Level of Harmonization and ERP Architecture in Multinational Corporations

Fatemeh Rahimi
Technical University of Denmark, fatemeh.rahimi@gea.com

Charles Møller
Aalborg University, charles@business.aau.dk

Information Systems: Transforming the Future

ACIS 2013
RMIT MELBOURNE

24th Australasian Conference on Information Systems, 4-6 December 2013, Melbourne

Proudly sponsored by

nab
ACIS 2013 Principal Sponsor

RMIT UNIVERSITY

CITRIX®

GS1 Australia

acs AUSTRALIAN COMPUTER SOCIETY

ACS Foundation
Advancing ICT through Education and Research

ACPHIS

AAIS
Australasian Association for Information Systems

Level of Harmonization and ERP Architecture in Multinational Corporations

Fatemeh Rahimi
Department of Management Engineering
Technical University of Denmark
Lyngby, Denmark
Email: fara@dtu.dk

Charles Møller
Center for Industrial Production
Aalborg University
Aalborg, Denmark
Email: charles@business.aau.dk

Abstract

While one-site, one-instance implementation was the common practice during the infancy of ERP systems, the growing business trend towards globalization and the advancement of ERP and telecommunication technology have increased the popularity of centralized single-instance ERP systems among multinational corporations. The ERP distribution decision in MNCs has been mainly associated with the corporate strategy and governance structure. As global ERP deployment benefits mainly come from business consolidation, and as there are significant costs and risks associated with centralized ERP implementations, this paper investigates the influence of level of harmonization in the choice of ERP architecture in MNCs. Though the findings indicate a negative relation between the level of harmonization and a centralized ERP systems' effectiveness, the study identifies the choice of ERP architecture to be more directly affected by the factors prohibiting further divergence, namely the corporate business process governance structure and the degree of similarity of its business models.

Keywords

Enterprise Resource Planning Systems, Harmonization, Standardization, ERP Architecture, Multinational Corporations

INTRODUCTION

The need for optimal system architecture has received significant attention in the post mainframe era and the advent of the client-server systems (Davidenkoff and Werner, 2008). Though this technological advancement led to the drift of IT governance towards decentralization in the 80s, the recentralization of IT was a 90s trend (Peterson, 2001). The study by Holland and Light (1999) and Molnar (2011) point to an increasing trend in centralization of separate, country-specific applications and legacy information processing systems. In line with the centralization trend, many multinational corporations (MNCs) are in the process of re-implementing their ERP system to replace the standalone applications that share very little information, necessitate significant manual intervention to consolidate business data, and incur higher total cost of ownership due to the uncoordinated technical architecture (Zrimsek and Prior, 2003). The motivation for uniform global solutions is as well derived from the rapid changes in the communication technology (Ghosh, 2003; Phelan, 2011); the significant maturity of ERP hardware, software and databases; the advances in ERP systems supporting multiple currencies, multiple languages and automatic handling of country-specific import, export, tax and legal requirements (Bingi et al., 1999); and the increasing business trend towards globalization (Carton and Adam, 2003).

Despite the advantages and while most of the technical barriers to global deployment of centralized ERP systems have fallen, a centralized architecture is not considered appropriate for all organizations, but the ERP strategy of an MNC is suggested to fit the corporate business strategy and constraints (Rayner and Woods, 2011). The most successful ERP projects are suggested to be those that support strategic business objectives and goals (Rayner and Woods, 2011). The majority of studies on information system architecture, and more specifically ERP architecture, have an emphasis on the alignment between MNCs' information system architecture and their strategic objectives and governance structure (e.g. Clemmons and Simon, 2001; Davenport, 1998; Hawking et al., 2007; Henderson and Venkatraman 1993; Ives and Jarvenpaa, 1991; Kay, 1998; King, 1983; Madapusi and D'Souza, 2005; Markus et al., 2000; Tractinsky and Jarvenpaa, 1995; Zrimsek and Prior, 2003). There are as

well few studies discussing the ERP architecture with respect to the information requirements and the interdependency among corporate business units, and the influence of external environmental factors (e.g. Clemmons and Simon, 2001; Gattiker and Goodhue, 2004).

While the importance of technical limitations and the corporate strategy and profile for the choice between centralized and decentralized ERP architectures is well-investigated, the impact of the level of harmonization of business processes and data structure on the choice of ERP architecture in MNCs have not been sufficiently addressed. In accordance with the existing literature, this paper uses the terms standardization and harmonization interchangeably to refer to the process of unifying diverse corporate processes into a global template. In other words, harmonization in an MNC is defined as the activity of establishing a limited set of solutions and balancing the requirements of the parties involved (Rosenkranz et al., 2010). Subsequently, the level of harmonization refers to the degree of commonality that is achieved between different process variants across an MNC (Remco, 2012) or the extent to which subsidiaries perform the same practices the same way.

Despite the fact that harmonization, and the consequent integration, visibility and control, are among the primary drivers of ERP consolidation efforts (e.g. Clemmons and Simon, 2001; Hufgard and Gerhardt, 2011; Seethamraju, 2009; Wyss, 2008), harmonization has been experienced difficult to achieve (e.g. Gattiker and Goodhue, 2004; Geppert and Williams, 2006; Sethi et al., 2008; Sheu et al., 2004). Considering the higher degree of difficulties and risks associated with ERP implementation in a global context caused by the magnitude of the required business change and the significance of the coordination tasks (Rayner and Woods, 2011; Rebstock and Selig, 2000), and the less satisfactory local-level implications of such projects (e.g. Carton and Adam, 2003; Gattiker and Goodhue. 2004; Molnar, 2011; Olson et al., 2005), it is interesting to see whether a centralized ERP is still justifiable in case of lower levels of harmonization. Furthermore, the recent emergence of loosely coupled systems and technologies based on service oriented architecture and web services and the advances in middleware technologies to integrate distributed ERP systems have made it even more interesting to look into the implications of tightly coupled centralized ERP systems for MNCs. Therefore, the study investigates the architecture of ERP systems in MNCs and the impact of the level of harmonization of business processes and data structure across an MNC on the choice between centralized and decentralized architectures.

The remainder of the paper is organized as follows: the theoretical framework will briefly discuss the previous studies with respect to the architectural choices for a global ERP solution, the factors decisive for the choice of ERP architecture, the advantages and disadvantage of technical and business consolidation efforts in global EPR projects, and the implications of a low level of harmonization for the potential benefits of ERP consolidation efforts. The theoretical framework is followed by the description of the research question and methodology. Next, the findings from the interviews with the key informants are presented and the paper is concluded with a discussion of implications, limitations and potential extensions of the research.

THEORETICAL FRAMEWORK

Global ERP architecture choices

MNCs are provided with several architectural choices for global ERP solutions. At one end there is the completely decentralized architecture, where the global ERP solution is distributed on several systems that work separately and independently, each have their own database, and may communicate with each other to a certain extent via individually defined interfaces. On the other end, there is the centralized architecture that consists of a single system on which all corporate applications and data are implemented on only one database. In its most extreme form a centralized system is configured as a single-instance system (also called a single-client system) opposed to those centralized systems comprising multiple clients. Though in a multi-client system the clients share the same system and hardware resources, the presence of multiple clients supports data separation and client-dependent configurations, and therefore a multi-client system provides a higher potential for incorporating variants in the same system (Davidenkoff and Werner, 2008). A decentralized architecture with shared services can be considered as a hybrid of centralized and decentralized architectures, in which shared service systems are the lead systems to which the subordinate decentralized systems are connected (Davidenkoff and Werner, 2008).

The remainder of the paper will have a greater focus on single-instance and completely decentralized ERP systems and their characteristics, and the comparison between the two as they represent the two ends of the architecture spectrum.

Global ERP Architecture Decision-Making

The previous studies discuss the IT distribution decision based on two sets of factors: business-related factors and technical system-related factors. While both influence the choice of architecture, the distribution decision is suggested to be made on business and not technical factors (Clemmons and Simon, 2001; Zrimsek and Prior,

2003). In the following, a brief description of these factors and their impact on the choice of architecture is presented.

Technical factors such as ERP-specific characteristics and infrastructural limitations are found influential on the choice of ERP architecture in MNCs. When deciding about a global ERP solution, sufficient attention should be paid to the feasibility of supporting multiple languages, time zones, add-ons, industry solutions, and country versions within a single system (Davidenkoff and Werner, 2008; Ghosh, 2003; Zrimsek and Prior, 2003). Furthermore, server sizing, storage capabilities, network requirements, and backup and systems maintenance planning are of vital importance when deciding for a global ERP consolidation (Ghosh, 2003; Kay, 1998; Zrimsek and Prior, 2003). Yet, the significant growth in ERP hardware and software, and communication technology has diminished the influence of technical constraints on the implementation of a centralized ERP system (Ghosh, 2002; Rayner and Woods, 2011). Nevertheless, critical business-related difficulties still remain (Davenport, 1998).

In an organizational context, IT serves as an instrument for change on one hand, but on the other hand, it is largely constrained by the organizational internal and external characteristics with those it must align. Managerial intents, organizational characteristics, and external environmental characteristics are explained to influence IT decisions including IT distribution decisions (Peterson, 2001; Tractinsky and Jarvenpaa, 1995). Davenport (1998) and Markus et al. (2000) point to the need for an association between the level of autonomy at the corporate business units and the ERP architecture, the degree of freedom in ERP package selection and configuration, and the level of data and process commonality across an MNC. Looking at a highly centralized information and communication system as a tool to impose centralization and formalization across an MNC, Clemmons and Simon (2001) suggest an alignment between the consequent control and coordination mechanism and the corporate strategy and governance structure. Correspondingly Kay (1998) considers centralized ERP applications suitable for firms that operate as centralized organizations. While a headquarters-driven centralized architecture is suggested to suit better global MNCs intended for a high degree of standardization to harvest world-wide economies of scale, multi-domestic MNCs with autonomous business units are recommended to implement a decentralized architecture reflecting domestic needs in terms of business processes and data definition (Hawking et al., 2007; Ives and Jarvenpaa, 1991; Madapusi and D'Souza, 2005). Local profit and loss responsibility, coupled with reliance on local information systems departments and local technology, encourage orienting the application portfolio towards local requirements leading to non-integrated technology platforms, databases, and applications (Ives and Jarvenpaa, 1991).

The degree of interdependence among the business units in an MNC, defined as the degree to which business units exchange information or material in order to complete their tasks, is suggested to affect the choice of a global ERP solution as well. Greater interdependence among corporate business units is associated with greater benefits from a centralized ERP and a common formalized language (Clemmons and Simon, 2001). On the other hand functional variety and differentiation among corporate business units, i.e. the uniqueness of tasks, technologies, environment, goals etc., and the consequent variety in information requirements can lead to significant ERP-related costs if a single, standard system is broadly deployed (Gattiker and Goodhue, 2004). Resilience, stability, adaptability and flexibility for future changes are other aspects to consider when deciding about the system architecture (Molnar, 2011).

Besides the above mentioned internal factors, external factors including the diversity of national cultures, governmental requirements and legal issues associated with trans-border data flow, and economics of computing are other factors suggested to influence global IT and ERP distribution decisions (Clemmons and Simon, 2001; Gattiker and Goodhue, 2004; Stephens, 1999; Tractinsky and Jarvenpaa, 1995).

ERP Consolidation

In the context of enterprise systems, standardization is the process of producing an agreement on technical and business specifications to be used consistently across a corporation to ensure that processes, information, formats and systems are interconnected and interoperable (Markus et al., 2000). Hufgard and Gerhardt (2011) break down the ERP consolidation process into two steps: technical consolidation and business consolidation. Consolidation with a single vendor solution can begin with moving all the supporting ERP hardware to one physical data center, without pursuing any common data structure and business processes, to reduce costs and achieve ERP infrastructure standardization. A further reduction in cost can be achieved by adopting new server and disk storage consolidation technologies (Zrimsek and Prior, 2003). At the most extreme form of technical consolidation, a client is shifted from one system environment to another, or two or more clients are merged to create a single unit (Hufgard and Gerhardt, 2011).

While moving to a centralized ERP system brings some cost-savings by eliminating site and office space expenses, reducing support costs, scaling back hardware infrastructure, eliminating the need for interfaces from one system to another and reducing the number of system software and database software (Hufgard and Gerhardt,

2011), it has its own drawbacks. Decentralized architectures may be preferred over centralized architectures when it comes to system complexity; risk of downtime and system outage; change impact testing; upgrade planning; backup and maintenance planning; problem identification and resolution time; and server, storage, and network requirements (Ghosh, 2003; Hufgard and Gerhardt, 2011; Kay, 1998; Markus et al., 2000; Zrimsek and Prior, 2003). In addition, integration, especially technical integration, increases interdependency and necessitates higher change control, and therefore may delimit business process agility (Hanseth et al., 2001; Seethamraju, 2009). The real benefits of consolidation become apparent only after business consolidation, as a solely technical consolidation is suggested to result in a highly complex system (Hufgard and Gerhardt, 2011).

Huber et al. (2000) suggest semantical standardization as one of the most important issues when implementing ERP systems in MNCs. System templates are the solution for defining semantical standards to achieve global standardization and ensure a common configuration and a common set of master data and processes across an MNC (Huber et al., 2000). Using a global template reduces ERP complexity by reducing variations in the overall solution. This impacts the management of the system during its entire life cycle; lowers the effort spent on analysing, applying, testing and deploying changes; facilitates upgrades; reduces data ambiguity; facilitates consolidation and corporate reporting; improves skill utilization and lowers resource head count required for application use, support and operations (Phelan, 2011). However, Phelan (2011) does not consider deployment of a global ERP template necessarily equivalent to an instance reduction strategy, as a global template can be used to ensure consistency across multiple ERP instances. Nevertheless, implementation of a global template may drive the elimination of variations in distributed ERP systems which subsequently results in redundancy of separate instances (Phelan, 2011).

Despite all the advantages mentioned above, achieving a consensus on standardization and harmonization of business processes and data structure has proved to be difficult (e.g. Gattiker and Goodhue, 2004; Geppert and Williams, 2006; Sethi et al., 2008; Sheu et al., 2004). The next section looks into the implications of a low level of harmonization on the effectiveness of a single-instance ERP system.

Level of Harmonization and ERP Architecture Effectiveness

Achieving a higher level of standardization is among the primary drivers of ERP consolidation efforts in MNCs to improve IT efficiency and enable a single source of truth (e.g. Clemmons and Simon, 2001; Hufgard and Gerhardt, 2011; Seethamraju, 2009; Wyss, 2008). Davenport et al. (2004) consider the very purpose of standardization of business processes to reduce the variability and variety of processes, terminology and definitions, information and data formats, and technology platforms and systems across business units to achieve efficiency and consistency in execution through automation and other means. However, global standardization is experienced to be affected by national differences in culture and language, government and corporate politics and regulations, management style, and labor skills (Sheu et al., 2004). In addition, standards tend to be confronted with the dilemma between universality and individuality, and efficiency and flexibility (Huber et al., 2000). There are studies arguing against the extensive use of global templates due to their negative impact on the local level flexibility (Hanseth et al., 2001). Furthermore, adapting business processes to a global template does not necessarily yield the same benefits across the business units of an MNC (Carton and Adam, 2003) and may not entirely reflect the local practices and requirements (Clemmons and Simon, 2001; Madapusi and D'Souza, 2005; Zrimsek and Prior, 2003). Deployment of a global template is also expected to be difficult in case the constituent business units are not willing to give up control (Phelan, 2011). The absence of a centralized control often results in multiple and varied ERP configurations across business units (Madapusi and D'Souza, 2005). Stressing the significant magnitude of business changes brought by simultaneous system and business consolidation, Ross et al. (2006) recommend business consolidation only after IT architecture maturity in terms of technology standardization. All these challenges may lead to lower than intended harmonization during global ERP implementations and consequently, as we will demonstrate, a reduction in the associated benefits with ERP consolidation.

Though ERP systems can be used to provide a common language between corporate business units, a misperception underlying ERP systems is that they automatically lead to discipline and process integration across organizations, while common business processes and data throughout an MNC are the necessary prerequisites for this goal (Huber et al., 2000; Sethi et al., 2008). As the level of localization of ERP systems increases there will be more difficulties in information sharing due to the inconsistent data formats and processes (Hawking et al., 2007). This will in turn influence the possibility of supporting international expansion and global operations, and the opportunity for controlling more remote subsidiaries, as control and coordination are enabled only through accurate, real-time information shared in standard format across departments, currencies, languages and national borders (Carton and Adam, 2003; Hawking et al., 2007). Accommodating diversified process and data within a single system, though possible, is costly, as each variant needs to be maintained and supported separately (Hufgard and Gerhardt, 2011). In addition, in such cases, investment in customized integration code might be

required to facilitate data alignment and to obtain an integrated and holistic view of business data (Madapusi and D'Souza, 2005).

The more harmonized the business processes across the business units of an MNC, the larger the fraction of the system will consist of the common core. It is argued that a larger core, and subsequently a smaller need for local tailoring, justifies a common global application (Ives and Jarvenpaa, 1991). Similarly, Davenport (1998) and Hawking et al. (2007) consider a good example of a firm suitable for a centralized architecture as a firm which has achieved a high level of commonality of business processes. Likewise Ghosh (2002) suggests success of a global rollout approach to depend on the level of harmonization across the organization. The winners of global ERP consolidations are seen to use their applications to standardize business processes and information across their corporation (Rayner and Woods, 2011). In case of low levels of harmonization Ghosh (2002) suggests avoiding a phased roll-out, and instead going for new implementation at each corporate business unit. There can be found examples of cases that failed in their ERP consolidation effort as a result of diversified processes caused by national and cultural differences (e.g. Sheu et al., 2004). A decentralized architecture is suggested to be more suitable for those MNCs incorporating a number of autonomous business units where data definitions and business processes reflect domestic requirements (Hawking et al. 2007).

RESEARCH FRAMEWORK

The concept of fit expresses the idea that the object of design must match its context in order to be effective (Livari 1992). Based on the contingency concept and the findings from the literature described in the previous section, Figure 1 suggests that the relation between ERP architecture and its effectiveness in terms of integration, control and coordination, and total cost of ownership is moderated by the level of harmonization, such that effectiveness will be higher at higher levels of process and data harmonization.
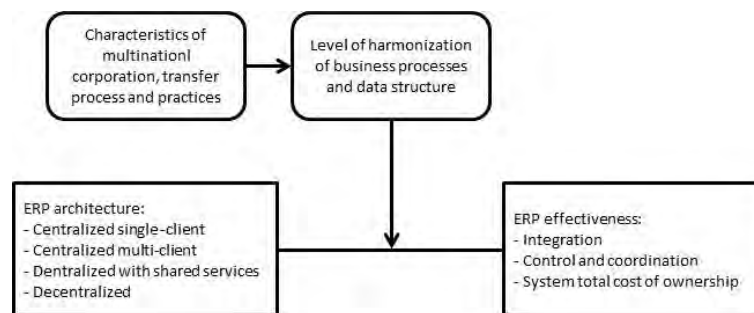

Figure 1 : Relation between ERP architecture and its effectiveness moderated by the level of harmonization

While the potential benefits of business consolidation may compensate for the drawbacks of technical tight coupling and limited local flexibility, an important question remains concerning the suitability of a centralized system in case of low levels of harmonization and the moderated associated benefits. Therefore it is interesting to see whether and how the level of achievable harmonization of business processes and data structure across an MNC should influence the choice of ERP architecture.

Though, the indirect relation between the level of harmonization and a centralized ERP effectiveness in terms of integration, control and coordination, and system total cost of ownership have been pointed out by few studies, it is not clear how much harmonization would justify a single-instance ERP system in MNCs. Failing to achieve the intended level of harmonization, it is important to study whether a single-instance ERP system with a significant number of diversified configurations is still justifiable considering the drawbacks of technical tight coupling and lower local flexibility. Therefore an empirical study was conducted to shed more light on the ERP architecture decision-making in MNCs, especially in relation to the level of harmonization of business processes and data structure across the business units.

RESEARCH METHODOLOGY

The rather exploratory nature of the study, the immaturity of theories in relation to ERP distribution decision especially with respect to the level of harmonization, and the context-dependency of such decision-makings make case study a suitable approach to enhance the construct validity and to provide a holistic understanding of the role of and the interplay between the different factors decisive for the choice of ERP architecture. As the first step and in order to study the decisive factors for the choice of architecture and especially the role of the level of harmonization in the ERP distribution decision, we have conducted a pilot study based on a series of semi-structured interviews with key informants, including three SAP consultants and an IT director, all engaged in single-instance SAP implementation in various MNCs. Among the SAP consultants, one has been working for more than seventeen years as the SAP technical architect assisting major MNCs with their SAP landscape

decision-making, the second one has been involved in two global SAP implementations, and the third is experiencing his first global single-instance SAP implementation as the solution architect. The IT manager was the initiator and the architect of the global SAP program in his respective company and was responsible as the program manager.

The informants have been involved in global SAP consolidation projects that have achieved various levels of harmonization: while some ended up with a high degree of commonality across the involved business units, others were not successful in realizing a high level of harmonization despite the single-instance SAP implementation. As Eisenhardt (1989) has stated, the theoretical sampling of the polar type cases makes the process of interest transparently observable. Flyvbjerg (2006) suggests that the polarity between the cases will help to obtain information about the significance of various circumstances for case process and outcome. Accordingly, the informants' engagement in consolidation projects with various level of achieved harmonization provided us with the opportunity to question the implications of a centralized SAP system with a low level of harmonization for an MNC, in terms of both business- and system-related outcomes, and the potential influence of the level of harmonization on the decision-making. The inclusion of the IT director in the study could ensure avoiding the potential bias coming from the loyalty of the SAP consultants to the system. It could also ensure including the business-related aspects of such decision-makings in the discussions.

The rather significant market share of SAP in comparison with other ERP vendors justifies the choice of vendor. The exclusive focus on SAP also controls for the potential variations in ERP architecture caused by ERP-specific characteristics. However, any extension of the findings to other EPR vendors' system requires a thorough study of the system and its product-specific characteristics that may influence the choice of architecture.

The interviews were tape-recorded and transcribed. The within-case and cross-case coding was performed based on the main themes and theoretical concepts. The potential bias in the interviews is expected to have been mitigated by triangulation of data sources, i.e. several interviewees and some documents, enhancing the credibility of the study.

FINDINGS

The findings from the interviews confirm the previous studies suggesting harmonization and the consequent visibility among the main drivers of SAP consolidation in MNCs. However, the informants did not consider a single-instance SAP implementation an equivalent to a harmonization effort, as a single-instance system could still accommodate various configurations to meet local requirements. It is technically possible to configure each business unit relatively separately in a single-instance system, meaning that a single-instance SAP implementation does not essentially require a global template roll-out.

> "Harmonization can be avoided even in a single system. Nowadays systems, especially SAP systems, are flexible and can be configured differently for different company codes. [Therefore] harmonization is more than a single system [implementation]."

> "Lots of specifications can be configured not only at the company code level but even at the plant level. Lots of the processes can be different in the companies."

> "It is not true [that a high level of harmonization is needed to implement a single-instance system]. You can do almost whatever you want in the ERP system."

Yet, identical configuration of system-level and client-independent features is inevitable in a single-instance system, necessitating a certain level of harmonization across the MNC. Consequently, the possibility for accommodating variants is the highest in a decentralized architecture, followed by multi-client and single-instance systems.

As a single-instance system still provides an MNC with a wide variety of options for localization, a high level of harmonization cannot be enforced through a centralized ERP implementation, but is achieved through negotiations between corporate business units. However, one informant argued that a single-instance system increases the potential for harmonization, as it highlights the local deviations and increases the chance of identifying and spreading best practices across an MNC.

While there are different opinions regarding the minimum level of harmonization to justify a single-instance system, all informants suggested a single-instance system as the starting point for any consolidation efforts, unless there were strong arguments against it. However, it appears that the distribution decision-making process is not an exact science.

> "By default, let's go for a single client and then convince me why it is not possible."

> "This kind of landscape planning is not exact science. There is a lot of history and religion involved. For the people deciding what to do and how to do it, it is mainly based on what they have tried before, what did work, what didn't work and what sounds good to them."

The business models and the IT and process governance structure of an MNC are suggested to be the most influential factors in the choice of architecture, whereas most of the technical issues with a centralized SAP system have been overcome. While network requirements, legal legislations on data storage and transfer, size of corporate business units, and corporate sell-off strategy are also mentioned influential in distribution decisions, a centralized system is suggested to be suitable only in case of the presence of a centralized IT and business governance organization and the similarity of the business models across the MNC. In other words, a decentralized MNC can still implement a centralized system as long as a centralized IT and business process governance organization is in place and compromise with respect to system configuration is achievable considering the degree of diversity of business models. While the similarity of business models across an MNC reduces the risk of incompatibility of the harmonized solution with the individual business units' requirements, the centralized IT and process governance ensures centralized decision-making with respect to system configuration and system management tasks e.g. change process, service level agreements, downtime planning, upgrades planning etc.

> "If there are similar business models and if there is centralized governance, and by the centralized governance I mean dictatorship to a certain level, then you can do a central system, otherwise you cannot. […] It's primarily IT governance but also process governance. You have to have global process owners."

> "What would have been important instead of just running the harmonization and single ERP program is to say you are not implementing anything before you have the corporate function in place that actually has the responsibility for the new business model and processes. Unless you have that you shouldn't continue. You should wait until the full governance is in place and it is anchored."

> "A single-instance system is about reaching compromise, so a global system needs the top management involvement. If they really think harmonization would destroy their business then they shouldn't do it. A single system will enforce harmonization and this will influence the autonomy, because they have to change some of the things they used to do."

> "On the business model, there will be limitations on what you can do, what processes and process variants you can support. […] There might be limitations of the functionalities that you can support in the same system simultaneously."

> "Don't go for a central system if you have many diverse businesses, otherwise I'd always try to centralize."

However, deciding about the architecture solely based on the existing business models and governance structure is not recommended, but the future evolvement is vital to be taken into account.

> "The risk is not that much about what we do today, but mostly in what we could do or like to do tomorrow."

> "A low level of harmonization may justify a multi-client system, but if the board is intended for a higher level of harmonization in the long term, then they should go for a single-client system, because a single system will enforce some level of harmonization anyway and also facilitates further harmonization."

While it might be technically possible to globally deploy a single-instance SAP even in case of a significant number of diversified configurations of business processes and data structure, implementing a single-instance system in MNCs with lower levels of harmonization runs the risk of facing conflicts at later points in time. Variants are typically the indicators of differences in the business models and/or autonomy in decision-making across an MNC. Even if the variants can be incorporated in the same system at the time of implementation, there is the likelihood of further divergence in the future, which then will cause major problems for the system management and maintenance. Moreover, the growing number of variants may eventually reach a point where it will not be possible to accommodate them all in a single system. The similarity of the business models and the presence of a centralized IT and process governance organization would mitigate the risk of further divergence.

> "[The risk is higher in case of a single system with a low level of harmonization] because they are not used to harmonize. […] All these variants come from somewhere and there is a likelihood that more variants come in future, which then may run the risk that these variants cannot be accommodated in the same system."

> "If you don't harmonize and let people build up their own way of doing business, they will come with even more requests for [local] optimization and in the long run it might not be beneficial."

The level of harmonization of business processes and data structure not only influences systems' complexity and costs along its lifecycle, but also impacts business agility at the corporate level, as a higher number of process variants will make it more difficult to dynamically modify, reconfigure and deploy business processes to accommodate potential future requirements of an MNC as a whole. Implementing a single-instance system in case of a low level of harmonization also influences system agility, as it necessitates more testing and maintenance effort to avoid unintended impacts of new and diversified configurations on the other parts of the system. Level of harmonization also affects system's user-friendliness, as the higher the number of business unit-specific options, the more difficult it will be to use the system in the daily operation.

> "The value of the template and rollout solely relies on the amount of commonality. […] The benefit of a template is that it should be easy to roll out and it should be easy to maintain. But easy to maintain depends on the ability to keep the template equal. [Otherwise] you don't get all the benefits of a central system, [especially] the low cost."

> "If you have a system with a high level of harmonization and want to change the way everyone is working, then the central system has a high agility. If you have a system with a low level of harmonization, then you can change one variant fairly quickly, that means you are agile for part of the business but no for the total business."

> "A single system with a low level of harmonization increases the test effort because you need to test more variants to make sure you have not influenced other parts unintendedly."

> "Putting all variants in a single client makes tables bigger with lots of different options for entries and this makes the system less user-friendly."

The findings also confirmed the negative impact of a low level of harmonization on the visibility and transparency and the MNC's ability to control and coordinate the business units spread all over the globe, as the reports from the corporate business units are not comparable unless identical business processes and data structure are followed. The lack of visibility and comparability in turn influences the effectiveness of management decision-makings. The negative relation between the level of harmonization and the degree of integration was as well confirmed by the informants and was discussed in relation to the ease of intercompany transactions and communications.

> "[Level of harmonization] also defines how good is your corporate reporting because it defines if the numbers are comparable."

> "Different data structure requires huge effort to convert the formats [for reporting purposes]. You will have difficulties comparing the figures, and may end up comparing apples and oranges. This can lead to wrong management decisions."

Despite the risks associated with a centralized system with a low level of harmonization and the moderated benefits, a centralized SAP still brings benefits, especially with respect to IT operational costs.

> "A central system with a low level of harmonization is a risk, that's why you shouldn't do it. But still you'll have some benefits, one of them being IT cost savings, the second one being the potential to harmonize without having to redesign the complete set-up."

> "A central system brings IT costs savings in terms of hardware and people running it. It also ensures higher security through proper disaster recovery, backup procedure, extra power units etc. Decentralization makes it more difficult to ensure the adequacy of these procedures for each single site. So you really save cost if you do it centrally."

However, the informants had different and in some cases even self-contradicting opinions when faced with the question concerning the financial feasibility of a single-instance SAP implementation in case of a low level of harmonization. While one considered cost savings from consolidated hardware and centralized IT management sufficient to justify consolidation efforts, the others were in doubt. Nevertheless, to answer this question, one informant again emphasized on the importance of the similarity of business models, the ability to reach a compromise, and the objectives behind the consolidation effort.

> "[The suitability of implementing a single system in case of low level of harmonization] depends on where [the company] wants to go. The question is more the other way around. Do they want to become harmonized? […] If the company has a centralized governance and identical business model, then it's ok to have a centralized system to save IT costs. A decentralized system in such case would not make sense. But if they don't have those two, then I don't believe they can centralize on the system level to reduce IT cost savings."

Given these statements, in case of no technical restriction for accommodating diversified requirements in the same system, implementation of a centralized system in an MNC with a low level of harmonization is recommended as long as the corporation is seeking higher efficiency and therefore is intended for more harmonization in the future, the limitations imposed by a centralized system are acknowledged, and there is a centralized governance organization in place to manage and maintain the solution.

> "If you have a 50% harmonization and you can live with the restrictions of a single instance and have the governance in place to support it, then 50% harmonization is better than no harmonization."

> "I'll be concerned if the level of harmonization is lower than 75%. You can still run a system with a harmonization lower than 75%, but it is really about management decision and business strategy. If they are not intended to harmonize and consider the decentralized structure the best model for the company then they shouldn't go for a single system."

On the other hand, if the sources of diversities lead to endless discussions while defining the scope of the global template and deciding about the system management aspects, implementation of a single-instance system may not pay off due to the significance of design and compromise costs. In such cases it might be more sensible to configure the various business units in separate clients or even in dispersed systems.

> "Of course sometime the bucket of money that you need to spend to build the template becomes too big compared to the benefits that you will get by rolling out the template both from the time and money perspective. So if you have a 30% commonality, you will end up in the template building in endless discussions of variants and what is part of the template and what is not, it might not be worth it."

> "Harmonization makes senses if there is a critical mass. Harmonization of a process with a low frequency may not pay off. It is also important to see how easy it is to harmonize."

However, while two of the SAP consultants considered a multi-client system as a potential alternative to a single-instance system in case of a low level of harmonization across corporate business units, the third consultant had a different opinion: the diversities caused by a decentralized governance structure can still lead to difficulties managing a multi-client system, as such systems still carry the limitations of a single system, and therefore need to be governed centrally.

CONCLUSION AND DISCUSSION

The practice exercised in global ERP implementation projects usually favors a single-instance ERP system due to its higher potential for IT cost savings and eventual business consolidation benefits. This study, by taking a critical view to this approach, investigated the importance of the level of harmonization of business processes and data structure across an MNC while justifying platform consolidation and process integration benefits against the side-effects of technical tight-coupling and lower local flexibility.

The interviews confirmed the findings from the previous studies suggesting the moderating effect of the level of harmonization on a single-instance ERP effectiveness in terms of the degree of integration, the level of control and coordination, and the system's total cost of ownership. In addition to these aspects, the informants also pointed to the indirect relation between the level of harmonization and a single-instance ERP user-friendliness, system agility, and business agility at the corporate level.

Though the pilot study confirmed the negative impact of a low level of harmonization on the benefits expected from a centralized ERP system, the findings do not imply the level of harmonization to be directly decisive for ERP architecture as long as the variants can be accommodated simultaneously within a single system, and the similarity of business models and the presence of a centralized governance organization delimit further divergence of business-unit specific configurations. In other words, while the level of harmonization negatively influences the benefits of a centralized system and therefore may potentially impact the distribution decision, the choice of a centralized architecture at a higher level depends on the existence of a centralized IT and business process governance organization and the feasibility of accepting the restrictions imposed by a single system to various corporate business models. As the findings do not indicate a high level of harmonization essential for a centralized and even a single-instance ERP system, they contradict some of the previous studies favoring a decentralized architecture in case of a low level of harmonization of business processes and data structure (e.g. Gosh, 2002; Hawking et al., 2007; Madapusi and D'Souza, 2005).

Underlining the importance of the similarity of business models is in line with some previous studies suggesting highly diversified business processes and information requirements, caused by significant differences in business models or industries, as impediments to implementation of a centralized standard ERP system as one standard ERP solution may not fit all business units' requirements (e.g. Gattiker and Goodhue, 2004; Zrimsek and Prior, 2003). Consistent with the previous studies, all informants also argued that a centralized ERP system would be more difficult to implement in a decentralized MNC. However proposing a centralized organization responsible for ERP and business process management sufficient for centralized ERP deployments contradicts the prior studies suggesting an alignment between an MNC's governance and control structure and the ERP distribution decision (e.g. Clemmons and Simon, 2001). This is an interesting finding for investigation in future studies.

While the findings indicate a high potential for localization even in a single-instance ERP system, and therefore the technical feasibility of a single-instance system with various configurations, it is still not clear whether a single-instance ERP is financially justifiable in the absence of business consolidation benefits. In other words, though the informants considered a single-instance ERP system harmless even in case of a low level of harmonization as long as the centralized IT governance organization and compromise on a single system's limitations are in place, one question still remains concerning whether an effort for a single-instance ERP implementation can be justified mainly based on technical consolidation benefits. The findings from the literature study and interviews indicated contradicting opinions in this respect. This question can be answered by an investigation into the positive and negative implications of a single-instance ERP system, especially with respect to the level of harmonization, and an evaluation and comparative analysis of the significance of the identified implications.

The investigation into the ERP architecture in MNCs and its business- and system-related implications is planned to continue through few case studies in MNCs with a single-instance SAP system. The most important condition for case selection will be the level of achieved harmonization to explore the dynamics between the level of harmonization and the choice and the implications of ERP architecture. Still, ERP consolidation efforts in MNCs are affected by a variety of other factors that should be considered during the case selection and data analysis. These factors may include business-related issues, e.g. corporate control and coordination mechanisms, and integration requirements; technical constraints, e.g. geographical distribution of subsidiaries and availability of

the required infrastructure; and project-related factors, e.g. project time, resource and scope constraints. In addition, as a centralized ERP, though appealing to the managers at corporate headquarters, may not fit the local business units' expectations and habits, the phenomenon needs to be studied both at headquarters and subsidiary levels to control the bias and enhance the internal validity.

REFERENCES

Bingi, P., Sharma, M. K., and Godla, J. K. 1999. "Critical issues affecting an ERP implementation," Information Systems Management (16:3), pp. 7-14

Carton, F., and Adam, F. 2003. "Analysing the impact of enterprise resource planning systems roll-outs in multi-national companies," Electronic Journal of Information Systems Evaluation (6:2), pp. 21-32

Clemmons, S., and Simon, S. J. 2001. "Control and coordination in global ERP configuration," Business Process Management Journal (7:3), pp. 205-215

Davenport, T. H. 1998. "Putting the enterprise into the enterprise system," Harvard business review (76:4)

Davenport, T. H., Harris, J. G., and Cantrell, S. 2004. "Enterprise systems and ongoing process change," Business Process Management Journal (10:1), pp. 16-26

Davidenkoff, A., and Werner, D. 2008. "Overview of Architectures," Global SAP Systems Design and Architecture, 1st ed., E. Tripp Ed., Boston, Galileo Press

Eisenhardt, K. M. 1989. "Building theories from case study research," Academy of Management Review, pp. 532-550

Flyvbjerg, B. 2006. "Five misunderstandings about case-study research," Qualitative inquiry (12:2), pp. 219-245

Gattiker, T. F., and Goodhue, D. L. 2004. "Understanding the local-level costs and benefits of ERP through organizational information processing theory," Information & Management (41:4), pp. 431-443

Geppert, M., and Williams, K. 2006. "Global, national and local practices in multinational corporations: towards a sociopolitical framework," The International Journal of Human Resource Management (17:1), pp. 49-69

Ghosh, S. 2002. "Challenges on a global implementation of ERP software," Engineering Management Conference, IEMC'02 (1)

Ghosh, S. 2003. "Global implementation of ERP software-critical success factors on upgrading technical infrastructure," Engineering Management Conference, Managing Technologically Driven Organizations: The Human Side of Innovation and Change, pp. 320-324

Hanseth, O., Ciborra, C. U., and Braa, K. 2001. "The control devolution, ERP and the side effects of globalization," ACM SIGMIS Database (32:4), pp. 34-46

Hawking, P., Stein, A., and Foster S. 2007. "The challenges facing global ERP systems implementations," The International Conference on Enterprise Information Systems, Madeira, Portugal, pp. 415-422

Henderson, J. C., and Venkatraman, N. 1993. "Strategic alignment: leveraging information technology for transforming organizations," IBM Systems Journal (32:1), pp. 4-16, 1993

Holland C. P., and Light, B. 1999. "Global enterprise resource planning implementation," The 32nd Annual Hawaii International Conference on System Sciences, Hawaii

Huber, T., Rainer, A., and Hubert, Ö. 2000. "Templates-instruments for standardizing ERP systems," The 33rd Hawaii International Conference on System Sciences, Hawaii, pp. 1-18

Hufgard, A., and Gerhardt, E. 2011. "Consolidating Business Processes as Exemplified in SAP ERP Systems," S-BPM ONE-Learning by Doing-Doing by Learning, Springer Berlin Heidelberg, pp. 155-171

Ives, B., and Jarvenpaa, S. L. 1991. "Applications of global information technology: key issues for management," MIS Quarterly (15:1), pp. 33-49

Kay, E. 1998. "Going global with ERP," Datamation

King, J.L. 1983. "Centralized Versus Decentralized Computing: Organizational Considerations and Management Options," ACM Computing Surveys (15:4) pp. 319-349

Livari, J. 1992. "The organizational fit of information systems," Information Systems Journal (2:1), pp. 3-29

Madapusi, A., and D'Souza, D. 2005. "Aligning ERP systems with international strategies," Information Systems Management (22:1), pp. 7-17

Markus, M. L., Tanis, C. and Van Fenema, P. C. 2000. "Enterprise resource planning: multisite ERP implementations," Communications of the ACM (43:4), pp. 42-46

Molnár, B. 2011. "The Country-specific Organizational and Information Architecture of ERP Systems at Globalised Enterprises," Business Systems (2:2), pp. 1-56

Olson, D. L., Chae, B., and Sheu, C. 2005. "Issues in multinational ERP implementation," International Journal of Services and Operations Management (1:1), pp. 7-21

Peterson R. R. 2001. "Configurations and coordination for global information technology governance: complex designs in a transnational European context," The 34th Annual Hawaii International Conference on System Sciences, Hawaii

Phelan, P. 2011. "Global ERP Template: Scope and Content Guidelines," Gartner

Rayner, N., and Woods, J. 2011. "ERP Strategy: Why You Need One, and Key Considerations for Defining One," Gartner Research

Rebstock, M., and Selig, J. G. 2000. "Development and implementation strategies for international ERP software projects," 8th European Conference on Information Systems (2), pp. 932-936

Remco, H. 2012. "A literature review in process harmonization: a conceptual framework," Beta Working Paper series 379

Rosenkranz, C., Seidel, S., Mendling, J., Schaefermeyer, M. and Recker, J. 2010. "Towards a Framework for Business Process Standardization", Business Process Management Workshops, S. Rinderle-Ma et al. (Eds.), pp. 53–63

Ross, J. W., Weill, P., and Robertson, D. 2006. "Enterprise architecture as strategy: Creating a foundation for business execution," Boston, Harvard Business Press

Seethamraju, R. 2009. "Effects of ES-enabled standardization and integration on business process agility," Pacific Asia Conference on Information Systems

Sethi, V., Sethi, V., Jeyaraj, A., and Duffy, K. 2008. "Enterprise resource planning systems implementation in a global subsidiary organization: Lessons learned," Journal of Asia-Pacific Business (9:4), pp. 373-394

Sheu, C., Chae, B., and Yang, C.-L. 2004. "National differences and ERP implementation: issues and challenges," The International Journal of Management Science (32), pp. 361-371

Stephens, D. 1999. "The globalization of information technology in multinational corporations," Information Management Journal (33:3), pp. 66-71

Tractinsky, N., and Jarvenpaa, S. L. 1995. "Information systems design decisions in a global versus domestic context," MIS Quarterly (19:4), pp. 507-534

Wyss, A. 2008. "Single Instance ERP: what you should consider," Lodestone Management Consultants AG

Zrimsek, B., and Prior, D. 2003. "Comparing the TCO of Centralized vs. Decentralized ERP," Gartner Research

ACKNOWLEDGEMENTS

COPYRIGHT