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Go2PI – Practically proved steps to implement the Physical Internet

Andreas Gasperlmair BA MA[1], FH-Prof. DI Hans-Christian Graf[1],
Sophie-Therese Hörtenhuber BA[1],
Dipl.-Ing. Florian Ehrentraut[2], Ass.Prof. DI Dr.techn. Christian Landschützer[2]

1. University of Applied Sciences Upper Austria – Logistikum, Steyr, Austria
2. Graz University of Technology – Institute of Logistics Engineering, Graz, Austria

Corresponding author: andreas.gasperlmair@fh-steyr.at

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Abstract: *The visions and concepts of recent research in "Physical Internet" (PI) try to avoid waste of resources in sustainable supply chains. Based on cross-company collaboration new principles of resource sharing shall be introduced. Therefore, higher-level coordination instances and new business standards are needed to increase the overall efficiency and to significantly reduce traffic in order to gain a substantial reduction in traffic. The research project "Go2PI" creates criteria and guidelines regarding aspects of technical infrastructure, information systems and operational processes to develop a provider neutral and open business model for distribution logistics. These guidelines are outlined and presented in this paper in three main implementation steps: Setting the vision for coopetition, standardization of logistics operations and standardization of financial clearing models. Additionally, further research objectives like business models, PI-hypersystem and the qualification process for transport service providers are described.*

1 Introduction

Current logistics research deals with the vision of the "Physical Internet" (PI, Montreuil, 2011) to avoid waste of resources in sustainable supply chains. Based on cross-company collaboration and cooperation, new principles of resource sharing shall be introduced. Therefore, higher-level coordination instances and new business standards are needed to increase the overall efficiency and to achieve substantial reduction of traffic while increasing service levels.

In Austria, for example, regional material flows are quite well connected by the existing transport industry; however, because of the fragmented nature of individual deliveries, which are generated by a big amount of different medium-sized companies and the special geographical and topological effects, deliveries are poorly bundled (Statistik Austria, 2014). On the one hand innovations of the smart production initiative connect dislocated production sights to regional production clusters thus enabling high-quality planning and production control. On the other hand optimized interfaces to connect enterprises via logistics and the expansion to integral value networks with variable capacities are widely missing. The research project Go2PI, which was co-funded by the Austrian Research Promotion Agency (FFG), is addressing these problems by applying the vision of PI to the Austrian logistics market.

2 Go2PI – The Project

The research project Go2PI (Roadmap towards the Physical Internet) is claiming to get a practical point of view on the visionary theories postulated by PI. Therefore, the research institutes University of Applied Sciences Upper Austria – Logistikum, Steyr and the Graz University of Technology – Institute of Logistics Engineering as well as the Austrian companies Aspöck Systems GmbH and Satiamo GmbH started their research in July 2015.

2.1 Project Objectives

Based on the practical case of an Austrian manufacturer in the automotive sector, Aspöck Systems GmbH, the scientific objective of the considered research project Go2PI was to evolve criteria and guidelines regarding aspects of technical infrastructure, information systems and operational processes to develop a provider neutral and open business model to optimize distribution logistics. Complementary focal points were container-management, cross-company data transfer as well as processes and methods for cross-company optimization of cargo. This should help to realize the following operational goals: sharing of resources and infrastructure across different sectors, increase of truck filling degrees by using modular intelligent containers (PI container) and optimization of logistical service.

2.2 Methodology

Derived from a case study, the paper covers criteria and guidelines regarding aspects of information systems, internal and external processes, processes to develop a neutral and open business model as well as the physical assets like PI container or PI handling technology in the area of distribution logistics. The methodology which could also be applied to similar cases in different industry branches to pave the way for a realization of the PI consists of the following steps:

1) Analyzation of the current situation of a small and medium-sized enterprise: key features and key areas to structure the analyzation

2) Development of the future scenario: application of a storybook approach and evaluation in order to derive requirements

3) Identification of gaps and outlining of potentials to realize the PI: application of assessment criteria and implementation paths based on the PI vision

A more detailed description of the methodology of Go2PI can be read in the supplementary paper "A case study derived methodology to realize the Physical Internet for SME".

3 Implementation steps towards a Physical Internet

The developed guidelines in the project Go2PI can be summarized and generalized to the following three main implementation steps, which become part of the developed roadmap towards the PI:

- Setting the vision for coopetition
- Standardization of logistics operation
- Standardization of financial clearing models

3.1 Setting the vision for coopetition

On the basis of the PI vision the initial step focuses on the definition of a fair benefit sharing model for the cooperation of competing forwarding service providers concerning assets and business information. Especially part loads and single unit loads - as mainly dealt within the project Go2PI - include a large proportion of inefficient use of transport capacity because of the nature of their structure, volumes, volatility and the differences regarding weights, dimensions, dates and destinations. Even logistics systems focused on this part of logistics, like breakbulk agents, suffer from a lack in fill rates, empty runs and cost pressures in both modalities road and rail.

In regard to the structure of consignments there is high potential concerning a sharing model. Like a superior authority this instance helps to gather shipment information from senders and capacities of freight forwarders to bundle cargo in an open company-crossed system. In the current logistics markets direct contact and relationships between senders and freight forwarding agencies are prevalent and lead to long-lasting customer loyalty. Therefore, some service providers developed to specialists in different industries and certain destinations with customized services and pricing models, which enable the highest service levels as well as easy operative processing. This rigid understanding of customer-forwarder relationship has to be softened in the first step in order to use the consolidation potential within the PI.

The most important and hardest task to convince freight forwarders to collaborate within the PI is to show the actual potential for each individual company. The theory is that PI can reduce empty runs and increase filling degrees within the whole system (Sohrabi and Montreuil, 2011). Additionally, economy as a whole is growing slightly and therefore demands for logistics services increase. The PI approach pledges to enable the logistics branch to accomplish rising demands of the market. But these arguments are not significant for each individual freight forwarder from an economical point of view. If there is no need for an additional truckload because of optimal consolidation of unit loads, any freight forwarder will lose this transport order. In the end it will be all about monetary benefits for logistics service providers to collaborate within the PI as interviews with freight forwarders have confirmed. Firstly, "qualified Physical Internet Service Providers" (qPITSP, details in 4.3) will have the chance to get additional unit loads to complement free capacities on their planned runs. The PI will support qPITSP actively with their consolidation task, which is crucial for their profitability. With intelligent and integrated cross-company-wide IT systems PI helps to realize this consolidation task with minimal process costs. Secondly, flexible financial clearing models (explained in 3.3) are ways to account the actual occurring costs and therefore create cost transparency.

3.2 Standardization of logistics operations

Building on the PI coopetition model, a concept for the standardization of information (data, formats and content), communication technology (electronic data transfer, data access and IT functionalities), logistics processes, products and mathematical optimization logics has to be created. This standardization is required in order to make the various products and services of the forwarders comparable and connectable. However, the risk exists that individual branch-specific solutions (specific unit loads, lead times and time windows) cannot be implemented in a PI solution in the first phase and are therefore continuously existing on the market parallel to the PI cooperation model.

Therefore, not only the diversity of transport management systems and ERP software but also the lack of consistent data structures in the background of these systems is a tremendous obstacle in the area of ICT. Thus, the integration of several partners to a central IT system requires an elaborate and cost-intensive design of interfaces. Therefore, it is a great challenge to identify widespread data standards (e.g. XML based) and design pattern for data classes in order to define the required shipment information to achieve standardization. The goal is to create a branch neutral data model to enable the PI functions of consolidating unit loads cross-company-wide and processing the actual transport as well as fulfilling all legal requirements. Furthermore, there should also be the possibility to transmit data specifically needed for a customer.

An early automated feeding of standardized shipment information into the system of the various partners in the network, gives the PI-hypersystem the necessary preliminary lead time to bundle cargo with different priorities according to predefined mathematical optimization logics including the capacity of the carriers. A remaining substantial barrier to implement these standards within the existing competitive market lays in the big market players who will definitely try to protect their huge investments in infrastructure and ICT made in recent years, which is interpreted as their competitive advantage. The further need for research within the topic ICT and software integration will be addressed more detailed in paragraph 4.2.

One unsolved question identified within the project Go2PI is, if a standardized PI container already shall be used in the first implementation phase as postulated by Montreuil et al. (2012) or if it is more practical to create a standardized intelligent identification technology at first, which can also be applied to existing unit loads. Interviewed forwarders and senders were quite critical concerning the implementation of standardized PI containers to substitute pallets as well as packaging in short term. Therefore, it seems to be a more acceptable and practical approach to create a communication module to interact with standardized identification tools at used hubs. Thus, PI unit loads (possibly a smart pallet) could be identified and handled within the network at each physical interface equipped with the corresponding hardware (e.g. smartphone or other reading devices). Another important constraint to consider is the compatibility for this potentially new system to unit loads which are not equipped with these modules. The practical example of CRC (Centre de Routage Collaboratif, 2016) in France shows that consolidation of shipments with existing standardized unit loads can already create significant benefits. Within the considered logistics market of Go2PI, euro pallets are widely used unit loads. One negative aspect compared to a PI container is the lack of information about the stackability of cargo using euro pallets. Practical examples showed that freight forwarders often do get an announcement from senders with an amount of trading units being shipped, but they often do not know what kind of goods are being shipped. Consequently, there is crucial information missing for the consolidation process. Furthermore, PI containers improve unit loads in terms of stability and safety. But the question whether to use an intelligent standardized container is again an economical one. Companies will make calculations including transport, handling and pooling costs, damages, thievery and direct costs for the unit load itself to compare it to the existing cost structure. Especially pooling costs for the reusable container are additional costs compared to systems using disposable package which have to be taken into account.

The practical use case of Go2PI showed that there is another critical issue concerning the vision of cross-company consolidation of freight within a flexible network: the lack of preliminary lead time for coordination and organizing the consolidation. The information from senders, about what is going to be sent, in which amount and what kind of unit load is often transmitted very late or sometimes not sent at all or the aviso for the freight forwarders hub is made just while loading. This is caused partly by a lack of consistent processes of the senders. Cargo management tools are often not integrated with other internal software tools used in sales, production and purchasing or important data is just missing. Resulting from that, big freight forwarders are organized very strictly with defined timeframes for first mile and last mile processes as well as exactly defined schedules for long runs in order to be able to guarantee fixed lead time for their customers. Freight forwarders know the market with its fluctuations in demand very well, so they can calculate capacities in trucks accordingly. Fluctuations in capacity in the short term lead to insufficient filling degrees for the last truck going to a specific direction which cannot be loaded adequately. Because of the mentioned strict schedules, there is no time for single unit loads, which are causing these insufficient filling degrees, to be consolidated cross-company-wide. Therefore, freight forwarders offer special tariffs for non-urgent freight that can be postponed for the next day and therefore are not causing additional transport. This kind of system for non-urgent freight combined with the appropriate financial clearing model will be mentioned again in paragraph 3.3. These closed logistics systems and networks work quite well and reliable, but do not allow cross-company-cooperation. They use their own sophisticated IT landscape for optimization and internal coordination of shipments. To enable cross-company-consolidation of freight and cooperation there need to be integrative cross-company-wide software tools (explained in 4.2.) and preliminary information about what exactly is going to be sent.

3.3 Standardization of financial clearing models

An additional crucial implementation step for the PI is the definition of rules for fair and flexible pricing, sharing of profits, shareholder models for direct members and partner models for additional service provider. A special economic incentive of the PI concept is the option of getting flexible transport tariffs in comparison to existing rigid ones. This means that monetary improvements (operational savings) in future are fairly distributed not only among the system partners, but also among the clients in the sense of variable transparent rates. Such a principle generated for non-urgent freight additionally enables the possibility of using low-cost transport time windows and creates further optimization potential as already mentioned in paragraph 3.2 (according to the principle “non-urgent goods are transported, whenever remaining capacity is available”).

Prices for transport services within the PI will consist of the elements shown in figure 1 sourced from Go2PI project documentation. Figure 2, also sourced from Go2PI project documentation then explains the cost parameters which are influencing those mentioned cost elements. Those parameters are also partly considered in today’s price calculations for some customers, but in PI there will be an impact on every single calculated transport price as there is the request for flexible financial clearing models. Those price influencing parameters can be explained as followed:

<u>Shipment related parameter:</u> Prices within the PI will be influenced by the type of unit loads (euro pallet, PI-container, etc.), by freight specific criteria like weight, bulkiness and stackability as well as by the transport distance. Concerning the transshipment costs there is a difference between Full Truckload (FTL) or Less Than Truckload (LTL) or even offering cross docking.

<u>Time related parameter:</u> As explained in detail in the paragraph “deceleration of supply chains”, time related parameter will have a certain role in financial clearing models within the PI as there is the urge to have time for the consolidation process to optimize utilization. A certain goal is also to have a flexible pricing system, which is dependent on the real occurring costs. For this reason seasonality and also the weekday of the delivery play a certain role.

<u>Service related parameter:</u> This cost driver depends on whether additional services during transport and delivery are required and what kind of service this is. This parameter differs from the service costs mentioned in figure 1, as there are “just” certain requirements for transport and handling the shipment which cause some modification of processes. Examples are handling of hazardous goods or special services like cash on delivery.

Sender/Receiver related parameter: Prices will also be dependent on total volumes of shipments sender and receiver are feeding the PI with, as there is enhanced potential for consolidation and optimization of processes.

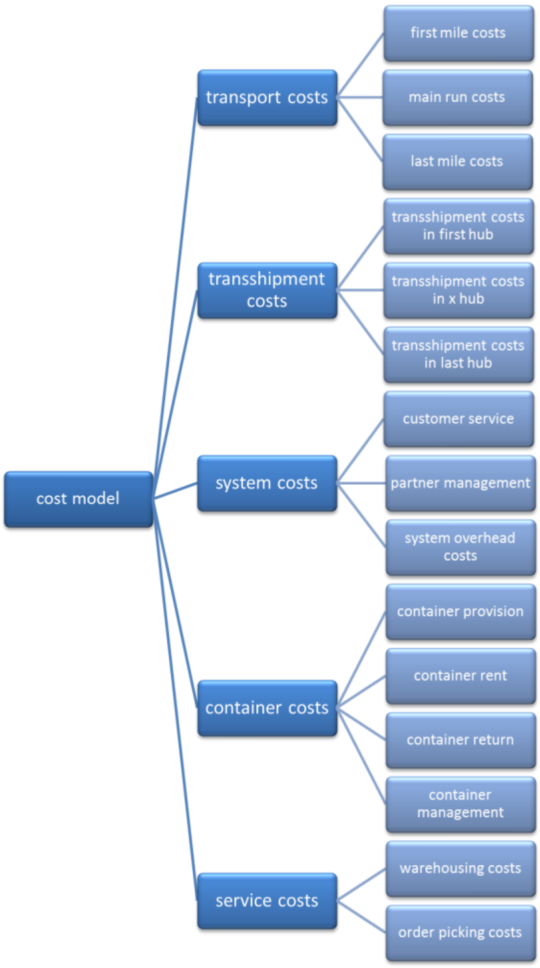

Figure 1: PI Cost Model

In fact, the different cost elements are quite similar to nowadays price calculations but are added by some PI-specific attributes.

Transshipment costs: In the PI there will be more transshipment activity for long transports, as there is the limit of four hours driving time for truck drivers for one direction (oriented on maximal driving time per day in Europe for truck drivers sourced from Chamber of Commerce Austria). The cost element “transshipment costs in x hub” describes all costs incurred at the hubs between the first and last hub.

System costs: Even if there are a lot auf automated processes operated by ICT within the PI, there will be the need for some kind of customer service, partner management and cost for administration.

Container costs: This element describes all costs for pooling, managing and providing PI containers.

Service costs: Additional costs will be accounted for additional services at the PI hubs like having decentral stocks directly at the hubs or picking costs.

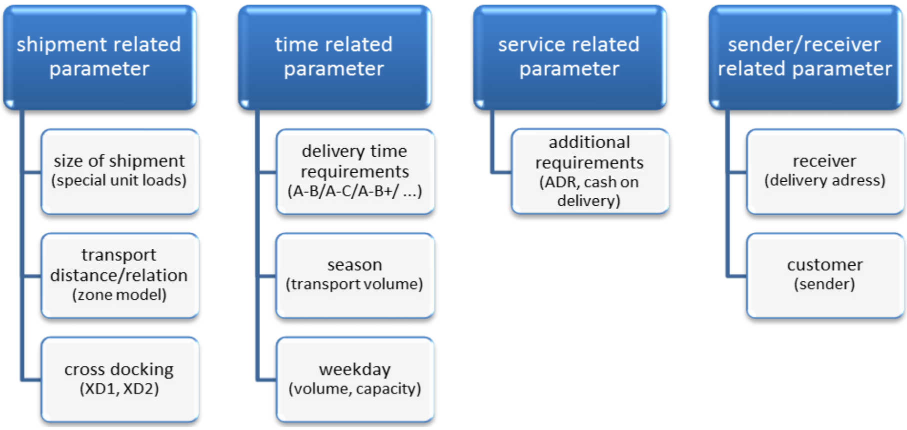

Figure 2: PI Cost Parameter

Deceleration of supply chains

A major factor for the implementation of flexible pricing models is the renunciation from the currently very popular delivery time commitments in the transport industry. Guaranteed service levels represented through the formula E + n (E = date of dispatch, n = number of guaranteed days of delivery) force the carriers to execute transportations even if the trucks are poorly utilized. On the one hand special tariffs were created in the B2B market, which result in higher prices for express-deliveries as incentives for customers to accept a longer delivery time. As a consequence forwarders have more time for consolidation and optimizing utilization of their trucks. On the other hand the market trend and competition are constantly reducing the factor n, especially in the B2C market. This is at the expense of utilization, cost and environmental impact and the e-commerce market pushes this development rapidly forward. Thus, in 2015 German retailers sold more than eleven percent of their products online and sent most of it via CEP services. This results in total sales of more than 52 billion euros and market players estimate that online retails continue to grow in 2016 (Bundesverband E-Commerce und Versandhandel, 2016). But logistics delivery flows run parallel and are often poorly utilized.

The practical experience of the project Go2PI shows a second trend: There is a weekly recurring fluctuation of offered capacities for international transports because of the needs of the truck drivers, as they wish to be home for the weekend. This means for example for Austrian shipments to Italy an aggregation of capacity at the beginning of the week and shortly after midweek.

The PI-theory would encounter this problem with the use of local drivers who would swap the PI-containers in truck-meets-truck traffic and therefore do not have to leave their home area (Montreuil, 2011). In daily life this is not possible; firstly, because drivers then have to take personal responsibility for the maintenance and attrition state of "their" vehicle to a greater extent when they are clearly assigned to it; secondly, because road traffic regulations in Europe holds the driver responsible for securing the load (Driving Regulation, 1967) and thus the driver (except for containers) will want to control the sequencing and securing of the cargo from dispatch to delivery. In Europe swap body containers are used most of the truck-meets-truck traffic. Nevertheless, exchanging theses standardized containers takes some time.

Thus, only the following possibilities remain:

- Freight forwarders execute expensive and underutilized tours which blow up the price agreements.
- Producers and customers adapt concerning the production and sales planning towards the transportation rhythms (= transport capacity oriented production).
- Goods have to be buffered to wait for free transportation capacities ("postponement").

In this third alternative the Go2PI project team sees a real PI approach, which also corresponds to the basic requirement for the economic effect of time-flexed transport pricing models:

The approach of flexible tariffs, as displayed in figure 3 sourced by Go2PI project documentation (2016) may lower prices when more capacity is available and increase prices when capacity is short. If shipments can be buffered or stored so that they can be delivered when there is a price advantage, this would sort out the problems of over-capacity as well as bottleneck capacity at the rate of 1:1. However, the construction of new warehouse space (at the dispatcher or at the hub) is required, which is cheaper in the midterm than the cost of current transportation disadvantages.

Figure 3: Principle of Equalization by Postponement

Therefore, already in 2013 the German transport specialist Matthias Schmidt from the TU Dresden called for a new and additional online trading mode, besides the established standard and express delivery, which is climate and environmentally friendly: "In the future when shopping online customers should have the option to choose a slower, but more environmentally friendly shipment." Schmidt calls this "waiting for the climate" and postulated: "If the providers have more time, logistics resources can be conserved considerably. So far, express deliveries caused poor utilization of vehicles. If the forwarders had more time, they would be able to drive the vehicles fuel-efficient and consignments would be collected at the hubs and therefore the vehicles would be utilized way better."

The increasing environmental awareness of the consumers should be used to promote such opportunities. This leads to the claim for cheaper offers with variable duration. Also industrial senders need cost incentives to use those potentials and to let go of temporally rigid delivery schemes. The PI philosophies of business and asset sharing motivate also the logistics stakeholders to cross-company bundling of goods and the use of volume synergies. The coopetive bundling of transport volumes and the deceleration through the consent to wait enables the economically optimized and environmentally friendly utilization of existing capacity via flexible transport tariffs.

4 Further research objectives

4.1 Business models

As Go2PI was focused on the implementation of PI in existing business networks, it became clear that new business models are necessary in order to execute PI as postulated. Advanced tasks (especially in the field of cross-company-coordination) are emerging which will lead to a certain modification of nowadays business models. On account of this, new PI business models as well as appropriate operation guidelines have to be developed – especially for small partners in order to enable a big standardized logistics network.

One crucial problem results from the lack of integration of existing logistics management software of the producing companies to the systems of their business partners. Orders in general and transport orders in particular are often generated manually without automated interfaces between the different software tools. Therefore, a new coordination tool would support the different stakeholders in their daily business and also achieve cost savings - this could be managed by the “Physical Internet Management Systems” (PIMS) (Sallez et al., 2015).

The project research showed that in Austria and Central Europe main freight forwarders operate own hub networks, whether owned or as shared properties. In the PI vision any hub is available for any PI partner. This means, that existing hubs are opened and shared and new hubs will be available for everyone as well. Thereby, a new business model of the “PI Hub Provider” is created, who is responsible for the infrastructure, maintenance, transshipments, storing as well as order picking – if required – for what he has to charge the different partners.

As the PI concept includes standardized reusable containers it is not far to seek that the supply of unit loads might be handled via a pooling system. This could be done by a “PI Container Pooling Provider”. His responsibility is to make useable empty PI containers available at the spots they are needed and charge the partners for it.

In PI the freight forwarders main tasks will not change considerably compared to today’s situation; nevertheless, not every transport provider will be able and allowed to participate right away. Interview partners addressed, that they have concerns regarding the trustworthiness and reliability of new partners they do not know. Therefore, it became obvious that some kind of qualification process is necessary in order to become a player in the Physical Internet. After passing the standardized qualification process, freight forwarders can call themselves “Qualified PI Transport Service Provider” (qPITSP) and offer their capacities in the PIMS. Thereby the quality of the system and its services can be guaranteed.

4.2 The PI-Hypersystem

A main identified research objective for the near future is the design of a pioneering cooperation model for the cargo management, which plans, consolidates and controls the single unit loads of all partners cross-company-wide via a designed internet platform. Furthermore, it has to be a centralized user open system that operates automatically and intelligently. Sallez et al. (2015) called it Physical Internet Management Systems (PIMS) in the Paper “On the Activeness of Physical Internet Containers”. Within the project Go2PI PIMS corresponds to the term “PI-hypersystem” which will be used as synonym in this paper.

The hypersystem needs to be able to integrate other existing systems like ERP systems, transport management systems or freight exchange platforms. PIMS have the responsibility of the main coordination function of the PI towards all his partners in a fair, economic and ecological way. Furthermore, it is a smart system that manages to achieve unsupervised learning which enables constant improvement. Further system components of the hypersystem are the pooling of advanced reusable PI containers (Landschützer et al., 2014) and the standardization of currently incomplete information flows and transport data between shippers, receivers and logistics companies.

So far the project Go2PI did not come to a conclusion, whether the PI-hypersystem is one all integrative platform or consists of several system models that correspond to each other. However, it does not make a difference regarding the tasks and objectives. Nevertheless, towards the users there has to be a standard user interface, which is easy to handle.

Furthermore, the fitting business model of asset and business sharing has to contain a set of rules (mathematical, organizational and legal) for a cross-company pooling of transport orders and transport capacities. This should enable a win-win situation for all stakeholders of the whole system as well as "fair" service remunerations. However, it is not declared whether the cost saving benefits of the PI is exclusively for each partner of the PI or if the profit is shared fairly as well.

Despite its "openness" the PI-hypersystem has to enable the maintenance of customer loyalty and data security. Dispatchers should have the authority to some degree to decide or give preferences with whom they want to forward their goods with. Hence, PI should enable coopetition as previously explained in 3.1 and above all this data security should be guaranteed.

Another aspect of the hypersystem is that any action has to be documented and invoiced automatically. This also means that transport documents or invoices are created digitally and forwarded immediately. Furthermore, the system might be able to request transportation according to individually set criteria regarding a purchase order. Another automatically initiated transaction might be the transportation of a damaged box to a maintenance spot. As already mentioned before, PIMS have to record all processes and services utilized and account them independently.

PIMS also coordinate access respectively reading and writing permissions. This means not everyone has the permission to see or manipulate data in PIMS. Furthermore, not everyone is allowed to open a PI container. All these rights are administered in the PIMS.

Another important factor in the PI is that all data that is relevant to the transport has to be entered in PIMS most likely via an automated interface. Moreover, production related data, like timetables, cycle time, production interval and picking lists shall be integrated in PIMS which are then used for better and more efficient planning of transports. This data will also allow PIMS to combine orders to optimize the utilization.

For the PIMS there should also be user-interfaces, most likely a smartphone-app as well as a web-platform, in which e.g. the place, the condition and the expected delivery date of the PI container are accessible at any time. In addition, customers can organize payments, tracking & tracing and services independently by using these interfaces. Another function that can be executed through the app is authorizing people like customers to open the PI container.

Further information that has to be entered and maintained constantly and faithfully from the PI partners is the “PI Partner Evaluation” of each other after a transaction. This is important, because it influences functions and operations of the PIMS. That means in periods with high capacity, well rated qPITSP will get the commission.

A major quite critical question remains: Do PIMS take over the tasks of a freight forwarding agency, as freight forwarders have a lot of coordinative tasks, which include the optimal utilization of trucks? However, a prospective loss of the direct contact from freight forwarding agencies to customers can be seen as very critical. Customers are likely to hold onto their personal contact to have somebody to be held liable in case of occurring problems. An implication out of this dilemma is the employment of customer service agents for special cases.

As mentioned before, there is still another main question remaining: Is the PI-hypersystem “just” an integrative platform to bring supply and demand together, or is the PI-hypersystem a proactive software tool, which not only integrates but also suggests qualified transport service providers for specific transport orders to optimize filling degrees, routes and costs. When the hypersystem has got the permission to allocate transport orders automatically because of its own set of regulations and mathematical algorithms, the hypersystem has a huge political role within the whole logistics network.

Therefore, following questions are crucial:

- Who organizes and creates this integrative platform?
- Who configures the set of rules and algorithms?
- Who is allowed to use the data within the PI?

4.3 Qualification Process for Transport Service Providers

The success of the PI will also be dependent on how senders trust the system concerning the reliability of the carriers. Therefore, a qualification process for these so-called "Qualified Physical Internet Transport Service Providers" (qPITSP) will be developed and designed. An open logistics system has got its limits (legal, trust, financial) when implemented in freight traffic. For a good reason there are certain certificates for freight forwarders (In Austria: concession for forwarding agencies) and the direct contact that help customers to find a reliable service provider. Within the PI particular actions will be virtualized. Accordingly, as mentioned before the direct contact between shipper and customer will be partly missing before the transaction, when the PI-hypersystem is permitted to allocate transport orders. Consequently, there need to be another authority, which ensures the integrity of the freight forwarder and the quality of their transport service. On the one hand you still have these certain certificates and on the other hand there will be the need for an individual audit to ensure the validity of the company. If a freight forwarder has all the requirements and the audit is positive, it becomes a "Qualified Physical Internet Transport Service Provider" called qPITSP and is allowed to operate within the PI.

5 Conclusion and Outlook

The Physical Internet is an innovative concept to avoid waste of resources in sustainable supply chains based on cross-company collaborations. Towards the realization of PI there is still a lot of research and work to be done – especially in the fields of business innovation. The fact finding project Go2PI highlights and defines various crucial research questions which definitely become part of the roadmap to the Physical Internet.

An important success factors will be the convincement of senders and freight forwarders. There is an urge to develop balancing mechanisms for capacities and cost to realize a postulated flexible financial clearing model. Another unanswered question addresses the legal situation within future PI systems. Strictly connected to this legal question is the future role of today's players on logistics markets like freight forwarding agencies. Does the central PI coordination instance just have a broker function to ally supply and demand? Or is there a central PI-hypersystem with standardized ICT-landscape which coordinates the consolidation of freight actively? Anyway, the PI-hypersystem will have a huge political role and therefore there are still crucial questions unanswered:

- Who is about to manage PI data and functions?
- Who initially invests in PI containers and the development of the ICT-landscape?

One imperative task will be the standardization of ICT in order to enable automated cross-company data transfer over a platform. Therefore, the next research task for the Austrian project team of Go2PI is the definition of data classes and standardized communication protocols for such a PI software platform. To define these standards, future PI players are requested to collaborate actively already during the design phase.

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