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ECONOMIC SUCCESS OF AUTONOMOUS COOPERATION IN INTERNATIONAL SUPPLY NETWORKS? – DESIGNING AN INTEGRATED CONCEPT OF BUSINESS MODELLING AND SERVICE ENGINEERING FOR STRATEGIC USAGE OF TRANSPONDER-TECHNOLOGIES

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ABSTRACT
The main contribution of this paper is to design an integrated concept for the goal-oriented, customer-focused design of logistic services. Increasing and changing requirements of industrial as well of trading firms as customers on the logistics service market induces the need for developing and using a methodology to evaluate potentials for the differentiation of logistic service providers by special logistic service offers. Therefore, the intelligent container will be examined as one AC-based technology for the Management of ISN.

ECONOMIC SUCCESS THROUGH AUTONOMOUS COOPERATION IN LOGISTIC SERVICE PROCESSES
In International Supply Networks (=ISN) as modern logistic structures "companies are involved in different supply chain networks which again compete among each other on the world market (Seebauer 2003; Lambert et al. 1998). These networks of supply chains shall be characterized as ISN." (Hülsmann and Grapp 2005) Today's logistics management has to face conflicting changes (Haller 2002). On the one hand, there is a need for concentration of logistics service providers on their core competencies. On the other hand, a proceeding differentiation of industry structures and increasing demand for logistics services take place (Klaus et al. 2006). This means, such a globalized logistics context of networks (Sydow and Windeler 1999; Sydow 2002) can be described by typical drivers of change and diversity like hyper-linking, hyper-competition, hyper-turbulence (Tapscott 1999; Siegele 2002). In turn, these phenomena cause complexity and dynamics in logistic processes (Hülsmann and Windt 2007).
The initial perception has been, that logistic systems with a higher degree of autonomous cooperation (=AC) – based on the intelligent usage of transponder-technologies (e.g. RFID) – could cope in a better and more efficient way with an increasing complexity and dynamics in ISN. Therefore, AC is expected to result in positive emergence (higher effectivity and efficiency of logistic processes) and a higher system robustness (better process quality, less errors and frictions) (Hülsmann and Windt 2007). Constantly, new technologies (e.g. RFID) of AC are developed. However, technological progress also has to contribute to economic success to be relevant for the management of ISN. As to Remer in a general sense economic success describes the financial profitability and earning power of a company (Remer 2004). Here, companies are understood as logistic service

providers involved in ISN structures. But to achieve economic success logistic service providers have to build up competitive advantage. This is necessary to react on fast changes in the environment (e.g. development in technology of competitors), which force logistic service providers to move rapidly. They have to differentiate themselves by offering customer-oriented, specialised logistic services (Müller-Stewens and Lechner 2005). Thereby it is intended to build up new advantages while undermining the advantage of competitors (D´Aveni 1995) to achieve relatively higher performance than that of their competitors (Wiggins and Ruefli 2002).

Technologies, methods and approaches as service offers of logistics service providers in ISN have to be systematically serviceable for the design of the portfolios of products as well as of processes. Competitive advantage by technological progress could be build up (Müller-Stewens 2005) – based on the organisational competencies resulting from the implementation of transponder technologies and AC as the major principle for the design of logistic processes. Consequently, the overarching question of this paper then is to examine how technological solutions like transponder technologies can be strategically used for establishing competitive advantages, for the positioning and differentiation of logistics service providers, and for the building and leveraging of organisational competencies (Barney 1996; Thiele 1997, Hamel and Prahalad 1997).

Following this argumentation line, the main objective of this paper is to develop an integrated concept for the strategic utilization of AC-technologies in ISN. It is not intended to examine contributions for success, but to realize economic success by building up competitive advantages (Hülsmann et al. 2008). The corresponding management tool which has to be developed shall consist of two parts. On the one hand, it has to consider the dimensions of business model design (Freiling 2004), on the other hand the design steps of service engineering (Burr 2002). Each element of this tool shall be used for designing systematically logistic services based on AC-technologies. Consequently, the paper will be structured as follows: **(1)** Introducing briefly AC as a management approach; **(2)** sketching the two components of business model design and service engineering and finally integrating them into one management tool for ISN; **(3)** applicating the developed tool by illustrating its functions for the intelligent container as AC-technology in logistic processes of ISN.

AUTONOMOUS COOPERATION AS A MANAGEMENT APPROACH FOR ISN

As to Hülsmann and Windt AC describes processes of decentralised decision-making in heterarchical structures. It presumes interacting elements in non-deterministic systems, which posess the capability and possibility to render decisions. The objective of AC is the achievement of increased robustness and positive emergence of the total system due to distributed and flexible coping with dynamics and complexity (Hülsmann and Windt 2007).

In a general, social system view-oriented comprehension AC as a management approach means leaving operative decision-making in its sub-systems, -units, and –elements while the individual system components operate independently from centralized decision-making structures (Hülsmann and Grapp 2005; Hülsmann et al. 2008). In consideration of an increased relevance of ISN management the need for intelligent systems with adaptive capabilities on a local level can be assumed (Wycisk et al. 2008). On a local level systems however follow central goals such as service levels. It may happen that local reactions in response to changes and deviations (i.e. incidents, delays, new orders etc.) occur (Herzog et al. 2003). In the practical management context AC is enabled in different ways to cope with logistical requirements. There are technologies (e.g. intelligent sensor networks of reefer containers in fruit supply chains), methods (e.g. autonomous routing) and approaches (e.g. collaborative vehicle routing and scheduling) of AC, which contribute to decentralize intelligence (i.e. local intelligence) and enable adaptive decision routines even on the level of single goods (Smart Parts).

BUSINESS MODEL DESIGN & SERVICE ENGINEERING AS INTEGRATED MANAGEMENT TOOLS

This paper intends to consider the systematic strategic differentiation and positioning of logistic service providers by AC-technologies. Therefore on the one hand the concept of business model design (Freiling 2004) for an economic-based structuring as well as on the other hand the service engineering approach for a systematic development of services (Burr 2002) is needed. Consequently, business model design and service engineering shall be described as two dimensions of one integrated tool. It is intended to use these concepts in an AC-based toolbox for the business model design of logistic service providers (see figure 1).

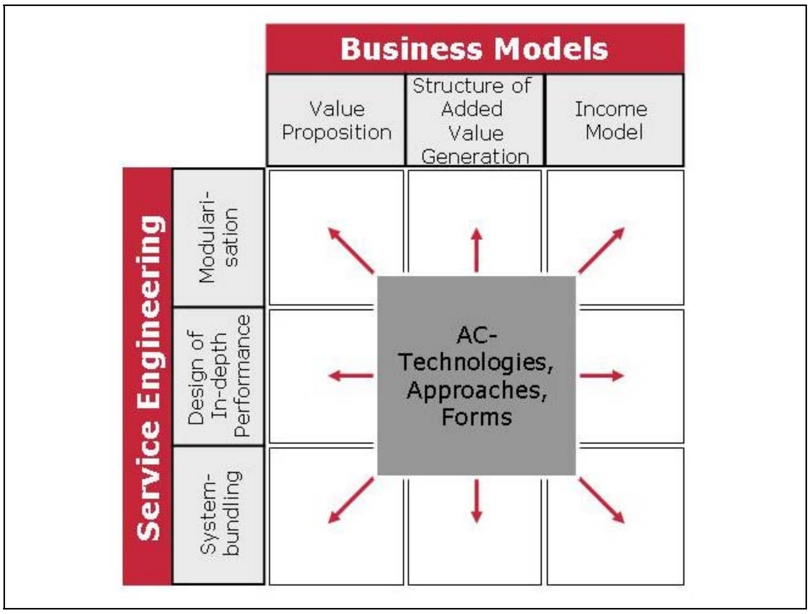

Figure 1. AC-based toolbox for logistic service providers

The concept of **Business Model Design** consists of the following dimensions: value proposition, structure of added value generation and model of income (Freiling 2004). The **1st dimension "value proposition"** refers to the market opportunity. This means the specific business activity to achieve competitive advantage (i.e. potentials for positioning and differentiation on the market of logistic services). The **2nd dimension "structure of added value"** generation refers to the technical-organisational realisation of the identified business activity (i.e. elements and processes for structuring a certain business activity in detail). The **3rd dimension "model of income"** means the concrete description and quantification of the revenue by the value proposition as well as the determination of charging of costs by refering on the model of income of the respective service offer (i.e. marketing and financial controlling for logistic processes).

From a more detailed perspective logistic service providers have to check the following questions for their business model design (Müller-Stewens and Lecher 2005) allowing them a goal-oriented proceeding: which services (e.g. AC-based logistic services) will be offered to which customers (e.g. trading or industrial firm)? (service offering model); How and in which structure this service has to be designed (i.e. focusing on resources or competencies of a logistic service provider, that offers a specific, customer-oriented AC-based logistic service in its portfolio)? (service design model); How can the target customer group (i.e. trading or industrial firms as customers of AC-based logistic services) be attracted, maintained and sustained (marketing model)? How shall the revenue mechanism be concretely designed (i.e. which customers prefer a logistic service at which price) (revenue model)?

The design steps of **Service Engineering** as a popular approach from service management (Keith 2004) are: modularisation, design of in-depth performance, and system-bundling) (Burr 2002). **1st step:** "Modularisation" means to define differentiated modules for one service that will be offered by a company (e.g. alternative logistic processes in which a specific AC-technology could be applicated). **2nd step:** "Design of in-depth performance" describes the degree of detailing a specific service (e.g. extent of the degree of logistic service´s activities that are executed by the logistics service provider itself). **3rd step:** "System-bundling" finally allows the combination of different modules which are, from an overarching perspective, each detailed to a certain degree (e.g. configuration and specification of a logistic service according to customer needs). This proceeding meets the need of adapting to currently changing markets (Haller 2002). Because of the tendency to increasingly individualised customer needs (Baumgarten and Thoms 2002) it is getting more and more ambitious for logistic service providers to create customer-oriented services with an adequate design. Thereby logistic service provider´s competence profiles are challenged. Consequently, the approach of a modular service architecture shall be used for an efficient exploitation and exploration of resource potentials (e.g. technologies), meaning options resulting from AC (Burr 2005).

Each element of this tool shall be used to systematically design logistic services based on AC-technologies. Both approaches have to be considered in an integrated way allowing either to increase logistics service quality by service engineering as well as explicitly formulating AC as part of every company´s business design and thus providing a basis for its evaluation.

ECONOMIC SUCCESS BASED ON COMPETITIVE ADVANTAGES BUILD ON AC IN ISN

In the following paragraph, the developed toolbox (see Figure 1) will be illustrated regarding its functions for evaluating services in the context of a practical logistic service example. As stated above, especially technologies of AC seem to have an increasing relevance for the design of logistic service processes. Now, it will be examined, if and how far the intelligent container as an exemplifying AC-technology (see Figure 2: Intelligent Container, WWW, 14.04.08) could be used as a logistic service to build up competitive advantages and thereby lead to economic success for the management of ISN.

The intelligent container is “an autonomous transport monitoring system for perishable and sensitive goods. The system links technologies from the fields of RFID, sensor networks and software agents to provide a permanent and freight-specific supervision of each transport package” (quod vide Jedermann et al. 2007; Intelligent Container, WWW, 14.04.08). If this concept is envisioned for the management of ISN, compared to a usual container the intelligent one seems to bear potentials for a strategic differentiation of logistic service providers because of its “new” capabilities (Hülsmann et al. 2007). This will be evaluated by using the toolbox (see Figure 1) containing the business model design and service engineering proceeding.

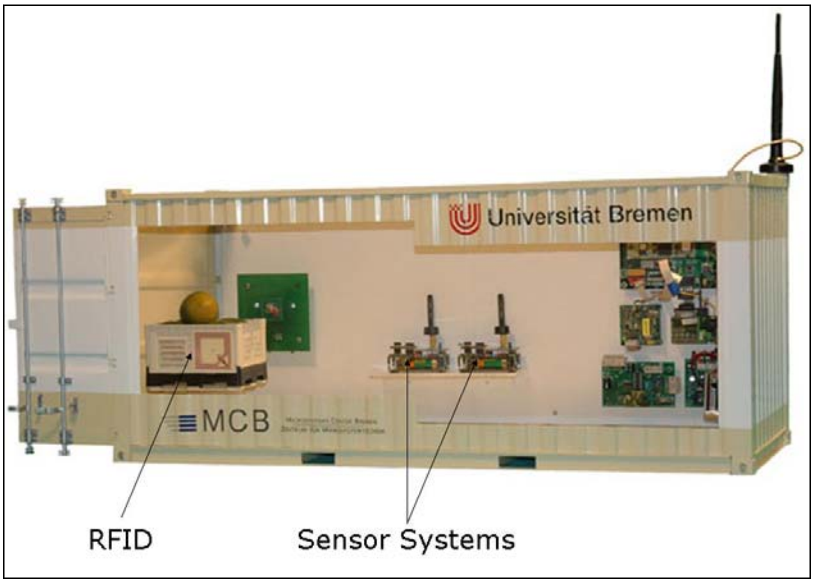

Figure 2. Intelligent Container: Intelligent Container, WWW, 14.04.08

A practical logistic context of ISN for which the concept of the intelligent container could be used would be the case of a logistic service provider that manages transportation processes for fruits as sensitive goods. In this example, containers are shipped with different types of fruits. The containers are equipped with AC-technologies such as RFID tags and micro chips inheriting all information needed to schedule their way all over the globe on their own. In these logistic processes of ISN containers represent smart parts that coordinate their way according to their individual logistic objectives (e.g. time, costs, quality and/or quantity) to their destination. They are capable to collect environmental information (e.g. traffic news, weather prediction, temperature, humidity and other relevant parameters) and additionally to exchange information among each other (Hülsmann et al. 2007).

In the following, the contributions of the nine toolbox fields (see below no. 1 to 9 in Figure 3) and their functions to evaluate will be considered for the example of the intelligent container as AC-enabling technology in ISN:

Modularisation & Value Proposition (no. 1) means in the chosen example, that the intelligent container is used as a part of logistic services equipped for the transportation of different goods (e.g. temperature sensors can be recalled to control the present status of the delivered bananas and their ripe degree). **Modularisation & Structure of Added Value Generation (no. 2)** describes, how and for which specific logistic processes the intelligent container could be used as AC-enabling service-technology (e.g. transportation of sensitive goods such as fruits). **Modularisation & Income Model (no. 3)** refers to the single cost positions for equipping a single container with a certain AC-technology and examines potentials for future revenues through the intelligent container (e.g. costs for temperature sensors and revenues from guaranteeing a specific ripe degree). **Design of In-depth Performance & Value Proposition (no. 4)** is about the degree of activity to which a logistics service provider is involved in the execution of its offer of the intelligent container as part of transportation services (e.g. consulting and acting as agent for the realisation of an optimal cold chain). **Design of In-depth Performance & Structure of Added Value Generation (no. 5)** specifies details for the application of the intelligent container as a specific service for logistic service processes (e.g. choosing transportation means and routes acoording to the actual ripe degree of bananas). **Design of In-depth Performance & Income Model (no. 6)** means detailing costs and revenues for the intelligent container as a specific service for logistic processes (e.g. transparent transportation process allows an early return-risk estimation for fruit wholesaler). **System-bundling & Value Proposition (no. 7)** describes the aggregation of different logistic service activities to one logistic service (e.g. lower guarantueed failure rate, flexible route adaptation, transparent transportation of fruits). **System-bundling & Structure of Added Value Generation (no. 8)** aims at the generation of an overarching definition of connected activities for usage of IC in logistic processes (e.g. timely optimal coordination of transitions between shipping and truck transportation and parallel consideration of ripening data of transported fruits). **System-bundling & Income Model (no. 9)** means giving an overview of all costs and prospective revenues from the intelligent container as a logistic service (e.g. all costs for acquiring, equipping the intelligent container and revenues from realising strategic options such as learning options for a flexible reaction depending on the ripe degree as well as the requirements of the fruit retailer).

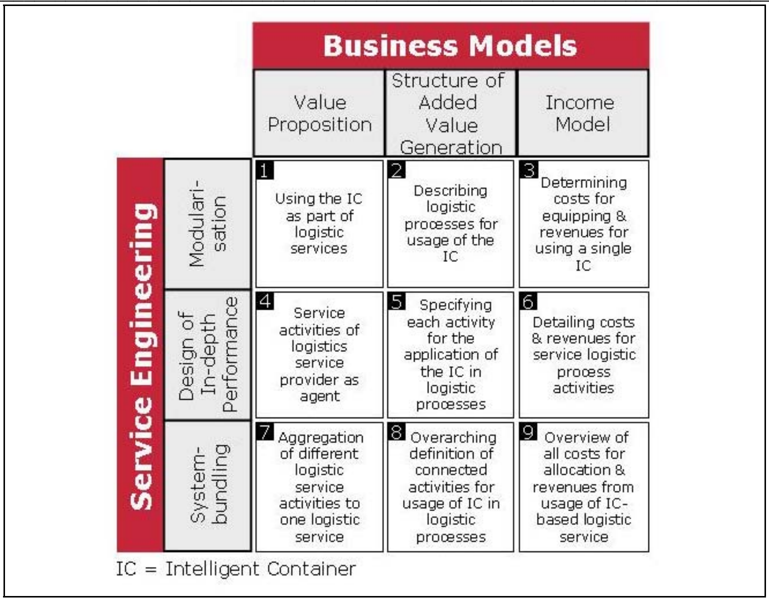

Figure 3. Intelligent container as AC-based logistic service

In how far does the intelligent container as AC-enabling technology lead to build up a **unique selling proposition (USP)**? Durability and profitability are two decisive characteristics to evaluate this question (Schmalen and Pechtl 2006). **Durability**: the intelligent container could represent a USP if it is adapted (e.g. by temperature sensors etc.) to the specific requirements of goods (e.g. fruits). This means only a USP if it is part of a sophisticated, unimitable logistics service concept so that it cannot be copied and substituted easily by competitors. **Profitability:** because there is an increasing demand that goods need to be transported worldwide the intelligent container with its specific functions represents a valuable offer to customers. They will be increasingly willing to pay a lot to ensure delivery reliability and high quality of their goods. To conclude, the modularity of the above illustrated integrated framing model (Figure 1 and 3) allows a flexible combination of logistic service activities and value chain structures for ISN-Management. The shown methodology contributes to generating competitive advantages, which finally leads to economic success of logistics service providers in ISN, under the precondition and decisive limitation that the intelligent container as AC-enabling technology in logistic processes is not imitable.

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