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Supply chain tracking: aligning buyer and supplier incentives

ABSTRACT

Purpose

This paper presents how the success of inter-organizational systems (IOS) implementation projects can be increased by aligning the different incentives of buyers and suppliers.

Design/methodology/approach

The research method employed is case study and its unit of analysis is a network of supplier and wholesaler (buyer) companies acting in the Finnish technical trade industry, which are implementing inter-organizational tracking. The implementation project followed an implementation process model developed to execute the case study.

Findings

For a buyer, the challenge in IOS implementation is that suppliers feel the adoption more difficult and have less identifiable benefits. However, in the case study, suppliers were ready to implement tracking solution because they understand that improvements in IOS help to apply common industry data exchange standards and will lead to better supply chain collaboration, which also increases their operational performance in the long run.

Research limitations/implications

This paper concentrates on supplier and buyer incentives but also the role of other supply chain members such as logistics providers could be analyzed to examine different factors for IOS implementation.

Practical implications

If the buyer takes a cooperative approach to IOS integration, suppliers can be motivated to integrate tracking as a part of their own operations. This high-level integration offers more options to improve the management and hence the performance of the whole supply chain than low-level integration.

Originality/value

IOS implementation projects are seldom studied from the perspectives of buyers and suppliers in the supply chain.

Keywords: Information and communication technology (ICT), Inter-organizational systems (IOS), Tracking, Radio frequency identification (RFID), Purchasing, Supply chain management (SCM).

1. INTRODUCTION

Organizations invest in new information and communication technology (ICT) solutions because they expect that new solutions will improve their performance. The improved performance may be obtained by cost reduction, improved productivity, or increase in quality. However, if the new ICT solutions have inter-organizational aspects – as most of the ICT solutions used for supply chain management (SCM) purposes have – the benefits of the technology remain modest or even fail to fulfill the costs incurred in implementation if the other supply network organizations do not integrate their systems with the same ICT solution. When SCM is based on the concept of cooperation between supply chain members and on the notion of competition between supply chains, not between supply chain members (Lummus and Vokurka, 1999), it should be in the interest of every supply chain company to adopt those inter-organizational systems (IOS) that increase the competitiveness of the whole supply chain. However, in practice, the adoption of these systems is relatively slow.

The adoption of IOS systems is usually regarded from the viewpoint of a single company, and the literature proposes either company specific reasons as incentives to adopt IOS, such as company's size, managerial interest, ICT expertise, etc. or examination of the role of other supply chain partners in dyadic relationships, where the benefits of the system are examined by evaluating the attractiveness to the other party (Bakker *et al.,* 2008). Papers that take a wider supply network IOS approach usually focus on explaining the supply network specific reasons for adoption, such as the number of actors in the network or the type of circulating products (Van Donk, 2008), or they examine the operating environment of the supply network, where mimetic, coercive and normative pressures from other companies increase IOS adoption (Teo *et al.,* 2003). However, although the study of Boonstra and de Vries (2008) shows the relevance of this question, the effect of different roles of companies in a supply network on IOS adoption is almost ignored, as some companies hesitate to adopt IOS because it may strengthen the power of stronger supply chain members.

This paper aims to fill the gap in the literature around the question of different roles of companies in IOS implementation by aligning the incentives of supplier and wholesaler (buyer) companies for implementing supply chain-wide tracking. The paper is based on a case study which included participating in the tracking implementation process in a technical trade supply network. A three-part model was used for conducting the case study (Table 1 in

Section 2.3), which the researchers designed together with participating companies. The first part of the model had six phases, which were performed during a 1.5 year Joint Feasibility Project with 16 forerunning companies of the industry. The phases for the second and third parts, which include the actual installation of the technology and further development, were defined at the end of the Feasibility Project.

After this introduction, the relevant literature is reviewed and the first part of the model is defined. The third section presents the used methodology. The fourth section presents the Feasibility Project of the case study, and describes the second and third parts of the implementation model: the phases of Individual Installation and Further Development, together with a discussion about the case study. Finally, the fifth section presents the conclusions.

2. LITERATURE REVIEW

In SCM, ICT is used to enhance service level, improve operational efficiency and information quality, and enable agile supply chain operating models (Auramo *et al*., 2005). In practice, ICT is expected to influence the following supply chain performance measures: (1) Cost, (2) Delivery, (3) Quality, (4) Flexibility, (5) Inventory, (6) Process improvement, (7) Innovation, and (8) Sales and financial (Zhang *et al*., 2011).

Venkatraman (1994) suggests five different levels to explain how IT transforms an organization's business in ascending order of importance: (1) Localized Exploitation, (2) Internal Integration, (3) Business Process Redesign, (4) Business Network Redesign, and (5) Business Scope Redefinition. In this classification, the higher the transformation level and the effect of IT on operations is, the bigger are the potential benefits (Venkatraman, 1994). Several articles discussing ICT solutions in SCM conclude that at least business process redesign is needed to get enough benefits to justify new technology implementation (e.g. Auramo *et al*., 2005; Lee *et al.*, 2011). And if the companies are able to integrate their information systems (IS) successfully, their operational performance will increase (Rajaguru and Matanda, 2012). Therefore, high-level integration, which includes exchange between companies of relevant real-time information about processes, offers the biggest benefits from ICT system usage. This notion of usefulness of IOS is also consistent with theories behind SCM, because even the definition of the concept SCM includes integration of the key business processes (Cooper *et al.*, 1997), and the theory behind integration states that increased

integration leads to higher performance (Pagell, 2004) due to increased visibility and higher predictability.

2.1. Tracking as an example ICT solution for SCM

Tracking is one function in SCM where advanced ICT solutions are needed (Wamba, 2012). Tracking systems, in general, send a message to the tracking database when a tracked item arrives at a predefined checkpoint in the distribution network. Barcoding is currently the most common technology used for tracking, but the use of more advanced Radio Frequency Identification (RFID) technology is increasing rapidly. (Pedroso *et al*., 2009; Holmström *et al.*, 2010)

The benefits of RFID tracking depend on the level of technology that is used. Wamba and Chatfield (2009) developed the idea of Venkatraman (1994) to be applicable in RFID tracking solutions. They created a four-level contingency model for effective RFID tracking integration across a supply chain: (1) Slap-and-ship, (2) Intra-organizational, (3) Inter-organizational, and (4) Network-organizational. According to their model, a higher integration level requires bigger investments, but respectively offers higher benefits. Despite the recognized need for higher level integration in RFID tracking, still only few organizations and supply chains implementing tracking have reached those higher levels (Chuang and Shaw, 2007; Wamba and Chatfield, 2009). The literature suggests that inter-organizational challenges are the main reasons behind the low number of integrated tracking systems (Hinkka, 2012).

Hellström (2009) proposes a model with six steps for the RFID implementation process based on previous literature and two different case studies, where companies implemented a returnable transport items tracking system.

(1) In the Initiation phase, the problem is identified. Based on the identified problem, different concepts to solve problem are developed and different system designs planned.

(2) In Adoption, a cost-benefits analysis is made to define and compare benefits and costs, and a trial is executed to test and verify technological performance.

(3) In Adaptation, a system integrator is selected, and technology is modified and installed.

(4) In Acceptance, employees and other users are trained with the system, and all involved organizations are informed about the use and implications of the system.

(5) In Routinization, improvements are made based on user experience, and the system is gradually used in improving decision-making with the help of the collected and processed tracking data.

(6) During Infusion, tracking implementation is expanded to cover other applications which had previously been too expensive.

2.2. Supply chain companies' different roles in inter-organizational tracking implementations

In IOS implementations, the supply chain partners must show commitment to each other (Rampersad *et al.*, 2012). In general, a buyer aims to create relationships with suppliers who have a good reputation, effective information exchange and the ability to solve customer problems (Claycomb and Frankwick, 2010). Alternatively, the greater the supplier value offered by a buyer, the quicker and more complete will be the response of any given supplier to requests from that buyer (Ramsay and Wagner, 2009). Thus, purchasing management literature highlights the importance of good relationships between a supplier and its key customers. Building cooperation and increasing coordination during the relationship enables both parties to improve their performance in a long and good quality relationship (Heikkilä, 2002). Improved quality of the relationship enables the parties to proceed from coercive power and detailed contracts to more flexible and collaborative control mechanisms. Likewise, IOS literature has concluded that joint IOS efforts strengthen the relationships between supply chain companies (Hadaya and Cassivi, 2007).

Still, IOS development efforts face challenges related to the division of costs and benefits, especially when developing tracking systems. In a traditional supply chain, which consists of manufacturers, distribution centres, retailers and Logistics Service Providers (LSP), the greatest benefits are found downstream in the supply chain (Soon and Gutiérrez, 2008). Therefore upstream supply chain members, and especially manufacturers, are often reluctant to even consider RFID tracking because they believe that they get little benefit from tracking, but the cost of purchasing and attaching RFID tags will fall on them (Dutta *et al*., 2007). The following example of Wal-Mart's initiative to build an RFID tracking system illustrates the challenge.

In January 2003, Wal-Mart mandated its top 100 suppliers to attach RFID tags to all pallets and parcels before January 2005. By using a mandate, Wal-Mart utilized its market power

over suppliers to accelerate the adoption of RFID technology in the company's supply network. Wal-Mart's initial aim was that the whole supply network would benefit from tracking. Still, in January 2005, the top suppliers attached RFID tags only on shipments to Wal-Mart, and only because they were obliged to do so. Very few suppliers even considered system integration with Wal-Mart's RFID tracking or saw major benefits of tracking for their operations. (Fries *et al*., 2010). Wal-Mart did not give any financial compensation to its suppliers if they increased the quality of their shipments with the help of tracking, which did not motivate the suppliers to invest in high-level RFID integration (Roberti, 2010). Therefore, the unilateral decision of Wal-Mart led to the lowest level RFID tracking implementation – Slap-and-ship – where the sum of benefits from tracking remained the automation of some of Wal-Mart's processes (Keating *et al.*, 2010; Kros *et al.*, 2011).

2.3. Defining the phases for inter-organizational tracking implementation project

Wal-Mart's initiative aimed to build an inter-organizational RFID tracking network, where all supply network parties would gain benefits. However, Wal-Mart's unilateral decision clearly failed to achieve its goal, although RFID technology became widely applied (Kros *et al.*, 2011). So, if the buyer company in the supply chain is the tracking system initiator and it aims for integrated RFID tracking, it must also consider suppliers' incentives for adoption.

Hellström's (2009) model was considered as a potential model for implementing such tracking. However, Hellström's model is derived from experiences with asset tracking implementations. This highlights that even if the tracked returnable transport items circulate also to other companies, the investments and benefits mainly fall upon a single organization. In inter-organizational tracking, the progression between the phases is not so straightforward and therefore we developed a refined model. Hellström's model and the developed model are presented in Table 1 in order to enable comparison of phases of a single organization's and inter-organizational RFID tracking implementation. The development of phases 1-6 are explained later in this section and the procedure behind the formulation of the rest of the phases (7-12) is explained in Section 4.2.

Table 1. Model of the inter-organizational RFID tracking implementation process (right) compared with the process model of a single organization (left).

Phases of single organization's RFID tracking implementation process (Hellström, 2009)		**Phases of inter-organizational tracking implementation process**	
Phase	*Content of the phase*	*Part*	*Phase*
1. Initiation	- Problem identification - Concept development and system design	A) Joint Feasibility Project	1. Problem identification and forming the project consortium 2. Study and analyze the existing processes 3. Concept development and system design 4. Cost-benefit analysis 5. Technology tests 6. Creation of roadmap for project continuation
2. Adoption	- Cost-benefit analysis - RFID trial		
3. Adaptation	- Choose system integrator - Installation of software and hardware	B) Individual Installation	7. Analyze internal processes 8. Company specific profitability calculations 9. Production pilot
4. Acceptance	- Education, training, communication		10. Adoption for production use
5. Routinisation	-System improvements	C) Further Development	11. Routinisation
6. Infusion	- Expanding the implementation		12. Infusion

The authors divided the inter-organizational tracking implementation process into three different parts: A) Joint Feasibility Project, B) Individual Installation, and C) Further Development. The Joint Feasibility Project resembles the Initiation and Adoption phases of Hellström's model. The content of this project needed to be defined before starting the implementation, while the content of the remaining two parts were only defined at the end of the Joint Feasibility Project. An inter-organizational development project is more complex than a project executed by a single company. As the nature of this kind of project is exploratory, and the results are unknown at the beginning of the project, it requires initial agreement about how participating companies commit and when new negotiations about the next steps of the project are needed. Finding suitable companies and convincing them of the benefits of the project also requires work. Therefore the Joint Feasibility Project needs to start by identifying the problem and forming a project consortium.

Hellström's model is premised on the idea of adopting simple RFID tracking first and then, in the Infusion phase, enlarging the system to cover other areas. However, in inter-organizational tracking, finding the suitable and beneficial application areas that would also motivate suppliers to adopt the technology is more difficult. If the aim is to obtain inter-organizational benefits and avoid settling for Wal-Mart's Slap-and-ship level of implementation, the supply chain processes need to be analyzed carefully. After studying and analyzing the existing processes, concept development and system design is needed, which Hellström (2009) included in the Initiation phase.

The Adoption phase in Hellström's model includes two activities: Cost-benefit analysis and RFID trial. In inter-organizational tracking, these activities have two levels: the company and the supply network. In an inter-organizational implementation, testing similar processes in many locations is unnecessary; instead the project can concentrate on testing certain intra-company and inter-company processes, and the results may be generalized to cover similar operations through the whole supply network. However, the title Adoption can be misleading since testing tracking in just a few spots will barely lead to immediate negotiations about the installation with system integrators. Instead, the execution of the cost-benefit analysis and tests may offer totally different results for different organizations in the supply network, and therefore new negotiations about the continuation of the project and the actual installation process may be needed. In order to take these considerations into account, the following phases were included in the proposed model in Table 1: "Cost-benefit analysis", "Technology tests" and "Creation of roadmap for project continuation".

3. METHODOLOGY

To research IOS implementation processes, a Finnish technical trade supply network was selected, and an exploratory case study project was conducted. Due to the breadth of the research area and the possibility of getting unusual access to data, a single case study was chosen as the research method (Yin, 1994).

The case supply network companies were interested in improving the efficiency of their logistics operations and decreasing their problems in SCM. The study set out to explore whether the introduction of tracking would provide a solution and, if it did, what kind of supply chain-wide tracking system best suited the Finnish technical trade industry, and how the system should be implemented. The case companies' own interest in the study, combined with the practical network structure of dominant wholesalers and major domestic manufacturers (see beginning of chapter 4), were the main contributory factors for the case selection. By choosing case study as a research method and by participating in the development process, the researchers were able to obtain first-hand information related to the research questions. Although the case supply network forms a single and unique research subject, 16 companies involved in the case offered diverse data. The comparison of the differences between the case findings and the findings of Wal-Mart's implementation enabled generalization of the findings to some extent.

Conducting the case study research required the elaboration of the existing RFID tracking implementation model of single organizations to make it applicable to the inter-organizational tracking implementation process as shown in Table 1. The first part of the process model, the "Joint Feasibility Project" with its six parts was performed and validated during the case study as follows:

1. *Problem identification and forming the project consortium*: The research project was established. This phase resulted in the following settings for the research project: The research project was conducted by two universities and Finnish subsidiary of GS1 (Global Standards One). 16 companies acting in the technical trade industry – 12 suppliers, 3 wholesalers and one LSP – participated in the Joint Feasibility Project.

2. *Study and analyze the existing processes*: Researchers visited at least one operation site of all the project participant companies, where they made observations, interviews and led group discussions. In addition, they arranged workshops, where representatives from all 16 project companies joined in discussing the current state of logistics operations in their supply chain.

3. *Concept development and system design*: Representatives of participating companies discussed problems and improvement needs for their supply chain operations at workshops, which resulted in definitions of possible RFID tracking scenarios that could contribute to identified needs.

4. *Cost-benefit analysis*: A model developed for the Finnish book industry (Hinkka *et al.*, 2012) was used, by which different RFID tracking scenarios can be compared to find investment payback time for a single company or alternatively for the whole supply network. To apply the simulation model to the case supply network, researchers used the latest RFID technology component prices from several system providers and information from similar tracking pilots and implementations. These results were analyzed in the context of case supply network companies' operations, and based on the analysis, the suggestive values for the most important cost-benefit factors were defined.

5. *Technology tests*: Two types of testing: (1) the researchers tested the technical suitability of different RFID products in a laboratory environment, and (2) the companies tested RFID tracking with the help of an experienced system integrator in their own operations and operations between companies in a commonly agreed way.

6. *Creation of roadmap for project continuation*: Test results were analyzed. Then the researchers arranged workshops for company representatives, where the participants discussed common practical issues concerning RFID tracking adoption and the creation of a roadmap for supply network-wide tracking implementation.

In total, the researchers conducted process observation visits to 21 different sites, interviewed 71 persons, arranged 16 group discussions, and lead 19 workshops during these six phases. The qualitative data collected was analysed throughout the case study. The preliminary analysis of the collected data was conducted when the memos were composed of each observation visit, interview or workshop. The conclusions from these events were discussed with all the stakeholders involved in the case studies. This preliminary analysis helped to pinpoint the most relevant data from each event and also helped to refine the researchers' prior understanding of the subject. Then a larger analysis was conducted after each phase of the case study. At this time, the researchers involved in the case study compared the findings of different events, identified common patterns or exceptions, and documented the experiences and results of the analysis.

4. CASE STUDY: TRACKING IMPLEMENTATION PROJECT IN TECHNICAL TRADE SUPPLY NETWORK

The case study focused on a Finnish technical trade supply network, where the majority of the participating 16 companies were specialized in heating, plumbing and air-conditioning (HPAC) products. According to experts from participating companies, the total value of the HPAC trade in Finland was about 0.9 billion euro in 2010. This value is almost fully divided between four companies, which control HPAC wholesales in Finland. Three of these four companies participated in the study. 80 % of HPAC products sold by the biggest wholesalers in Finland are also manufactured in Finland. The share of the participating supplier companies is about 30 % of the total HPAC sourcing of the participating wholesaler companies. The participating LSP stocks one of the wholesaler's products and it already uses RFID tracking with several customer supply chains. The LSP announced that it can offer RFID tracking to any customers who want to implement it.

4.1. Buyer and supplier roles during different phases of project

The first implementation phase, "Problem identification and forming the project consortium", was launched when one of the major HPAC wholesalers (i.e. the *buyers*) wanted to get information about the suitability of RFID tracking in its operations. Inspired by successful technology tests, the company asked its competitor wholesale company and some neutral expertise organizations to develop a joint project for investigating tracking adoption possibilities in the whole industry. The initiators recruited other wholesalers and a large base of suppliers for the project, supposing that the investments in tracking would not pay for themselves without a threshold share of supplier companies.

In the second phase, "Study and analyze the existing processes", the researchers had the possibility to discuss with every companies' representatives confidentially. Besides the general interest in RFID technology and the development of the companies' own processes, improving supplier-buyer relationships motivated both manufacturers and wholesalers to participate in the project. All the participating wholesalers mentioned that the creation of a neutral forum for discussing common development issues in the industry together with their suppliers was an important reason for project participation. For most of the supplier companies, the main reason for participating was to improve their relationships with their best customers and perhaps gain competitive advantage over their rivals if they could improve their responsiveness to the requirements of their customers.

In the third phase, "Concept development and system design", the wholesalers remarked that the pallet level recognition is too inaccurate and they would need parcel- or item-level tracking. The suppliers approved that requirement.

In the fourth phase, "Cost-benefit analysis", it was eventually clear for all parties that the wholesalers' benefits are rather straightforward to capitalize (e.g. increased automation in receiving shipments leads to decreased number of errors and less need for manual work). Supplier benefits are more difficult to estimate, because unlike the wholesaler companies, the supplier companies' operations vary considerably and putting a price on certain process improvements is difficult. However, most supplier companies were satisfied with this phase of the project, believing that there would also be some benefits for them if RFID tracking was implemented. Most suppliers were not worried about the investments that RFID tracking might require, although the costs of attaching RFID tags would fall on them. However, two suppliers out of twelve withdrew totally from the project after this phase, believing that RFID

technology is not mature enough to offer the desired benefits for them. These companies believed that they had already got enough information to implement Slap-and-ship tracking, if needed. One supplier refused to participate in tests, but it reactivated later in the sixth phase.

In the fifth phase, "Technology tests", representatives of the wholesaler companies selected two locations for testing the receiving of RFID-tagged shipments. The project offered all supplier companies the possibility of testing RFID tracking in their own facilities, and arranged a wider spectrum of hardware for two of them, which were selected mainly based on generalizability and geographic location.

At the beginning of the sixth phase, "Creation of roadmap for project continuation", the representative of the biggest participating wholesaler company made a public presentation about their tests and announced that the company would start an RFID tracking installation project together with their preferred suppliers within about one year. Furthermore, the different views of wholesaler and supplier companies on performing the actual installation clarified rather quickly. The project participants formulated a framework for the roadmap creation in one workshop. In the following workshop all participant companies were asked first to create their own roadmap including the schedule for installation. Later suppliers and wholesalers created their own joint "typical" roadmap. The contents of these roadmaps are explained in greater detail in the following section.

4.2. Roadmap for implementing industry-wide tracking system

The "Creation of roadmap for project continuation" phase is a watershed in an implementation project. In this phase, the companies are rather familiar with their own and other supply network companies' opportunities and costs of implementing RFID tracking. Because of this increased knowledge, companies' motivation for implementation may have changed since the beginning of the project.

As described in the previous section, the creation of a roadmap has two parts: (1) defining the phases of installation, and (2) arranging the phases in an agreed order with realistic schedules. In Hellström's (2009) model, these activities belong to "Adaptation" and "Acceptance" phases. Adaptation includes choosing a system integrator and installation. Acceptance includes training of users, and agreeing with all involved organizations about implementation and use of the system. From a larger viewpoint, SCM innovation literature considers acceptance to be an organization-level factor, which is concerned with how well an

organization's constituents receive the innovation (Hazen *et al.*, 2012). In the case study, the participating organizations estimated that the Adoption phase of Hellström's model would need to be run again, but now from the single company's perspective. Therefore the companies agreed that the roadmap for "Individual Installation" should include the following phases (Table 1):

7. Analysis of internal processes
8. Company specific profitability calculations
9. Production pilot (planning, build-up and execution)
10. Adoption for production use

Although the Joint Feasibility Project offered a considerable amount of data for companies to support the RFID installation decision, the companies believed they needed more time to analyze the data themselves inside each company, compare it with their own processes, and discuss with their IS providers the technical preconditions and costs of implementing RFID tracking. They also expressed willingness to test the simulation model designed in the fourth phase according to their own company values uploaded from their own ERP (Enterprise Resource Planning) system, complemented by cost and time estimations of their IS providers. The companies considered that it is every organization's own decision whether the company specific profitability calculations lead to installation.

Furthermore, Hellström's (2009) model has two additional phases: "Routinisation", which includes system improvements and processing the collected tracking data for decision making; and "Infusion", which includes expanding the implementation to cover other applications than tracking. However, the case study companies considered these as additional company-specific phases, thus not including them in their installation roadmap. Therefore, these two phases remain the same as in Hellström's model, but are positioned under "Further Development" in the inter-organizational RFID tracking implementation process model.

Considering the schedule of the roadmap, the wholesalers estimated that it would take about 12-13 months to complete phases 7-10. All the representatives of three wholesalers ended up with roughly the same schedule (Figure 1), when they designed their own roadmap. They estimated that it would take about five months to analyze internal processes and execute profitability calculations, and then they would be able to decide on piloting. Planning, building-and executing a pilot were estimated to take about two months each. These estimations mean that the decision on adopting the system would be taken after about 11

months after starting the installation project. In practice, the wholesalers thought that the pilot and adoption into production use would be done with one or two most suitable suppliers, and then the number of suppliers would be increased one or two at a time.

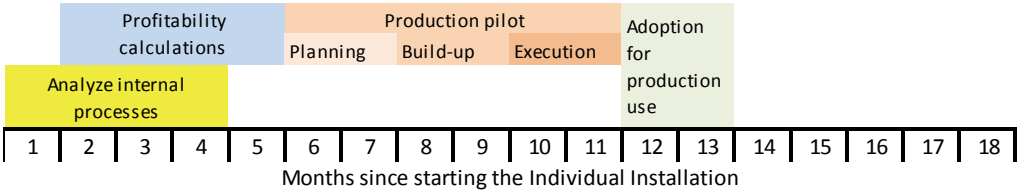

Figure 1. Common wholesaler roadmap for "Individual Installation" part.

Representatives from seven suppliers out of a total of twelve participating in the project participated in a workshop, where the roadmap for installation was designed. When the suppliers planned their own roadmap based on their resources and other prerequisites, they chose a timeline of 10 to 30 months to implement phases 7-10. The representative of the supplier with the shortest estimated timeline, 10 months, added:

"Our company management supports RFID tracking installation. The marketing department can promise to our biggest customers that we'll dispatch RFID-tagged shipments with two months' notice if needed. But if we want to integrate tracking as a part of our own processes, the realistic duration in our company is estimated to be about 10 months."

After discussions, the participating suppliers created together a "typical" roadmap (Figure 2), which could work as a guideline for supplier RFID tracking implementation. They estimated that it would take about 18 months to complete all the phases 7-10. The beginning closely resembles the wholesaler roadmap, but in the suppliers' roadmap the decision to move to pilot installation would be done one month later. The pilot planning would take three months, and building-up and executing the pilot would take four months each. Pilot planning could start before the formal decision on starting the pilot is made, and therefore the decision on adopting the system into wider production use is after about 16 months from starting the installation project.

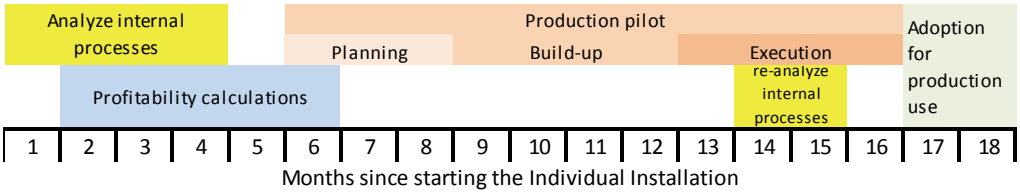

Figure 2. Common supplier roadmap for "Individual Installation" part.

The biggest difference between the supplier and wholesaler roadmaps is the length of the estimated installation time. At the workshop, where the roadmaps were created, the company representatives discussed the reasons for the difference. Table 2 presents the most essential part of the discussion by presenting the quotes from representatives of suppliers and corresponding comments from wholesalers.

Table 2. Quotes regarding the roadmap of RFID tracking installation based on workshop discussion.

Quotes from supplier representatives	Quotes from wholesaler representatives
"If we want to discuss with our ERP provider about possibilities to integrate RFID tracking to our ERP, it will take one month before we reach the right persons, and it will take another month before they have time to meet us face-to-face."	*"Information systems are vital part of our operations and we usually don't have any problems when trying to discuss with our system providers. Besides, our ERP already has RFID tracking readiness."*
"Logistics is only one part in our operations. Ensuring that we manufacture products that our customers need is our main priority. Good logistics can't help, if our products don't sell."	*"The logistics is the main driver of our company's business. Other departments need to adapt for the requirements of logistics."*
"Our logistics processes are multiple. We have several production units and warehouses in several countries, a lot of sourcing and outsourcing, and traffic between manufacturing plants. Different customers around the world require different kinds of logistics solutions."	*"Our logistics processes are rather simple. Basically, we have incoming and outgoing shipments. Most products are stored between these, while the rest, for example, are cross-docked. Although we have operations in several locations, multiple customers and suppliers, the processes are rather similar everywhere."*

Based on discussions, the workshop participants ended up with the following two conclusions:

1. For wholesalers, the business is built around logistics. Therefore all development efforts related to logistics get high priority inside the company. Besides, despite the huge amounts of handled products and the great number of suppliers and customers, the processes are straightforward and similar between different customers and suppliers. For suppliers, the core business is to manufacture products, and logistics is only one of many supportive functions. The processes of suppliers are also multiple; they may have several production units and warehouses in many countries, sourcing and outsourcing, and traffic between sites. Therefore, defining processes where RFID tracking could add value takes time.

2. As logistics is an essential part of wholesalers' processes, they have close relationships with their IS providers, and they can support inter-organizational information exchange with relatively little effort. Suppliers usually have several IS inside the company, because they may operate in several countries and have different kinds of operations. As the IS of the suppliers are usually more tailored, it tends to be more demanding to make modifications to them.

4.3. Discussion about the results of the case study

In general, an asymmetric position between supply chain members complicates the adoption of inter-organizational RFID tracking: Downstream companies in the supply chain will gain more if RFID tracking is applied, but suppliers find RFID tracking adoption more demanding than buyers. This difference was also visible in the companies' motivations to continue for the Installation in the closing seminar of the Joint Feasibility Project. The following two comments were selected from that discussion:

"The most important outcome from the project was that by installing RFID tracking, the industry will gradually adopt common information exchange standards regarding interfaces, markings, etc. which are needed to introduce Advanced Shipment Notifications (ASNs) for incoming shipments." (Wholesaler representative.)

"This project has highlighted the importance of common industry standards, which would help us to develop our own information systems in considering the increasing needs for inter-organizational information exchange." (Supplier representative.)

The statements above indicate the companies' understanding that an increased ability to transmit information in electronic format improves supply chain operations considerably.

Therefore, especially from the wholesaler companies' perspective, item-level tracking using RFID is a value adding functionality, which could motivate suppliers to update their IS to enable electronic information exchange.

For suppliers, one of the main incentives to participate in the project was to strengthen the relationships with their biggest customers. However, as seen from the statement above, they also seemed to agree with the wholesalers about the need for information exchange standards. Besides, suppliers would gain benefits also for other operations if their largely tailored ERP's used even some information exchange standards. Therefore, suppliers were not too worried about finding easily capitalized benefits that would offer fast payback time for their RFID tracking investment, because they believed that the other benefits mentioned above would justify the efforts.

When there was a consensus about the benefits of building an industry-wide tracking system, the buyer companies – i.e. the wholesalers – understood their responsibility related to their strong power in the supply chain. They knew that they could try to mandate their suppliers to attach RFID tags to their shipments, as Wal-Mart did. However, that decision might have resulted in supply chain-wide costs of tracking being higher than the benefits that the wholesalers may obtain by improved tracking. In that case, the competitiveness of the whole supply chain would have decreased, although the wholesaler companies had gained some benefits. To reduce suppliers' barriers to adoption and to get as many suppliers as possible to implement RFID tracking, the wholesaler companies planned to help their suppliers in the following ways:

- The wholesaler company follows the slower schedule of the suppliers.
- The wholesaler company purchases some RFID equipment and especially RFID tags for suppliers, because in joint buying the companies can get considerable discounts.
- The companies combine their negotiation power when discussing with IS providers in order to avoid expensive overlapping work.

5. CONCLUSIONS

Building IOS requires a cooperative approach between buyers and suppliers. In the case of this paper, the immediately usable application – tracking – motivated companies to plan high-level system integration. When buyers understand the challenges that downstream companies

have in tracking adoption, they can lower suppliers' implementation barriers by aligning their own incentives with suppliers' incentives, for example, by adjusting their own installation roadmap with the supplier roadmap.

Related to previous IOS literature in the field of SCM, this paper provides a new research perspective – actor perspective – for IOS implementation efforts. As a single case study is based on a unique case, it would be interesting to conduct similar research in different kinds of supply chains to test the transferability of the results. For example, the buyers dominate over suppliers in the case supply chain, but would the results be similar with reverse power balance of companies? Another issue which may require further research is the role of outside organizations in IOS implementation project, i.e. GS1 and research organizations, acting as facilitators. Generally speaking, the actor perspective used in this paper could be used more in IOS research to search solutions from unconventional viewpoints. Furthermore, the case LSP already supports IOS implementation and RFID tracking, which is the reason why the role of the LSP is largely neglected in this paper. However, this may not be the case in general, so studying the role and incentives of LSPs could be an important subject of future research.

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