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Integrating the Internet and enterprise resource planning (ERP) systems in South African electricity utility companies

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1 Introduction

There is little information on integrating the Internet and enterprise resource planning (ERP) systems in electricity utility companies. This is because the Internet is a relatively new development and the electricity industry is in the process of transformation.

One key benefit of implementing ERP systems is to standardize, streamline and organize information shared across the entire organization. The Internet makes it easier to share and communicate information across the entire organization. There is also a need for organizations to exchange information with suppliers and customers to meet information requirements (Deise *et al*. 2000:65).

The key question addressed in this research was: *What are the requirements for integrating the Internet and ERP systems in South African electricity utility companies?* In considering this question, the definition of integration by Goodhue, Wybo and Kirsch (1992:300) was adopted. They define integration as being able to share information across an organization to meet information needs of individual business units.

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2 Framework for integrating the Internet and ERP systems

2.1 Integration of information systems

The role of information systems in organizations has shifted from enabling transactions to supporting strategic and competitive objectives with a customer focus approach. Information systems are being set up to service customers by providing offerings that will allow customers to perform basic query functions on the system (Remenyi 1993:62; Remenyi, Money and Twite 1993:21). The integrating of information systems refers to bringing together various application systems to operate as a single computer system. As stated by Goodhue *et al*. (1992:300), the main benefit of integrating application systems in an organization is to share information. According to Turban (1995) and Beath (1991), other benefits include:

- replacing paper-based systems with shared resource computer systems;
- capturing data once;
- storing a single copy of data in a manner which can be accessed by all authorized users; and
- allowing the selection and manipulation of data in a variety of ways to suit the need of different groups of users.

2.2 ERP systems

An ERP system is defined by Markus *et al*. (2000:245) as a software package that enables the sharing of business information stored on a common database among targeted business units in the entire organization. The purpose served by an ERP system is that of organizing, codifying and standardizing the business processes and information or data. Furthermore, ERP systems provide an enterprise with a common language and a common data repository facility that make it possible to access data in other business units, for example sales or production scheduling systems (Hammer 1990:110; Lee and Lee 2000:281; Davenport 1998:123-124; Norris *et al*. 2000:12–13; Adam and O'Doherty 2000:306; Sumner 2000; El Sawy 2001:192; Francalanci 2001). Internet capabilities are also being embedded into ERP systems to enable integration with Web-based applications.

2.3 Internet use in organizations

The Internet can be defined as the use of electronic networks for communication between information technology systems of organizations or as a network of networks with excellent throughput capabilities, for example e-mail, file transfer, World-Wide Web (WWW) and remote log-in (Graham, Spinardi and William 1996).

Graham *et al*. (1996) presents two views of Internet use in organizations. Firstly, the Internet is viewed as an information technology with interest centred on software, data transmission systems and messaging capabilities. Secondly the Internet is viewed as a business innovation focusing on the harmonizing of practices within a community of firms linked by electronic means.

The use of the Internet by organizations brings about numerous business opportunities. These include overcoming geographical and cost barriers to new markets, improving service to customers, access to world-wide communication, streamlining internal processes, restructuring relationships, sharing scarce information and enabling applications (Dunn and Varano 1999:63–64).

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3 Electricity industry scenarios

The electricity utility industry in South Africa is in the process of being commercialized. The government has tasked the National Electricity Regulator (NER) to oversee the commercialization process, which is controlled by the Department of Mineral and Energy Affairs. At the moment the electricity industry in South Africa is vertically integrated. This means that one company (ESKOM) controls generation, transmission, distribution and supply.

The restructuring of the electricity industry needs a slow and deliberated process. Horvei (2000:6–9) suggests that some of the following constraints must be managed as a starting point to regulate the industry:

- Inefficiencies in the overall power generation and distribution
- Technical weaknesses particularly in the distribution area
- Poor financial performance of electricity supply industry participants, that is, return on investment, cost of financing and strong limitations on public sector financing
- Electricity prices being used as political instruments
- Unsustainable subsidies to various consumer groups
- Electricity supply structures that do not allow for efficiency through competition.

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4 Research methodology

The nature of this research required a qualitative approach where interviewing and document sources were used to gather data. This research can also be described as exploratory qualitative research because the problem it investigates is not well understood. This is due to the newness of the area and a lack of focused previous research on the subject. According to Ghauri, Gronhaug and Kristianslund (1995:27–28) and Creswell (1994:146), quantitative methods seem inadequate in researching a new area like this. Therefore further exploration using qualitative methods was necessary.

4.1 Sampling

The respondents were selected using a purposive convenient sampling (Merriam 1998). Selected respondents were either information systems practitioners within the electricity utility industry or qualified and experienced PhD holders who had an understanding of the electricity utility environment. The selected 19 respondents were interviewed for 45 minutes each and their responses audio recorded and transcribed for analysis.

4.2 Data gathering methods

The primary data collection methods for this research were semi-structured interviews and a documentary search. The semi-structured interview proceedings were audio recorded and transcribed for analysis. Documentary evidence from the Electronic Commerce green paper was used in the analysis.

4.3 Data analysis

According to Yin (1994:102) 'data analysis consists of examining, categorizing, tabulating, or otherwise recombining the evidence to address the initial prepositions of a study'. Data analysis in this study was based on a comparative method that included the comparison of data within interviews and between interviews (Merriam 1998). A constant comparative method was applied in the analysis of the interview data (Merriam 1998; Creswell 1994).

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5 Results

First the findings in terms of Internet, ERP and integration requirements are described. Secondly implementation requirements are discussed.

5.1 Findings in terms of the Internet, ERP systems and integration

The following findings were derived from the interviews:

5.1.1 Internet as an information exchange

Respondents stated that Internet use in an organization is mainly: 'The dissemination of information and the reception of information.'

5.1.2 Workflow management

Respondents stated that apart from being a 'communication tool, the Internet is used for workflow management'. This is a new function that is not mentioned in any of the literature reviewed. It was also mentioned that workflow management is mostly part of an ERP or a transaction processing systems approval process workflow.

5.1.3 Electronic procurement

The second aspect that was reported by respondents, which did not receive coverage from the literature reviewed, is *electronic procurement* (e-procurement). Respondents mentioned that '[they] use the Internet for electronic procurement of goods from suppliers'.

5.1.4 Legislation of Internet and electronic commerce

Respondents mentioned that within the South African environment the use of the Internet as a business tool has not yet been legislated. They said that 'there is no legislation in South Africa … the government is taking too long to produce the white paper from the available green paper'.

5.1. 5 Limited implementation of ERP systems

Respondents supported the limited functionality type of implementation. The reason for limited function ERP implementation is because of the complexity of the electricity utility industry. Respondents had various replies about the implementation of ERP systems:

- 'There are several systems'
- 'Our ERP systems are the least important to us'
- 'Billing or reaching out to our customers is important to us'
- 'Customer relationship management is important to us'
- 'ERP is important to us'
- 'There is work management, then asset management and then outreach management. The ERP is just one of them'
- 'In the ERP, we basically look at things like finance and HR (human resources) and those are the only components in the ERP that are important.
- [It is] successful in terms of giving all the functionality rolled out to all the people. There tends to be a slight over run in terms of time and budget.'

5.1.6 Integration of information systems

Respondents indicated that integration of systems would bring added benefits for organizations because data can be shared without having to implement many different computer systems: '*To integrate applications is to be able to put all the data you have together so that your different functions or different areas of the organization can talk to each other*.'

5.1.6 Summary

In conclusion one can therefore say the Internet as an information exchange is used for:

- sending and receiving information from within or outside the organization, mainly for communication and research purposes;
- workflow management within systems, especially purchasing systems where approvals are required; and
- electronic procurement to facilitate on-line buying of goods and services from selected suppliers that are participating in the electronic trading market.
  It can also be said that:
- there is limited implementation of ERP in South African utility companies;
- finance and human resources are functions supported by ERP systems in South Africa because best-of-breed systems are used to support core functions; and
- ERP implementations are successful in terms of providing functionality, but there is usually an overrun in terms of budget and time.

Respondents had a good understanding of systems integration and expressed the need for integration guidelines to enable organizations to maximize the use of available systems for servicing customers.

5.2 Findings in terms of implementation requirements
Emerging from interviews and documentary search, findings in terms of implementation requirements for integrating Internet and ERP systems were presented in terms of technology, processes, people aspects and environmental issues.

5.2.1 Technology aspects of implementation requirements for integration
Technical support and knowledge: The key technical support and knowledge issues mentioned by respondents included 'the ability to configure the flexibility [and] adaptability of systems and [the] knowledge of implementation consultants or workers'.

ERP Internet capability: One of the new developments within ERP systems is the embedded Internet capability within ERP systems. Respondents stated that 'ERP manufacturers are already including Internet capabilities in their systems by making them Web-enabled'.

Supplier partnerships: Supplier partnerships in South Africa are based on what respondents termed as 'what do you bring to the party'. Respondents claimed that:

'ERP systems and Internet service providers tend to form strong relationships with large organizations that have a strong financial backbone because they will gain more in terms of license fees etc. Smaller organizations like municipalities are neglected, they are required to abide by unfair support contracts.'

One of the respondents claimed municipalities are given a 'take it or leave it' situation as far as partnerships are concerned.

Organizational infrastructure: WAN and bandwidth: According to respondents, an organizational technical infrastructure is composed of:

- databases
- communication (networks)
- security standards.

Costs implications: Respondents mentioned that the cost implications of an integration project could be categorized in the following manner:

- Initial purchase price of systems
- Implementation costs
- License fees
- Maintenance costs.

Technical aspects barriers: The barriers mentioned by respondents include:

- Availability of resources
- Consulting cost implications
- Maintenance costs
- Initial cost of ERP system
- Connectivity problems
- Lack of risk sharing
- Little choice of implementing partner.

5.2.2 Process aspects of implementation requirements for integration

In the questions on the process factors, respondents were asked to discuss how implementation support, change control, product support, and process design and ownership will impact the process of integrating of the Internet and ERP systems in the electricity utility industry.

Implementation support: The importance of implementation support cannot be over-emphasized. Respondents stated that 'implementation support is important from the system supplier, internal resources and specialists like consulting firms.'

Change control: Respondents stated that in terms of integrating the Internet and ERP systems, change control aspects are such that they 'should be viewed in terms of the system development life cycle, monitoring site specific configuration and customisation tracking'.

Product support: Product support, especially from suppliers, is regarded as an important aspect when involved in an integration of the Internet and ERP system. However, respondents were still concerned about the frequency at which upgrades of software are conducted. 'Software suppliers release new upgrades too often and the support of earlier releases is terminated too quickly.'

One of the respondents stated that 'competition is a blessing to customers', and that product support has improved because of competition and suppliers' fear of loosing market share.

Process design and ownership: Correct business processes are important to integration. Respondents said that: 'Systems are configured according to processes, and organization resources should design and own processes.'

5.2.3 People aspects of implementation requirements for integration

Respondents discussed how executive sponsorship, change management and user participation would impact on integrating the Internet and ERP systems in an electricity utility company.

Executive sponsorship: Respondents stressed the importance of executive sponsorship in an integration project, especially after the integration exercise, when business will be conducted in a slightly different way: 'Executive sponsorship should be part of the business plan at system enquiry level to identify who is responsible. [This person] should put support structures in place and use a baseball bat if necessary to make the system work.'

Change management: It was stated by some of the respondents that: 'Relevant stakeholders should be involved or informed about change initiatives that impact their work.'

User participation: Respondents stated that user participation is a very important requirement in an integration project, but that:

'Care should be taken to involve users at the right levels and phases of an integration project. Respondents mentioned that if executive sponsorship is available, users who do not have the right skills to be involved directly into the project will receive feed back from executives at briefing sessions. One the areas where users can add value would be during the business requirements and data collection phase.'

Knowledge transfer: Respondents said knowledge transfer is a nice word to use, but in practice it is difficult to ensure that its implementation takes place: '[Knowledge transfer] could be viewed in terms of the integrator sharing knowledge with the consultants on the project and the consultants sharing knowledge with users from the business.'

5.2.4 Environmental aspects of implementation requirements for integration
Respondents discussed the environmental aspects of integration requirements and barriers in terms of government policies, experiential barriers and security.

Government policies: All respondents agreed that decisive government policies are important in that they give organizations a sense of stability in the environment in which they conduct business: 'The government needs to finalize the Internet policy and accelerate the deregulation of the electricity utility industry.'

Experiential barriers: Respondents expressed concern over the target market for integrated Internet and ERP systems: 'More than half of the population do not have access to the Internet let alone electricity. Integrating the Internet and ERP systems might not be a priority at the moment [since] they are required to meet electrification targets by government.'

Security: Respondents reported that 'it is worrying to note that most of the organizations are not making security issues a priority, they are more worried about implementing systems'.

Respondents further stated that 'security threats to information systems should be taken seriously because no one is untouchable, [even] the Microsoft head office was hacked into in October, 2000'.

Respondents stated that while security breaches are not an everyday occurrence in the South African environment, it is important to protect the most valuable asset in an organization, which in this case is information.

5.2.5 Summary
Implementation requirements of integrating the Internet and ERP systems in terms of technology, processes, people and environmental factors were considered and the following are the summary of the findings:

- Technical support and knowledge systems should be flexible, scalable and implementation partners are required to have in-depth system knowledge.
- Supplier partnerships require suppliers to share the risks of the integration project and put in place reasonable license agreements.
- Organizational infrastructure in terms of databases, communications networks and security standards should operate at optimal level to meet integration project needs. The speed of communication over the Internet or bandwidth is the main area of

concern and must be improved.
- Cost implications, which include initial ERP system purchase price, consulting fees and maintenance costs, must be managed.
- Implementation support requires skilled resources to support the implementation of an integration project.
- Change control for site-specific configurations for an integration project should be managed in terms of the system development life cycle.
- Product support should be analysed in terms of supplier commitment to supporting their products to meet customer requirements as far as enhancements are concerned.
- Process design and ownership should be managed from within an organization that undertakes an integration project.
- Executive sponsorship should be part of the system inquiry plan, and executives should take an active role throughout the phases of an integration project.
- Change management should form part of an integration project to deal with people issues throughout the project.
- User participation ensures buy-in, therefore users should be involved at the right levels to achieve the objectives of an integration.
- Knowledge transfer requires that internal resources must be part of an integration project to ensure that knowledge needed to continue with the project remains within the organization.

From a people perspective, successful integration of the Internet and ERP systems depends on:

- sufficient executive involvement in the integration project;
- change management interventions in terms of communicating the process;
- user involvement at the right levels;
- Internet policy and the deregulation of the electricity utility industry to provide a stable environment for conducting business;
- electricity access to all South Africans; and
- security measures that manage any security breach in the systems.

The following paragraphs reflect some conclusions drawn from the findings in this study, particularly concentrating on integrating the Internet and ERP systems in electricity environment learners.

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6 Discussion

The respondents highlighted two uses of the Internet and ERP that is mentioned in the literature reviewed, namely workflow management and electronic procurement. By using Internet workflow capability, information or documents are automatically transferred from one user to another without user intervention.

Commercialized electricity utility companies in South Africa have implemented limited functionality ERP systems. These organizations bought the whole ERP suite, but only implemented financial and human resources modules. The rationale for implementing only these two modules is that they prefer using best systems for each functional area. Core functions like generation monitoring, distribution regulation and customer relations management are supported by other systems and not ERP systems. ERP implementations are successful in terms of providing functionality. However, there is usually an overrun in terms of budget and time.

One of the key requirements of having a successful integration is the ability to configure the systems to meet business needs. Technical support and knowledge in terms of the ability to configure the systems for integration purpose are very important. The technical capability of the system should be flexible enough to adapt to changing business operating environments and user requirements.

The Web-enabled functionality on an ERP system makes it easier to exchange information with other systems that have similar data formats. New versions of ERP systems are Web-enabled and would make the process of integrating the Internet less difficult. Large ERP manufacturers have realized the importance of adaptability and flexibility for their systems, thus resulting in the standardization of data formats.

Organizations are reluctant to do integration initiatives on their own because system providers are not committed to true partnership and the sharing of risk. ERP system supplier support disappears once the source code is tampered with by the user organization.

Organization infrastructure forms the foundation for integration because communication depends on where and how the data are stored. If databases, communication networks and security standards are not reliable, an integration project is guaranteed to fail.

Technology requirements for integration are:

- a flexible (scalable) system
- adapting to requirements
- sharing the implementation risk
- improving communication networks to meet business needs.

Barriers to integration are:

- lack of resources
- implementation and maintenance costs
- Internet connectivity problems
- the rate at which new versions of software are released.

The implementation must be supported, especially by the product supplier, since integration project costs are high. In the South African environment, implementation support is not of concern because there is access to international resources. The only problem is the cost of getting the implementation support. ERP system and Internet service providers charge different amounts for software and implementation support. It would be better if the software charge included some implementation support as a gesture of showing commitment to the product.

It is important for organizations to make sure that some of their human resources are working side by side with the implementation partner as a way of retaining skills after the project is completed. Organizations should improve their own resources, especially people, because they understand the business better and can carry out implementation support beyond the life of a project.

The change control is one of the important aspects of an implementation project. Because ERP system and Internet software codes are developed outside South Africa, it is important to manage change control so that license agreements are kept. When undertaking an integration project, change control should be monitored from inception of the project until completion. When carrying out an integration project, change control is also critical in terms of reconfiguring a site's specific enhancements in a new software upgrade.

The process design and ownership is very important because information systems are implemented to support business processes. If business processes are not well designed, integration efforts will not get the desired results. Organizations involved in Internet and ERP integration should commit human resources who have a thorough understanding of the business to design processes on which the integration will be modelled.

The process requirements of integration are:

- management of customization or site specific configurations;
- commitment from system suppliers to support their product; and
- using experienced resources from the business to design processes on which the integration will be based.

Executive sponsorship, especially in the new electricity utility companies, gives an organization a sense of direction and ensures buy-in of the new integrated system processes at all levels. One problem with executive sponsorship is that some senior executives are technology shy. They do not want to get involved in technology projects and consequently delegate all the responsibility to their information technology (IT) managers.

Change management is necessary to look after employees whose day-to-day work is affected by the new system. Process improvement should be presented in a non-threatening manner to the users through planned change initiatives.

Management should make sure that users are involved at the right levels since the integrated system will impact their work directly. Without user participation, the project might fail. Users might sabotage the process if they are not in agreement with it.

To transfer knowledge to the business, selected users from the business must be involved in an integration project so that they can learn how to perform certain functions. If knowledge transfer occurs, organizations will become less dependent on consultants for day-to-day integration maintenance. Knowledge transfer must be actively managed so that the project is not dependent on a few individuals.

It was noted that, with or without government policy, business are doing what is called self-regulation. Most businesses within the electricity utility sector have implemented systems that enable the integration of the Internet and ERP systems. Customers are provided with self-service facilities even though there is no white paper on Internet policy and electronic commerce.

Even though IT providers are aware of security threats and try to make systems that adhere to specific security standards, it is not enough to rely on these security measures alone. It is important to note that having an anti-virus program does not mean that systems are secure. Organizations must develop policies and procedures that prevent and deal with security threats. Even though hacking and the unauthorized view of information is not a real problem in South Africa, relaxing controls could in the long run prove catastrophic. There is also need to have disaster recovery plans and business continuity plans as part of managing IT in organizations.

Environmental factors that prevent the integrating of the Internet and ERP systems are:

- a of lack of clear government policy on the Internet;
- commercialization of the electricity utility industry that is still in process;
- minimum access to the Internet; and
- electricity shortage to the larger part of the population.

Government should move quickly to a policy regarding Internet access and use, as well as the commercializing of the electricity utility industry. This will assist the role players to understand the priorities and bring a sense of stability to the electricity utility industry. Individual companies within the electricity utility industry should take security threats seriously to protect their valued asset – information.

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7 Conclusion

The Internet and ERP systems are part of information systems that organizations depend on when conducting business. The Internet and ERP systems offer useful functionality in the smooth running of an organization. It would be very beneficial to integrate or combine the functionality derived from the Internet and ERP systems to serve the customer better. However, in the South African electricity utility industry, companies are not yet ready to integrate the Internet and ERP systems due to the following reasons:

- ERP systems are not used for core functions because of implementation types;
- electricity utility industries are not ready for integration because commercialization is still in its early days; and
- connectivity problems due to the bandwidth.

Integrating the Internet and ERP systems could only make sense with top-end customers such as companies, institutions and municipalities because Internet usage among individual household customers is low. The South African government should provide a white paper to legislate the use of the Internet as a business tool.

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