Exploiting iCargo - Towards data sharing in collaborative communities

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Abstract

The iCargo[1] project [1] has demonstrated how organizations can cooperate in orchestrating and managing logistic chains targeted towards the reduction of their environmental footprint. Further take-up of the iCargo ecosystem approach requires a more comprehensive view on how to maximize its added value. This article introduces several value dimensions in order to assess what iCargo has achieved and what are possible next steps on the roadmap of developing and deploying similar ecosystems. These value dimensions focus on operational efficiency, customer experience and new business models. Per value dimension a number of maturity levels are being introduced. Based on these maturity levels, it is shown where the iCargo ecosystem is positioned currently and which improvements and/or extensions are possible in its further development and deployment. The article concludes with a personal view of the author as to how the take-up of iCargo services can be initiated, taking critical success factors into account.

The insights reported have been resulting from pilots executed in European research & demonstration projects in transport & logistics (2007-2014), as well as from commercial implementation. Logit One enables logistics actors to implement end-to-end visibility and lateral collaboration. Within the iCargo project, Logit One was responsible for the iCargo Monitor and for the pilot demonstrations.

Keywords: Freight logistics, visibility, collaboration, execution, iCargo, ecosystem, communities

Introduction

The logistics industry is nowadays being characterized by many requirements, but the present article considers the following ones as predominantly relevant because they are related to the inherent character of change that the industry is confronted with:

- Agility: The capability to rapidly reconfigure a supply chain to meet customer demands;
- Resilience: The capability to handle unexpected events to prevent high losses whilst meeting customer demands;
- Reduction of costs & footprint in the context of ever faster delivery cycles and smaller shipments;

It is a challenge to an industry where a large majority of transport companies are SME's and a relatively small part of them use automated transport management systems. Still, information technology can be a driving force to meet the above requirements. A first example is synchromodality, whereby selection of transport modes, time-slots and service providers for hinterland transportation are based on real-time service availability. A second example is the Physical Internet [2] whereby standard load units are routed through hubs. Both are examples where local knowledge is used in transit to make the most optimal planning decisions. These examples are seen as representative for a class of IT innovations that are built on a combination of the following elements:

[1] Grant Agreement Number 288383 "iCargo - Intelligent Cargo in Efficient and Sustainable Global Logistics

1) Large collections of data can be aggregated and shared: Large amounts of data from logistics entities, business services and application services can be exchanged with one another in ways that are open, ad-hoc and efficient.

2) The aggregated data become meaningful: Data, when properly consolidated, become sufficiently reliable, complete & relevant to support decisions that positively impact the logistics process that is being executed.

3) The orchestration of collaborative processes becomes possible: Decisions made by multiple individual actors on the allocation of their resources can be coordinated to ensure that dependencies of external processes (not under control of an individual actor) are taken into account.

4) The organisation of business communities becomes effective: Motivations for planning decisions become driven by objectives, stated explicitly or not, that are related to the performance of the community as a whole – including a mechanism for redistribution of the benefits in a way that motivates individual actors to be (and remain) a member of that community.

Note that not all of these elements are primarily of a technical nature. Obviously the first element forms the technical foundation upon which the others can build further. Based on that foundational capability to share data, meaningful information has to be derived from it, processes have to be coordinated and shared intentions have to be stated towards a global optimum with respect to the use of logistics resources. Especially the last element displays the need to shape the required business conditions in order to make effective use of the technical elements.

While the 'iCargo ecosystem' in the narrow sense is limited to the first element, it is the totality of elements that makes up the ecosystem in the wide sense.

A recent publication by DHL [3] identified three value dimensions along which value would be created by the emergence of the use of big data. We consider the use of (meaningful) data as one of the drivers for change in logistics, but we extend it by collaborative processes and business communities with shared intentions. Still, the value dimensions in [3] are seen as a useful starting point for analysis because the succes of the iCargo ecosystem will depend on the value it is able to add to its users.

Adapted to the topic of this article, we would like to re-phrase these value dimensions as follows:

A. Operational efficiency	**B. Customer experience**	**C. Business models**
1. Transparency	1. Added value to customer	Revenues from:
2. Planning	2. Customer preferences	1. Existing services
3. Process quality	3. Customer interaction	2. New services

This article describes how the stated value dimensions can be relevant for the iCargo ecosystem, and makes an attempt at drafting a roadmap for further development & exploitation of the iCargo results.

Some of the ideas in this article have been presented earlier on the CLECAT Freight Forwarders' Forum 2014 [4] and on the Intermodal Europe 2014 in Rotterdam [5].

We use the following roles introduced as part of the iCargo ecosystem [6]:

- The Logistic Service Client (LSC) is the user purchasing the door-to-door service solution, typically representing a manufacturing or distribution company. Along its traditional objectives of competitive performances and cost, the LSC is interested in lowering emissions along the supply chain.
- The Freight Service Integrator (FSI) is the user providing the combined door-to-door service to the LSC, typically representing a freight forwarder, a 3PL company or the LSC itself through its

logistics department. The FSI needs to integrate, plan and coordinate different logistic services into an effective and efficient door-to-door solution.

- The Logistic Service Provider (LSP) is the user providing transport and logistics services contributing to the door-to-door solution like, e.g., carriers for the various transport modes, handling and warehousing companies. The LSP needs to make its transport resources accessible and well utilized when participating in co-modal door-to-door chains.

It should be noted that the FSI is regarded as both applying the Logistics Service Client role (when collecting logistics service information and booking logistics services from Logistics Service Providers (e.g. carriers)) and a Logistics Service Provider role (when publishing his services and interacting with his customers (e.g. shippers).

These roles are part of the so-called Common Framework for ICT in Transport and Logistics (Common Framework for short) [7]. The framework provides specifications of the logistics sector as seen from different viewpoints and at different abstraction layers: A Reference Model decomposing the entire freight logistics sector into domains, roles for each domain, a functionality viewpoint, a processes viewpoint with process models, and an information viewpoint with information models and interface definitions. Several of the Interfaces have been incorporated as part of UBL 2.1 [8].

Increase operational efficiency

In a business context, operational efficiency can be defined as the ratio between the input to run a business operation and the output gained from the business. Improving operational efficiency requires improved measurement, improved planning and improved execution.

More transparency leads to better measurement

Transparency in logistics is obviously vital to the capability to make sound planning decisions. We distinguish between the following three maturity levels:

– *Level 1: No situational awareness*

  Data are being provided per individual shipment and for isolated legs in the logistics chain used for that shipment. The user of these data is being confronted by fragmented data sources that are disconnected and provide inconsistent data.

– *Level 2: Data reliability and completeness*

  Data available is being consolidated in multiple cascading ways. Multiple data sources are used to establish, through cross-reference, logistics facts that are reliable. Existing logistics facts can be combined to deduct additional facts which are not implied directly by the data available. Logistics facts are being used to inform on the status of the execution of individual transport & logistics services. The status of individual services (which constitute legs in a logistics chain) can be used to assess the status of the logistics chain as a whole, using actual data as well as knock-on effects. The AS IS status of the logistics chain is continuously compared with the TO BE situation according to the logistics chain planning.

  The problem of disconnected and inconsistent data and how to use data consolidation to solve it has been extensively studied in the DHL pilot of the COMCIS project [9].

– *Level 3: Risk management*

  Data is cross-referenced between multiple shipments and between multiple parties over time in the logistics value chain. Analysis of data over multiple shipments and tenants, through predictive analysis, leads to demand profiles and risk profiles (for suppliers, services, transshipment points, etc.) and further increase the potential of taking pro-active measures to optimize the use of resources, manage supply chain disruptions even before they happen, benchmark Logistics Service Providers as part of contract (re-)negotiations, etc.

Within the iCargo project, level 2 has been demonstrated by the iCargo monitoring services. Level 3 requires large sets of operational data, methods to identify patterns within these data sets, and methods to use that knowledge in the decision making process.

Optimize planning through collaboration

Collaboration allows resources of Logistics Service Providers to be planned more efficiently, fulfilling dynamically changing requirements of shipments and using capacities with dynamically changing availabilities. Key objectives are to do 'same for less' (saving costs and at the same time reducing the environmental footprint) and 'more for same' (delivering a better service for the same costs) [10]. We distinguish between the following three maturity levels:

- *Level 1: Adjacent collaboration*

  Subsequent legs in the logistics chain exchange information in order to make sure that the timing of these legs is aligned and information is being passed from one leg to the next to enable its activation. Such alignments take place with respect to individual shipments. Each leg involves choices concerning modality, service provider and timing. The collaboration between adjacent legs is focussed on that timing.

- *Level 2: Synchromodal collaboration*

  Real-time information is being used dynamically to make decisions on matters of timing, modality and service provider selection (among those providers that are part of the community) – based on chain-wide situational awareness and real-time capacities available (at a certain cost). Information is used not only from adjacent legs but also from any other leg in the logistics chain. Optimization not only takes place for single shipments, but on the level of the whole transport network.

- *Level 3: Open collaboration*

  The alignment activities have an open horizon in multiple ways. Information is being used on demand patterns and not only on known shipments. User preferences (e.g. regarding point and time of delivery) can be dynamically updated. Capacities can be sourced outside the business community and can also result from unused capacity that was first claimed by others, etc.

Within the iCargo project, aspects of levels 2 and 3 have been demonstrated. The iCargo planning services aimed to establish a cost optimum for a transport network, not for individual shipments only. Furthermore the planning services made use of transport services (and their schedules) which were published through the iCargo ecosystem, and for road services real-time availability is used during planning. Achieving levels 2 and 3 in full requires further advancements in dynamic and real-time capabilities.

Higher process quality improves execution

Much of the performance of a logistics process is depending on the quality of its execution. This is especially true in those situations where anomalies occur during execution and process quality suffers from not handling them.

- *Level 1: Black-box*

  No awareness exists of supply chain anomalies. If such anomalies occur, they are being addressed in an ad-hoc manner.

- *Level 2: Control tower*

  A single party takes operational responsibility for the end-to-end execution of the logistics chain. End-to-end visibility is being deployed in order to have a good view on disruptions of the supply chain. Remediation of such disruptions is being done by in-transit re-planning of those parts of the logistics chain that are not completed or in execution yet. It may be possible to organize a faster mode of on-carriage, an earlier port of discharge or a fast lane customs service in cases of urgency.

Other examples include the release of small batches of cargo by air freight in combination with the bulk of shipments shipped by ocean freight in order to manage stock requirements of high value cargo at maximum efficiency and with minimum interruption of supply.

– *Level 3: Data sharing*

Multiple parties each coordinate part of the supply chain. They share information such that it is possible for individual parties to have a more global view of the end-to-end chain (with sufficient detail but not unveiling irrelevant or commercially sensitive details). Examples:

a) The data that can be shared between a terminal operator in the port of discharge and a freight forwarder handling the on-carriage: The terminal operator benefits from knowledge on mode and timing of the planned on-carriage, while the freight forwarder benefits from knowledge on real-time terminal events.

b) Sharing of data on current and future empty container positions between forwarders, carriers and other Logistics Service Providers: The effective re-use of empty containers requires maximum availability of such information and thereby also requires that the business interests are aligned between the parties involved.

c) The interaction between Logistics Services Provider and production plant: With accurate & timely knowledge exchanged on the arrival time of cargo the plant is able to plan its production efficiently, while the Logistics Services Provider does not need to expedite its shipments[2] to meet static delivery KPIs. Result is a more cost efficient and more seamless flow of cargo.

Within the iCargo project, aspects of levels 2 and 3 have been demonstrated. There are opportunities for more systematic and ad-hoc data sharing, not requiring upfront arrangements between the parties involved. In addition there are opportunities to extend the in-transit re-planning beyond the last mile operations.

Improve customer experience

Customer experience is the sum of all experiences at various touch points a customer has with a supplier of goods and/or services, over the duration of their relationship with that supplier. Allen et al. [11] assert that businesses must be able to execute what they refer to as the "Three Ds":

- Designing the right offers and experiences for the correctly identified consumer, offered in an enticing environment.
- Delivering these propositions by focussing the entire team across various functions to deliver the proposed experience.
- Developing their capabilities to please customers again and again, with an emphasis on developing consistency in execution.

In the context of this article we focus on the design aspect as this influences the product roadmap to support the ecosystem. However we do acknowledge that professional and consistent service delivery is important for implementing that roadmap.

We consider designing new services that maximize the added value to the customer, designing the service to match customer preferences, and designing the service to optimize customer experience.

[2] In practice such expedited shipments may account for up to 25-30% of the total number of shipments.

Designing services that maximize added value

It is a general trend that organizations focus on their core competences and outsource other activities. When that is accompanied with loss of control, disaster follows. Sometimes control can be achieved by managing the service levels at which the outsourced process is being executed. In other occasions that is insufficient, and the customer needs more insight or even capabilities to control the key parameters of the outsourced process. In line with the DHL trend report, designing new services increases customer loyalty and retention.

- *Level 1: Provide transactions*

  The customer (in this case a Logistics Services Client) provides an order and the provider (in this case a Logistics Services Provider) fulfils it. The latter provides a physical logistics service but may do so by using its own assets or those of third parties.

- *Level 2: Provide information*

  The provider delivers the Logistics Services Client an information service that goes beyond the mere scope of delivering a physical logistics service. Examples:

  a) The provider gives the customer visibility on cargo flows that are not controlled by the provider.

  b) The provider gives the customer advise on suitable empty containers that can be re-used, without actually arranging them as part of delivering a logistics service.

  c) The provider gives customers information on available excess capacity that can be used at marginal cost.

- *Level 3: Provide processes*

  The provider delivers a Logistics Business-Process-as-a-Service (BPaaS). BpaaS is a business process delivered through a cloud services model and can be seen as a next progressive step from Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS) [12]. While SaaS delivers a software application, BPaaS allows the customer to outsource the execution of a business process to a cloud service. When the customer is able to configure the rules underlying that process then he still retains a degree of control on the process.

Within the iCargo project, levels 1 and 2 have been demonstrated. In order to achieve level 3 services, an even more profound understanding of real-world logistics processes is required. Part of that is capturing how flexible and dynamic an outsourced process should be and what degree of human intervention is to be supported.

Designing the service to match customer preferences

Online marketplaces show that it is possible to provide a huge variety of products to the customer, while still employing a highly standardized delivery process. Product suppliers in niche markets can be offered exposure to a customer base that was previously beyond their reach. It is reasonable to expect that this phenomenon will also become relevant for logistics. The service should be designed to to perform precise customer segmentation and targeting.

- *Level 1: One size fits all*

  The customer (in this case a Logistics Services Client) is being offered a limited set of service options. The quality, with which these services are being delivered, is similar for all users. Alternatively the service levels are agreed outside the context of the ecosystem (as part of bilateral contracts).

- *Level 2: Quality-of-Service classes*

The customer can opt from a range of predefined Quality-of-Service (QoS) classes, each having its own price implications. These QoS classes are taken into account when planning and executing individual shipments.

It is a debated issue whether the QoS concept is feasible within the industry at present, as there is an obvious disconnect between Freight Service Integrators and Logistics Service Providers with regards to reliability. The world's largest ocean freight forwarder has recently been requesting differentiated container services from ocean carriers, although the biggest container line has just stopped providing a premium product because customers were not prepared to pay higher rates.

Collaborative sharing of information in the ecosystem - through improved predictability of deviations and their consequences, and remediated by flexible planning - may be a more efficient way towards reliability than costly measures to rigidly stick to the original shipping plan ('physical reliability'). One only has to think of the hugely inefficient emergency air freight shipments wasting millions of dollars often undertaken simply for the sake of fulfilling static delivery KPIs for individual physical logistics services.

- *Level 3: Long-tail of (combinations of) logistics services*

  The customer can express precise requirements as to the performance of individual shipments. A large set of options for end-to-end routing and service combinations are being offered. This number is further increased when the customer himself can configure combinations of services into end-to-end logistics chains. The customer is able to find transport options that he was not aware of before.

Within the iCargo project, demonstrations were still at level 1. The idea of long-tail is certainly embraced by iCargo. However, the concept of QoS classes (as used in the telecommunication world) has not yet been touched upon. It is expected that this will become more relevant as part of the Physical Internet developments.

Designing the service to optimize customer interaction and service

Logistics Services Clients want less involvement in choosing the options, leaving the execution and choice to Freight Service Integrators based on SLAs. These integrators however want ecosystem based services to support them to find and compose services in the best possible way – not to replace them.

- *Level 1: Producer-consumer model*

  The customer (a Freight Service Integrator) requests an offer from the ecosystem. The latter presents an offer and, after acceptance by the customer, executes it. The role of the customer is limited to accepting the offer and paying for it.

- *Level 2: Customer integration in the process*

  The customer is able to state his preferences for the offer requested from the ecosystem – concerning the timing, modes, transshipment points, service providers etc. to use. He is being presented with multiple alternatives, each with its own characteristics, and has the possibility to choose the option that suits him best. The organization leading the ecosystem delivers this option to the customer as a single transport contract. Also in case of in-transit re-planning, the new alternatives developed can be presented to the customer for validation, esp. if there are price implications.

  This level is what constitutes the value add of a freight forwarder today, albeit not very well supported by automated information exchange but more through manual interaction between the various players in the transport chain. This manual interaction is tedious and inefficient - hence huge efficiency gains can be lifted by automating this functionality.

- *Level 3: Marketplace*

The customer requests an offer and states his preferences. Alternatives are presented to him for end-to-end logistics chains that meet the requirements. Each alternative offered possibly integrates multiple service providers (as is also the case in lower levels), but now the customer can select the party that offers this alternative as a single contract, or execute the integration activities himself.

Within the iCargo project, demonstrations were still at level 1. In order to make a first step towards level 2, the customer (or a Freight Service Integrator) should be allowed to use automated (re-)planning mechanisms, while still being able to use his own professional knowledge and make adjustments where he sees fit.

Capitalize on new business models

New revenue stream can come from existing services or from completely new services.

Expand revenue streams from existing services

When organizing logistics, a service user (Logistics Services Client or Freight Service Integrator) will go through three phases - see figure below. In order to reach a wider potential market, a Logistic Service Provider can offer its services to a wider group of potential users and narrowcast that offering at a specific point in time to those users that might be particularly interested in it.

Figure 1: Main phases in logistics business processes

- *Level 1: Contracted services*

  When composing end-to-end chains from individual transport & logistics services, the latter are being selected from a limited set of contracted services. This usually based on volume commitments over a period of time, as this allows the carriers to plan utilization of their transport assets. The pricing and availability is being arranged on beforehand.

- *Level 2: Use open services*

  Service providers publish their transport & logistics services in an open marketplace. When integrating these into end-to-end chains, pricing and availability needs to be agreed on the spot. Alternatively service providers can be contacted to establish contract conditions for future use.

- *Level 3: Real-time capacity sharing*

  In addition to the above, service providers publish in real-time which capacities they (will) have available. E.g. where will my trucks be located after handling their current assignment? In this case the one looking for road services can pick the service provider that will have minimum re-positioning costs.

Within the iCargo project, demonstrations were given on all levels.

Creating new revenue streams from entirely new services

As opposed to existing transport & logistics services that require a single Logistics Services Client and a single Logistic Service Provider, new collaborative services require multiple participants.

- *Level 1: Pre-arranged collaboration*

  Many forms of collaboration can be tried out with few participants that have aligned their individual business interests on beforehand. It is often used to deliver a proof of concept.

– *Level 2: Focussed communities*

  After it has been shown that an idea for a new collaborative service works, it is time to spin out and try to incorporate a larger number of participants. In this stage it is important to set up a community of actors with similar or aligned interests and having the same geographical focus (e.g. operating services alongside a specific corridor). It helps if there is a facilitator that has sufficient footprint to warrant neutrality and attract attention to the initiative. If required for take-up, it helps if participants are allowed to create a closed user group within the community.

– *Level 3: Federated communities*

  The activities of Logistics Services Clients and Logistic Service Providers are seldom limited to a single geographical area. End-to-end logistics chains cross the globe. Sometimes users want services that can support their global business. However, these services may play a role in the competitive positioning of specific hubs and corridors. One global approach does not do justice to that.

  Consider the example of a port authority of a major seaport that wants to support a community platform to enable horizontal collaboration on logistics operations between port and hinterland. The authority wants to help services that give the port its competitive advantage. It is considered to be a trusted third party and can use its reputation to achieve a critical amount of users for the platform.

  Not recognizing such regional interests may scare away the buy-in from facilitators like the port authority introduced above. Voluntary interconnection between individual communities (and the services provided) may be a solution. Think global, act local!

Within the iCargo project, demonstrations were limited to level 1. But the technologies developed are a starting point to support level 2.

Conclusion and outlook

The iCargo project has demonstrated how organizations can cooperate in orchestrating and managing logistic chains targeted towards the reduction of their environmental footprint. This article argues that further take-up of the iCargo ecosystem approach requires a more comprehensive view. We have introduced several value dimensions in order to assess what iCargo has achieved and what is needed more.

iCargo performed as follows on the identified value dimension:

- Operational efficiency: iCargo performed well on this dimension. Further improvement is certainly possible and will be a logical next step when the ideas will mature and benefit from feedback experienced during the pilots.
- Customer experience: iCargo performed relatively low on this dimension. We see that as a logical consequence of the deployment stage we are in. When bringing the iCargo innovations to the market, that will certainly receive more attention. In addition, we observe this shortcoming also in commercially available solutions, so it should not be a show-stopper to start deployment.
- Business models: iCargo demonstrated how existing services could be improved and how collaborative services could be deployed in pre-arranged partnerships. The real challenge will be how to go beyond that stage. This requires an innovative approach where conflicting requirements need to be addressed:
  - Achieving sufficient critical mass & reach
  - Providing a trusted & neutral environment
  - Focus communication on a coherent target group

A community based approach has been presented. We advise to start-up such communities based on one or more value added services that have undisputed and sufficient added value to the users in

monetary terms, or which have strategic value to the users. Simplicity of use is of the utmost importance in order to drive user acceptance beyond the stage of initially use (either mandated or by early adopters). This phase will teach us what are the motivational factors that support (or hinder) actors to take part in the ecosystem. Logit One is presently following this approach in its deployment activities.

Based on positive deployment results, there certainly are opportunities to roll out the ecosystem approach more widely. This will have its technical challenges. As the most important of these, we consider the need to make it easier for new actors and services to integrate ad-hoc with the iCargo ecosystem. This involves large-scale sharing of data, low entry barriers for using the value added services, real-world data governance, and mechanisms to share the benefits of collaborative services.

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