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Towards a Framework for Enterprise System Integration in Industries

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Introduction

Information Systems Integration (ISI) refers in general terms to creation of some sort of linkage between two or more previously separated Information Systems (IS) that from the beginning never were intended to work together (Markus, 2000). ISI is defined as the extent to which information through different communication networks can be shared and accessed for organizational use (Bhatt, 2000; Wyse and Higgins, 1993). Strongly related to this is the concept of Enterprise Systems (ES). ES are organizational supporting systems, normally based on an Enterprise Resource Planning (ERP) system as core, that consists the informational spine of the organization (Alvarez, 2008). With Enterprise System Integration (ESI) we refer to integration of ES as a specific type of IS.

Industries are integrated by individual organizations' ES to a varying degree. Bank and financial institutions can carry out instant, electronic transactions with almost any other institution in the world. In the automotive industry electronic coupling of actors have led to decreased inventories and faster production cycles. On the other hand, industries such as construction seem to present ES integration that is only marginal in comparison. The existing knowledge on how and why different industries are integrated in their ES is limited, not to say non-existent. Bhatt (2000) investigated the effects of ESI on business process improvements in the Fortune 500 US

companies and found that the industry type was one of two significantly affecting variables, which indicates that within industries there are specific characters that influence the ESI.

Integration seems to be a continuously topical challenge for the field of IS in practice, but yet a rudimentary treated topic in IS research. Since the 1960's and 1970's integration in various form has been on the agenda of IT and IS managers. 5 decades later the topic is more relevant than ever. In a recent survey of more than 500 North American and European CIO's, more than 68% claimed that "Integrating/Extending existing systems and processes" was one of the five top priorities for the future making integration the highest priority in the survey (CIO-Magazine, 2006). Despite the importance of integration, historically and contemporary, the field is sparsely developed. Theoretical development is needed in two directions in order to influence and improve practice. ISI itself is a meagerly explored concept. For example, the conceptualizations of aspects such as integration depth, integration intensity and types of integration is still underdeveloped. Exceptions includes integration levels (e.g. Al Mosawi, Zhao, & Macaulay, 2006; Linthicum, 2001) and writings on integration architecture (e.g. Markus, 2000) In addition even less is known about how ISI, and consequently ESI, is affected by the political, organizational, structural and managerial context in which it exists.

Our purpose is to create a framework useful to describe how ES are integrated in an industry and explain why it is integrated in that way. ESI from an industry perspective is a distinctive gap in the existing knowledge of IS integration. The research on ESI that do exist has primarily treated intra-organizational integration (e.g. Alsene, 1999; Karuppan & Karuppan, 2008) and two-part integration with inter-organizational systems (IOS) and electronic data-interchange (EDI) in Business-to-Business (B2B) and Business-to-Government (B2G) relationships (e.g. Lim & Palvia Prashant, 2001; Masetti & Zmud, 1996; White, Daniel, & Mohdzain, 2005; Zinner-Henriksen, 2006). Less is, however, known about the industry-wide ESI (Browne, Sockett, & Wortmann, 1995; Konsynski, 1993; Themistocleous, Irani, & Love Peter, 2004).

The industry level as an integration context differs from intra-organizational and two-part ESI in that no common management function is available and that disjoint economic unit in an industry hinders compensation of efficiency loss in one place to be compensated by more significant gains in another part. These are essential components of the existing approaches to ESI but they are inappropriate when discussing integration of ES in industries. By fulfilling the purpose above we contribute to the development of the field of IS integration both in direction of concept development as we use, test and refine existing concepts in our development of a framework but also by exploring a type of IS integration in a new organizational context.

Research methodology

The applied methodology is structured case study (Carroll & Swatman, 2000), that builds on the construction of a preliminary theoretical framework which is used to structure the gathering of empirical data and later to analyze the data and draw theoretically grounded generalizations (c.f. Yin, 1994).

Our objective with this study is, as said above, to create a framework useful for describing and explaining ISI in industries. The contribution will be evaluated using criteria for evaluating these types of theory as suggested by Gregor (2006).

In total nine companies were investigated including three farmers, four food producers, one corporate function of one grocery chain, and one large grocery store. In addition the Swedish Agricultural Agency (Jordbruksverket), the Swedish Health Department (Smittskyddsverket) and the Swedish customs (Tullverket) were included to represent supervising actors. The research questions were organized in two parts. The first part was centered upon the business model

concept, targeting customers, products, business processes, work activities, organizational structure, and suppliers in order to get a background to each company. The second part covered existing IS and ISI. The main method used was interviewing. In total 17 semi-structured interviews were made. Interviewees were selected in order to provide a broad representation of those involved. The nine investigated companies:

- Askriden AB has a milk production with 250 milk cows.
- Bramstorp Gård AB produces sugar beets and peas.
- Coop Norden is the corporate function of the second largest grocery chain.
- Danisco Sugar's facility at Örtofta refines sugar beets into raw sugar – has a monopoly.
- Findus AB is specialized in frozen food, such as vegetables (illustrated by peas), meat and fish.
- ICA Tuna is a local grocery store and belongs to the ICA group.
- Skånemejerier is a cooperative owned and a leading actor among dairy products.
- Swedish Meats is the leading slaughter house in Sweden and also a cooperative.
- Tygelsjö Mölla is a pig farmer, who delivers 4500 piglets to Swedish meat.

Based on the data material four stories of information integration were condensed, based on four product flows: milk, pork, sugar, and peas. These product flows were chosen based on some unique features regarding need for integration along the value chain, e.g. planning horizon and harvesting are critical time constraints for pea farming.

A preliminary theoretical framework

The study described in this paper took use of a preliminary theoretical framework which is described in this section. The ambition of the framework is to capture both the industry level as a context for ISI and the basic characteristics of the ISI that exists in an industry. We are thus interested in both the internal and external of the actors in the industry: which processes that exist within a specific organization and how that organization relates to other actors in the industry. One concept that embraces both internal and external aspects of an organization is the business model concept by Hedman & Kalling (2003).

The business model concept

The business model concept by Hedman & Kalling combines strategic and organizational theories that consider the internal operations of an organization being the key to success (i.e. Resource Based View) with theories that regards an organizations interaction with its context as determining (i.e. Porterian models of I/O). The model includes customers and competitors, the offering, activities and organization, resources and factor market interactions (Figure 1).

We will primarily use the model to a) identify the relation our investigated organizations have, both forward and backward in the value chain to customers and suppliers as well as horizontally to competitors, upwards towards monitoring organizations, and downwards if the organization is monitoring another organization. We will also use the model to b) understand the business of the organizations, as Bhatt (2000) identified that the industry type had impact on the level of ISI without further referring to what characteristics caused that impact.

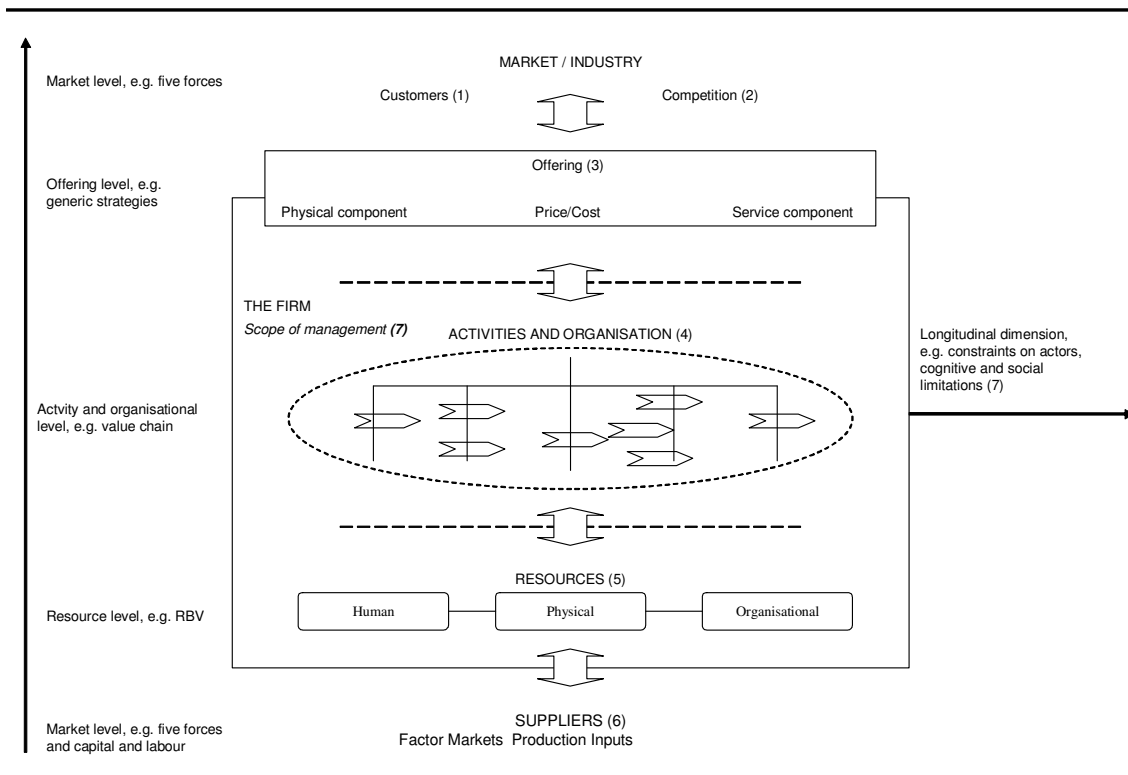


Figure 1. The Components of a Business Model

ESI – useful concepts to describe the integration between actors

The business model concept permits identifying particularities of the business of investigated organizations and to identify relations between organizations in an industry but doesn't help in describing the ESI in these relations. As explained, the collective understanding of ESI is still limited and tools for describing, categorizing and differentiate between integration and integration are still sparse. However, we have identified a few concepts that may be useful:

- ES typology (Weill & Broadbent, 1998): infrastructural, transactional, informational, strategic.
- ESI levels (Al Mosawi, Zhao, & Macaulay, 2006)): IT, IS, Organizational, Strategic
- ESI architecture: Enterprise-wide, Middleware, P2P, Data warehouse, SOA. (Davenport, 2005; Markus, 2000; Zhu, 2005)
- ESI intensity: High/Low (Themistocleous & Irani, 2002), Massetti and Zmud (1996): Volume, Breadth, Diversity, and Depth.

The empirical case: ESI in the Food industry

This section will contain the story of ESI in the Food industry. Here it will be shown how well our preliminary framework serves its purpose of being useful to describe ESI in industries.

A potential extension of the framework is whether the integration is a pull or push flow of data.

Findings and analysis

This section will contain the analysis which will be directed towards explaining why the food industry is integrated as it is. It will show differences between different parts of the food industry depending on aspects which includes:

- Batch/continuous production
- Product sensitivity
- Presence of “Value chain captains”

Based on the framework's ability to explain the ESI it can then be evaluated by the criteria for explanatory theory.

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