these insights by taking other perspectives as well.

Bounded rationality and satisficing

Any making of a decision as an individual, always has its restrictions to a certain degree, either in terms of the availability of a limited number of alternatives of choices, cognitive limitations of an individuals' mind, or limited available time to make a decision. These

limitations, or boundaries of rationality are discussed further by Herbert A. Simon (1972). He emphasizes the fact that an individual who makes his decision under these boundaries, acts as satisfier, where he is seeking a satisfactory solution, rather than an optimal one. In the next section, we will provide a brief presentation of this so-called 'bounded rationality', and how it may occur.

Simon (1972) denotes rationality as 'a style of behaviour that is appropriate to the achievement of given goals, within the limits imposed by given conditions and constraints.' Theories of rational behaviour may prescribe how an organization (or people) should behave under certain conditions, in order to achieve certain goals, or it could also describe how organizations do behave. Any individual, any organisation once faces goal conflicts. Many times. In fact, a proper theory of organizational rationality must be able to deal with the phenomena of goal conflict. The author presented three limits on perfect rationality: uncertainty about the question what would be the consequences that would follow from each alternative that the decision maker has to choose among. Lack of information about the (set of) alternatives. And, complexity of the alternatives, which hinders a valid judgment .

When an individual applies the weighted additive rule, Simon (1955) argues that it may be beyond an individuals' bound, particularly when a decision requires great effort and long decision time. In line with the concept of bounded rationality, Simon (1955) presented a satisficing heuristic as an alternative, to lower the accuracy level and in the meantime to lower the decision strategy's effort. The heuristic suggests that an individual should choose the first alternative that meets the minimum goal level.

How could such a heuristic apply to a freight transport mode choice? For instance, when an LSP receives a shipment request that late, that he does not have the time to evaluate all the possible alternatives? Or when he receives the request on time, but is busy with other more urgent matters? The LSP would then go for the first alternative which appears, that matches his attributes and criteria. However, is this the case in business reality? We will come back to this question in the empirical section.

Theory of planned behaviour

The bounded rationality approach, including satisficing heuristics and other utility models help us to map the attributes and alternatives that are evaluated by the decision maker. To predict and explain human behaviour in specific contexts, Ajzen (1991) has developed a theory of planned behaviour that builds on a framework that illustrates the nature of the behaviour-specific factors. Human behaviour is according to this theory regulated by three mechanisms:

- Behavioural beliefs produce a favourable or unfavourable attitude towards the behaviour.
- Normative beliefs result in perceived social pressure or a subjective norm.
- Control beliefs give rise to perceived behavioural control.

All these lead in combination, to the formation of a behavioural intention. As a general rule, the more favourable the attitude, the stronger the subjective norm, and the greater the perceived control, the stronger the person's intention to perform the behaviour in question. Intentions are indicators of how strongly a person is willing to try. It's worth mentioning that a behavioural intention only finds expression in behaviour if the person can decide whether to perform the behaviour or not. The last element in Ajzen's planning model, is behaviour, where the intentions are carried out or not, when the opportunity appears. Aarts and Dijksterhuis (2000) added habits to the framework, that can overrule intentions and lead to automatic behaviour. The above is depicted in figure 4:

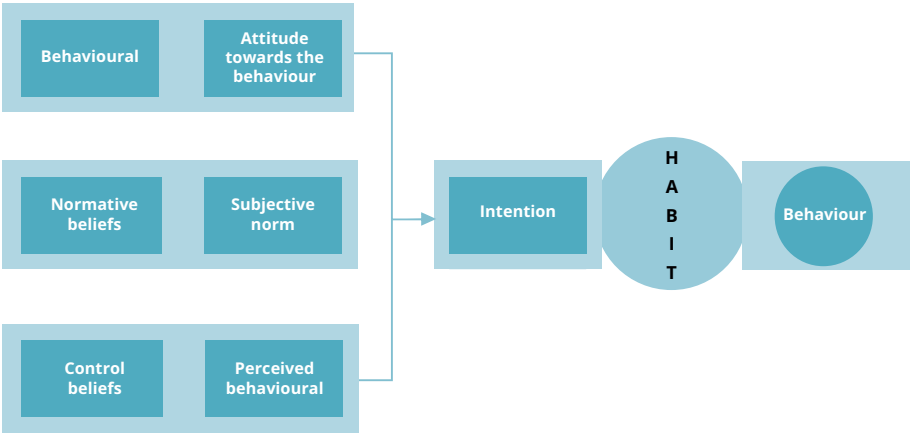

Figure 2 Theory of planned behaviour, including habits, based on Ajzen (1991) and Aarts and Dijksterhuis (2000)

How could this theory apply to a freight transport mode choice? It shows for instance that if an SC manager has a very positive attitude towards sustainability, this may affect his mode choice. Alternatively, if a transport planner has the habit to use a road carrier, this may overrule good intentions. This raises the question how attitudes, norms and intensions interrelate on an organisational level. Is there any mechanism in the organisation which helps to spread norms and create common attitudes? Or to deal with internal differences?

The role of habit

Habit is a next issue that interferes when making decisions. The existing literature on this phenomenon shows a lot of different definitions on habit, made by various authors, including on synonyms for habit such as: repeated actions, routine and past behaviour. However, not every author agrees on these being a synonym. For instance Klöckner and Matthies (2004) rather understand habit as a behavioural script- that negotiates between behavioural patterns and situation cues. They state that by repeating the same behaviour under the same circumstances, the association between patterns of behaviour and cues is being learned. The complete pattern of a behaviour is called by them as past behaviour, where repeated actions are defined as the part that is frequently repeated. And the repeated actions that are under control of the habitual scripts, that are conducted without thinking- considered subconsciously- are defined by them as routines. In addition they describe the power of a habit as the more often an action is repeated, the more powerful these habits influence the intention (Klöckner and Matthies 2004). For instance, in a freight transportation mode choice, in case a shipper choses to transport a shipment by road, and doesn't think about or considers other options, because that's how they have operated over time, Klöckner and Matthies would say his decisions are made based on habit. The direct relation between past and future action shows that an individual simply do things as he did them before (Aarts and Dijksterhuis 2000).

In his article Rasmussen (1982) relates decision strategy' choices, to a degree of automation or experience with a decision that an individual has. In addition, he gives a classification of various types of human behaviour, which may lead to different types of errors, and can be compared to habits. For instance, in a freight transport mode choice situation, this can mean that if a shipper has a negative attitude towards modalities with which he has no experience (in many cases rail or inland waterways), he will probably not choose them. Rasmussen categorizes such constraints as human errors.

The influence of the organization

On a company level organizations develop a company mission, vision and strategy that helps the company to go into the direction thats suits with the characteristics and features of the company and the demands of its network. The overall company strategy will be translated into department strategies, which again will be translated into goals, which are made measurable with key performance indicators,. This idea of translating an overall company strategy into measurable KPI's can also be found in the balanced scorecard as developed by Kaplan and Norton (1992). see Figure 3.

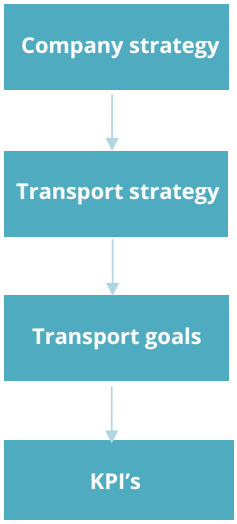

Figure 3 Strategy deployment

As Pieters et al. (2012) showed, at least in the Dutch case, the majority of logistics service providers have adopted sustainability in their overall company strategy. We expect this to be the case in more countries.

We argue that if, for example, a logistics or transport related company has defined sustainability to be key in its overall business strategy, we expect sustainability tobe key in its transportation strategy as well. And, as 'what you measure is what you get' it would be part of the KPI's of the transportation department as well. A KPI could for instance be percentage share of transport kilometres by barge, or average utlization rate of trucks. The company for example could develop mechanisms to stimulate the SC managers and transport planners to prioritize good scores on these KPI's by making them personally responsible and rewarding them in case of getting good results. Or, by including sustainability in its planning and control cycle, a company could continuously monitor and steer itself into the desired direction.

To conclude, we expect that in case this 'translation' mechanism appears to work properly, a company can influence the attitude and intentions that SC managers and transport planners have towards choosing multi modal transport, in a positive way.

Conclusion: Framework of mode choice processes

The literature shows that the restrictions of rationality of decisions are manifold. Limitations may be due to limited information, too large complexity of alternatives, or too little time to make proper judgements. Norms, attitudes and perceived control may not all be in line with each other, both on the individual and organisational level. Habits interfere with attitudes, norms and definitely with the actual behaviour. Getting norms, attitudes and control in line with each other on an organisational level, often is supposed, but can't be taken for granted.

In principle, disruptions may occur between all stages at the strategic level, between all stages at the operational level, and in the alignment between strategic and operational level, as illustrated in figure 4.

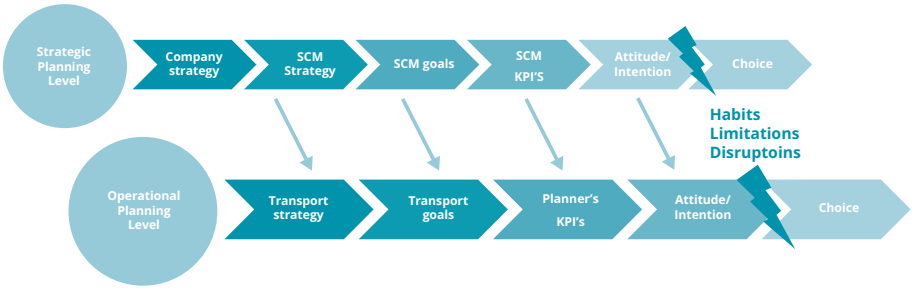

Figure 4 Framework of mode choice process

Next to that, within large companies, planning also is defined and the tactical level in between strategic and operational level. In the SCOR-model for example, a division in three is made regarding logistics planning, that results in a 'strategic' long term planning, 'tactical' medium term planning, and an 'operational' short term planning. Such a distinction does not apply for all cases. At least a distinction has to be made between the strategic and operational level. That is what we will do in this report.

In the previous we argued that a mode choice is the result of a behavioural choice process from an individual (with attitudes, beliefs, habits and limited rationality) and that an organization is expected to influence their employees to act in line with its strategy. These two processes (organizational and personal) occur at both the strategic and the operational level. For instance, on the strategical level a SC manager might conduct a yearly transportation tender that is used as a guideline by the transport planner to plan the daily transport. The SC manager may also hold a strong positive attitude towards sustainability and this may affect

the attitude of the transport planner. The framework in figure 4 puts the two processes and levels together and will be used in the next section to describe the case studies we conducted.

Case studies

Case 1: Logistics Service Provider A

Company description and characteristics

The first company we interviewed is a logistics service provider, hereby called "LSP A". The company can be categorized as a small to medium sized company, operating with 2 facilities in the Netherlands. They are operating mainly in the road transportation segment, with a core business as courier (express). In addition, they offer various services for their customers, depending on what the customer demands. LSP A has its own trucks, but offers services with other transportation modes such as by air freight, rail or by barge, which they outsource (using third party logistics). Their customer market is mainly within Europe, with the flexibility to ship goods outside the EU borders. LSP A handles shipments of different sizes, the specific amount was not mentioned during the meeting.

Mode choice- how the company chose the modes in general

Our respondent is the founder of the company, and makes decisions at strategical level. In addition, he has a good insight in the operational part of the company, which proved to be enough to answer on our questions on operations as well.

The company makes its mode choice based on the customer request. As they are frequently last-minute requests, this results in most cases in road transportation. Road is often the fastest alternative and time pressure also favours habitual (=road) choices. Furthermore, LSP A favours road transport, because they have their own vehicles. In case the customer asks to send the shipment by barge or by rail, 3PL service is used to meet these requests. Otherwise, they prefer to do the shipments themselves by road so they control and guarantee a high service level. The location of LSP A does not give much room for other modal choices, especially for domestic shipments. For international shipments (within EU), there is more room for intermodal solutions. For instance, shipments to the UK are done by truck/rail intermodal transportation combination. On the other hand, shipments to Italy are done by truck.

LSP A tries to optimize and consolidate their courier transports, for instance by driving up to Amsterdam, but in most cases they drive back with an empty vehicle. This is partly due

to the uncertain transport forecast planning. LSP A can plan up to 10 trips in the morning, however, by the end of the day they could end up with 35 direct transports, both pallets and packages, as their customers call them very last minute.

Besides consolidating transport, LSP A also tries to use appropriate vehicles. When the customer for instance needs to ship one pallet to Amsterdam and asks for a truck, LSP A makes sure to ask the customer about the weight and size. Based on these two factors, LSP A can advise the customer on alternative vehicles (in terms of size) they can send. They always try to downsize the car. The customer is also informed on alternative delivery dates, instead of "delivery tomorrow", LSP A offers longer lead-times (3 days) for a reduced price. If the customer accepts the offer, it will mean less trucks on the road. However, if the customer doesn't accept the offer, they will not discuss it further, but rather meet the customers' request.

To summarize what we have discussed above, LSP A is operating in the courier segment with their own vehicles. A characteristic of this segment, is that everything needs to go fast, i.e. time is a constraint, and last minute request are remarkably high. As a result of this, it makes it quite challenging for the transport planners to develop a plan which involves intermodal transportation for the shipments. Their decisions are also limited by their own interest to use their own trucks and earn profit of the delivery of the shipment, including making sure they provide the service a customer is expecting- personally-, and not through a 3PL.

Organizational stimuli for sustainable mode choice

According to our respondent the company does not have any policy or KPI's that support any green choice, at this moment. Their trucks and cars are diesel fuel vehicles, which is according to them most efficient and convenient. However, their warehouse has an eco-lightning. In addition, LSP A is open to alternative options, electrical vehicles for instance. The electrical vehicle market is a growing market today, however, the electrical vehicles for freight transport is not quite developed yet. The option would be favoured if the electrical vehicle could drive 500-800km.

The company wants to expand its business by starting with a number of new facilities. An expansion will contribute to the opportunity to combine goods, and avoid empty vehicles on roads. This is the reason why they want to expand from 2 facilities to 8 facilities in the upcoming 10 years. Thus, as long as it's convenient within the time frames that their customers request, they try to combine to greater extent, however, that is not always possible.

Personal attitude and disturbances (habit, rush orders)
In general, transport companies that operate in the courier segment, are usually constrained by time. As the customer requests are arriving last minute, the only freight transport mode that is convenient at that moment is road transportation. Thus, the company does try to combine as much as possible, but that's not always possible. Educating the customer is not considered to be their task.

The governments' contribution to advocate multimodal- seen from the LSP's perspective
According to LSP A, the government could try to make multimodal freight solutions more cost-efficient and more easy to use. The last mentioned is concerning LSP A especially. Due to their location, the closest rail station is between 14-17km. Along with what is found in the literature, facilities should be close to a railway infrastructure, when considering intermodal solutions (Stank and Goldsby 2000); (Henstra and Woxenius 1999). The government could additionally advertise the multimodal concept more, especially through some sort of training. The result of this would be that multimodal solutions will appear as something interesting for logistics service providers to investigate further.

Case 2: Logistics Service Provider B

Company description and characteristics
The second company we interviewed is a logistics service provider, hereby called "LSP B", and can be categorized as an international company. LSP B operates within the global forwarding, supply chain, and distribution segments. They offer various transportation services, such as air- and sea-freight, including import and export for their customers in EU. In addition, they use their own trucks for the routes that cannot be done by rail or sea (LSP B does not own their own vessels or trains, these are used through a third party).

Mode choice- how the company chooses the modes in general
Our respondents' role in the company is managing director. At the moment, LSP B makes its mode choice based on the customers' request. However, the company offers a wide variety in transportation services, which includes road, rail, sea, and air. Among all the alternatives of freight transportation modes, LSP B favours particularly rail. In addition to the cost saving aspect, there are two reasons why they favour rail as a freight mode transportation:

1. The rail operator will pick up the container the first or second day after arrival and brings it to the inland depot, which results in no extra charges from the port.
2. Going by truck directly from the port, the trucker gives a two hours to the client to load/ unload the container. If the time is exceeded, the client gets extra charges.

According to our respondent, 90 % of the cases, the customer chooses truck as freight transportation mode for their shipments. If the customer chooses the alternative by rail or by barge, it costs the customer two extra days. According to LSP B, these shipments seem to be regular shipments in most cases. A suggestion from LSP B which would contribute to an increase in variety of modal choice, is better planning from the customer. On the other hand, when the customer is requesting a lower cost option, combined transportation is not necessary the cheapest option in the Netherlands. The trucking cost does not differ much from barge cost. Furthermore, barge has always a problem, for instance low/high water and rail does not have much capacity left.

Organizational stimuli for sustainable mode choice

LSP B has a policy which states that if a shipment is near an inland terminal, the company will always try to advice the client to use rail or barge (preferable rail). LSP B includes cost and transit time information in the advice . In most of the cases, the customer rejects the advice of alternative freight transport modes will go by truck. There are no KPI's on sustainable mode choices.

The governments' contribution to advocate multimodal- seen from the LSP perspective

The first point our respondent emphasised was the new sea terminals, and the additional costs that are related to the transportation from the terminals. The additional cost is €100 (€ 50 each way), and in a such small country as the Netherlands, where you have to pay (roughly) around €1 per km, makes trucking all the way quite cheap compared to other countries. These terminal costs should be limited.

Inland waterway transport has become very attractive in the Netherlands, as there are more and more inland waterway terminals in the Netherlands. The chance of having a company or a warehouse close to an inland terminal is quite large. According to our respondent that is the main reason why barge is chosen more often.

Case 3: Logistics Service Provider C

LSP C is a transport company, with a core business in truck transportation with handling of up to 7 parcels, and 0.5 to 3 pallets. Other smaller shipments are done through their LSP by smaller trucks (Sprinters). The type of commodity LSP C transports is special consumer products. Their also provide last mile distribution. Other parts of LSP C's business is cross-docking and temperature controlled services due to health care products. Even though the company operates trucks, LSP C still considers other modes as well.

We interviewed two employees of LSP C, one of them has the role as a process- and implementation manager (Strategic level), and the other respondent is a transport analysist (Operational level).

Mode choice- how the company chooses the modes in general

LSP C operates only on roads, with trucks in various sizes. Considering the short time between their cut-off time and delivery planning, and the fact that they are distributing in cities, road is the only feasible option. This also applies to the few long distance lanes they have, for instance from France (cross-dock shipment). These lanes include as well the cut-off time: this morning they're loading goods in France, and the shipment has to be in their facility in the Netherlands the same night. It prevents room for other modality options, beside truck. By air could be an option which meets the requirements of the shipment. However, it would be significantly expensive.

The last five years, LSP C had some issues regarding negative numbers. Three years ago, all the shipments were done by LSP C. In some occasions, they had to drive 20 km for two parcels, and at that time they could not avoid these shipments, it's a part of their business. For that reason, LSP C started up with a new project, which involved collaboration with other LSPs that could handle the smaller shipments- partners with expertise in handling 1-7 parcels. In terms of shipments, 70 % of LSP C's delivery are now transported with their own trucks, and the remaining 30 % of the shipment is delivered by their Benelux partners. In terms of volume, LSP C covers 97 % of the delivery and the 3 % remaining is covered by partners. This lead to huge yearly cost savings.

Organizational stimuli for sustainable mode choice

The time the interview took place, LSP C had 2 city hubs with electrical vehicles. These city hubs are not cost efficient, however, LSP C believes in these kind of hubs, and it's part of providing "smart logistics" for their customers. LSP C is expecting to have city hubs (electric hubs) in 12 of the cities in the Netherlands they provide service to. The city hubs are a sustainable movement for their last mile delivery and despite that they are not profitable, they are important for showing that they are a green company.

The governments' contribution to advocate multimodal- seen from the LSP perspective

Economical profitable city hubs are difficult to realize, partly because of the challenge to start a collaboration with other LSP's, and the lack of financial compensation from the governments side. The idea of city hubs is supported by the government, in terms of moral support. The government does not require transport operators and LPS's to use city hubs. Although our respondent is not in favour of this "mandatory" city distribution from the governments' side, it could increase its use.

Case 4: Shipper A

Company description and characteristics

Shipper A is a manufacturer of fast moving consumer goods sold in supermarkets. Their production facility is located in the Netherlands, where the shipment goes out to their customers in the Netherlands, as well as Benelux (Belgium, Netherlands, Luxembourg). Their customers are mainly retailers in the Benelux. On daily average they ship about 30 to 40 truckloads. Retail Benelux is shipped via Shipper A's LSP, which is located approximately 100 KM from their manufacturing location. In additional to their Benelux customer market, Shipper A supplies as well the Scandinavian market from their warehouse. Shipper A's respondents' role in the company is Supply Chain Analyst, both for operational as strategical issues. The respondent does research on how the company can use multimodal freight to a greater extent for their shipments..

Mode choice- how the company chooses the modes in general

The most used freight transport modality is truck, and the reason is because of history, this is how the company have been operating in the past. However, according to our respondent, they do explore different options of combinations. Shipper A is experimenting with barge as a freight transport mode for the inbound shipment coming worldwide to the Port of Rotterdam. At this moment, rail is not used for their lanes. However, our respondent is (at the time the interview took place) investigating one possibility, which is from their production facility in the east of Europe to the Netherlands. In theory it's possible, however, Shipper A needs to see if it works in terms of price.

Shipper A has a warehouse located approximately 30 km away from their production facility. If the volumes are too high and they don't have space, they use this warehouse as an escape. However, the volumes are increasing rapidly, and according to our respondent, Shipper A cannot expand anymore. Due to this challenge, Shipper A is trying, especially with the big volumes, to ship as much as possible directly from their factories. The advantages are the cost savings they achieve, additionally avoiding paying ship-owner and goods-in/goods-out storage. Furthermore, Shipper A tries to arrange their LSP's around the production area, where the direct shipments are transported directly to the distribution centres. However, there are a few exceptions, whereby supply is done on store level.

Shipper A uses as well LSPs for some of their lanes. Shipper A, doesn't have any specific preferences regarding mode choice when they approach their LSPs. They just specify the load locations, destinations and required service level. If the LSP offers a solution that fits these requirements for a reasonable price, then it is good for us, regardless of the used mode.

There is one particular LSP that Shipper A has a long term relationship with. They work together on doing things better, by for instance optimizing lanes. This cooperation involves

several discussions on how to operate better. This LSP provides freight transport service by truck, air, and barge. Even though these discussions mean a risk for the LSP that Shipper A might choose a modality that is not owned by the LSP, the LSP believes that a long term relationship is most beneficial and profitable. This is according to Shipper A, correct.

Our respondent pointed out the importance of meeting other LSPs and shippers as well, share best practices and experiences. With these meetings, it provides room for discussing details in real case scenarios.

The majority of Shipper A's stock comes down to just in time/ days. However, for some products Shipper A holds stocks for 2 to 3 months. The reason is because of the pour prediction of production facilities in some parts of the world. The production there is not well enough developed in order to keep up with Shipper A's forecast. The large stock levels make sure that rush orders (leading usually to less sustainable mode choices like road and air) can be prevented.

Organizational stimuli for sustainable mode choice

In terms of environment and sustainability, Shipper A has a "lean and green plan". They have to reduce CO2 by at least 20% and preferably by 28% in five years (the plan started in 2015). To achieve the target, their strategy was to combine inbound and outbound flows. This can be done by trying to improve direct shipments, where they add shuttles from the factory to the external warehouse. By using more heavy trucks in combination with roundtrips, additionally by moving into barge.

The governments' contribution to advocate multimodal- seen from the shippers' perspective

According to Shipper A, the government should pro-actively inform shippers on their plans. For instance, our respondent learned on a meeting that the government of the province of Gelderland are planning to open a new rail terminal, the Valburg Terminal. If our respondent had not attended these meetings, Shipper A wouldn't have known about it. The government should bring together the shippers when they develop new plans. Some shippers are approached by the government (like our respondent), which is very good, but many are not.

Case 5: Shipper B

Company description and characteristics

Shipper B can be categorized as a large European manufacturer of frozen fast moving consumer goods. The whole production logistics and the physical distribution is organized from the Netherlands. Their business is to supply restaurants and super markets. Shipper B has two parts of their business; the inbound flow of raw material, and the outgoing temperature controlled flow which accounts for 97 %. For their shipments, they have over 50 LSPs in total. The respondent is a transport manager, and is responsible for all the temperature controlled transport (globally).

Mode choice- how the company chooses the modes in general

There are two flows for Shipper B. The transportation within Europe is mainly done by road transport, . The transportation outside Europe are handled in containers, over 2000 containers a year. The shipment to Italy is transported by rail, however, it's not big volumes going out of the Netherlands. For the UK market they use truck at this moment, however, Shipper B is looking at intermodal freight solutions. However, the volumes are not enough for the UK market to set up an intermodal freight solution by itselves. By this reason, Shipper B is looking together with the LSPs on how they can combine flows with other producers from the same areas as Shipper B is located in.

For their customers in Sweden, the shipment used to go by truck until Shipper B sat together with one of the hauliers and requested their shipment to be transported by rail. For the LSP as a road transport company, it was a mental shift in thinking "I am no longer someone who does road transport to Sweden or Scandinavia, I am a region transport arranger for the customer to Sweden, and if I go by road it's fine, but it can also be by vessel, or train". This was according to our respondent a way to open the haulier eyes, to look at alternative ways. As a result of the meeting with the haulier, Shipper B set up together this haulier system, where they send full loads shipments, three days a week, into Sweden.

Regarding export flows outside Europe approximately 20 % of their volumes are done by barge, going from Ports of Rotterdam to Antwerp in Belgium. The reason why Shipper B started to look into intermodal solutions, was the significant increase of their export flows from the containers, where they grew in 6 years with approx. 300%, and is still growing. That was their turn over point. Our respondent put then an effort to get in touch with "Bureau Voorlichting Binnenvaart"- an information agency that acts as an intermediary for all questions concerning inland waterway transport, to see what they could do there to go to Rotterdam by barge.

Also an advantage of using intermodal freight solutions is food safety. Food-safety is getting more and more a topic in FMCG andis about securing that no one can get the access to the food (and about temperature control) and this is better organized in non-road modalities.

Organizational stimuli for sustainable mode choice

There is a sustainability strategy, but not specifically for logistics. It is the respondents' dream that everything they ship over a distance of at least 700 km is done using an intermodal solution. He advocates this dream to his employees as a way to tickle them. Sitting back and using truck, because we have always used a truck, is not the way forward for him.

According to our respondent one needs to look into the advantages in the whole supply chain, transport is not the only part of it. The big challenge is that intermodal solutions require significantly high volumes. Therefore, Shipper B is also internally looking for ways to bundle flows and thus increase the use of intermodal solutions. The goal for this plan is to go from 20 % of their shipment sent by barge, to 60-70 % by barge.

At the time the interview took place, Shipper B did not use rail freight transportation for their shipments. However, it is an ongoing plan on setting up a system which includes sending one trailer every day to south of Germany. Compared to the high volumes that are already sent to Germany, one trailer is not much. However, according to our respondent, it's a step. It's more about the thought of a way to change how the operations are already done. And showing that it's possible to people. In addition, a new program from the province Gelderland includes an opening of a new rail terminal in Valburg. Shipper B could, as a start, use this rail terminal as a connection point, by sending shipments from Cologne to Stuttgart in Germany. Further, increase the tours 5 times a week, with 45 loads as outbound to southern Germany, and 15-20 inbound loads coming back to the Netherlands. As a big company with relative high volumes on roads, Shipper B feels a responsibility to get these volumes off the road somehow.

Shipper B takes part of the "Lean & Green" programme, and is still working on this.

Personal attitude and disturbances (habit, rush orders)

Many current mode choices are not very sustainable. However, our respondent has a dream of using intermodal solution for all freight over 700 km for instance and uses this to tickle the employees, to think about it. Our respondents' biggest challenge when it comes to new ideas is how to make the employees change the way they are doing things, to change their habit. However, the thought is there, there is an intention of more sustainable decisions, but changing habits is a challenge according to our respondent. We asked our respondent how he would proceed with this, to change the habits of the employees. Our respondent asks his employees to set a system in place, and sets a personal goal- which can be in terms

of salary growth. However, an important detail is to put the focus on people who want to change, and not on the people with negative attitude towards changes. It is important that the responsible is motivated and is open about disadvantages, for instance, lower service level if using rail, and the lack of flexibility when using intermodal, compared to road.

Shipper B is aware that there will come a time when they no longer have the choice to make changes due to a lack of truck drivers and possibly increasing government regulations and traffic jams. That is the main reason why at this moment they are looking at the alternatives that are out there. As mentioned earlier, a couple of their lanes done by intermodal solution are not profitable (but still break-even). However, the new plan they set up for shipments to Sweden was, according to our respondent, not because of money, but a way of thinking. If Shipper B can do it breakeven, then it's already accomplished.

It's not only a challenge to include employees and LSPs into changes, it is also a challenge to convince customers, especially for the ones that are used to "order today, deliver tomorrow". For these customers, there is a need for a long term process, Shipper B cannot switch that from one day to another- "It's impossible" according to our respondent. However, Shipper B has experienced when they ask the customers to change their ordering, for instance, instead of order today and delivery tomorrow, how about three days, there has been a split. Some of the customers are very open to that and see the advantage of planning ahead. Others don't want to because they focus on low stock levels.

Shipper B is also interested in combining their flows with other shippers' flows. However, questions about gain sharing and competition laws can arise. Therefore, for now our respondent believes that 4C (Cross Chain Control Centres) would be the future.

The governments' contribution to advocate multimodal- seen from the LSP perspective
According to our respondent, the government should include the cost of environmental impact in the pricing of transport modes, preferably on European level, this will eventually push people to go over to more sustainable transport, for instance rail. Transport is all about the cost, and money is the strongest incentive. This could be done in a fair way by for instance pay taxes per km, depending on congestions, especially into Amsterdam. To send a truck to Spain costs less than use of intermodal. Shipper B is already doing something by short-sea shipping (SSS) to Spain, however, they are competing with the road prices, which are ridiculously cheap according to the respondent. For example he could imagine that the French government would put a stop on the transits road transport that they are having in France. A new rail terminal is built in the city Mets in Franc. which requires the incoming trucks that are going transit, to go on the train now. This is something Germany could do for Poland for instance, and the train could leave every 10 minutes.

Case 6: Shipper C

Company description and characteristics

Shipper C can be categorized as a global manufacturer of high tech materials used in various industries like construction and wind industry. Shipper C has customers located all over the world.

Mode choice- how the company chooses the modes in general

Our respondent arranges the transport from the factory located in the Netherlands to the client. Shipper C does not own any vehicles, but uses LSP's. For the clients in Europe, Shipper C uses only trucks as freight transport modality, this includes southern part of Europe as well- Turkey, Spain, Italy. For the international clients, the products are transported overseas as full containers loads (20 or 40 TEU). The road shipments can be sent as combined or partial, and is mainly 10 pallets (3 load meters). An important factor why Shipper C uses 3PL, is because of the cost savings and because a 3PL can consolidate. Because of low volumes, it would be more expensive for Shipper C to buy directly.

There are two ways Shipper C uses an LSP in Europe, one for the Benelux market and one for the rest of Europe. For the Benelux market, Shipper C does a tender to compare LSP rates in the Netherlands, every three years, and chooses the 2 cheapest LSP's. One of them is a local company which doesn't have any additional travel costs, in case of unsuccessful delivery attempts. For the market outside Benelux, they use a global leading LSP.

For the shipments that go overseas, Shipper C compares the rate every month because of low container volumes. The use of barge is only to supply the harbour at Rotterdam and not inside Europe. The LSP they use for this type of shipment can do air freight as well, but it's not used much. In case the customer places a rush order, the customer pays the air freight, which is the reason why Shipper C doesn't spend much time in comparing air rates. The shipment that goes by barge or by truck is usually paid by Shipper C.

The biggest volumes go to Germany, by truck. As mentioned earlier, truck is the only freight transportation modality used within the European market. Rail has never been an option for Shipper C. Our respondent learned from his predecessor that is involves too much handling.

Shipper C gives information on the shipment and the requirements to the LSP. Whether Shipper C sends the shipments by rail/barge or by trucks, depends on what the LSP offers. If the LSP decides to send the shipment by rail, that's fine for Shipper C, if it's by truck, that is also fine. Shipper C doesn't really care about which freight transport is used for the shipment, as long it meets their requirements on cost and lead time. In most cases, the LSP doesn't offer alternative ways to send the shipment, beside trucks. The LSP just gives a transit time and rate for a truck delivery and Shipper C then compares this with other

LSPs and chooses the cheapest one. Shipper C would be interested on information on other options that are for instance more sustainable and cheaper, but have a longer lead time. They could then negotiate with their customers on this. However, the LSP doesn't offer these options (and Shipper C doesn't ask for them!).

On the other side, Shipper C has noticed a trend from their customers, they are ordering more Just-In-Time (JIT). This means for Shipper C's delivery performance an increase of stock. The machines don't have enough capacity to meet the JIT orders, and this results in higher stock level. The order system in general, is yearly orders, however, most customers order ad hoc, and as soon as possible needed. Shipper C's customers share their forecast with Shipper C. Shipper C doesn't share their forecasts with their LSP's. If the customer plans their forecast ahead, Shipper C will offer them discount, if the customer uses JIT order planning they will not offer any discount. However, because of the common used JIT order planning, Shipper C doesn't have the space to keep stock, which is an increasing challenge they are facing at this moment. Compared to the past, the time between order-to-order and delivery was 1 month, today it's 1-2 weeks. For standard product, Shipper C has a lead time of 2 weeks, and for customer-made products the lead time is longer.

The reason why Shipper C's customers are ordering JIT, is because many customers don't have a forecast. The specific market Shipper C supplies is Business-to-Business (B2B). The end customer is the sub-contractor which makes it a special market. The main contractors make an offer to win the tender. The sub-contractors don't give any stock forecast, simply because they don't know whether the tender that they are part of will win. The one who wins will then hire, for one construction work, 1000 sub-contractors, and these will then buy all the material they need.

Organizational stimuli for sustainable mode choice

Our respondent is making decisions on operational level. However, if the decision makers at strategic level need information about transport, they consult him. Because our respondent can have an insight in Shipper C's strategical decisions, he also see the gap between the strategical and operational level. Lowest cost is preferred by the CEO; service is more favoured on operational level than lower cost.

Although lower cost of freight transportation is favourable at the strategic level, this does not mean it can`t be sustainable as well. In practice, sustainability doesn't need to cost more. However, for Shipper C, cost matters. If the option of more sustainable choice is less expensive, they accept the choice.

Despite that Shipper C doesn't have any policy on sustainable mode choice, part of their operation is done in a sustainable manner. For instance the product they develop which

is used in the marine, is of light material. This contributes to less fuel, and lower the CO2 emission. At the factory, they will receive new led-lights, which are more sustainable. However, the main reason is because of cost. Shipper C gets subsidies from the government, which makes it cheap.

The governments' contribution to advocate multimodal- seen from the Shippers' perspective

The most important incentive for Shipper C to consider an increase in usage of multimodal freight, is cost. If the government would make the intermodal/multimodal freight transportation cheaper and cost effective, than transportation by road, Shipper C would go for the option of intermodal solution. This applies as well for other services that could be used in a more sustainable manner, as long as the government provides any discounts on being more green, Shipper C would accept the offer.

According to Shipper C, the local government has not engaged actively in the region where Shipper C is located to stimulate sustainable transport and he has never been contacted on this matter by the government.

Case 7: Shipper D

Company description and characteristics

Shipper D can be categorized as a global leading manufacturer, producing consumer products. The main factory is located in the Netherlands, and from there Shipper D supplies the European market. There are approximately 5000 loads going out of the factory in the Netherlands, mainly to the UK and Germany, on yearly basis. For the Benelux market, 2500 loads are sent out. In the Netherlands, their customers are the retailers, like supermarkets. However, most of the products go to Germany. Our respondents' role within the company is Supply Chain Manager.

Mode choice- how the company chooses the modes in general

Because of Shipper D's location and the high daily volumes, the company can store their products for at most one day (approximately 2000 pallets). For this reason, the most frequently used freight transportation modality is truck, used in 90 % of the cases. The company doesn't have an own fleet and uses LSPs for their shipments. They prefer to send the shipment directly to the end-customer, which is the cheapest option. However, if the shipment needs to be consolidated with other items, they will ship it through an LSP. When this task is given to the LSP, it is their task to do the consolidation and create the customer order, and further being picked up by a carrier and shipped to for instance a German customer. Intermodal solutions are already used for the NL-UK lane, truck to closest

inland terminal, barge to Ports of Rotterdam, short sea to the UK, and for the last mile it's done by truck. Shipments to Italy are done by truck. This is mainly because of infrastructure limitations, their location is not nearby a rail station, otherwise it would be an option to them.

How the company chooses their freight transport modalities is driven to a high degree by costs. There is a long-term relation with one LSP, because of a strategic partnership for which the LSP invested in building a new warehouse. Apart from that, a tendering process takes place on a yearly basis in which Shipper D shares their yearly forecast. After Shipper D has shared their requirements on the shipments, and the LSP's have submitted their options, Shipper D selects five LSP. The company also asks the LSPs to advise them on different modalities. Requirements can be discussed. A multimodal solution that is cheaper, but has a longer lead time than required is considered and can actually win.

On a daily basis the transport planner puts the loads in a software system. This functions as a market place: the five LSPs have access to the system and can bid on the loads. The cheapest LSP wins. However, the transport planner makes sure that the agreements from the yearly tender are met. So, if a certain volume was promised to LSP X in the yearly tender and this volume is not yet reached, the transport planner can decide to give the load to LSP X, even if LSP Y offered a lower price. The transport planner also takes the service level of the LSPs in consideration.

For Shipper D, it does not matter how the shipment is transported, as long it reach the desired pick-up time at the factory, which is crucial, due to lack of warehouse capacity Shipper D has, also the loading time at the receivers' side is required for the LSP to meet. So, if an intermodal solution would mean same lead-time, but less cost, Shipper D would choose that option. In addition, Shipper D is open to suggestion by keeping the requirements as they are, and lowering the cost. If this would mean to choose other freight transport modalities, Shipper D would do that then.

Organizational stimuli for sustainable mode choice

According to our respondent at this moment, the company does not have a sustainability strategy. However, Shipper D would still want to achieve some kind of environmental goals, despite that there is no key strategy on this. As an example, they agreed in the contract with the particular LSP they have a long term partnership with, to yield a 20 % energy reduction on a yearly basis. This will be reached by using the newly built warehouse which is much more energy efficient than the old one.

No sustainability KPI's are measured. However, KPI's on waste and utilization rate are measured and have a direct positive effect on sustainability.

Personal attitude and disturbances (habit, rush orders)
Shipper D was acquired by a large investment company, with profit (cost) driven investors. Our respondent holds a strong positive attitude towards sustainability and found that to convince the managers on a strategic level to look at more sustainable alternatives, he has to show the savings related to the request. If there is a saving aspect, it would most likely be favoured by the strategical level.

Shipper D may also be disturbed by rush orders. Although the shipments are planned on a yearly basis, there are a few emerging markets. Sales is eager to sell to these markets and uses direct rush shipments (LTL truck shipments without return loads) to meet customer requests. However, from a sustainability point of view it would be better to ship through a distributor in these markets, who has the power to combine the shipments.

The governments' contribution to advocate multimodal- - the LSP perspective
The government could contribute to increase the opportunity for Shipper D to use alternative freight modalities, by building a rail terminal closer to their factory (our respondent is aware of plans for the Valburg terminal). It would be ideal for the shipments to Poland and Italy. A way to 'force' Shipper D to change over to a more sustainable transport, is by making road transportation less interesting for them. For instance by add road taxes, which is done in other European countries.

The local government has said they want to be "the logistical hotspot", however, according to our respondent, offering a piece of land to build a warehouse on, is not what makes the area the logistical hotspot. If the government could provide multi modal terminals and secured areas for international truck drivers, that would be ideal.

Conclusions

As we showed in the first paragraph, we expect companies that consider sustainability to be key in their business strategy, to is translate their business strategy into a sustainability transport strategy, and that again into (smart) goals on emissions, modal split, utilization rate etcetera, which can be monitored by dedicated KPI's. We expected such translation exercises to have a positive impact on decision makers' attitude towards sustainability, which in the end should lead to sustainable (multi modal) mode choices. Figure 4 summarized the elements of the theoretical framework behind this assumption. This ideal situation however, was, not found in any of the case studies. The following findings can be drawn from the case study.

Strategy deployment and personal attitude

- Not all interviewees are aware of a companywide sustainability strategy. Furthermore, this companywide strategy is not translated into a sustainable SCM and transport strategy.
- In absence of a sustainable transport strategy, there are also no sustainability / modal split KPIs. However, some existing KPIs, like utilization rate and waste do favour sustainable solutions.
- Some SC managers from the shippers we interviewed hold a strong personal attitude towards sustainability, despite the lack of a transport sustainability strategy. As a result, multimodal solutions are actively sought.

Shipper – LSP interaction

- Cost is by far the most important criterion on which decisions are made. Of course, other requirements like speed and reliability have to be met, but the LSP who meets these requirements for the lowest cost, will usually be hired.
- Shippers expect the LSP to advise them pro-actively on multimodal solutions. LSPs often do not do this, because the shippers do not explicitly ask them to. Habit also plays a role here: they have always used road, so why consider anything else?

Shipper – government interaction

The shippers that hold a strong personal positive attitude towards sustainability are partly aware of and enthusiastic about governmental actions to stimulate sustainable transport. For instance, the province of Gelderland stimulates shippers to consolidate their freight, brings them into contact with LSPs who can offer multimodal solutions and consults and informs them regarding their plans for a rail terminal. However, not all shippers are aware of this and information is not always shared broadly.

The conclusions are summarized in figure 5

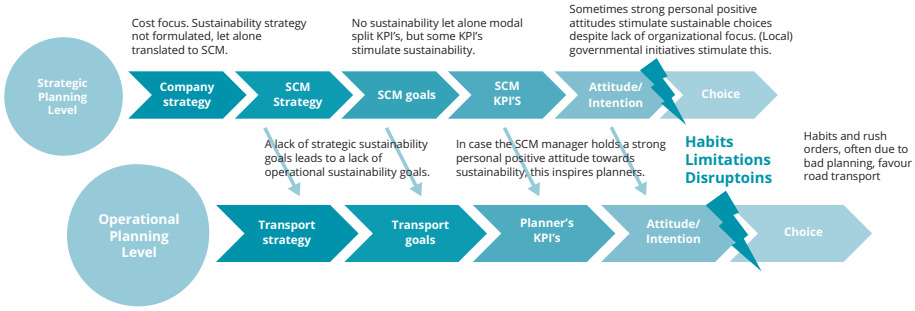

Figure 5 Mode choice process: ideal situation and company reality

Recommendations

All companies hold a strong cost focus. Shippers and LSPs point towards each other for exploring multimodal solutions. On the other hand, positive attitudes of SC managers still lead to doing so and governmental programs that bring together shippers and LSPs support them in this.

We therefore recommend road authorities to challenge companies to use multimodal solutions, which can be done in the following ways:

- Increase the cost of road transport. Many shippers and LSPs indicated that road transport is very cheap. And as cost is their main mode choice attribute, increasing cost of road transport will make it less attractive immediately.
- Join programmes of (local) governments or initiate them that bring together shippers and LSPs and challenge them to consolidate loads and use multi modal solutions. A good example of how this is done in the Netherlands is the NewWays / Lean and Green Off-Road programme (http://lean-greenoffroad.nl).
- Stimulate companies to set targets on modal split. This will increase the priority given to multimodal solutions and make the mode choice a real choice again, instead of an automatic habitual choice.
- Obligate or stimulate companies to make the CO2 emissions of their shipments

transparent. Let LSPs e.g. print the CO2 value of a customer shipment per kg goods on the bill of lading, together with an indication of how multimodal solutions would score and how well they perform in comparison to other shippers. Like the previous recommendation this will increase the priority given to multimodal solutions and make the mode choice a real choice again, instead of an automatic habitual choice.

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References

Aarts, H. & Dijksterhuis, A. (2000). "The automatic activation of goal-directed behaviour: The case of travel habit." Journal of environmental psychology 20: 75-82.

Ajzen, I. (1991). "The theory of planned behavior." Organizational behavior and human decision processes 50(2): 179-211.

CEDR (2017), FALCON Handbook, understanding what influences modal choice

Harsanyi, J. C. (1977). "Morality and the theory of rational behavior." Social Research: 623-656.

Henstra, D. & Woxenius, J. (1999). "Intermodal transport in Europe." TNO-report (Netherlands).

Kaplan, R.S. &. Norton, D.P. (1992). "The Balanced Scorecard - Measures that Drive Performance". Harvard Business Review. 1992, Jan-feb, pp.71-79.

Klöckner, C. A. & Matthies, E. (2004). "How habits interfere with norm-directed behaviour: A normative decision-making model for travel mode choice." Journal of Environmental Psychology 24(3): 319-327.

Pieters, R., Glöckner, H. H., Omta, S. W. F., & Weijers, S. (2012). Dutch logistics service providers and sustainable physical distribution: searching for focus. *International Food and Agribusiness Management Review*, *15*(B), 107-126.

Rasmussen, J. (1982). "Human errors. A taxonomy for describing human malfunction in industrial installations." Journal of occupational accidents 4(2-4): 311-333.

Simon, H. A. (1955). "A behavioral model of rational choice." The quarterly journal of economics 69(1): 99-118.

Simon, H. A. (1972). "Theories of bounded rationality." Decision and organization 1(1): 161-176.

Stank, T. P. & Goldsby, T. J. (2000). "A framework for transportation decision making in an integrated supply chain." Supply Chain Management: An International Journal **5**(2): 71-78.