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Is Collaboration Necessary? Or: Might the Physical Internet be implemented by Internalization?

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Abstract: *This paper discusses the necessity of collaboration in transport logistics, outlining two contrary case studies (retailer amazon and the small-structured fresh vegetables sector in Austria). We question if an internalization of crucial logistical activities might also lead to an implementation of the basic concept of the Physical Internet (PI). On a first glance, in-sourcing is contradicting the PI mindset as there is only little collaboration in this setting. So far, we consider that especially the PI community should investigate this topic of developments in more detail. If the PI, or the main concepts of the PI, could be realized via internalization as carried out by e.g. amazon, one should think about loosening competition rules. Furthermore, we would like to encourage this discussion together with ALICE via the organization of an event during one of the next ALICE plenary meetings with corresponding representatives on the podium.*

Keywords: *collaboration, internalization, competition, fresh vegetabels, retail*

1 Introduction

Which kind of challenges is humankind facing now? What is driving us? And where does it lead us to? In 2018, the European Union identified five priority societal challenges underlying the next research framework programme “Horizon Europe” where targeted research and innovation can have a tangible impact, i.e., health, inclusive and secure societies, digital and industry, climate, energy and mobility, and food and natural resources (EC 2018). Considering these aspects and the trend towards a greater socio-economic and political individualization, fair and responsible action and management become more and more relevant for today’s society. As a result, companies will be acting increasingly fair and responsible, assuming that fair and responsible action will guarantee profit and sustainable growth (cf. Schwab et al. 2019). In that context, logistics plays a central role in supporting companies to become “fair”.

Four main drivers that affect “fair and responsible logistics” can be identified (cf. UN 2015, p. 21 and DHL 2015, p. 3):

- changing societies (growing consumer demand for more transparency and fairness, increase in the consumption of fair and responsible products),

- disruptive technologies (convergence of social, mobile, cloud and big data technologies to achieve more transparency in and access to (green) supply chains)
- climate change and
- stringent policies (increasing regulatory framework for compliance and anti-corruption measures and social and environmental standards for businesses). (cf. UN 2015, p. 21 and DHL 2015, p. 3)

"Fair and responsible logistics" even goes beyond common measures to reduce the environmental impact of logistics activities by challenging industry's sustainability agenda. One would be advancing the circular economy concept and closed-loop supply chains, e.g. by offering biodegradable packaging, reverse logistics concepts as "Uber for waste", or extensive renewal processes for consumer goods (cf. Islam, Huda 2018, p. 48, Jammernegg et al. 2018). Another one would be the fair access to solutions that will help the underprivileged to improve their living circumstances, e.g. by creating small sachets for hygienic products at prices that are affordable for low-income families, or empowering local entrepreneurs by strengthening local farming by sourcing directly from farmers (cf. Chen, Chen 2019). An increase of transparency and responsibility in supply chains by promoting and facilitating fair production and trade, comparable to Green Supply Chain Management (GSCM) would be another important key aspect of the trend to "fair and responsible logistics" (cf. Jayaram, Avittathur 2015, p. 237). Last, logistics and/or supply chain management can substantially contribute to the "base of the pyramid", cf. Reiner et al. 2015.

A possible concept to enable "fair and responsible logistics" could be the Physical Internet (PI).

However, we have to state that the concept of the PI has its weak points. E.g., collaboration is most often seen as the most challenging need on the path to the PI (cf. Pfoser 2017). Even more, one has to raise the question whether collaboration is necessary at all. In this context, we will mention some examples of a well working (partly) global logistics network serving up to billions of customers – e.g. amazon and alibaba. Their main corporate philosophy is, however, not to collaborate, but to internalize (which means in sourcing of as many processes as possible). However, main decisions are taken by the companies and – that is the most important implication within this paper context – without the need for cooperation with other (maybe competing) companies.

Up to now, it can be observed that collaboration in most logistical services suffers from a lack of confidence in competitors and other market participants. Logistical operations include data, which has to be handled privately. Logistic service providers may not (and do not want to) share relevant information with others, e.g., for bundling, or route planning. Thus, considering an elimination of trust issues, is it possible to achieve the same positive effects of the PI when only one starts at the beginning? For this, the use case of amazon (and alibaba) is presented here.

2 Internalization of logistics services

Obviously, whilst talking about logistics services, there are two main complementary strategies to be applied. The first one is out-sourcing, i.e. the (sub-)contracting of logistics services with external companies. The second one, unsurprisingly, is in-sourcing of all logistics services. Please be aware, that in-sourcing does not necessarily mean that all assets like personnel, vehicles, etc. are owned and/or paid by the company itself but that (main)

decisions are taken by the company. On a first glance, in-sourcing is contradicting the PI mindset as there is only little collaboration in this setting.

2.1 The use case of amazon (and alibaba)

When talking about global logistics as well as PI, two companies come to one's mind: amazon and alibaba. Both in the retail (for everything) market. Moreover, they sell literally everything: That is, the goods to be delivered are from tiny, e.g. sewing needles, over huge, e.g. full-size rhinoceros, towards virtual, e.g. e-books or music. Obviously, logistics services cannot be "standardized" for every order. It can be assumed that it is hard to find a logistics service provider who can cover all different kinds and sizes of articles world-wide. So, one would expect that this market would require collaboration.

However, and this is on a first glance surprising, the main strategy of amazon seems to be to in-source all logistics services. E.g., in Vienna, Austria, amazon started to take over home deliveries from the Austrian federal postal service for the greater region of Vienna in autumn/winter 2018 (Der Standard, 2018). As reasons for this in-sourcing, amazon stated that internalization guarantees that order times with assured next-day deliveries (or even same-day deliveries) can be extended as negotiated release times with postal services does not need to be met. That is, from that point of view, internalization is essential as extra time needed for handing goods over logistics partners can be eliminated. At the same time, one has to question, whether the chosen approach has offers more benefits than just convenience for customers.

Amazon customers may have experienced weird situations, which, might be explained due to efficient logistics services. E.g., when ordering more than one time from the same product at the same time, it is not guaranteed that they are delivered within the same parcel. Even more, it is not assured that they are delivered on the same day or by the same logistics service provider. However, why? One explanation could be that the individual items are not stored at the same warehouse. Instead of consolidating the orders first and then send it to the customer, each warehouse packs the items and sends them directly. One now has to state the question: "Is this convenient for the customer?"

Likely, that consolidation takes place, as now all items independently from their origin warehouse have to be delivered to the delivery basis responsible for the last-mile delivery. In order to visit the customer just once (i.e., to save travel time and therefore costs), it might be cheaper to consolidate the items (which does not necessarily include a re-packing of the items into one box). That is, in-sourcing can have positive effects with respect to cost and emission savings.

Another showcase of cooperation through internalization at amazon is the concept of the marketplace. The marketplace concept provides individual companies the capability to sell their products via the well-known and accustomed look-and-feel of the amazon platform. In addition, companies can use the amazon warehouse and logistics services such as storage place and shipping partner such that companies only have to bear the economic risk while amazon (or their subcontractors) carry out all other operations.

Interestingly, this concept is exactly the idea often fostered by the PI community that warehouses have to be shared amongst companies. Instead of each company owning their own warehouse, all (amazon) warehouses around the world are open to all participating companies such that an even distribution of goods according to the PI idea can be achieved.

To be honest, both use cases of internalization as described above – if carried out carefully – have positive impacts from an economic point of view as well as from an environmental point of view. Even more, both use cases "mimic the PI idea" which is to cooperate in order to achieve these positive effects.

2.2 Food logistics in Austria – The use case of fresh vegetables

In 2014, a study was carried out in Austria to identify research, technology and innovation potential at interfaces between transport and logistics (cf. Stein et al. 2016). The scope of the study consisted of analyzing supply chains of varying complexity in the automotive, fresh vegetable, CEP services, and recyclable materials sectors. From the results of the study, valid statements on collaboration in the food logistics sector, especially for fresh vegetables, can be derived.

Austrian vegetable and horticulture, including fruit and potato production, represents an important sector within domestic agriculture, accounting for around 11% of production value. Pure vegetable production amounted to approx. 3% of the agricultural production value in 2012 (cf. BMLFUW, 2013b, 17). With the exception of field vegetable production in market fruit farms, Austrian vegetable production is mainly carried out in small and medium-sized production units. The average area used in horticultural vegetable production is 1.40 ha and in field vegetable production 5.81 ha. However, it is assumed that vegetable cultivation will lead to a further reduction in the number of farms, with a simultaneous expansion of the areas under cultivation and higher yields per hectare, or an increase in the number of planted trees per unit area. In the course of increasing the degree of specialization of individual farms, the crop rotation is adjusted to the quantity demanded, so that the number of crops decreases (cf. Hambrusch and Quendler, 2012, 11ff).

Supplying the population with regional vegetables is becoming increasingly important. The (Austrian) origin plays a particularly important role in consumers' decision to buy vegetables. This shows the confidence of consumers in product safety and product quality of Austrian vegetables, as well as the efficiency of existing quality assurance systems. In addition, environmental aspects, such as short transport distances, are playing an increasingly important role in consumers' purchasing decisions (cf. ibid, 2012, 50ff).

Within the scope of the horticultural and field vegetable survey 2004 (cf. Statistik Austria, 2005), latest data on vegetable marketing were collected: 76% of all gardeners sell directly to the end consumer in the form of a consumer market, their own shop, as well as via gastronomy and hotels. 32 % of the enterprises use resale to trade and 13 % resale to producer organisations or wholesale market (11 %).

2.2.1 Requirements for transport in the fresh vegetables sector

Both for the transporter and for own fleets, transport conditions result from the packaging requirements of the food retail trade. The protective function of the packaging is given top priority. Transport packaging must be temperature-resistant, stable, corrosion-resistant and

hygienic, stackable, compatible and meet the economic requirements of the food retail trade. In principle, reusable transport packaging is used.

One aspect that must not be ignored in the transport process is the container types used in food retailing, some of which differ greatly from one trading company to another. For example, REWE Group works with foldable trays made by Container Centralen GmbH with dimensions of 600*400 mm in three different heights (110, 167 and 220 mm), which only have a height of 36 mm when folded (cf. REWE, 2009). This reduces waste on the one hand and makes the reverse transport of empties more efficient on the other (cf. REWE, 2010). At the same time, the retail companies have strict requirements with regard to the containers they deliver. For example, SPAR AG has specified that fruit and vegetables (unless otherwise agreed) must be delivered in STECO returnable packaging (cf. SPAR, 2013). These are foldable reusable plastic packaging produced by IFCO. Depending on the turnover, the size of the vegetable containers varies (higher turnover requires larger crates with more contents), as do the package sizes, which entails additional logistical work (due to the need-based order picking). Hofer KG delivers fruit and vegetables in non-folding pool crates.

Cooling zones

With regard to the transport of goods with different temperature requirements, so-called multi-chamber refrigerated vehicles have proven themselves, which divide the loading space into two temperature zones. This enables a more efficient use of the loading volume of a truck. Thermo- and insulating hoods are also used in the transport of temperature-dependent goods. This means that goods with very different temperature requirements can be transported, such as frozen goods (-18°C) together with fruit and vegetables (6°C) and ambient goods (20°C) (cf. Krautz, 2014). The cooling zones and insulating hoods ensure optimum product quality.

2.2.2 Specific characteristics of the fresh vegetables sector

Both consumers and retailers have high expectations of the quality of products. To certify this, products are labelled with quality seals and logos. In order to receive a seal of quality or a logo, products must comply with specified standards. The labelling of products with quality labels can be based on private law or on EU food quality regulations. Private quality seals are awarded by the brand owner, who himself defines the quality requirements and determines the number and form of controls (cf. BMLFUW, 2010, 106). In addition, there are quality and safety standards such as the International Featured Standard, which is intended to ensure uniform verification of food safety (cf. IFS Management GmbH, 2014a).

The International Featured Standard (IFS) and the worldwide GLOBALG.A.P. are among the Europe-wide valid and recognized standards. Quality seals are awarded to conventionally produced products. The AMA seal of approval and Pro Planet are relevant for fruit and vegetables in Austria

All products produced organically comply with EU Regulations (EC) No 889/2008 and (EC) No 834/2007. Organic farming aims to have the least possible impact on nature in the production of agricultural goods. The use of artificial fertilizers and pesticides is essential for organic production. Only living organisms or mechanical processes may be used. Only natural or naturally derived substances may be used as fertilizers. Great importance is also attached to the welfare of farm animals, animal welfare and animal species-specific standards must be met and go beyond the Animal Welfare Act. Genetically modified organisms (with the exception of pharmaceuticals) are prohibited. Within the EU, organic foods are labelled with

the European Union's organic seal of approval. This is shown by a leaf consisting of stars on a green, white or black background. Below the logo there is a code of the authority or body responsible for control. The origin is also subdivided and labelled into "EU agriculture", "non-EU agriculture" (production of raw materials in third countries) or "EU/non-EU agriculture" (if the raw materials were partly produced in third countries) (cf. Regulation (EC) No. 834/2007, Article 24).

In addition to the EU organic seal of quality, there are many other seals of quality and private labels in Austria that identify organically produced products (e.g., *AMA-Biosiegel, SPAR Natur Pur, JA! Natürlich, Zurück zum Urspung)*.

Efficient Consumer Response (ECR)[1]

Efficient Consumer Response is the cooperation of all companies along a value chain and therefore of great importance for the vegetable sector. Like Supply Chain Management (SCM), ECR is based on the so-called pull strategy, since production and supply are geared to demand at the point of sale (cf. Ahlert and Kenning, 2007, 198ff). In contrast to supply chain management, which considers the entire supply chain, ECR focuses primarily on the processes between producers and retailers (cf. Meffert et al., 2012, 582). On the logistics side, an efficient, demand-driven replenishment of goods should be guaranteed. The aim is "to save resources by optimizing the processes between manufacturer and retailer (e.g. by reducing inventories) and to better satisfy demand (e.g. fresher vegetables through shorter delivery times)" (cf. Meffert et al., 2012, 584). The special feature of the food industry is that the goods turnover rate is much higher than in other sectors. Very precise planning is obligatory in order to avoid excessive losses due to spoilage on the one hand and to guarantee the supply of fresh goods on the other.

Identification codes

Different techniques for product identification are used in logistics and trade. The most important technology is a barcode, which is available in different versions. PLU (price look-up) numbers play a decisive role in retail as well. The most important identification codes used for fruit and vegetables are discussed below.

GS1 barcodes

When marking a product with a barcode, it is important to distinguish what the product is marked for. A distinction is made between consumer units for the scanner cash register, retail units (repackaging and overpacking) and transport units for standardized retail units, such as pallets (cf. GS1 Austria GmbH, 2014).

The end consumer units should be uniquely identifiable worldwide by their number. For standardized consumer units, this is guaranteed by a Global Trade Item Number (GTIN) (cf. GS1 Austria GmbH, 2014). Standardized end consumer units are equalized articles that the end consumer (consumer) pays at the scanner cash register of the retailer. Examples would be chocolate, milk, ready meals, etc. In the case of goods that are charged by weight, such as vegetables, for example, standardized end consumer units are not used because variable end

[1] ECR is a grocery industry supply chain management strategy aimed at eliminating inefficiencies, and excessive or non-value-added costs within the supply chain, thus delivering better value to grocery consumers. https://www.researchgate.net/profile/Paula_Swatman/publication/228588591_Efficient_Consumer_Response_a_preliminary_comparison_of_US_and_European_experiences/links/0912f50bc0809a6378000000/Efficient-Consumer-Response-a-preliminary-comparison-of-US-and-European-experiences.pdf

consumer units are used here (cf. Austria GmbH, 2013a, 1). The barcode symbols used are EAN-13, EAN-8 and UPC-A (North American form of EAN-13) (cf. GS1 Austria GmbH, 2013a, 2).

In the case of variable end-user units, on the other hand, identification is more difficult. By restricting the number, the variable end-user units can be allocated to 13 positions exclusively nationally (not worldwide) (cf. GS1 Austria Gmbh, 2014). Areas of application are products which are calculated by weight and not yet weighed or per unit of goods sold, as well as pre-packaged and excellent vegetables supplied to food retailers by the producer. The 13-digit article number has a 2-digit prefix, followed by a 5-digit identification number (HPID), then a field for the value of the variable unit and finally a check digit. The check digit is titled Modulo 10 (cf. GS1 Austria GmbH, 2013b, 1).

Price Look-up (PLU) Code

PLU codes are four- or five-digit numbers that make it easier to identify fruit and vegetable products at the checkout or during inventory. The code ensures that the correct price is paid by consumers without the cashier having to be able to identify the product. The four-digit codes are not assigned according to any particular system; they are random numbers assigned to a product. They are glued to conventionally produced products. The five-digit codes, on the other hand, identify biologically produced products or products containing genetically modified organisms. The digit 8 presented here means that it is a genetically modified product, the digit 9 indicates that it is a biologically produced product. The PLU codes are issued by the International Federation for Produce Standards (IFPS) and are not mandatory (cf. International Federation of Produce Standards and Produce Marketing Association, 2014).

2.2.3 Non-collaboration in the food sector due to…

Especially in the fresh vegetables sector, a small-structured supplier portfolio (smallholder farmers / gardeners) prevents logistical collaboration (in Austria). Producers face a large number of different seals of quality and (quality) standards and are confronted with high demands on his or her products. Whilst deliveries depend much on the time of harvest, the required quantities are based on an annual cultivation plan. However, retailers demand flexibility, and announce concrete order quantities approx. 1-2 weeks before delivery, which makes collaborative transport planning or routing difficult.

Moreover, food retail works with different types of containers, which makes picking more difficult, especially during preparation. Various types of containers also generate additional costs due to increased storage requirements. Customer-specific packaging is required. This prevents the goods from being handled quickly and leads to a negative effect on the freshness of the vegetables. At the same time, repacking is too time-consuming, so once products are packed for a trading partner, they cannot be sold elsewhere.

Mostly, transport is outsourced to the freighter, who also takes care of route planning. The maximum delivery time between the central warehouse and the branches is 18 hours. They are confronted with short order windows and short delivery time windows. Additionally, each actor works with his or her own IT solutions.

3 Conclusions and Discussion

As explained in the previous section, for some branches and/or companies (horizontal) cooperation is not the target. Even more, they focus on internalization and solely managing the whole supply chain. The question is, however, whether this approach – which is successful for at least some companies – finally leads to the same (positive) impacts as an ideal realization of the PI would lead. It is not easy to answer this question but from our perspective, we have to state that it seems to be likely that the main impacts will be met. However, especially in the European Union competition regulations are taken serious meaning that competition on the market is fostered and therefore cooperation and monopolies are not allowed or at least are checked in detail.

As in the case of fresh vegetable logistics, logistical collaboration is prevented by its special supplier structure; which is the case in sectors such as automotive as well. Moreover, varying short term and long term planning horizons complicate collaborative transport planning or routing. Moreover, different types of containers that are used in different branches makes picking more difficult, especially during preparation. Various types of containers also generate additional costs due to increased storage requirements. Customer-specific packaging is oftentimes required. This prevents the goods from being handled quickly. PI boxes such as the MODULUSHCA box are first approaches to solve such challenges.

However, another additional question arises here: If one company starts to optimize its own logistics services and this company reaches a critical mass, it might happen that others “jump on the train” and cooperate (voluntarily or not) with this company. The result finally is, that competitors are collaborating through this large company. One good example for this procedure is amazon. Being large by itself (and having reached the critical mass), collaboration with competitors started via the marketplace concept. Nowadays, amazon even provides storage space within its warehouses and therefore other companies being direct competitors cooperate with each other in logistics services since they participate in the amazon network. That is clearly an indicator that the original goal of amazon, i.e. internalization of all process, led to a positive development towards an application of the PI.

Further research should tackle the question how ‘fair and responsible’ logistics could be measured, and how the impact of ‘fair and responsible’ for the PI could be proved. Moreover, there is need for research identifying how different future logistics scenarios could influence the development of competing logistical strategies. How the theory of the PI could be expanded by defining internalization as an element of the Physical Internet (or Intranet?) is a further aspect to be discussed.

So far, we consider that especially the PI community should investigate mentioned topics in more detail. If the PI, or the main concepts of the PI, could be realized via internalization as carried out by e.g. amazon, one should think about loosening competition rules. Furthermore, we would like to encourage this discussion together with ALICE via the organization of an event during one of the next ALICE plenary meetings with corresponding representatives on the podium.

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