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Analyzing Enterprise Systems Delivery Modes for Small and Medium Enterprises

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ABSTRACT

Prior studies have suggested that Small and Medium Enterprises (SMEs) have unique characteristics that impact their ability to successfully implement enterprise systems. This paper analyzes three modes of delivery for enterprise systems: integrated ERP, Best of Breed (BoB), and Software as a Service (SaaS), and determines how well these delivery modes are aligned with the requirements of SMEs. An analysis of prior research on enterprise systems and SMEs suggests the integrated ERP approach may yield several additional benefits compared to the BoB and SaaS approaches for SMEs. The analysis framework presented can be used to guide the selection of appropriate enterprise systems delivery mechanisms for SMEs and ultimately help improve their effectiveness.

Keywords

Enterprise systems adoption, ERP, Best-of-breed, Software-as-a-Service, Small-Medium Enterprise, systems implementation

INTRODUCTION

In an increasingly competitive climate, small and medium enterprises (SMEs) search for ways to increase their competitive advantage from both an internal perspective (e.g. organizational efficiencies and interconnectivity) and an external perspective (e.g. customer and supplier relationship management) (Dempsey & Griffin, 2007). One solution some SMEs have implemented is a customized enterprise application that integrates management of operations, internal communications between departments, and external communications with customers and partners. The implementation of this type of application has allowed for greater interconnectivity throughout the company, increased productivity, decreased operational costs, and enhanced customer service (Loh & Koh, 2004). Three predominant approaches currently exist:

- The single integrated enterprise resource system (ERP) – the implementation of a software solution from a single vendor that provides functionality and interconnectivity across all departments of the company.
- The best of breed system (BoB) – the implementation of multiple software applications from different vendors, each providing optimal functionality for operations and creating interconnectivity within the company.
- The software as a service system (SaaS) – the implementation of software applications from different vendors, where the applications are purchased as a service and operated via the internet.

Until recently, the cost of purchasing and implementing enterprise systems was high and required significant resource commitments from the company. As a result, the typical consumer of enterprise applications has been larger, more profitable, and well-established companies (Sledgianowski, Tafti, and Kierstead, 2008). However, this trend is changing as vendors realize that the enterprise application market for medium-large enterprises has become saturated; looking for new markets, many enterprise application vendors have begun to develop software solutions directed towards the needs of SMEs (Sledgianowski et al, 2008; Deep, Guttridge, Dani, and Burns, 2008).

Prior studies have suggested that SMEs have unique characteristics that impact their ability to successfully implement enterprise systems (Deep et al., 2008; Kugel, 2007; Sternad et al, 2009). In the following sections, this paper analyzes three modes of delivery for enterprise systems: integrated ERP, Best of Breed, and Software as a Service to determine how well these delivery modes are aligned with the requirements of SMEs.

IMPLEMENTATION OF ENTERPRISE APPLICATIONS IN THE SME

It is critical prior to purchasing an enterprise application that an SME has an understanding of the important elements for successful implementation. Unsuccessful implementation can create profound losses within the SME, resulting from the cost of implementation, employee disengagement, and customer dissatisfaction (Loh & Koh, 2004). Such losses present a far greater risk for the SME than the medium-large enterprises, as “they have more frequent losses and display greater heterogeneity with respect to liquidity and solvency” (Shin, 2006). The risk of unsuccessful implementation of the enterprise application system, coupled with the inherent costs of enterprise application implementation (e.g. implementation costs in excess of original budgets and initial firm performance declines (Shin, 2006), are often deterrents for enterprise application adoption of SMEs.

There is evidence however, that if SMEs want to compete effectively within their market and enhance their sustainability, adoption of an enterprise system is necessary. A significant amount of research has been completed on the operations of SMEs and findings show that in comparison to their larger counterparts, SME management do not typically have a good overall sense of how their business operates or the roles of their employees, and have limited access to performance measurement data (Kugel, 2007). The reports produced by SMEs are generally less accurate and do not provide management with a precise view of how the organization or its employees are performing (Kugel, 2007). This lack of insight into performance could have a potentially profound effect on the overall success of the SME, which is the basis on which enterprise application vendors have targeted this market.

Loh and Koh (2004) examine elements that are critical to SMEs in the implementation of enterprise applications and provide a comprehensive literature analysis of previous research. The paper concludes that comprehensive project management, a good business plan, a vision, management support, effective communication, a culture of change management, and evaluation of performance are some of the key success factors in implementing enterprise applications (Loh & Koh, 2004). Sternad et al (2009) came to much the same conclusion, except that project management and change management skills were argued to be less important as at larger firms.

Loh and Koh (2004) describe several barriers to success in enterprise systems implementation, such as inappropriate software selection, inexperienced project leaders, poor project planning, ineffective teamwork, unclear roles and responsibilities, and conflict between business objectives and enterprise application objectives. This paper focuses on “inappropriate software selection” as the key factor in the success of the enterprise systems implementation for SMEs, due to the rapidly evolving alternatives for of enterprise systems delivery for SMEs.

CHARACTERISTICS OF THE SME

Throughout the literature, the two dominant characteristics distinguishing SMEs from larger firms are the limited resources and limited knowledge base of SMEs (Loh & Koh, 2004; Welker, van der Vaart, and Pieter van Donk, 2008; Kugel, 2007; Sledgianowski et al, 2008; Hsu, Lai, and Weng, 2008). Limited resources and knowledge can impact the choice of enterprise application, as the system may need to be affordable and easy to implement.

As a result of limited resources, SMEs typically lack strong information technology diffusion processes (Shin, 2006) and thus tend to share information within the organization and with external partners through means of informal direct communications (e.g. telephone, email, and meetings) (Welker et al, 2008). The use of informal communications within the SME can foster an inherent lack of structure, and lends to the idea that management within many SMEs may not have a clear understanding of the operations or the potential capabilities of the organization (Kugel, 2007). In addition, lack of a robust information technology infrastructure and the knowledge of how to implement and support such an infrastructure means that an enterprise application that does not rely on an existing information technology infrastructure and is easy to implement and maintain would be beneficial to SMEs.

Kugel (2007) reports that SME management may not be aware that they could afford an enterprise application, nor may they understand the performance improvement such a system could render. Without the assistance of an enterprise application, many SMEs largely rely on desktop spreadsheets to support business processes and monitor operations (Kugel, 2007). As a result, the SME may lack transparency in their financial operations and reporting (Shin, 2006), and may have less accurate reporting processes (Kugel, 2007).

Although lack of formal processes might not be considered a positive characteristic within an organization, for the implementation of an enterprise application the presence of informal processes can actually lend positively to implementation. An SME with informal structures may be more open to adaptation of work systems (Deep et al., 2008),

which is often imperative when implementing an enterprise application. Medium-large enterprises that have more established work systems and roles may be less open to changing work systems and therefore, require the flexibility of an enterprise application that can be adapted to existing work systems. Conversely, the SME that is open to modifying processes and structures has the flexibility to implement an enterprise application with less flexibility for modification.

As noted above, employees within the SME may have diverse roles and although this can be detrimental to the development of formalized processes, it can also be of benefit in implementing enterprise applications. Companies that foster diverse roles, often provide significant training for employees in order to ensure that they can obtain a diverse skill set (Kahn, Bali, and Wickramasinghe, 2007). Fostering a culture of training and education is very important for the implementation process of an enterprise application, as employees are often more adaptable and responsive to change (Kahn et al, 2007). An SME that fosters such a culture may have the capability to effectively support the implementation of a sophisticated enterprise application.

The preceding characteristics of SMEs can be condensed into five key categories (see Figure 1). These key characteristics will be utilized later in the paper to compare to the characteristics of enterprise applications, and increase understanding as to which systems might be most appropriate for the SME.

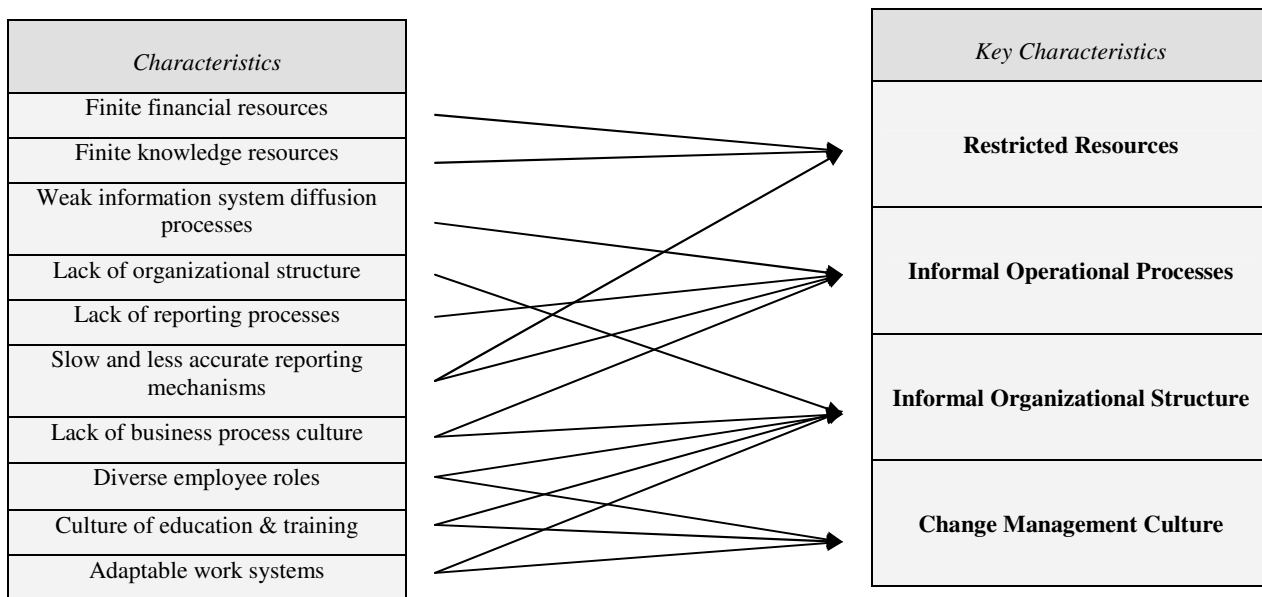


Figure 1- Deduction of the Key Characteristics of the SME

CHARACTERISTICS OF ERP SYSTEMS

Integrated ERP systems are single integrated enterprise applications that are purchased from a single vendor and provide a broad functionality and interconnectivity across all departments of the SME (Dempsey & Griffin, 2007). This type of enterprise application can provide an opportunity for the SME to eliminate inefficiencies through the implementation of new work systems (Light, Holland, and Willis, 2001), may offer a broader functionality for the operations of the SME, and assist in the creation of work processes that might have not otherwise been considered (Chester, 2006; Deep & Griffin, 2008). There are significant benefits for an SME that has informal operational processes, as the ERP system can provide new processes and increase structure (see Table 1).

If implemented correctly, an integrated ERP system can offer operational efficiencies, reduced staff requirements, and the ability to improve information technology capability seamlessly through vendor supplied upgrades (Light et al, 2001). The benefit of implementing an ERP system can be great, as an organization has to maintain a relationship with only one vendor, the vendor provides services to implement, maintain and upgrade the system and as such, the organization does not need to rely significantly on internal information technology expertise (Light et al, 2001). The information technology expertise that will be required in the operation of the ERP system will necessitate only a single skill set from the information

technology department and therefore, potentially require fewer employees in the management of the system. For an SME that is focused on outsourcing, does not want to invest in the development of internal information technology expertise, and does not mind the control of daily operations being in the hands of an external party (Sledgianowski et al, 2008), the ERP system should be considered.

Despite the ability to integrate functionality from each department through one application and the resultant efficiencies, there are many less positive aspects of the ERP system and implementation process that should be considered. Emphasis has been placed on the benefit of dealing with a single vendor; however, should this vendor be unresponsive, inefficient, or financially unstable, the SME could be left with an ERP system that no longer has optimal utility (Dempsey & Griffin, 2007). By placing the functionality of all operations in the control of a single application and a single vendor, the SME accepts a modicum of risk; the implications of vendor/application failure could be detrimental to the sustainability of the SME.

In addition, the functionality of an ERP system is determined by the vendor (Light et al, 2001) and what they consider the 'best' way to operate and manage a business. The ERP system is designed in a manner that can be generalized to multiple businesses and as such, during implementation one of two things will have to happen, (a) the software will need to be adapted to match existing work systems within the SME, or (b) the SME will need to adapt work systems to match those of the software (Deep et al., 2008). In order to obtain the full benefits of the ERP system, the recommended implementation plan for all organizations is adaptation of the work system to accommodate the functionality of the software. However in contemplating such an approach, SMEs must be cognizant of the resources that may be necessary in order to make such organizational changes. It is the miscalculation of the time needed to modify work systems and implement the ERP system that often leads to the project exceeding the original budget and implementation failure (Dempsey & Griffin, 2007; Chester, 2006). Hsu et al. (2008) reports that these miscalculations that have led to more failures than successes in ERP implementation.

Integrated functionality across departments	Adaptation of work system required
Standardized functionality	Single vendor relationship
Provision of formal processes	Single vendor risk
Few internal IT resources required	Standardized and regular upgrades

Table 1 - Summary of Integrated ERP Characteristics

CHARACTERISTICS OF BEST-OF-BREED SYSTEMS

The Best-of-Breed (BoB) system is similar to the Integrated ERP system in that it provides functionality and interconnectivity of operations throughout the SME; however, the BoB system offers functionality through the implementation of multiple software components from different vendors (see Table 2). Whereas with the ERP system the SME will obtain a 'one-size-fits-all' system, the BoB system allows the SME to obtain operational functionality through a collection of software applications that may better suit their existing work systems. Each of these applications is developed by a vendor who is generally focused on one business problem and as a result, BoB systems can provide a very rich functionality (Chester, 2006).

Integrated functionality across departments	Existing IT infrastructure required
Customized functionality	Extensive staff training on many applications
Functionality based on existing processes	Maintenance of multiple vendor relationships
Minimal work system redesign required	Mitigation of risk through multiple vendors

Table 2 - Summary of BoB Characteristics

The main advantage of the BoB system is the maintenance of greater flexibility and the ability to choose a collection of software applications that may each individually suit a need of the SME (Light et al, 2001). The BoB system allows for integration of the applications into work systems and as a result, creates less demand on the employees of an organization to modify operational processes and roles. It is recommended that even with the implementation of a BoB system, that SMEs look at implementation of an enterprise application as an opportunity to in some manner, re-design and optimize processes – BoB systems provide flexibility in achieving this endeavour (Light et al, 2001).

In order to effectively implement a BoB system, there must be an information technology infrastructure in place. Without the existing hardware, software, and internal information technology expertise, implementation of a BoB system would be very expensive as this infrastructure would need to be developed (Sledgianowski et al, 2008). Even with the existence of an information technology infrastructure, the need to develop interconnectivity between the different applications and maintain that interconnectivity as applications are upgraded, requires significant skill and knowledge on the part of the information technology department (Light et al, 2001). SMEs should be aware that a commitment to a BoB system can be accompanied by high costs for training staff to maintain applications and interfaces between applications, training staff to learn about upgrades and new components, and providing additional training as staff turn-over occurs (Chester, 2006). As a result, the SME should consider an alternative to the BoB system if such costs are not feasible.

Another factor that must be accounted for by the SME in implementing a BoB system is the requirement to work with and facilitate cooperation among multiple vendors. BoB systems necessitate the development of relationships with multiple parties on the part of the SME, and require BoB vendors to work together to create interconnectivity (Dempsey & Griffin, 2007). If cooperation between vendors is not achieved, the responsibility of interfacing the applications on an ongoing basis will fall to the SME (Dempsey & Griffin, 2007). Despite the potential costs of working with multiple vendors, the SME does mitigate risk when implementing a BoB system, as the demise of one vendor or one application is not likely to denote the failure of the entire system (Light et al, 2001).

CHARACTERISTICS OF SAAS SYSTEMS

The Software as a Service (SaaS) system is similar to the BoB system in that it involves the implementation of software applications from different vendors; however, the applications are purchased by the SME as a service and operated via the internet (see Table 3). In implementing a SaaS system, the SME would incur far less upfront cost than with ERP or BoB systems, as the software is rented rather than purchased and the cost of hardware, software, installations, upgrades and maintenance are not incurred (Sledgianowski et al, 2008; Sun, Chen, Zhang, and Liang, 2007). This can be an attractive model for SMEs that do not have a large cash flow; however, SaaS can also be costly in the long-term, as per-use or monthly costs for the provision of software will continue for the life of the SaaS system (Tuppas, 2008).

No upfront costs to SME	Few internal IT resources required
Interfacing can be difficult and costly	Mitigation of risk through multiple vendors
Interconnectivity may not be optimal	Adaptation of work system required
Standard functionality	Standardized and regular upgrades

Table 3 - Summary of SaaS Characteristics

Despite the cost savings for implementation, SaaS can have significant expenses tied to it. Similar to the BoB system, interconnectivity between SaaS applications and/or existing software applications must be developed and maintained in order to ensure optimal functionality (Weil, 2007). Unlike BoB systems, SaaS systems cannot be customized to suit specific business processes (Weil, 2007); an SME must have a clear idea of their work systems and be willing to adjust them to the requirements of the software.

Functionality can be further impeded, as many SaaS vendors do not support interconnectivity provided by other vendors. An interface between an SaaS application and another application will have to be out-sourced to those specific SaaS vendors (Weil, 2007). Furthermore, additional expenses can be incurred as many of the per-use or monthly payment versions of SaaS systems do not allow for interfacing with other vendors; when an SME is in need of interconnectivity, up-front payments to upgrade to more sophisticated versions of the software may be required (Weil, 2007). These interconnectivity issues are common, as this is a new segment of the enterprise application market and as such, applications for some areas of

organizational management are not available (Sun et al, 2007). As a result, the need for interconnectivity with legacy software systems or components of BoB systems is likely.

Despite interfacing issues, SaaS does provide the SME with a way to obtain an enterprise application that requires few information technology resources for the rapid implementation, integration, and maintenance of the system (Weil, 2007). For SMEs with little to no information technology experience or interest in developing an internal information technology infrastructure, this type enterprise application system could be highly beneficial.

ASSESSING ALIGNMENT BETWEEN SYSTEMS DELIVERY CHARACTERISTICS AND SME CHARACTERISTICS

In Tables 4-6, we provide a framework for examining the characteristics of enterprise applications and whether they positively or negatively affect the SME. For each enterprise application characteristic a score of +1, 0, or -1 is given, depending on whether the characteristic has a negative or positive effect on the SME. For each enterprise application a total score is given, which provides us with an indicator as to the most appropriate enterprise application for the SME. It should be noted again, however, that not all organizations have the same characteristics and the following is only a generic analysis.

Table 4 provides an evaluation of the characteristics of the ERP system against the characteristics of the SME. Overall, the standard work systems and functionality provided by the ERP system would allow for the development of more effective work processes than the informal process currently in place. Although change to existing work systems would be required by the SME, the existence of diverse employee roles and the change management culture could make this transition much smoother. In addition, the SME would not require as many resources for internal information technology expertise, as many of these functions will be outsourced to the ERP vendor.

ERP CHARACTERISTIC	Alignment	SME CHARACTERISTIC	Explanation
Integrated functionality across departments	+	Informal Operational Process	ERP provides the SME with a framework to connect departments
Standardized functionality and provision of formal processes	+	Informal Operational Process	ERP provides a clean slate for the SME to implement new work systems
Implementation process often exceeds timeline & budget	-	Restricted Resources	Exceeding timelines can be detrimental to the SME as the delay in effective functionality could decrease business & increase operational costs
Provision of formal processes	+	Informal Operational Process	ERP modifies processes and increases formal structure
Few internal IT resources required	+	Restricted Resources	IT resources are outsourced to ERP vendor, & only a single skill set required internally
Adaptation of work system required	+	Culture of Change Management & Org. Structure	Work systems are likely not optimal, change is positive & will be easily achieved due to the change management culture
Single vendor relationship	0		A factor to be aware of, but that can not be scored on a negative or positive basis.
Single vendor risk	-	Restricted Resources	If vendor is financially unstable, SME may not have the resources to overcome losses
Standardized and regular upgrades	+	Restricted Resources	Maintenance of a state of the art IT system, with few resources required
TOTAL = 4			

Table 4 - Alignment of ERP with SME needs

Table 5 provides an evaluation of the characteristics of the BoB system against the characteristics of the SME. Overall, the BoB system creates increased interconnectivity between departments, but this interconnectivity is based upon the adoption of software applications to existing work systems. This could decrease the resources allotted to work system redesign; however, might align to work systems that have not yet been optimized. In addition, the BoB system requires the presence of an information technology infrastructure that may not be present in the SME and as such, would require significant resources to develop. In addition, maintenance of multiple vendor relationships and the potential of having to maintain the interfacing between applications internally, could also require significant resources from the SME.

BoB CHARACTERISTIC	Alignment	SME CHARACTERISTIC	Explanation
Integrated functionality across departments	+	Informal Operational Process	BoB provides the SME with a framework to connect departments
Customized functionality	-	Informal Operational Process & Org. Structure	BoB customizes applications to work systems that may not be optimal
Functionality based on existing processes	-	Informal Operational Process & Org. Structure	BoB aligns to work systems that may not be optimal
Minimal work system redesign required	-	Informal Operational Process & Org. Structure	BoB aligns to work systems that may not be optimal
Existing IT infrastructure required	-	Restricted Resources	BoB requires an existing IT infrastructure that may not be present and would require significant resources to implement
Extensive staff training on many applications	+	Culture of Change Management	BoB requires staff training which would be easy to implement due to the SME culture
Maintenance of multiple vendor relationships	-	Restricted Resources	If vendors can not work together, significant resources will be required to maintain interfacing
Mitigation of risk through multiple vendors	+	Restricted Resources	If one vendor goes out of business, the entire system is not effected.
TOTAL = -2			

Table 5 - Alignment of BoB with SME needs

Table 6 provides an evaluation of the characteristics of the SaaS system against the characteristics of the SME. Overall, the SaaS system does not appear mature enough for any company to rely on solely for their enterprise application needs, as interfacing with other applications and therefore, interconnectivity between the departments is not optimal.

The preceding analysis provides a framework through which SMEs could make an appropriate enterprise application system selection. Through the characteristics of the SME gathered through a literature review, it could be concluded that the ERP system would be the most beneficial enterprise application choice as the ERP system obtained a score of 4, the SaaS system obtained a score of 2, and the BoB obtained a score of -2.

SaaS CHARACTERISTIC	Alignment	SME CHARACTERISTIC	Explanation
No upfront costs to SME	+	Restricted Resources	SaaS will be beneficial for the SME with limited cash flow
Interfacing can be difficult and costly	-	Restricted Resources	Outsourcing interfacing issues could be costly to implement and maintain
Interconnectivity may not be optimal	-	Informal Operational Process	SaaS may provide less than optimal interconnectivity between departments
Standardized functionality	+	Informal Operational Process & Org. Structure	SaaS provides a clean slate for the SME to implement new work systems
Few internal IT resources required	+	Restricted Resources	IT resources are outsourced to SaaS vendors & only a single skill set required internally
Mitigation of risk through multiple vendors	+	Restricted Resources	If one vendor goes out of business, the entire system is not effected.
Adaptation of work system required	-	Informal Operational Process & Org. Structure	Work systems are likely not optimal, change is positive & will be easily achieved due to the change management culture
Standardized and regular upgrades	+	Restricted Resources	Maintenance of a state of the art IT system, with few resources required
Total = 2			

Table 6 - Alignment of SaaS with SME needs

CONCLUSIONS AND DISCUSSION

Prior research that has examined factors within enterprise application selection has either focused on the critical factors that need to be considered for successful enterprise application implementation or focused on the factors that need to be considered when choosing between ERP and BoB systems. This paper makes a contribution to the existing body of knowledge, by comparing characteristics of not only integrated ERP and Best of Breed (BoB) systems but Software as a Service (SaaS) systems as well, to generalized characteristics of the SME. Little research has been completed focusing on SME implementation of enterprise application systems and as such, it is the hope of the author that SMEs find practical utility in this paper.

By analyzing the characteristics of SMEs, we observe that ERP systems are better aligned with SME that are seeking for enterprise solutions. Although BoB and SaaS systems have a lower implementation cost and the ability to mitigate risk to external vendors, ERP will allow SME to develop stronger business processes that are more sustainable and a higher potential for long term growth. This paper does have limitations, as the categorization of the key characteristics of both the SME and the enterprise applications is purely subjective and not exhaustive. In order to obtain full utility, SMEs should use the characteristics and the scoring mechanism as a guide, ensuring that the key characteristics of their organization are captured accurately. In addition, it should be noted that as enterprise application systems evolve, their characteristics will need to be modified. Although SaaS is in its infancy, there are a number of vendors currently developing applications in order to make this system more robust and as a result, the SaaS system might increase in functionality and interconnectivity in the near future. Such changes could change the utility of this system for an SME, and must be considered.

Further research should be completed creating an increasingly robust list of characteristics for both the SME and enterprise application systems; in addition, as the enterprise application space matures, examination of a new parameter will need to be completed. Increasingly enterprise application vendors and looking to open source software as a way of managing organizations, with a low cost and little need for internal information technology infrastructures, this new form of system might be the future answer to SME enterprise application issues.

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