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Ashley Davis
davisash@uga.edu

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Ashley Davis
University of Georgia PhD Student
davisash@uga.edu

Abstract

Enterprise Resource Planning (ERP) customization is a major source of concern for organizations implementing or using ERP systems. Customization has been used to explain implementation failures for years. However, the question of which types of customization have negative effects and which types of customizations have positive effects has not been fully explored. Case studies show that lack of customization sometimes causes negative consequences. What is the reason that some customizations are needed while others should be passed by? Using strategic alignment and systems agility as a basis for understanding the impact of customizations, this paper attempts to gain insight into the impacts of ERP customization.

Keywords: Enterprise Resource Planning, ERP, Enterprise Systems, Customization, Agility, Strategic Alignment, Systems Agility

Introduction

Implementation of Enterprise Resource Planning (ERP) systems has been a source of pain for organizations since the inception of ERP software. One of the sources of pain is customization. Beyond being a source of pain in implementation, customization affects the organization in an on-going fashion through increased maintenance costs, increased complexity, and less flexibility of the system. For these reasons, many have argued that a "vanilla" implementation, i.e. without customization, is the "best" way to implement ERP systems. However, when business processes in an organization cannot be modeled in an ERP system without customization, the impact of a decision to not customize becomes relevant. The opposing forces of the requirement to customize to include business processes and the desire to successfully implement an ERP system without: additional complexity, additional maintenance costs, and less flexibility deserve further research. This paper proposes that all customizations are not created equal, and a certain type of customization is beneficial. Specifically, strategic customizations will enhance the IT infrastructure strategic alignment with the business strategy. Non-strategic customization, such as consistency customization, will impact the system agility of the corporation.

This paper draws from the ERP literature and Information Systems (IS) strategic alignment literature. Both are reviewed in the sections that follow. Based on this literature review, research hypotheses are developed. This paper closes with a quick methods section, briefly outlining how this study might be conducted.

ERP

ERP systems are large complex systems, many times modular in nature, but ultimately, enterprise systems are packaged software. As such, enterprise systems will have the same issues as packaged software. The issues with packaged software, as described by Gross and Ginzberg (Gross and Ginzberg, 1984) of "uncertainty about package modification time and cost, vender viability, and the ability of the package to meet the user needs" have plagued Enterprise Systems. Changing packaged software to meet user needs is the essence of customization. Given the scope of ERP systems, reaching into most of the business functions of an organization, the insight from Lucas et al (Lucas, 1998) that "…either the organization has to change its procedures, compromise on processing needs satisfied, or modify the package" applies to ERP systems directly. Business processes must be changed or the ERP system has to change (Davenport, 1998) when there is a misfit between the organization and the packaged software.

The term "misfit" has been used by scholars when ascertaining the situation that comes about when implementing ERP software that does not mirror the business processes of the organization. Classifications of these misfits have been developed (Soh, Siew, & Kien Sia, 2003; Soh, Siew, & Tay-Yap, 2000). Company specific requirements, that the ERP package is not capable of meeting, is one type of misfit identified by Soh, Siew et al in 2000. In 2003, a follow-up paper by Soh et al expanded on the categorization of misfits. In this study, Soh et al define a framework for assessing misalignments in ERP implementation. In both papers, the resolutions to the misfits are outlined. For several types of misfits, customization is the resolution; however, these papers do not look into whether the misfit is strategic. These studies are very insightful as to the sources of misalignments, but the purpose was not to assess the impact of each type of misalignment on the organization. This paper attempts to address this gap by studying the impact to strategic alignment of different types of customization.

Customization

Numerous studies of the critical success factors for ERP implementation success conclude that the preferable way to implement ERP software is sans software modification (Nah & Zuckweiler, 2003). However, for reasons of misalignment and strategic alignment, customizations of enterprise systems are necessary. One estimate is that 20% of the processes in an organization cannot be modeled in an ERP system without customization (Scott and Kaindl, 2000). Software modification and customizations are needed for the ERP system to meet the needs of the organization; however, the issues associated with customization are far reaching.

Because customizations are built as part of a development effort, many times during an implementation time frame, customizations may have minor bugs (Markus, Axline, Petrie, & Tanis, 2000; Soh, et al., 2000) that the vendor supplied ERP software would not. These bugs can cause delays in development during the implementation of an ERP, and affect the successful implementation. Customizations have been found to have negative affects on the outcome of ERP implementation projects (Gattiker and Goodhue, 2004; Levin, 1998; Parr and Shanks, 2000). The example case in Gattiker and Goodhue (2004) where the entire implementation budget was spent on just four of 20 plants illustrates the problems that customization can bring to bear on an ERP implementation project. In general, less customization will mean shorter implementation times (Levin, 1998), thus the inclusion of "vanilla" implementation in so many ERP implementation critical success factor studies (Nah & Zuckweiler, 2003).

The complexity added by customization is an issue for organizations implementing ERP systems. An ERP system is already a complex system, requiring massive amounts of organizational change as part of the implementation process (Barnes, 1999). The added complexity of customizing the ERP system is problematic.

The problems associated with ERP customization do not end with implementation. Customization of an ERP will have maintenance and upgrade impacts (Zrimsek and Geishecker, 2002). Each time a change is required to the system, the effect of the change on the customization will have to be assessed by the organization, as the software vendor will not support these customizations. Many times, this requires bringing in an expert to help with this assessment. These additional requirements reduce flexibility or agility of the system. As well, ERP software vendors do not usually support customizations in future versions of the software. For example, an upgrade of accounting software is required each year to be compliant with tax law. If a company is using an ERP system with customization, the effect of the tax law upgrade will have to be tested with the customization of the system to ensure processing continues as expected. The added complexity required by customization of ERP systems reduces system agility as well.

Definition of Customization

Customization in this paper will refer to either interfaces or modification. The reason for only using these types of customization is that historically, these types of customization require the most upkeep, and will have the biggest impact on strategic alignment and system agility. Also, interfaces and modifications are both "code" change type customization, meaning that a certain amount of custom programming is required to achieve this type of customization. Modifications (Haines and Goodhue, 2004) are code changes that the vendor does not support. This notion of "code changes" as a particular and influential form of customization is supported by other academic studies (Gattiker and Goodhue, 2004) as well as by practitioner journals. So, the conceptual definition of customization for the purposes of this paper is: Customization is a code change put into place because the ERP business process does not mirror the "desired" business process.

Two types of customization will be studied: strategic customizations and consistency customizations. Strategic customizations are important, as these types of customizations aid in strategic alignment. Consistency customizations are customizations made not for strategic reasons, but for the purpose of replicating a "status quo" business process.

Strategic customizations are any customizations that are made with the purpose of achieving a strategic goal or furthering a strategic initiative. The reason these are so important, is that a strategic customization should be in support of the strategy of the company, thus is aligned with the strategy of the company. When a modification or customization is made in support of the strategy of the company, this will further the alignment of IS strategy and business strategy, and the impacts should be positive.

The other type of customization that will be considered is a customization that is made for consistency purposes. Attention has been paid to customizations that are necessary because of a lack of fit between the ERP and the business processes; however, customizations are being made to mimic the status quo, or to mimic a poor business process. These types of customizations are not strategic, and should be differentiated from strategic customizations. These customizations are "consistency" type customization. An example of a consistency customization is when an organization has reporting requirements that include certain headers, footers, and general formatting of data that is not readily available from any of the thousands of generic reports available from the ERP system. The organization may have to code this sort of change, rather than even use the reporting tool available from the ERP software. This type of change is not strategic. This type of customization only re-enforces a pre-ERP way of reporting with no added strategic value. This is a "consistency" type customization.

Though different types of consistency customization may exist as well as different types of strategic customization, for the purpose of this research and for parsimony, we group these into two categories: strategic customizations and consistency customizations. Consistency and strategic changes are not two ends of a continuum, but are separate concepts. This paper treats strategic customizations as separate and distinct from consistency customizations.

Decision to Customize

The decision to customize is complex (Haines and Goodhue, 2004). Several studies have discussed the issues and concerns inherent in the customization decision (Haines and Goodhue, 2004; Parr and Shanks, 2000). This paper does not attempt to include all the different reasons that firms customize enterprise system. This paper only uses these as a basis for understanding that the decisions are complex, and are therefore made with a trade-off in mind.

The decision (to customize or not to customize) and the reason for customization (strategic versus consistency) are addressed in this paper. The major problem faced with the decision to customize is the conflicting objectives of "vanilla" software for a successful implementation and customization to include legacy business processes. Organizations may make a decision not to customize, only to be forced to customize after implementation when a serious strategic threat to the organization manifests (Gattiker and Goodhue, 2002). Therefore, more attention to the nature of customization as part of the decision making process is required. Haines and Goodhue (2004) identify the many different factors that affect ERP system customization. Exploring the factors that affect ERP system customization is beyond the scope of this paper. The focus is the outcome of the decision, and the impacts of strategic and consistency customizations.

Strategic Alignment

There is much literature that studies the importance of the strategic alignment of IS with the business (Henderson and Venkatraman, 1994; Hirschheim and Sabherwal, 2001; Sabherwal and Chan, 2001). IS alignment is an important, yet elusive goal (Chan, 2002; Hirschheim and Sabherwal, 2001). The next section outlines how this study differs from and builds on previous explanations of IS strategic alignment. Henderson and Venkatramen (1994) put forth that IT Strategy as well as IT Infrastructure and business process should "fit" the business strategy. The focus by Henderson and Venkatramen (1994) on IT Infrastructure supports the assertion that this paper makes, that the infrastructure should support the strategy, specifically in customization choices. Another significant point to understand from Henderson and Venkatraman (1994) is the technology implementation perspective. "…technology implementation is concerned with the strategic fit between the external articulation of IT strategy and the internal implementation of the IT infrastructure and processes with their corresponding impact on the overall organizational infrastructure and processes (Henderson and Venkatraman 1994 p. 211)." This perspective links IT infrastructure and IT strategy, then subsequently links to business strategy. Since ERP customization is part of the IT infrastructure, these links are critical to supporting the hypothesis that the nature of the customization will impact strategic alignment.

Sabherwal and Chan (2001) focus on IS strategy and aligning the systems or business applications with business needs and using them to derive strategic benefits. An important finding is that it is necessary to understand the nature of the IT investment within an organization, not just the level of IT investment. I attempt to build on the concept of "nature of IT

investment" to include the types of systems, and specifically the nature of the system as being customized for strategic purposes versus customized for consistency purposes and the impact of such on strategic alignment.

The process of IS and Business alignment is addressed by Hirschheim and Sabherwal (2001). The argument in the paper is that IS Strategy can affect business strategy. This paper (Hirschheim and Sabherwal, 2001), however, addresses IS strategy at a high level, and does not account for the actions that IS can take to enable a strategy that is in alignment with the business. Thus, I am addressing this gap. It is clear that IS strategy at a high level has been studied and indeed there is a correlation between this high-level strategy and business performance (defined any number of ways); however, there is not a study that looks at the specific actions that IS and the business can take as part of an implementation process, i.e. decisions regarding customization of enterprise software, and how these decisions affect strategic alignment.

Business processes cannot be separated from an enterprise system. The very nature of an enterprise system is an integration of business processes, data bases, business units, etc. The fit between the business process and the system has been studied (Gattiker and Goodhue, 2002) and determined to be important to positive business outcomes. Gattiker and Goodhue (2002) take the need for IS to be strategically aligned and study the application of this alignment at the subunit (department) level. Building on the view of that paper, one way to determine if the implemented system supports the strategy of the company is to look at if the implemented system contains customizations that are strategic, or merely consistent with the current operations of the company.

Systems Agility

Closely related to the strategic alignment of business processes and IT infrastructure is the agility of the organization's systems or systems agility. Agility is a relatively new concept in academic and practitioner literature; however, related concepts have been studied extensively. For example, strategic flexibility from the strategic management literature, as Chen (2004) notes, is a closely related construct. Strategic flexibility was studied back in the early 1980's in terms of exit barriers (Harrigan, 1980) and was defined as a firm's ability to redeploy its assets without friction. More recently, strategic flexibility was defined by Shimizu and Hitt (Schimizu and Hitt, 2004) as "an organization's capability to identify major changes in the external environment, to quickly commit resources to new courses of action in response to change, and to recognize and act promptly when it is time to halt or reverse such resource commitments."

The definition of strategic flexibility provided by Schimizu and Hitt (2004) is very close to many of the definitions that are available for agility. Table 1 quickly addresses many of the definitions currently in use.

Table 1: Agility Definitions

	Source	Definition
1	Sambamurthy et al (Sambamurthy, Bharadwaj, & Grover, 2003)	"…agility encompasses a firm's capabilities related to interactions with customers, orchestration of internal operations, and utilization of its ecosystem of external business partners. Operational agility ensures that firms can rapidly redesign existing processes and create new processes for exploiting dynamic marketplace conditions."
2	D'Aveni; Goldman et al 1995; as cited by Sambamurthy et al 2003	"Agility is the ability to detect opportunities for innovation and seize those competitive market opportunities by assembling requisite assets, knowledge, and relationships with speed and surprise."
3	Zaheer and Zaheer (Zaheer and Zaheer, 1997)	Breaks agility into two parts alertness and responsiveness.
4	Haeckel (Haeckel, 1999)	Defines adaptive companies in terms of sense-and-respond organizations, stating that truly adaptive corporations must "… manage information in a particular way; it must be managed as a system; and its leaders and employees must commit themselves to very different behaviors and responsibilities" essentially stating that sense-and-respond organizations function very differently than traditional organizations. It is believed that Haekel is referring to the adaptability of corporations as a form of agility for corporations.
5	Gartner (Gartner, 2001)	"Agility is the ability to respond quickly and effectively to rapid change and high uncertainty."
6	Dove 2001 (Dove, 2001)	"Agility is the ability to manage and apply knowledge effectively, so that an organization has the potential to thrive in a continuous changing and unpredicted business environment. Agility implies not only the ability to

	Source	Definition
		respond to unanticipated change (response ability) but also to act proactively with regard to change"

One of the differences between strategic flexibility and agility is the need for proactively sensing changes as opposed to simply being flexible in terms of reaction to change. The concept of agility also more clearly accounts for the business process change internal to the organization as part of organizational change in a responsive and sensing capacity. Part of the internal ability to be agile is systems agility. Chen (2004) further examined agility and defined systems agility as the ability of a firm to change their information systems effectively, quickly, and at less cost to meet business needs (Chen, 2004). Chen's definition of systems agility is used for the purposes of this paper. One component of system agility as defined above is the flexibility of the system. An attractive characteristic of ERP software is flexibility (Gattiker and Goodhue, 2002; Soh, et al., 2003). Customization of ERP can limit the flexibility of the ERP (Soh, et al., 2003); thus, organizations should consider whether customization is needed as this decision will impact the system agility. By and large, consistency customization reduces system agility.

Hypotheses

Research Question: What is the effect of ERP customization on firm strategic alignment and system agility?
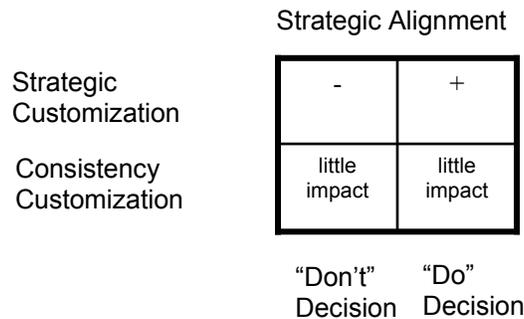

Figure 1. Effects of Customization on Strategic Alignment

This 2x2 is a contingency framework from which the following four hypotheses about strategic alignment are derived:

H1: Strategic customization that you don't make will have a negative impact on Strategic Alignment.

H2: Strategic customization that you do make will have a positive impact on Strategic Alignment.

H3: Consistency customization that you don't make will have little or no impact on Strategic Alignment.

H4: Consistency customization that you do make will have little or no impact on Strategic Alignment.

Using the strategic alignment literature as a base (Henderson and Venkatraman, 1994; Hirschheim and Sabherwal, 2001; Sabherwal and Chan, 2001), these hypotheses portray a reasonable attempt to determine impacts of the different types of customization (strategic and consistent) on strategic alignment. The definition of strategic alignment, "Strategic alignment means the fit between the priorities and activities of the IS function and the business unit. The goal in strategic alignment is for IS priorities, capabilities, decisions, and actions to support those of the entire business (Chan, 2002)" is used in this paper. Although all the hypotheses are supported by the aforementioned literature, and the previous paragraphs make arguments to support these hypotheses, a quick summary of the arguments follow.

Hypotheses 1 and 2 draw heavily from strategic alignment and the ERP literature. From a strategic alignment perspective, Henderson and Venkatraman (1994) specifically address IT infrastructure and business strategy "fit". Since the ERP system is part of the IT infrastructure, and customization to improve alignment is a large part of the ERP system (Scott and Kaindl, 2000; Soh, et al., 2003; Soh, et al., 2000), decisions to make strategic customization should influence strategic alignment. Also, Davenport (1998) argues that the business goals should drive the system choices, supporting the need for customization to support the business strategy.

Hypotheses 3 and 4 are supported by the case study findings from Gattiker and Goodhue (2002). Gattiker and Goodhue study ERP impact. ERP impact is defined as ERP's effect on a subunit's (department's) ability to access necessary information, the ability to coordinate with other areas, and the overall fit between ERP and task needs. Two case studies are presented (Gattiker and Goodhue, 2002) that support the position that whether the change is strategic, impacts the likely outcomes from ERP implementation. Specifically, in a case where vanilla ERP systems were implemented for non-strategic business subunits, the impact on the organization was minimal. This supports the hypotheses that customizations that are not strategic will have very little impact on the strategic alignment.

However, in terms of systems agility, the extent of the consistency customization will determine the impact of such customizations. By "extent" we mean level of difficulty of the customizations in question. Very complex consistency customizations are more likely to negatively impact systems agility than low complexity consistency customizations. Those impacts are found in decreased systems agility, as described in hypothesis 5:

H5: Consistency customization that you do make will have a negative impact on Systems Agility.

Hypothesis 5, centers on the idea that needless complexity will decrease system agility. Needless complexity is created if a system is customized for reasons other than strategic reasons. The argument is that customization creates a more burdensome system, which diminishes the efficiency of the system and thus diminishes system agility.

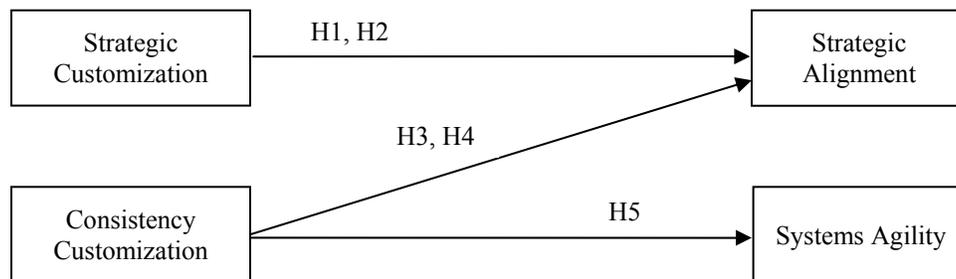The actual research model is as follows:

Figure 2: Research Model

Methods

A survey instrument to measure the nature of customization, strategic alignment, and systems agility will be created. A new measure will be created for customization, while strategic alignment and systems agility will be measured with modification to existing measures. After these measures have been developed and validated, a pilot survey will be performed. This survey will involve managers from organizations that currently use ERP systems. Since different business units will contribute to and have different impacts on strategic alignment and systems agility, it is possible to use several participants from each organization representing different business units. In the pilot, perhaps only an equal number of IS and business managers is needed. After a successful pilot, and any needed re-tuning of the instrument, the final survey would be completed. For the final survey, one IS manager and one business manager from each business unit participating in the organization would complete the survey. This would ensure that the perspectives of IS people and business people were included in the study as the contribution of both parties is relevant to strategic alignment and systems agility measurement. The author has access to senior executives who will be respondents on this questionnaire.

Implications/Conclusions

Implications to both the research community and practitioners will result from this study. Both the research community and practitioners will benefit from a better understanding of the impact of ERP choices in customization on strategic alignment and systems agility. The understanding that perhaps critical success factors concerning customization should include information as to the strategic nature of the customization is another valuable contribution to academia and practitioners. This research attempts to study implementation outcomes other than adoption or success. The study of implementation outcomes in terms of strategic alignment and systems agility will yield contributions to academia. Although there is emerging research on customization, the contribution of this research lies in a focus on two specific types of customization and their impacts.

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