THE CONCEPTUAL FRAMEWORK FOR BUSINESS PROCESS INNOVATION

Towards a Research Program on Global Supply Chain Intelligence

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Abstract: Industrial supply chains today are globally scattered and nearly all organizations rely on their Enterprise Information Systems (EIS) for integration and coordination of their activities. In this context innovation in a global supply chain must be driven by advanced information technology. This paper proposes a research program on Global Supply Chain Intelligence. The paper argues that a conceptual framework for BPI is required to approach innovations in a global supply chain. A research proposal based on five interrelated topics is derived from the framework. The research program is intended to establish and to develop the conceptual framework for BPI further and to apply this framework in a global supply chain context.

1 INTRODUCTION

Few words are more ubiquitous in business or society today than "innovation". This reflects that businesses are striving for ways to survive and thrive in an increasingly complex and connected world (IBM, 2006). Organizations today are required not operate effective business processes and also to accommodate for changing business conditions at an increasing rate. Consequently the ability to develop and implement new processes driven by EIS is a central competence in most industries, and furthermore it is a critical practice for a global enterprise.

The next practice in Global Supply Chain Management is BPI (BPI). BPI is the transformation of a global supply chain driven by a new advanced Enterprise Information Systems technology. This technology holds the potential to "close the control loop", but until now few organizations have managed to unleash the full potential of global supply chain intelligence. Thus, there is an emerging need for managing the transformation and for new approaches that will lead to robust global supply chains. The emergent challenge and opportunity for an organization is to architect, design and orchestrate adaptive global supply chain networks. Adaptive supply chain networks exploit innovations to improve efficiency and responsiveness and consistently achieve these objectives. Consequently not only sense and response, but also robustness and resilience are emerging concerns to most enterprises (Sheffi, 2005).

Innovation is inevitably tied into technology and especially IT. Modern Enterprise Information Systems (EIS) from the major vendors contain vast amounts of new concepts and tools, but let's face it: quite often these wonderful tools are used (and sometimes misused) to create trivial solutions. Why is that? Maybe because we as users and as organizations are not able to grasp the enormous complexity of the task of changing inter-organizational processes spanning global supply chains, numerous organizational boundaries and countless IT-systems.

This paper is fueled by the idea that there is a huge potential contribution in using advanced EIS to transform an organization and create a better alignment between business and processes. This is a practice that can be described as BPI (BPI). Davenport, Prusak and Wilson (Davenport et al., 2003) simplify the innovation process into four steps: 1) scanning and identifying ideas; 2) packaging the idea; 3) advocating the idea; and 4) making it happen. They come up with two extreme roles: the "guru" packagers and the creative "idea practitioners". This outlines a playground for an innovator as a mediator who transforms the big ideas into practice and makes it work. Although innovation theories often emphasize the innovator´s

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role in the process Christensen, Anthony and Roth (2004), others take a completely different stance. Michael Schrage argues that the innovative prototype creates innovations, not the innovator. His point is simply that the process of working (and playing) with the prototype models is more important than the design process. His work illustrates how leading enterprises master this modeling process and are able to transform the learning into innovative products on the market. His message is simple: you need to be able to model your ideas, play with the models and learn by doing (Schrage, 2004).

1.1 Research Approach

The fundamental theoretical lens on this problem is the system's perspective, i.e. the business process is considered as a work system and BPI is considered a systems engineering process. System Development and in particular IS development is a well-known and mature perspective. This perspective is mainly focused on software development which is not the main issue here. However, this perspective can inform the model architect about modeling in an organizational context. These fields are very rich - for more details see (Møller, 2007).

Enterprise Information Systems are the technical and the organizational context for integrated process development. The EIS and the process models are the new components of an information system. The EIS has also changed from static systems towards a new generation of EIS driven by process models (Møller, 2005). It is equally important to understand the old architecture and the new architecture of the systems. We need to consider the vendors, how they relate and also the adoption of new technologies.

The global supply chain is the business and organizational context for developing integrated processes. The arena for process innovation has changed from the internal processes towards the external processes in the supply chain. This has many implications, including the fact that the roles of the information systems are becoming more prominent. Many of the modern inter-organizational issues are only touched upon to some extend, and they need to be provided using various real life cases.

The theoretical foundation for Business Processes is rooted in the industrial engineering tradition. Many adjacent theories, tools and techniques like "Lean" or "Six-sigma" should be identified in order to establish a comprehensive framework. In the computer sciences tradition there is an emerging process modeling community based on mainly process model standards and workflow systems. Today the workflow community is very engaged into standards, general models and modeling and design techniques.

The Process Innovation Laboratory (Π-Lab) has been proposed as a comprehensive framework and a collaborative workspace for experimenting with process models. The Π-Lab is using a combination of integrated action learning and concept development approach to facilitate innovation. This methodology is called innovation mediation (Møller, 2007).

This paper establishes the conceptual framework for a new methodology for developing business processes in a global supply chain based on advanced Enterprise Information Systems. The proposed research program evolves around the conceptual framework and has five interrelated activities: 1) to establish the theoretical foundation for BPI in the supply chain. The objective is to identify, capture and to categorize the general process theory in a supply chain context. 2) to set up the conceptual context for developing global supply chains. The objective is to identify and enhance new concepts and the methods for developing global supply chain intelligence. 3) to create the conceptual basis for managing advanced Enterprise Information Systems. The objective is to identify and transform the new concepts and the technology management perspective based on new advanced Enterprise Information Systems. 4) to develop innovation mediation as a methodology for BPI. The Π-Lab is proposed as a comprehensive framework and a collaborative workspace for experimenting with process models. The Π-Lab is using an integrated action learning and concept development approach to facilitate innovation. 5) to execute a number of industry driven action research projects on BPI. These projects serve as the shared empirical basis and furthermore a national and international network of researchers and industries on BPI will be established.

The conceptual framework is based on previous research on operations management and information systems, and this particular research contributes to each of the topics with the Π-Lab and Innovation Mediation as the main contribution. Thus the research approach of this program is a combination of theoretical studies, conceptual development of methods and tools and explorative action research. The research we embark on is based on engineering and computer science, and it is called design science. This study uses Design Research in Information Systems in an emerging "lens" or set of

analytical techniques and perspectives complementing the positivistic and interpretive perspective in IS (Hevner et al., 2004). The design research involves the analysis of the use and performance of designed artifacts to understand, explain and very frequently to improve the behavior of aspects of Information Systems. Design science ultimately is theorizing on business process design or innovation, and the research activity framework is elaborated in the following section.

2 BUSINESS PROCESS INNOVATION

Process Improvement (Davenport, 1992) is business-oriented of nature and consistently focused on hard facts and value. The first wave of process improvement used continuous improvement (kaizen) techniques to empower people to solve problems. This proved to be a very successful approach and today we see the lean movement which is based on this thinking with tools such as the 6-sigma and others.

Since the beginning of the 90´s there has been an enormous focus on business processes and business processes as a source of innovation. This marks the second wave and the understanding was that the business processes were inhibited by organizational and cultural boundaries. Consequently techniques like Business Process Re-engineering (BPR) emerged using a clean slate approach was attempted and new IT was applied as a silver bullet. New IT was often embodied in the first generation ERP systems (or more general EIS) and after the EIS technology was widely adopted, new problems emerged. First of all the implementation issues were considerably but the most prominent problem was the claimed inflexibility of the EIS (Davenport, 1998).

All together business models require processes to be integrated across the supply chain in order to accommodate for transparency demand, and the EIS technology naturally is the major component in this architecture. Consequently the information technology has become a barrier for process improvement. These issues are also addressed by the major ERP vendors that compete to provide the next-generation EIS technology as well. Recently we have seen, how they approached these challenges (Møller, 2005), and we conclude that we are facing an emerging disruptive change that will allow for future EIS to be driven by process models. This is also called process aware IS (Dumas et al., 2005).

Process models and enterprise modeling have been around for a while, Extended Enterprises and integration have been a major issue for industry and research, and here we use the concept of an integrated business process model to frame these enterprise models. Meanwhile the trends and tendencies in logistics and supply chain management have reinforced the need for process integration leaving the supply chain scattered and distributed from globalization and outsourcing. Most important the need for customer driven supply chains requires new approaches to process integration across enterprises, and we use the concept of process innovation to frame these approaches. Consequently, we need to explore and understand the implications of this new situation - there are several research opportunities in this context.

2.1 Supply Chain Management

Supply Chain Management (SCM) has become one of the most important new business concepts. Global competition and outsourcing have caused the fragmentation of the supply chain, and supply chain excellence is now a prerequisite for competitive advantage (Christopher, 2005). APS was enabled by refining the mathematical programming models and in particular the genetic algorithms applied to solve the network problems of an entire supply chain. The APS systems facilitate the central management of the supply chain activities and processes in real time, essentially by extending the MRP/II planning concepts to encompass the entire supply chain, and as a result the systems in effect are SCM systems (Møller, 2006b).

A recent study of the perceived benefits from implementing ERP Davenport, Harris and Cantrell, (2004) shows that the key factors driving ERP benefits are: (i) integration of processes; (ii) optimization of processes; and (iii) informate, or the transformation of the company based on EIS data. On the other hand, Davenport and Brooks (Davenport and Brooks, 2004) argue that early ERP was not primarily focused on the supply chain, but the businesses that were able to extend their Enterprise Information Systems into the supply chain with “bolt on” SCM systems have experienced substantial benefits.

The challenge is to transform new ideas and advanced technology into business value. In other words: How can we effectively apply new advanced Enterprise Information Systems in a global supply chain in order to create process integration? The key to these benefits goes through the development of infrastructural and strategic capabilities embodied in

ERP combined with the SCM systems - the next generation of ERP (Møller, 2005).

2.2 Enterprise Systems Management

Few IT innovations have had as much impact on business organizations in the past years as Enterprise Information Systems. EIS are a standardized software package designed to integrate the data used throughout an entire organization (Davenport, 1998). Many large enterprises have implemented EIS and have now taken their next step on the EIS journey. This journey is often described in terms of waves (Shanks et al., 2003). The first EIS wave includes the acquisition, configuration and implementation along with resulting changes in the organization after going live with the system for the first time. The second wave includes making continuous improvements and maximizing the benefits from EIS. The EIS have changed fundamentally over the last ten years (Møller, 2005), and companies are now taking advantage of the web-based technologies and advanced functions in order to establish an integrated extended enterprise (Davenport and Brooks, 2004). First wave EIS implementations have been explored through case studies which have focused on for instance EIS strategic options, how to avoid failures, how to identify issues of alignment, and business process reengineering issues. Only recently we have seen research aimed at EIS beyond the cost-intensive implementation phase. However, the work we have seen on the actual application and impacts of EIS has a clear message: These systems have the capability to transform a business, but only if the organization is able to integrate the activities – not only internally, but also across the external value chain. This requires the enterprise system to be managed as an independent area in the organization to fully exploit its potential and ensure that it continues to produce business benefits. We believe that this calls for a new management competence or function: Enterprise Information Systems Management (Møller, 2006a).

Simultaneously the EIS have evolved tremendously, driven by: the changing business requirements, the new technologies, and software vendors´ innovations (Markus and Tanis, 2000). In the recent years the ERP systems evolved into what is often summarized as ERP II systems and the organizations are now taking advantage of new web-based technologies and advanced functions in order to establish an integrated extended enterprise (Davenport and Brooks, 2004). These issues are also addressed by the major ERP vendors who compete to provide the next-generation EIS technology as well. Recently we have seen how they approached these challenges (Møller, 2005), and we conclude that we are facing an emerging disruptive change that will allow for future EIS to be driven by process models (Dumas et al., 2005).

Contemporary Enterprise Information Systems (EIS) from the major vendors such as SAP, Oracle and Microsoft offer vast amounts of new tools and concepts based on the best practices. However, changing inter-organizational processes spanning global supply chains, numerous organizational boundaries and countless IT-systems are a complex task challenging research and education (Møller et al., 2006).

2.3 Innovation Mediation

The central research question is therefore: how can we establish a methodology for BPI in a supply chain based on new advanced Enterprise Information Systems technology?

The relationship between a business process and the organizational context is widely debated. This program is leveraging on the idea of an integrated business processes as an identifiable concrete model represented in an enterprise system, and applied in practice in a supply chain. Consequently, the research tasks are narrowed down to the need to create: 1) A method to innovate business processes; and 2) a tool to facilitate BPI. This idea has previously been proposed as the Process Innovation laboratory, or the Π-Lab (Møller, 2007).

Innovation Mediation is an explorative approach to study integrated business process modeling in a controlled environment embodied in the Process Innovation Laboratory. The process innovation laboratory is a collaborative workspace for experimenting with process models. The Π-Lab is a comprehensive framework for studying, for teaching and for learning practical problem solving and system design using integrated process models. The Π-Lab facilitates innovation by using an integrated action learning approach to process modeling, which includes contemporary technological, organizational and business perspectives. Innovation Mediation in this context consists of five central elements: Innovation Mediation is a method to develop integrated process models in a (1) process innovation laboratory using based on (2) the theoretical framework for process innovation. Models are established in a controlled environment using two principles: (3) conceptual modeling and (4) experimental learning. This is assumed to lead to (5) the process innovation.

We can distinguish between "in-vivo models" which mean "live models" or "in-vitro models" which means models in a controlled environment. In an area where models are more significant and established, the notion of a laboratory is often central to experiment with "in-vitro" models. In business and in particular in a supply chain context, a laboratory is less familiar. However we have seen cases with simulation and role playing games like Forrester's Beer game. They are in many aspects examples of a process lab. The models we are interested in are architectural concept types of models with many aspects and the representation is closely related to new IT and finally, the models span organizational boundaries.

In architectural patterns have been successfully applied as overall abstraction of designs. Patterns were originally conceived by Christopher Alexander (Alexander, 2003), a Berkeley Professor of Architecture with a background within mathematics, physics and chemistry. Alexander's work is based on the idea that nature is organized into a limited number of structures which repeat themselves. He describes architectures using fifteen properties. To understand and to describe these repeating structures is a new way of generalizing design knowledge that is labeled patterns. A pattern language is just a precise way of describing someone's experience. These ideas have spread to the object oriented development world, were patterns are used as an abstraction of a solution in a given context. Recently patterns lead to the development of a catalogue of processes (Malone et al., 2003). The pattern is a reference design and the idea of reference models has cached on in several modeling related areas, such as enterprise modeling, information systems architecture (Zachman, 1999). In this context a pattern is expressed as: the issues concerning a solution to a problem in a certain context. The use of patterns is a learning approach. The complementary idea to learning is the idea of conceptual modeling or modeling in the large. Conceptual modeling is an overall approach to develop complex systems in a holistic organizational context. Conceptual modeling integrates concepts and concept modeling develops links from detailed aspect models to overall holistic models and links from the current situation to the future situation. Concept modeling can also be understood in a learning perspective and the effect is based on sharing mental models that sometimes are referred to as boundary objects.

The pivotal point of this methodology is based on the idea that the future systems are model driven. Consequently there are two ways in which the integrated models may be studied: 1) "in-vitro", that is in a controlled environment like in the lab, or 1) "in-vivo" where the process is embedded in the organizational and business context.

2.4 Practices for Global SC

Innovation Mediation and modeling is mainly about gaining insight. A central idea to explore is the idea of integrated action learning. Innovation means getting new ideas, and consequently BPI needs to be based on generating new knowledge on the process models. Therefore we apply a learning perspective on modeling. The ideas are often framed e.g. by Kolb's models on experiential learning (Kolb, 1984). Kolb's model explains learning as a circle with four elements: concrete experience, reflective observations, abstract conceptualization and active experimentation and testing in new situations. In this framework the activities are taken as a checklist for activities leading to learning. Consequently Innovation Mediation needs to include: 1) Intervention: Planning and executing test on the models; 2) Experience: Observation of result of the interventions; 3) Reflection: Explain deviations from expected results; and 4) Conceptualization: Make the experiences general.

The theory of learning is often connected to the action research paradigm. Here we will assume that the inclusion of many different perspectives can emulate aspects of reality to a certain extend. The shared empirical basis of this program will be based on a smaller number of industry driven action research projects on BPI. These cases provide the program with a "live" laboratory for changing processes.

3 CONCLUSIONS

This paper has now outlined the conceptual framework for a research program on BPI based on advanced EIS in a global supply chain context. The paper has argued that most industrial supply chains are globally scattered and nearly every business relies on their EIS for process integration. In this context innovation is inevitable driven by advanced information technology. Consequently there is a need for new approaches to BPI based on advanced EIS. This is the central research question for the proposed program. The program is established in an applied research framework aiming at changing practices towards global supply chain intelligence.

This global supply chain intelligence research program is basically dealing with the issues of how to design and implement effective and robust

(resilient) supply chains, and the program is focused on learning and theorizing based on theoretical concepts and practice. The main research contribution of this program is to develop and to test the Innovation Mediation methodology. However, there is also a significant contribution to the supply chain and EIS theories. This paper is an abridged version of a working paper found at: http://www.hha.dk/bs/wp/inf/I_2006_02.pdf.

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