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Building Enterprise Integration Through Enterprise Resource Planning Systems

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BUILDING ENTERPRISE INTEGRATION THROUGH ENTERPRISE RESOURCE PLANNING SYSTEMS

Completed Research Paper

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Abstract

Intense global competition, dynamic business complexity, as well as increased customer sophistication (e.g., one-stop shop, one face to all) are demanding large complex organizations to integrate their enterprise operations. One way to attain the goal is through ERP-enabled enterprise integration. How do organizations execute their enterprise integration strategies through ERP systems? Through a case study of a large Asian logistics organization, we chronicled the multiple trajectories towards enterprise integration. Our findings show that enterprise integration demands simultaneous attention to system, business, and strategic integration. Moreover, as it is a fluid concept, careful consideration of key dimensions of integration and implementation path are necessary to carve out the enterprise integration strategies. Our findings also show that even though integration is frequently desired, it is an unfamiliar concept to many and thus require emergent learning and continuous governance efforts to prevent divergence.

Keywords: enterprise integration, business integration, system integration, enterprise systems

Introduction

Enterprise integration is becoming an increasingly pertinent organizational issue. Organizations get more complex as they pursue rapid business growth. As an organization expands, organizational fragmentation increases which, in turn, reduces the visibility required by organizations to enact strategies quickly throughout the whole organization. Enterprise integration, which is the process of achieving unity of effort among the various subsystems in the accomplishment of the organization's tasks (Lawrence et al. 1967), has emerged as a way to deal with such complexities. Through enterprise integration, an organization is able to attain the goal of acting as a collective unit via tight coordination and cooperation.

In the push for enterprise integration, Enterprise Resource Planning (ERP) systems have been developed as the tool to enable enterprise integration. In fact, ERP systems have been touted as the comprehensive packaged software solutions that seek to integrate the complete range of a business' processes and functions, in order to present a holistic view of the business from a single information and IT architecture (Gable 1998). It then seems promising for an organization to achieve enterprise integration through its ERP systems. However, research has proven otherwise, where roll-outs of ERP systems have met with problems such as inadequate support due to weak corporate strategies and high integration costs (Alberts 2008; Wailgum 2009; Zaino 2004). For example, when Hewlett-Packard was integrating with its biggest North American divisions via an ERP system, instead of reaping benefits of the intended integration, a huge financial loss of \$160 million was incurred (i.e. this was about five times the project's estimated cost). These failures suggest a need to better understand how ERP systems can better support the pursuit enterprise integration.

In this paper, we attempt to broaden the understanding of the organizational issue of enterprise integration and how it shapes the use of ERP systems in contributing to a unified entity. Our research question is: How do organizations execute their enterprise integration strategies through ERP systems? This study can potentially make important contributions to both the academic and practice field. While there are already streams of research on integration, few attempts have been made to discuss the notion of enterprise integration and its strategies. Discussions on integration are often too simplistic, assuming that it is merely an unitary concept of connecting disparate silos together (Volkoff et al. 2005). However, integration can actually be a dynamic concept where it requires continuous management. Furthermore, enterprise integration enabled by ERP systems has been understudied and poorly understood. This paper can be seen as an attempt to reduce these academic gaps. Finally, this paper seeks to create value for practitioners by offering insights into the management of enterprise integration and ERP systems.

The rest of the paper is structured as follows. First, we briefly review the literature relevant to the notion of enterprise integration and enterprise systems. Second, we give a description of our research methodology and the findings obtained. Finally, we close with a discussion of the findings and its implications.

Prior Research

High Differentiation and High Integration

Organizations get more complex as they pursue rapid business growth. Products and services have to be innovated extensively and an assortment of customer relationships has to be managed well in order to maintain their competitive edge in each region. To deal with these complexities, organizations have ridden on the waves of differentiation by fitting the functioning of business units to their local environments. For example, local business units dealing with environments of high uncertainty will primarily be concerned with the goals of their local environment, be pre-occupied with getting the task done than maintaining interpersonal relationships with other business units, have a lower degree of formalized structure, and have time-orientation that relate to the local environment itself (Lawrence et al. 1967). Such arrangements allow an organization to reach into more markets quickly as it is able to understand and meet the local customers' requirements. Hence, as an organization expands, groups of employees are differentiated along various dimensions that include functional, product and geographical specialization (Braganza 2002).

While differentiation brings some benefits, there are signs that reveal the need for organization to concurrently hold a more integrated approach over these business units. For example, a decade of merger and acquisition activities

since the 1980s has left UBS with a confusing array of brands selling similar products and services to the same pool of potential clients (Lal et al. 2007). By February 2001, UBS had reported a net profit after tax of 36% below previous year results. Organizational boundaries can create disparate work flows and subcultures that can hinder the exchange of knowledge across different departments (Huang et al. 2001). Such organizational fragmentation can lower the visibility required to provide one-stop solutions to customers. For example, UBS Investment Bank division alone is organized around four categories, namely, equities, fixed income, rates and currencies, and investment banking and private equity. It has over 5700 institutional clients and employed over 15500 staff in 30 countries (Lal et al. 2007). The sheer size of operations within a single business division already makes it difficult to achieve visibility within the division, much less across the whole organization. In addition, environmental factors such as globalization, intense competitions and heavy regulation are also demanding such large organization to work closely together in order to enact changes quickly throughout the whole organization (Overby et al. 2006; Sambamurthy et al. 2003; van Oosterhout et al. 2006).

Indeed, while being differentiated, business units may still have interdependencies among them that organizations can tap on for synergistic benefits (Thompson 1967). For example, increased environmental complexity results in the need for increased interdependency as both the headquarters and the subsidiary are posed with a situation of mutual vulnerability (Ghoshal et al. 1989). Imperfect knowledge and fluctuations in the environment induce both the headquarters and the subsidiary to engage in reciprocal exchange relationships to make the realization of even independently disparate goals more predictable over time. Burgelman et al (2001) discuss how an over-emphasis on diversified strategies makes it difficult for an organization to capitalize on deepening competence and capturing market share through the continuous concerted action of multiple business units. This happens when strongly decentralized sub-units are reluctant to support the reinforcement of corporate-driven strategies, but instead, develop their own organic strategies. Such cases often require strong top management intervention that emphasizes on the need for an integrated strategy.

The interdependencies across business units is also a result of resource allocation, where the scarcity of resources creates a zero-sum game across different business units (Burgelman et al. 2001). What one unit gets, the other unit will then be devoid of the resource. Hence, such instances call for the need for business units to share resources among them. For example, when the resource levels of the subsidiary increase, the subsidiary may desire autonomy including the right to commit resources to pursue local interests that may not necessarily be in unison with the headquarters interest. Nonetheless, the headquarters would still have to maintain control over the subsidiary resources since it represents a pool of rich resources in an overall resource distribution that cannot be altered at will.

To sum up, it is then optimal for an organization to have both a high level of differentiation as well as a high level of integration. Nonetheless, the greater the level of differentiation, the more difficult it is to achieve a high level of integration (Lawrence et al. 1967). Extensive coordination is needed among the disparate components (Adler 1995; Crowston 1997; Malone et al. 1994). In addition, complexity can drive changes in the interdependencies between components across time. A different combination of components may be required when the existing integration strategy is no longer effective. For example, as phases of work unfold within a time-bound project, departments typically experience different degrees and types of interdependence, and they interact with varying intensities and via different coordination mechanisms (Adler 1995). This suggests that one should not assume that the relationship between components would be held at a constant. Instead, under conditions of uncertainty, these interdependencies can be altered. Integration should then be dynamic, allowing people to handle changes as well as to vary their strength of interdependencies between components.

Understanding Enterprise Integration

In reviewing the literature, we find that the definitions for integration are often brushed across intuitively as coordination and cooperation (Ettlie et al. 1992). Coordination is defined as managing dependencies between activities (Malone et al. 1994), while cooperation refers multiple parties working together (Kollock 1998). Inferring from these definitions, integration will then be implied to be the management of dependencies between the components for combined benefits. However, such definitions seem to suggest that integration takes place only between components that are dependent on each other. In particular, coordination theory suggests that a dependency must be present, or otherwise, there is nothing to coordinate (Malone et al. 1994). In a similar manner, for components to reach a state of cooperation, interdependencies stemming from segregation for tasks have to be formed. However, integration demands more. We propose adding a perspective to this current view, where the integration concept also refers to the fundamental platform for coordination and cooperation to take place. As such,

integration may bring together components that are independent to each other. For example, it is possible to integrate two product divisions that have long been operating independently of each other. By bringing them to a common platform, it does not require them to work together immediately, but rather, it introduces opportunities for the divisions to coordinate and collaborate in the future. Integration, in this case, refers also to the act of creating potential dependencies among components. It recognizes the nature of complex environment whereby it may be impossible to preplan for interdependencies (Anderson 1999; Beinhocker 1999; Tan et al. 2005).

There is a need to highlight the increase in the number of dimensions to be integrated. The well-established contingency theory of organization by Lawrence and Lorsch (1967) addresses only the integration of functional units. The examples cited in the prior paragraphs have evidenced how organizations are now integrating across geographical regions, product division, and even IT systems. Ghosal and Gratton (2002) propose that for effective integration, the managers have to integrate the company's knowledge bases, build social relationships among people (social integration) and shape a shared sense of identity (emotional integration), that are all supported by a standardized technological infrastructure. Barki et al (2005) contends that integration can involve both the successive stages within the primary process chain of a firm, as well as the administrative or support activities of the process chain of a company. As such, there is a need to conceptualized integration beyond functional units in order to achieve a fully integrated enterprise.

In fact, various approaches have been taken to define enterprise integration. One stream of research emphasizes the definition on business components of the enterprise, covering aspects such as business functions, knowledge and process integration. For example, enterprise integration makes "the multiple units, functions, and sites of large organizations work together to increase capacity, improve performance, lower cost structure, and discover opportunities for improvement that do not appear until you look across functions" (Cash et al, 2008: 90), includes "an ongoing collective process of constructing, articulating and redefining shared beliefs through the social interaction of organizational members" (Huang et al. 2001: 161) and involves both synthesizing and decomposing of processes into more manageable forms (Basu et al. 2003).

Another stream of research defines enterprise integration through the integration of technological systems. For example, enterprise integration reflects "the capability to integrate a variety of different system functionalities" (Lee et al. 2003: 56), includes managing the connectivity and compatibility of system data, applications and infrastructure (Duncan 1995), and seeks to provide "an end user, at any location, with the capability of assessing information stored at any level of the information processing system and enabling [one]... to interchange and share information with any other end user at any location within a single interconnected network and providing the potential for eventual customer access to data" (Mudie et al. 1985: 310)

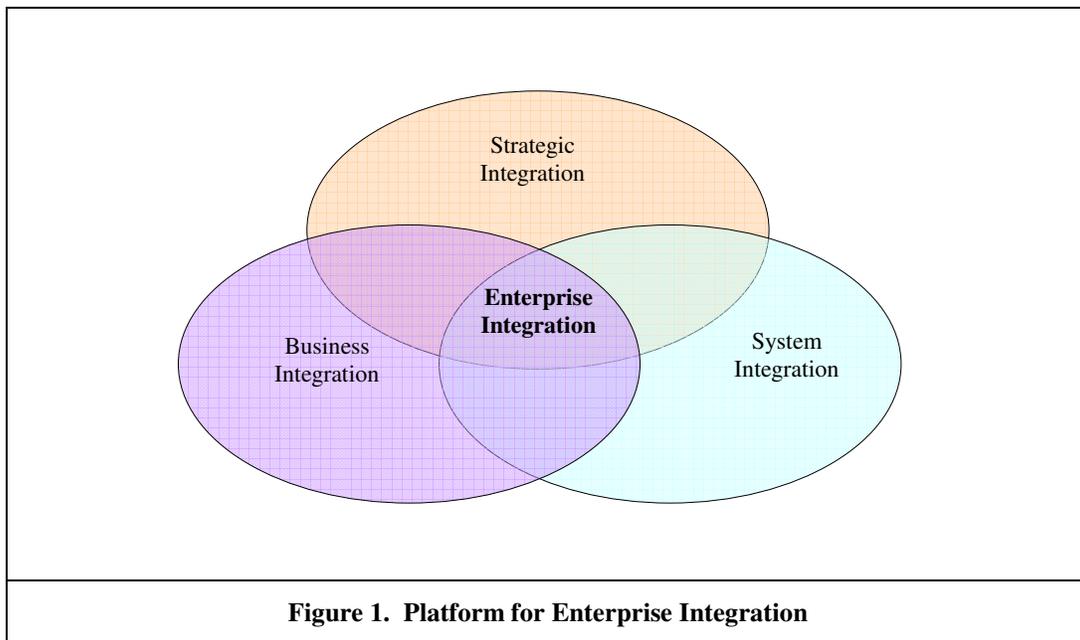
A major limitation that we uncover in this literature review is the assumption that enterprise integration is equivalent to these other forms of integration. This creates an inconsistent and vague understanding of enterprise integration. For example, is enterprise integration just another term for process integration? Or, does a successful attempt at system integration allow an organization to achieve enterprise integration immediately? This, apparently, is not the case. Such conceptualization of enterprise integration then becomes too simplistic, often neglecting the contribution of, as well as the need to manage together with, other forms of integration.

What appears to be missing as well is a discussion of enterprise integration at a more strategic level. In particular, few researches has been done to examine how the strategic thrusts of an enterprise are integrated together and eventually executed as "one enterprise". Integration should result in synergistic outcomes such as attaining better revenues or the ease to pursue new opportunities. For example, integration can plays strong and central role in the creation of manufacturing cost efficiency and new product flexibility capabilities (Swink et al. 2005). It moderates the influences of product-process development, supplier relationship management, workforce development, just-in-time flow and process quality management practices on certain manufacturing capabilities. Integration strategies can also drive towards the exploitation of new business opportunities that extend the corporate strategy and more fully exploit the company's growth potential (Burgelman et al. 2001). For example, by integrating footwear, apparel and equipment product division, Nike was able to implement a global strategy for the women's market to provide integrated and concept-based collections (Denend et al. 2007). This allows Nike to compete with competitors such as Reebok and Adidas in the women's market, which was estimated to be \$13 billion.

Enterprise integration, as we contend, involves a high-level management of all integration efforts within an organization. Considerations has to be given to the business processes, organizational structures, people and technology (Barki et al. 2005). This, broadly speaking, can be aggregated into three distinct areas, comprising of not only the business and system integration (Markus 2000), but also strategic integration. Business integration refers to

the creation of tighter coordination among the discrete business activities conducted by different individuals, work groups or organizations, so that a unified business process is formed. System integration refers to the creation of tighter linkages between different computer-based information systems and databases. We would refer to strategic integration as the “brain” behind all integration initiatives. It drives business and system integration, as well as communicates and links top management’s definition of “one enterprise” to the rest of the staff in the organization. Each of these three areas of enterprise integration has its own importance and aggregate to present a holistic conceptualization of enterprise integration. Figure 1 below illustrates our conceptualization.

Following the discussion above, we construct our definition for integration to be as “bringing components together onto a common platform, which creates the options for components to establish, change, or vary their strength of interdependence among one another, for a synergistic outcome”.



Executing Enterprise Integration Strategies through ERP systems

One approach for an organization to execute its enterprise integration strategies will be through its ERP systems. The ERP systems are intended to enable a seamless flow of information across the whole organization (Davenport 1998). It then appears as a good start to achieve enterprise integration by leveraging on ERP systems to facilitate collaboration across different business and technological boundaries. In addition, an information technology (IT) initiative can be beneficial, since the nature of IT work requires the IT staff to take a systemic, detailed and central view of the organization and hence, they are able to provide support for even the most hidden interdependencies between processes and data (Cash et al. 2008). Furthermore, IT staff typically has more experience in integration than the staff in other departments, since they work on a regular basis across the organization to build common IT infrastructure, shared databases and enterprise systems or even to help drive business integration efforts. For example, the research conducted by Cash et al (2008) in 24 major, often global, U.S. and European corporations finds that half of the CIOs were charged with improving horizontal integration of the business.

While many papers have examined system integration enabled by ERP systems (Kishore et al. 2006; Lee et al. 2003; Sikora et al. 1998; Umapathy et al. 2008), few has taken a broader and higher-level perspective to examine how an organization can execute its enterprise integration strategies through the ERP systems. In planning its ERP-enabled enterprise integration strategies, an organization should take into account the strategic, business and system factors that may affect the effectiveness of the enterprise integration. Any changes in each of these three domains can

possibly require a different set of enterprise integration strategies. However, current literature tends to discuss integration single-dimensionally, where it assumes that there is only one degree of integration which does not change over time. These papers will, for example, simply associate higher level of integration with greater business values (Koufteros et al. 2005; Langdon 2006). A major flaw exists in such conceptualization, since integration can actually be more complex and dynamic, where different levels of integration may be required between different units, in accordance to their fit with their strategic, business and technological environment.

One business factor that can affect the effectiveness of ERP-enabled enterprise integration strategies is the level of similarity between business tasks, business units and business process (Barki et al. 2005; Volkoff et al. 2005). For example, Barki et al (2005) contend that task complexity and task independence affect the suitability of mechanisms that enable integration. They illustrate that when the number of interacting parties is high and task are highly complex, standardization is likely to be more appropriate than merely asking the affected units to mutually adjust to each other. Volkoff et al (2005), on the other hand, find that because of process and data standardization in an ERP system, integration becomes more difficult and achievement of benefits are less likely if the units being integrated are highly differentiated. Other business factors to be considered can include the social structures of the organization. For example, globally dispersed organizations that seek to achieve enterprise integration will have to manage cultural factors such as the power distance among peers, subordinates and superiors, as well as the preference for collective or individual activities (Shore 2006). These complexities have to be reconciled with the integrated logics of the ERP system, before an organization can achieve enterprise integration.

In a similar manner, system factors can play a role in determining the ERP-enabled enterprise integration strategies. For example, the compatibility, connectivity and modularity of technological systems have to be considered when deciding which units are to be integrated (Byrd et al. 2000). In addition, an organization should ascertain if it has sufficient resources to perform massive data migration, set authorization profiles, and to retain the ERP knowledge in the long run.

In summary, prior research from business and system integration literature suggests that many factors can affect enterprise integration, and hence the decisions to carry out any kind of integration efforts may actually change over time. Notwithstanding the abovementioned, the presence of many notable cases ERP implementation failures (Alberts 2008; Wailgum 2009; Zaino 2004) suggests that much research is still needed to understand how ERP-enabled integration can be achieved. This leads us to our research question: How do organizations execute their enterprise integration strategies through ERP systems? Since literature on enterprise integration is thin at the strategic level, we suspect that the approach taken to plan for enterprise integration is typically incremental and partly emergent, where it includes a continuous process of learning and adaptation.

Methods

Our research is based on a six-year case study conducted between 2003 and 2008, and the chosen site is a large Asian logistics management organization, LogCo. LogCo focuses on moving personnel and cargo across and between continents. It has three principle business units (BUs), where each is dedicated to a particular transport role of air, land and sea. Each BU manages and maintains their transportation facilities around the world. This case depicts LogCo's ERP-enabled enterprise integration journey in three trajectories: (1) enterprise logistics integration, (2) enterprise finance-logistic integration, and (3) enterprise human resource (HR) integration.

Two rationales backed our choice for a case study research design. Firstly, a case study design enhances the richness of our data as we are able to adopt multiple data collection methods that methodologies such as surveys do not provide (Yin 1984). Secondly, ERP-enabled enterprise integration is an area that has not been explored in-depth previously and thus, a case study permits a comprehensive understanding of this organizational issue (Lee 1989).

We were invited by LogCo to observe the case site and develop case reports for their internal uses. Hence, we were able to obtain comprehensive access to written documentation including milestone review presentations and minutes of meetings. In addition, one major concern of LogCo was to capture the diverse views on the ERP-enabled enterprise integration. As such, we conducted a series of interviews with the managers and users selected from various management levels as well as different business units during each phase of the project. As of now, we have interviewed around 20 people (note that the project is still on-going and hence we are still expecting more interviewees). As the journey of enterprise integration took many years, some of these interviews included some repeated interviewees from the senior management. It was necessary to speak to them again in order to capture both the sentiment of users during and after each integration trajectory.

These interviews were conducted on a face-to-face basis. Most interviews were at least an hour long. Questions focused mainly on issues of implementing the ERP systems to achieve the desired level of integration. In the initial interviews, interviewees were asked about their role in the ERP implementation, the tasks that they were involved in, and the deliverables they were responsible for. We then asked interviewees on their perceptions of enterprise integration and their sentiments on how the ERP system had held to enable integration. Interviewees had to describe their specific experiences during the integration phase, focusing on problems, and issues, and how they or others resolved them. We then posed further questions, depending on what interviewees said and what was gleaned from documents and other interviews. In conducting interviews, we obtain interviews from multiple interviewees from each stakeholder group.

The interviews were conducted by two or three researchers, who also had to take notes because a tape recorder was not used. The interviewees were uncomfortable with discussing issues in the presence of a tape recorder. Hence, to ensure that the interview quality was not compromised by fatigue, we limited ourselves to not more than three interviews per day. In addition, at least one of the interviewers had prior experience working with or consulting for LogCo and was thus familiar with the corporate context. This ensured that we would better appreciate what the interviewees said and also to better direct questions to surface issues. At the end of the interviews, we made sure that all the interview notes were consolidated and typed within twenty-four hours by one of the researchers present at the interview. Any differences in the interview notes were then quickly resolved through discussion and clarification among the researchers present at the interview. Finally, we had to write one case for every phase of the enterprise integration project. Multiple individuals in the organization provided detailed comments which we have incorporated into our findings. Such validation by interviewees increases the quality of our data.

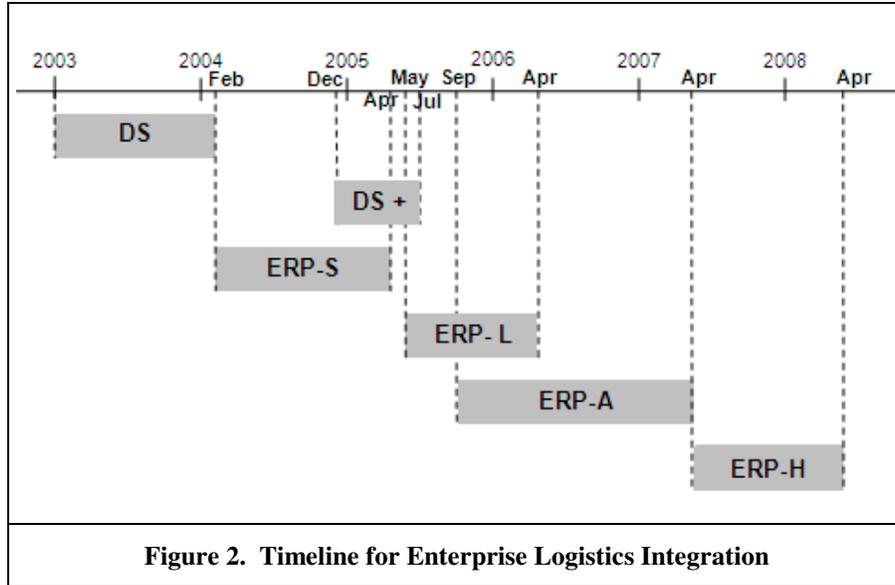
Findings

The vision for LogCo's enterprise integration journey was for the Air, Land and Sea BUs to possess capabilities that provide fast and reliable transportation for every customer around the world. The BUs operations would be interconnected in order to leverage on each other's strengths and cooperate effectively. At the same time, these BUs would also see improvements to administration, training, human resource management, planning and logistics.

First Trajectory: Enterprise Logistics Integration

The journey for enterprise integration started with the logistic function. Logistics processes were usually generic across three BUs, and synergies could be obtained by instituting common processes and data through the best practices embedded in a ERP system. Previously, the traditional independence of the three BUs had resulted in logistics systems that were highly fragmented and costly, where each BU maintained their own system. The inconsistencies in the data produced made enterprise planning and decision-making across the three BUs difficult. As such, the move towards an integrated LogCo called for an ERP system, which was conceived as an end-to-end system to support the transactional needs of the organization, as well as to provide cross-BU information visibility. In this case, SAP system was used to integrate the logistic processes in and across three core tracks: supply management (SM), engineering management (EM) and finance management (FM). For example, SM processes would include procurement of stock items and warehouse management, EM processes would include corrective maintenance and modification, and FM processes would include the revision and allocation of annual budgeting.

The logistic integration trajectory comprised of six phases. The journey started with the Design (DS) phase, where the objective was to create a common blueprint, detailing the organizational structure, processes and roles that would be adopted across the three BUs. Design Plus (DS+) phase was launched to accommodate additional, mainly BU specific, requirements surfaced during DS that could not be addressed within the DS timeframe. The SAP system was first implemented for the Sea BU (ERP-S), followed by the Land BU (ERP-L), Air BU (ERP-A) and finally, for the functional units at the headquarters (ERP-H). Figure 2 below shows the timeline for enterprise logistic integration.



The Central Operations Department (COD), in particular Central Logistics Division (CLD), was formed in 2000 to drive the integration efforts by arbitrating and balancing the three BUs' requirements, as well as ensuring that the SAP system would meet the needs of COD. CLD was given the mandate to oversee the operations and support costs of the three BUs. It was also responsible for the funding of all IT systems in the BUs' Enterprise Resource Segment, including new capital investments as well as operating and maintenance expenses. Nonetheless, the integration effort witnessed many challenges.

Firstly, a look at the data revealed that some of the enterprise integration challenges lay at the strategic level. The enterprise integration strategies were unclear and people at different hierarchical levels had different interpretation of the enterprise integration objectives. While the senior management met frequently to discuss the directions and key issues of the progress, the notion of "one enterprise" was not disseminated clearly to the staff in the lower hierarchical levels. For example, while CLD took an integrated BU position, the three BUs were focused on ensuring that they obtained process efficiencies and new capabilities for their operations. One user noted that the lack of clarity about enterprise integration scope and prioritization of objectives encouraged many users to "throw in" as many requirements as they could during the Design phase.

There was also a need to manage user buy-in so as to engage multiple stakeholders. This was particularly evident when the implementation was extended to the functional units at the headquarters (i.e. the ERP-H phase). Unlike the three BUs who pushed aggressively for the new system to meet their requirements, these administrative users could not appreciate the change in the system. They had limited experience with ERP systems since the usage of these systems was secondary to their work. They had low transaction volume and used the system only for basic functionalities. Hence the cooperation was more passive, and it was difficult to coordinate among them to solicit requirements. In addition, ERP-H was to be implemented for 19 separate functions that are highly diverse in their orientation and functions, ranging from Finance Division (FD) to the Research Division (RD). With equal standings across these sub-units, the command authority over users was weak even though FD was assigned as the Operation Manager (OM) for that project.

"During sea, land and air implementation, POCs [point of contacts] are [with us] full time. Most of the time, we see them sitting with us in the building. When Heads of Sea, Land and Air BUs say "go", everyone goes. Unfortunately, during ERP-H, there's no head honcho. They don't feel the urgency. FD has no power to commit people. Most people are part-time. They don't turn up, [or] they send us a representative."

"The user base comes from various departments, and it's difficult to get concurrence for specific issues. The user base is not focused. It spans [different departments], and they take care of their own interests. No doubt we have sessions to confirm design, but there are differing views and the solution is not finalized,

because the interests differ. Before ERP-H, we have top management pushing down, saying this is the way to go, but right now there is no such role.”

Another point to note was that the vision of enterprise integration was not kept constantly in sight. The objectives of superior cross-BU information management slipped into the background when there was a significant turnover of key personnel such as the Deputy Head of CLD and a knowledgeable CLD senior manager. Even though the project was carried on with the message that standardization was important, it was primarily because of the predecessors' effort. However, the higher objective for standardization, i.e., cross-BU information visibility, was not given much attention. Transactional aspects of the SAP system such as the ability to generate purchase requests were implemented and tested rigorously. However, management level reporting and monitoring functionality was not fully implemented, even by ERP-A.

“At this stage we are working like the old system. Get all my business, transactions done, we categorize this as success. But we are not at the stage where... this is a far more superior system that can help us in sense-making, better data-mining... We are getting the system to work, nobody is complaining. We are still at the first level, 1st order advantages... “What I need to run around in a week, now I can get it in 10 minutes”... We have not moved to the stage where there's visibility, there's wealth of information that we can put side by side, learn new information, new patterns, break new ground. Reports are still on old templates, old business rules, traditional ways of doing things, old paradigms.”

Secondly, the silo-ed nature of the BUs had to be integrated. Differences in opinions arose among the three BUs about which process was to be the standard. For example, in some instances, the BU that had the most complex procedure in a certain domain had so much opinion that it slowed down the entire workshop. In the extreme case, some aggressive users became intransigent and refused to remove their processes from the base template and localize them. In fact, due to the massive efforts required to negotiate and finalize the design of a standard process, some track scenarios could not be completed on time and the DS+ phase had to be launched to complete them. As an illustration, there was still insufficient detail on how the design of ERP would handle the integration across scenarios and with other systems in LogCo. Other major incomplete scenarios to be done in DS+ were budget planning simulation (for multi-year budgeting, planning and reporting), the portal (a web-based interface for users to access the system) and development specifications.

In addition, the large number of stakeholder groups involved in enterprise integration often made it unclear where the authority to make decisions lay, as well as who is to be responsible for communicating the decision to various hierarchical levels. For example, the roles of OMs were ambiguous. The SAP consultants had expected the OMs from each BU to hold an “one enterprise” position when discussing which processes to be standardized. However, this was not the case. The OMs from the three BUs worked “to protect their BU's interest”. They saw their role as focused on overseeing their staff in the project to ensure that they meet their BU's requirements, reporting to senior management of their own BU, and giving feedback to the project's management on whether their plans were feasible and supportable. Business Process Managers (BPMs), on the other hand, did not help to resolve such disputes, mainly because they felt that they belonged to a particular BU and was not certain of the processes of the other two BUs. Such roles uncertainties slowed down the integration process.

To mitigate these problems, the Head of CLD clarified process ownership by having each scenario owned by a key BU and a SAP consultant partner, supported by designated representatives from the other BUs. Top managers from CLD were made the executive owners for the FM, EM and SM tracks. Since none of these executive owners were from the three BUs, this helped to ensure that the decisions made were not biased towards any BU. They would make the ultimate decision for conflicts that could not be resolved between users and consultant team members. A team was also set up to carry an internal technical review of the solutions proposed before releasing them. In particular, the three BUs had to have strong justification for any customization needed, or else, they were expected to “use standard SAP the standard way”.

Tough and uncompromising leadership was important in pushing for the harmonization required. Head of the CLD sent a strong message to the project team that “if the project sank, they would all sink together”. For example, when the project was significantly behind schedule, he allowed only a two-month extension to the project. He also took the stand to stop the staff from taking vacation leave until the project phase came to an end. The effectiveness of such leadership was complemented by the organizational culture, where “once [the three BUs] know that there is no point in bickering, they will fall in line.” Previously being more concerned about their own BU's specific needs, the senior management from each BU subsequently shifted their focus to attaining an integrated system across the BUs. The track team representatives followed suit, and their outlook became more aligned to the overall objectives of

LogCo's enterprise integration journey. As one of interviewees put it, these process owners were now "wearing LogCo's caps".

Thirdly, a large part of the enterprise integration efforts was devoted to ensuring system integration. For the three BUs to now use a single system, data definition across the three BUs had to be made consistent. However, each BU had tracked information at differing levels of granularity. For example, a chair would be recorded as an asset by the Sea BU, but to the Land BU, the chair was not an asset. The difference meant that extra work was needed to synchronize the data as well as to ascertain asset ownership, in order to have shared data that made sense and is of value to each BU.

"Land BU has a lot of things – chairs, cups – all are considered stores. They don't treat them as assets. But Sea BU follows a different coding. They satisfy the description of an asset, a low value asset, and have to be tracked until condemned. This resulted in a couple percent of the master data not being loaded. So if the master data is not loaded, then the transactional data also can't be loaded."

"Like a car owned by Sea BU. Sea BU must create the maintenance requirement but Land BU is the owner of the equipment. Sea BU has to relinquish ownership and Land BU has to create the ownership of the material."

Another continuous challenge that had to be dealt with was the interfaces between the SAP system to other internal and external systems. There was a need to understand the specific terms in SAP system, and how these terms were to be reconciled with the terms used for other systems.

"We found out that open commitment [in an existing IT system] is an open PO. It could be issued but there's no goods receipt. For SAP, it's a good receipt but the invoice isn't issued yet."

When integrating with external systems, challenges arose when cooperation had to be sought to ensure that the new interfaces would function correctly. Some external companies were reluctant to allocate time to test the interface. To make matters worse, the cooperation was also dependent on the turnover of staff in these external companies. Many who understood their systems had left. In one instance, the vendor responsible for a system had changed recently, and the new vendor was less familiar with how the existing interface actually worked.

"There's a change [in the vendors]... and there's a change of manager and in the technical team maintaining [the system]. We sent the testing files and it took a long time to come back. We're not sure why."

Eventually, the interface issue was resolved through indirect testing. Instead of testing the interface directly with the vendors, the SAP team tested the output of the SAP system against the output of another internal system that was interfacing with the external system. The fundamental idea was that if the output of the SAP system was identical to that of the internal system, there should not be a problem interfacing with the external system. The rollout schedule was also modified to include a soft launch to ensure issues with the SAP-external system interface could be caught.

The end of the ERP-H phase signaled the success of logistic system integration across the three BUs. The integration had facilitated the reorganization of BUs so that they were able to leverage on each other's core competences. The traditional silo mentality was also noted to be diminishing across the three BUs. The design blueprint template had achieved more than 80% standardization, significantly higher than the 60% original target. SM track achieved more than 90% standardization, EM exceeded 80% and FM achieved almost 100%. There was also greater cross-BU visibility for CLD to manage the enterprise resources. In addition, the SAP system implementation experience and relationships established across the three BUs had provided a platform for future inter-BU collaboration and sharing of best practices.

"Because now CLD manages all warehouses, we use SAP to see individually across all warehouses. We see data in terms of inventory management, in terms of cost across all 3 different contracts. We are also the contract managers, so we use that to standardize inventory management across all 3 three BUs, and also influence operational details across 3 three BUs."

"For example, Air BU put up some proposal to set-up SAP across geographical regions. It's Air BU, but everyone needs it. I told them [Air BU] to put up a comprehensive proposal and they did it in one meeting. There were no quarrels! Land BU had a project that is useful to Air BU. The last I heard, Land BU tried out the systems in an Air BU context. This is unheard of!"

Nevertheless, even after the SAP system was supposedly to have been implemented successfully across LogCo, some integration challenges appeared to be outstanding. Some users expressed their lack of appreciation for the integrated nature of ES.

“Beyond my area of responsibility I don’t know. The SM track, what’s inside I don’t know. Because it’s all integrated. My action affects the other tracks but I don’t know. There are certain things I feel we’re handicapped. There’re fields in the system I don’t know what they are. I don’t know what they mean.”

Another challenge was the need to deal with the continuous requests for enhancements when users became more comfortable with the SAP system. For example, the current SAP system would only capture assets as a whole system. An aeroplane would be captured as an aeroplane. From the logistic perspective where Air BU has to maintain their own aeroplanes, the information would be more valuable if they are able to break it down into the subcomponent levels, allowing them to account individually for engines and wheels. These requirements remained to be worked out.

Second Trajectory: Enterprise Finance-Logistics Integration

The SAP system was originally conceived as an end-to-end system that supported the transactional needs of LogCo, as well as to provide cross-BU visibility of resources. Any financial focus in the project was largely logistic related such as stock procurement and fund approval. However, the 1997 Asian Financial Crisis prompted an unexpected restriction on the growth of LogCo’s budget, making it clear that their reliance on cash accounting did not allow rapid and accurate BU-wide assessment of financial resources. As the logistic integration implementation was carried out, the LogCo’s leadership sensed that the SAP system was able to provide the opportunity to achieve the additional strategic objective of enabling resource planning and allocation at a strategic level. Decisions could be made not just on operational needs, but also on financial considerations. As such, SAP system was then subsequently used to help integrate all finance processes, in order to achieve the new financial goals of strategic outcome-based budgeting, rigorous resource management, and streamlined financial governance.

In linking day-to-day logistic and financial transactions to strategic performance outcomes, the SAP system would enable a new real-time dashboard to senior management. Senior management would be able to know the cost of transportation as well as the availability of resources immediately, without having their staff to prepare the information manually. For example, the Budget Planning and Allocation (BPA) application interfaced with the SAP system to facilitate the uploading of prior period’s budget or actual resource consumption data. Users could then manipulate the data to plan the next period’s resource and fund budgets. Once the planning was done and approved, the new budgets would be pumped back into the SAP system for budget monitoring and tracking. Various analyses could be performed to measure and compare budget performances across different units at a click of the SAP system.

In line with this strategic direction was thus the need to actively engage senior management to define and operationalize the strategic outcomes that were important to LogCo. The challenges arose when not all such capabilities can be attached to a dollar value.

“The challenge is what you want to do with the visibility, how can we quantify value and how to tag a cost? How much is it worth to make a BU attain the highest level of performance? If you spend \$1 million to get to the top, but another BU spends \$1 million to attain something lesser, do we condemn you? We can figure out the cost, but how do we interpret it? It is difficult to gain clarity because in our business, we must keep the cutting edge. Those are new capabilities. How much is it worth to build a specific new capability? I think it’s not going to be a quick answer. As we change and evolve structurally, there are new answers that will come out of the discussions.”

In addition, while the SAP system had helped to lay the foundation for resource management, exploitation of the new financial goals was still relatively passive. User buy-in to the new resource management mindset remained limited, and much effort would be required to inculcate the resource management mindset needed to achieve the integration at the resource level. Some users, for example, tried to replicate the old fund structure in the SAP system by creating numerous commitment items (CI)s and internal orders (IO)s and demanding “hardchecks” for resource objects such as IOs. Other users treated fund and resource management as identical.

“The way we manage our fund is such that we have higher headquarters to manage. We don’t manage the budget. It is given to you. Every start of the financial year, they will tell us how much is allocated to us.”

And for the rest of the year, we live with it. We are actually not budgeting, but playing with the figure so that the final figure stays put. We cannot change the figure. Why do budgeting then? What's the point of doing budgeting for BU? We only make sure the money is still there."

"Fund and resource are supposed to be different. But as at now, I don't think there is a lot of emphasis on resource yet. So, to me, I treat them as the same. Just the term they use. Just like sub-fund. Resource is a sub-fund."

Even the senior management was passive in using the SAP system to generate reports to achieve financial visibility or to make more informed decisions.

"My boss only looks at the final figures at the end of the year. I don't think they are very interested in the reports. ... Last time, we did not have such visibility. Utility payments, rentals, personnel cost, for example, are managed by a central body or other departments. So we couldn't look at it. But now through SAP, we can see how they affect us (through resource reports). But there's no one and no emphasis to tell senior management to see. No one is tracking. Unless someone come and tell us to do so, we don't look at that kind of reports."

Nonetheless, the implementation, led by FD, has largely been successful, where the SAP system had in many ways streamlined the financial processes and strengthened the auditability of financial transactions. In addition, the seamless linkage between fund management and logistics functions also strengthened financial control. The greater financial visibility through ES also provided a more complete picture for decision making.

"Previously, we link with 15-20 agencies. All correspondence is through e-mail and Excel. You talk to 20 people and you need 5-6 people to do it. Now with SAP, it's all in the system. Just key in the code and you get the report... You look into the figures and get quality [in the] numbers. That's our value add to the organization. Number crunching should not be our value."

"Previously, funds were in the financial management system. What we work on is in logistics management system. You used two systems, and tally them offline. Then you check to see if it doesn't exceed [the budget]. Now funds management is very integrated. There's now financial visibility there [in SAP]. It checks the commitment of funds before it can be cut. There's no fund, there's no way."

There were, however, a few outstanding stumbling blocks to achieve this integration vision. One core challenge that surfaced was the tensions between the integrated design of SAP and the decentralized structure of LogCo, making it difficult for the integration efforts to achieve much visibility. Information sharing across LogCo units had not been a common practice. Information concerning one unit was often not intended to be made available to another.

"The nature of our business is fairly dynamic and highly decentralized. I'm not sure how much we can stretch to reach a state of total resource visibility. In terms of money, we know how much to spend and where we are spending. But how much information is to be pumped into the system? I don't know. Even when we operate on the same SAP platform, the level of information available to different people is different, so there may be a "de-synch" here!"

The main manifestation of such tensions was in the area of authorization and access rights. In some cases, users had access to data or processes which they were not "supposed" to control. In other cases, users were unable to access data to perform their jobs. Organizationally, this implied a need for more concerted effort to review enterprise-wide authorization management, especially for data access across three BUs and functions.

Another outstanding integration issue arose due to the integrated nature of the SAP system, where the costs and benefits derived from it fell disproportionately on the separate stakeholders in LogCo. This surfaced the mismatch between an integrated system and the silo-ed nature of business units. The processes or work allocation across the business units had to be reassessed in order to ensure that the integration effort was creating efficiency at the expense of other users. For example, the design of the acquisition management module required project managers to perform laborious data input into SAP system for more detailed reporting of asset acquisitions.

"For goods acceptance, we can trigger the asset (accounting) and it immediately goes into the record. But someone needs to do the data entry upfront. But who does it – procurement or project team? There is a "de-synch" in benefits and work. A lot of time, the information resides in quite senior people who should not be employed to do data-entry. To be fair to them, they should be running their projects."

Third Trajectory: Enterprise HR Integration

While the logistics and finance functions were going through the SAP system-enabled integration, another independent SAP system (subsequently referred to in this paper as HRERP) was setting itself to be implemented in the HR department concurrently. The objective of the HR integration was to streamline and standardize all HR processes across the BUs and the various functional departments. The LogCo HR value chain covers broad activities such as organization management, talent management, and HR service and operations which support the necessary planning, employment and HR activities.

Much effort had to be taken to ensure system integration due to the numerous integration points present. The legacy systems to be replaced by HRERP comprised a myriad of 52 IT applications linked to a multitude of non-HR systems in LogCo, such as the SAP system for logistics and finance, as well as external IT systems connecting to institutions such as banks. As a result of the web of connections to diverse systems, there were over 290 interfaces in place, and they were in various forms of connection, such as flat files transfers, FTP, HTTP, database links and information brokers. In addition, a total of 54 data sources and 196 info-systems would have to be migrated from the legacy to the new HRERP system.

This problem was exacerbated by the need to maintain data confidentiality as customers' privacy, in terms of the goods or personnel to be transported, had to be retained. As such, vendors that were involved to help data integration were not granted access to production data. Even users' access to data was on a strictly "need to know" basis. As a result, most parties did not have a clear understanding of how different pieces of data are related. To ensure data integration across the modules, a team was specially arranged to provide the integrated data perspective. They worked closely with the design team to complete a detailed data mapping, in order to ensure that all data types in all existing applications were either mapped to the new system, or verified as dropped because it was no longer needed.

As for now, the HRERP had merely reached the end of its design phase. Nonetheless, few integration challenges were foreseen by interviewees. The HRERP implementation was a separate effort from the SAP system implemented for the logistics and finance. Subsequently, the enterprise integration project will witness efforts to combine the SAP system with HRERP. The integration of mega systems necessitates the joint ownership of both the logistics and HR communities. There is a need for an authoritative project champion that spans the separate boundaries. In earlier ERP implementations, the three BUs had an easier time obtaining stakeholder agreement, because their project champion, the Head of their respective BU logistics, had the authority to push decisions through. In contrast, FD had a harder time pushing decisions through in ERP-H, because FD did not have the authority to manage the other LogCo's functional units. A corresponding integration initiative that crosses logistics and HR will require a very senior individual in LogCo to champion.

"We have put in 4-5 years of efforts into ERP and we cannot stop here. If we stop here we go back to the old days. ERP should cover the operations side. SAP [for logistics and finance] and HRERP have to integrate. Many things can be done with ERP, but where is the sponsorship? A stronger push is needed to bring ES to the next level!"

In addition, even though the HRERP is also a SAP system, it is at different version levels with the SAP system used for logistics and finance. HRERP is on SAP 6.0, while the system for logistics and finance uses SAP 4.7. System integration efforts have to be taken to ensure that these systems are well-maintained and can talk to each other.

"When the proposal was put up, the guy was like "we just fully launched in April 08, why upgrade?". But the people forget that SAP system [for logistics and finance] was done since 2002. It was top notch then, but come on, it's now 2008. Everything in SAP is already in phases and it is hitting obsolescence. How are we going to determine the version strategy that we are going to adopt? So is everything going to be on different instances? For HRERP, it is on different instances. Is there going to be only one instance? Or 2 instances? What version of software?"

Discussion

The data reveals the complexities in managing enterprise integration. In the subsequent paragraphs, we analyze these findings to obtain a clearer understanding of enterprise integration and at the same time, propose ways that we can manage them.

Enterprise Integration Composes of Varying Levels of Challenges in Business, System and Strategic Integration

Across the multiple trajectories of the enterprise integration journey, we witness varying levels of challenges in business, system and strategic integration. For example, when the integration initiatives started for the logistics department, LogCo had to handle a series of business, system and strategic integration issues since this was the first attempt at seeking consensus from the silo-ed departments. Even when the system integration was supposedly completed via the successful implementation of SAP system, business integration issues were still present. The fragmentation in business was reflected when some users were unable to understand how their action would affect the other departments and when inter-service processes remained under-leveraged.

During the second trajectory of enterprise finance-logistic integration, system and business integration issues were relatively minimal. This was largely because data definition, system interfaces problems as well as business process standardization had already been sorted out during the logistic integration phase. The finance-logistics integration was riding on the same ERP system. In contrast, strategic challenges dominated during this phase, where management was unclear about the new financial paradigm enabled by ERP, and users did not internalize the resource management mindset to achieve the integration at the resource level. Users generally did not understand the design of the funds and resource management framework in the ERP system and this resulted in limited buy-in from the multiple stakeholders for the enterprise integration initiatives.

The third and final trajectory of enterprise integration journey saw the HRERP implementation facing system integration challenges again as the organization attempted to integrate the new HR system with the finance and logistics system across LogCo. System integration was challenging due to the incompatible versions of the two ERP systems as well as the complexity of integrating the two large and complex systems.

Evidently, the process of building enterprise integration is challenging. Different sets of issues can surface at different parts of the journey. To achieve enterprise integration, an organization has to be prepared to manage different extents of system, business and strategic integration challenges at all times.

Enterprise Integration is Fluid in Nature – A Need for Continuous Negotiation

The first trajectory of enterprise logistics integration saw largely cross-unit integrations, where most efforts were dedicated to reconcile the needs across the three BUs as well as the functional departments in the headquarters. In the second trajectory of enterprise integration, the integration initiatives became cross-functional in nature, where LogCo attempted to integrate the activities between logistics and finance. Finally, in the third trajectory, an even broader cross-functional integration was planned to link logistics and finance, together with HR. These findings revealed that the dimensions of enterprise integration can vary and change over-time. When planning its enterprise integration strategies, an organization thus has to be clear – what are the important and relevant integrating dimensions for the organization and how should they be prioritized in mapping out the implementation path for enterprise integration? Given the various integration possibilities, senior management must decide on what “one enterprise” means to them and communicate this direction of integration with clarity and commitment down to the rest of staff in the organization.

The fluid nature of enterprise integration highlights the need to negotiate across the various boundaries of organizational dimensions. Decision authority must be laid down clearly for the multiple stakeholders to ascertain who can assess the cross-unit or cross-functional information, as well as who have the authority to act when conflicts arise. The complication arises when the progression to the next level of enterprise integration (for example, from cross-unit to cross-functional) render existing champions as ineffective. A higher authority is often needed to orchestrate the next level of integration. Senior management then has to be prepared to address these questions: Who owns the integration dimension? Who would drive the integration efforts? A continuous process of negotiation is required to attain and maintain users buy-in for the full enterprise integration journey.

Enterprise Integration is Emergent in Nature – A Need for Continuous Learning

The integrated enterprise is, by and large, an unfamiliar and complicated concept for many organizations. As a result, integration strategies are usually developed incrementally through the lessons learnt from prior levels of integration. This approach introduces lesser complexities than as compared to launching integration efforts in a big

bang approach. Enterprise integration is then achieved through these cumulative initiatives. For example, the decision to integrate the finance and logistics activities together was not clearly envisioned at the outset. In fact, it emerged as the logistics integration was along the way. The SAP system was initially set out to support largely the logistics needs of the organization, as well as to provide cross-BU visibility of resources. However, a resource crunch in year 2003 made LogCo recognized that they needed a strategic budgeting management system to link resource inputs with output. Looking at the value that the SAP system was able to offer, the finance-logistic integration started, and the enterprise integration objectives evolved to include the strategic purpose of enabling resource planning and allocation at a strategic level.

The emergent nature of enterprise integration strategies can be supported by organizational learnability (Garud et al. 2006). Emergent learning is necessary as organizations take time to see new possibilities for the integrated data and scenario. Time is also needed for the organization to derive lessons from prior integration experiences and then apply them to subsequent integration efforts. One way for an organization to manage emergent learning will be to set up a committee that oversees the integration initiatives in the organization (Cash et al. 2008). This committee will take an enterprise view by exploring how one integration initiative can potentially enrich another, such as through the sharing of best practices. Head of CLD, for example, had established a few cross-BUs and cross-functional committees to explore the new informing possibilities offered by the integrated ERP system.

Nonetheless, while planned enterprise integration strategies are necessary, contextual factors or barriers may exist to prevent the organization from achieving the intended integration. The findings in the case study revealed that some of these barriers can include the silo-ed nature of business units, organization's decentralized culture, management turnover and user resistance to change. Business dynamism can also play a part in shaping the direction of the enterprise integration strategies. For example, when intense competition requires an organization to integrate across geographical regions for tighter operations, the enterprise integration strategies have to be modified to extend the SAP system to overseas business units. In these cases, organization has to learn how to deal with these factors, and modify their enterprise integration strategies accordingly.

Enterprise Integration must Continuously Counter Divergence Pressure – A Need for Mega-System Governance

One of the benefits of the SAP system implementation has been the ability to develop a standardized system to meet the finance and logistics needs of the three BUs and the 19 functional departments. However, as time progresses, there is a danger that the three BUs and LogCo departments will want to customize the SAP system to their own needs while compromising the usefulness to others. There is thus a need to ensure that changes or enhancements to ERP do not lead to unnecessary divergence. Continuous efforts to coordinate across units need to be instituted to consistently connect these silos together.

Conclusion

Our study depicts the journey of enterprise integration. Enterprise integration involves the management of business, system and strategic integration challenges. It is dynamic, evolving in accordance to environmental and organizational factors, and hence demanding a need for continuous and incremental learning. Selling, persuading and negotiating are necessary to engage multiple stakeholders.

Clearly, our paper can benefit from additional work that extends our initial conceptualization in several ways. Future research can delve into specific measurable constructs for measuring the extent, as well as the success of enterprise integration. Additional research can also be done to explore the mechanisms that can help to achieve the ERP-enabled enterprise integration strategies.

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