

Enterprise Systems and Supply Chains

Johan Magnusson and Andreas Nilsson

Abstract Enterprise systems in the form of Enterprise Resource Planning (ERP), Customer Relationship Management (CRM) and Supply Chain Management (SCM) systems have become the very backbone of organizational value creation. Through this, they both act as enablers and constrainers for processes such as supply chain management. This chapter focuses on establishing the basics to the current development of technology and business.

Keywords Enterprise systems · Supply chain management

1 Introduction

Enterprise systems in the form of standardized, enterprise-wide information systems have proliferated the market for the past decades. At the core of this technology lies the digitalization of the full scope business processes, from sales to manufacturing and procurement. Since these systems have now become an integral part of the infrastructure for value creation in most firms, all processes have become amalgamated with the information technology support.

From this basic premise follows the necessity for students of business processes to have an understanding of the underlying technology. Students of e.g. supply chain management need to be aware of the intimate interplay between the very processes that they are involved in and the technology. In addition to this, much of the work with optimizing supply chains is dependent upon both the analytical

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capabilities of corporate software (i.e. proprietary, standardized commercial-off-the-shelf software) and the available data (i.e. data residing in enterprise systems as well as external sources of both a structured and non-structured nature).

This chapter on enterprise systems and supply chain management explores the links between the processes and technology, as well as opens up for a critique of the presently dominating perspective on technology as merely supporting. In contrast, technology is regarded as both supporting and at the same time regulating work.

To aid the student, we have enclosed an excerpt from the book “Enterprise System Platforms: Transforming the Agenda” (Magnusson and Nilsson 2014). The book is published by Studentlitteratur in Lund, Sweden and is intended for students and practitioners with an interest in better understanding what this interplay between technology and business is, was and is currently evolving towards.

2 The Six Forces of IT

In Fig. 1, we summarize the underlying forces that are descriptive for these past few years’ evolution. As seen in the figure, we have not addressed the intricate interplay and influence between the identified forces, but instead focused on describing them in a sequential manner. Albeit an interesting aspect of the development, we have refrained from this level of analysis for the sake of readability and to avoid the logical fallacy *post hoc ergo propter hoc*.

Fig. 1 The six forces of IT



2.1 The Digitalization of Everything

This new technology, let's call it Information Technology.

Leavitt and Whisler (1958, p. 41).

Since the 1950s, the type of technology referred to as *information technology* (IT) has been introduced into more and more aspects of social life. Stemming from machinery intended for calculating large amounts of data (large in the relative use of the term) for the military, government and business, the technology was early on identified as having fundamental implications for various strands of life.

In relation to business, one of the prominent thinkers in relation to IT at the time, Harvard Professor of Accounting John Dearden (1922–1989) offered his vision of what the end-state of the current level of technological development was.

... the more information available, the better the decision. This end is to be accomplished by having vast amounts of data stored in a computer memory, by having this information constantly updated by point-of-action recorders, by having direct interrogation of the data stored in the computer's memory available to the executive, and by having immediate visual display of the answer.

Dearden (1964, p. 128.)

Readers of today may find it hard to understand the extent to which this line of thinking was radical, but needless to say we see substantial evidence of Dearden's foresight in today's business environment. The rise of business intelligence (BI) solutions and the developments surrounding Big Data seem almost eerily hyphenated in the quote. In addition to this, Dearden also highlights one of the underlying drives behind this strive for total and real-time information, i.e. rational decision making. If every physical action and event is recorded, we will be in a position where all of our decisions, in theory, will be informed and hence freed from irrational guess works. When action becomes digitalized information, we can handle it in a rational manner.

As noted by March and Olsen's (1986) dominating garbage can model and Simon's notion of *bounded rationality*, the very concept of rationality warrants further attention. Human decision-making is, perhaps by definition and default, more a-rational or quasi-rational than rational? It is not the intent of this book to take a stance in relation to this question. Interestingly though, we would advise the reader to carefully take stock of the *intent* of the information technology currently available. We believe that herein lies a proverbial conflict between the design and use of information technology. This is of particular interest when we consider recent developments such as the rise of solutions for 'Prescriptive analytics', with the systems themselves actually making the decisions.

Digitalization does not, however, stop at the updating of information in a 'computer's memory' as noted by Dearden. It has vaster consequences, and according to some, it also brings with it the blurring of boundaries between the physical and the non-physical, between work as we have known it for years and work as we (perhaps) will know it in the future. Researchers such as McAfee and Brynjolfsson (2008) note that the main attribute of information technology is the

digitalization of the very atom of business itself. This atom is the process; or in other words the workflow that in aggregated form constitutes business.

With the rise of enterprise systems such as Enterprise Resource Planning (ERP) systems during the 1990s, processes are hard-coded into the very fabric of information technology *en masse*. They are manifested through blueprints, and the only way to execute a process is through the information technology interface. The upside to this is the rapid deployment of process related innovations, such as e.g. an optimal way to handle returns for a global consumer goods firm. Through information technology, this could, once again in theory, be implemented overnight leading to a homogenization and optimization of the entire firm's global process for return handling.

Through the works of researchers such as Clayton Christensen, we have started to understand the disruptive implications of IT for social and corporate life. Through phenomena such as the Internet of Things (or the Internet of Everything), more and more of what we have seen as separated from IT is rapidly becoming entangled in technology. Industries where IT traditionally has been seen as an administrative or production technology are undergoing shifts where either the entire product or service is digitalized (such as in the music industry), or IT is becoming a substantial part of the product (such as in the automobile industry) or service (such as in the management consulting industry). This shift brings with it new entrants and competitors, echoing the premonition put forth by Michael Porter in the 1980s (1985).

2.2 *The Standardization of the Unique*

Before we address the issue of standardization, we need to clarify what we are actually referring to when we refer to Standardization. Perhaps the best way to do this is to clarify what standardization *is not*, to eliminate some of the common misconceptions related to this term. Standardization *does not* mean that all things are the same. In this manner, the existence of standardized processes within a firm *does not* mean that all processes are homogenous. It *does not* mean that all configurations are equal, or that variants of processes cannot be found. We refer to standardization along the lines of the Capability Maturity Model (CMM), where processes are standardized if they are described following a previously agreed upon notation and nomenclature. Hence, following technology standards does not mean that we may only use the predefined applications of technology, but that we must stick to certain rules and regulations in our application of technology. Related back to CMM, the final level of maturity in terms of standard compliance simply means that we use the same language in describing our objects.

IT has traditionally been geared towards economies of scale, where the organization agrees upon the 'best' way of configuring a process and then selects or develops an information system to support this in an economically rational manner. This has given rise to organizations striving for what they often refer to as *global*

processes, or global process templates, ensuring that the organization as a whole follows the same process for e.g. financial reporting. The underlying rationale behind this is that following a global template: we ensure both economies of scale and internal communication, agreeing to one set of definitions and a common workflow. This has given rise to the birth of Shared Service Centers, or centralized ‘factories’ handling the entire organization’s administrative needs related to specific processes. The core of this idea is that there should not be any individualized customizations to the process, but that everybody needs to agree on what is set in the global template.

This poses an interesting question with regard to the tradeoff between economies of scale versus economies of scope. In economies of scale, the striving for efficiency is highlighted, whereas in economies of scope the striving for effectiveness and adaptability is emphasized. Global processes could be regarded as a concrete example of how organizations strive for economies of scale, at the potential cost of economies of scope. This brings forth the issue of agility, and the increased demands on firms not to consider competitive advantage as something that can be sustainable over time. This is in sharp contrast with previous conceptions of strategic management, in which ‘sustainable competitive advantage’, where the resources were not easily imitated, was seen as the optimal state for an organization. Today, we are more and more turning our attention to issues such as dynamic capabilities, agility and continuous change, with ‘sustainable’ competitive advantage being a contradiction in terms.

Enterprise systems come with a predefined set of processes, geared for creating global processes, similar to what Upton and Staats (2008) refer to as the building of a cathedral. The key to the cathedral is the issue of knowing exactly what you want, and the inability to use the structure before it is completed. Once completed, it will stand for hundreds of years, supporting the identified requirements of the past. The tradeoff between efficiency and effectiveness (or scale and scope) is clear: how can organizations with a constant need for reconfiguring their processes and business models achieve both efficiency and effectiveness through standardized processes?

2.3 The Commoditization of Processes

One of the general trends is the shift of things traded towards commodities. In this process of commoditization, products or services that were previously customized are repackaged into commodities.

Being packaged as commodities brings with it the promise of reducing the cost involved in making a transaction on the market in question (often referred to as the *transaction cost*) through decreasing the time that a customer has to spend in selecting what she is intent on buying. At the same time, it reduces the cost involved in switching between vendors (often referred to as the *switching cost*). Since the commodity is packaged in a similar fashion by different vendors, the buyer can, at least theoretically, exit her relationship with a current vendor and

engage with a new one, this without the characteristics of the commodity changing noticeably.

While the commoditization of products has been going on for quite some time, the commoditization of services has only recently been addressed on a larger scale. In 2005, Professor Thomas Davenport published a paper in the *Harvard Business Review* on how *processes* were currently undergoing commoditization (Davenport 2005). As Davenport argued, the rise of process standards such as COBIT, SCOR and ISO14001 bring with them a common nomenclature and language to describe the processes. This can be regarded as a first step in the commoditization of processes.

When firms can describe their processes in a manner that can be understood by actors on the outsourcing market, processes will become a commodity traded like any other one on an open market. If we as a firm, for instance, were to describe our supply chain process following the SCOR methodology, we could more easily communicate our process specifications, the expected level of performance and the cost to external parties. If the said process were to be sourced to a lesser price from an actor on the open market than from internal resources, then we could choose to outsource this particular process to the vendor most meeting our requirements in terms of price and quality.

This phenomenon of sourcing processes (or sub-processes) from external vendors is referred to as Business Process Outsourcing (BPO) and has throughout the past couple of years seen a radical increase in market size. At the same time as this development can be understood from an economic point of view, it raises several questions as to the very nature of the firm. What actually constitutes the firm as we understand it? What constitutes the boundaries of the firm?

The impacts of the commoditization of processes have also been highlighted for firms working outside of traditional industry. Christensen et al. (2013) advocate an upcoming commoditization of the services offered by management consultants, where we see firms such as McKinsey and Associates packaging elements of their previous delivery for faster and more efficient delivery. The potential of technologies such as crowdsourcing of analysis (e.g. Kaggle.com), prescriptive analytics (e.g. Ayata) and self-service BI (e.g. Tableau Software) shifts a large portion of what was previously supplied by the management consultants as a complete package. In other words, new technology-induced solutions are disrupting the very firms that have recommended firms to invest in the said technology.

2.4 *The Consumerization of Technology*

Any user having been exposed to corporate IT while at the same time using consumer IT will testify to the sharp contrasts between the two. Consumer IT has experienced a drastic growth during the past couple of decades, creating a chasm within a technology that initially was designed for the corporate realm. IT was initially so complex and costly that any consumer-directed application of it would

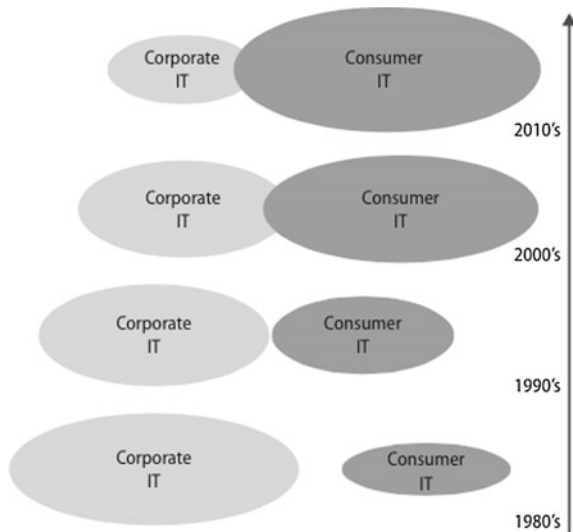
be commercially impossible. It was a technology designed for professionals, be they accountants, physicians or officers.

During the 1980s, a new wave of technology started to proliferate the market. The IT industry was starting to re-frame itself towards end users, through innovations such as desktop computing and the spinoffs this technology brought with it. In the following decade, the Internet was introduced as a medium through which communications could be made even less costly and available for a larger part of the community. In the early years, vendors strived to create value in what initially best could be referred to as an empty room. Connecting people (which coincidentally was the byline of Nokia, one of the dominant cellphone vendors at the time) and achieving network externalities, along the lines of what is commonly referred to as Metcalfe’s law: the utility of a network increases exponentially with every added node (Gilder 1993).

As the incumbent vendors saw the massive potential of a market for consumer IT, they were at the same time distraught about how to feed the rapid onslaught of innovations back into the market for corporate IT. Having established themselves on a market where they currently had a strong position, they were adamant towards making radical changes to their existing solutions. Hence, the direct effects of a massive increase in innovation for consumer IT did not spill over to the corporate side.

At the same time, new challenging vendors of corporate IT saw massive potential in the new technology being introduced for consumers. In it they saw the necessary prerequisites for transforming the graphical user interface (GUI) and the way we as users consume technology. With the introduction of software as a service (SaaS) as a delivery model for software, challenging vendors often offer the intended customers the option of trying their solution out for free (Fig. 2).

Fig. 2 Illustration of how consumer and corporate IT have changed over the past few decades



This challenges the previously so dominant position of the incumbent vendors, and opens up for a blending of consumer and corporate IT through the introduction of a new line of products and services. At the same time it creates a market for vendors that sell their solutions directly to the end user, not necessarily attending to often centralized models of IT procurement for the customer. This in turn creates a situation where a larger and larger part of an organization's total IT spending is becoming decentralized, with a lack of corporate cost control as a direct consequence. This phenomenon is referred to as "Shadow IT", and according to prominent industry analysts, the proportion of IT spending that falls within the category of Shadow IT will reach as much as 90 % by 2018. We will address this in more detail in the Sect. 2.6.

2.5 The Co-creation of Value

In the shift towards cloud-based delivery models such as SaaS, we have a hard time seeing the value of our infrastructure in the books. Instead of procuring a resource, we subscribe to it, and hence we have no depreciation and no book value of the service in question. A service (such as SaaS) is in this respect something that generates value momentarily on usage, and not something that we can place in our inventory if we wish to use it later on instead of now. In addition to this, the value of a service is created in the meeting of the client and provider/service, and hence not simply created but rather *co-created*.

In research, there has long been a strong tradition of looking into strategic alliances and other inter-organizational collaborations. Despite this, there seems to be a lack of understanding in terms of which mechanisms exist between organizations involved in co-creation. This is noted by Sarker et al. (2012), in their study of how an ecosystem of partners surrounding a large ERP vendor is involved in the co-creation of value.

Perhaps the best example of the allure of co-creation can be found in Google's business model. When we ask our students (in a highly unscientific manner) about who Google's customers actually are, the answer is predominantly the students themselves, in giving them the right answers to their searches and supplying them with the service of finding value on the Internet. In response to this answer, we then ask if perhaps they might be mistaking "customer" for "factory worker", with the following logic: the students generate revenue by advertising for Google. At the same time, they share their personal sentiments and information while optimizing the algorithms behind the searches. Hence, they are involved in both direct revenue generation and the accruelement of structural capital for Google. As noted by Baudelaire (2011) in his famous poem *Spleen in Paris*: "The greatest trick the devil ever pulled was convincing the world he didn't exist." Co-creation brings with it the possibility of displacing the traditional roles of producer and consumer, creating what is often referred to as "prosumers", i.e. actors involved with the parallel production and consumption of a product or service.

An alternative to this is the growth of what is commonly referred to as the *sharing* or *collaborative* economy. According to The Economist (2013), this grew to a \$26 billion market during 2013. Examples such as Airbnb, a service that supports sub-letting private lodgings to travellers, or Uber, a ride-sharing service, thrive on platform logic in connecting private owners of lodging and transportation with consumers wanting to share resources. These firms are competing with traditional channels such as hotels and taxis, as well as toppling the previous composition of services offered by e.g. travel agencies through co-creation.

2.6 The Disintegration of Systems

Turning and turning in the widening gyre

The falcon cannot hear the falconer;

Things fall apart; the centre cannot hold;

Mere anarchy is loosed upon the world.

W.B. Yeats, The Second Coming

In the early 1950s, novelist and Nobel laureate Chinua Achebe described the social transformation taking place in a small, Nigerian rural village. With the inflow of new norms and influences, the social fabric of everyday life started to change, resulting in both wonderful new possibilities and the loss of that which once was.

The situation described in the novel is one of disintegration. Defined as the “shift from larger to smaller pieces”, disintegration is also central to understanding what has been happening for the past 30-odd years within the IT industry, particularly in relation to enterprise systems.

Software development has undergone several shifts since its birth in the 1950s (some would argue that the development of software goes back even further, to Thomas von Neumann or even Karl Leibnitz). Central to the change in development methodology and software architecture has been the striving for re-use and loose coupling of code snippets. These snippets were first referred to as functions, later on objects and currently services. The services of today stem from a new approach to building systems first introduced in the late 1990s and referred to as Service Oriented Architecture (SOA).

SOA stipulates that a system should have the ability to use and issue services from and to (from the system itself) external systems. Hence, a system designed following a SOA approach should both be able to share its own code and calculations with other systems, and not be self-sufficient in terms of code. Hence, the exchange of services between systems (often referred to as *web services*) becomes a signifying mark for SOA based systems.

In stipulating and agreeing on the standards for the exchange of the said services and the possibility of utilizing internet protocols instead of proprietary network solutions as the medium for exchanging services, the cost of integration has

radically decreased on a per unit basis. The implications of SOA on IT in general and enterprise systems particular have been an increased disintegration, somewhat paradoxically due to the increase of inter-system integrations. Since systems no longer need to be self-sufficient in terms of code and functionality, the previously so strong *raison d'être* for monolith solutions has become obsolete. With integration being standardized, it is now possible to combine services from a number of systems into one single set of functionality, without a disproportionate increase in cost.

Hence, the disintegration of systems is expressed in the increase of cross-dependencies between systems and the possibility of satisfying functional requirements through combining existing services from a multitude of systems. The consequences of this can be seen in such diverse phenomena as SaaS and Shadow IT, and a mean decrease in project scope for software development. Much in line with what Chinua Achebe described in “Things fall apart”, disintegration brings with it both substantial possibilities, but also significant problems for users and vendors alike.

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