

THE ALIGNMENT BETWEEN SYSTEM AND OPERATIONAL EFFECTIVENESS: A CASE STUDY IN THE ELECTRICAL SECTOR IN AUSTRALIA

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Abstract--Organizations are increasingly investing in complex enterprise information systems. In most cases, claims are made concerning how these expensive systems will produce considerable improvements in the operational performance of the organizations. Nevertheless, there is evidence that many of these systems fail to deliver the expected outcomes and often fail completely. This study explores the linkages among system effectiveness, operational performance, and the organizational factors that influence the balance that these systems require. As current literature is silent in regard to such interactions, this research uses a qualitative approach, based on unstructured interviews with employees at different levels in an electricity distribution enterprise, to build on the existing literature and to further confirm and refine a theoretical framework.

Keywords— System effectiveness, Operational effectiveness, Performance measurement, Information systems strategies, Enterprise information systems

I. INTRODUCCIÓN

Many organizations are investing substantial resources in enterprise information systems (EIS), but the extent to which they enhance the organization's performance is not yet well understood [12]. There is an expectation that EIS will increase a firm's operational effectiveness (e.g., decrease operational costs, increase flexibility and reliability, and improve quality). There is also often an expectation that EIS will not only boost profitability [14], but also ensure the firm's sustainability and enhance competitive advantage. It is important to gain a better understanding of stakeholder's expectations in regards to the operational performance, and how implementing EIS can improve operational effectiveness [24]. Improving operational effectiveness involves determining key performance objectives and establishing benchmarks.

However, some organizations are failing to benefit because they either do not measure performance or what they do measure is inappropriate [29].

Effectiveness of information systems (IS) needs to be measured from the organization's perspective. System effectiveness can be defined as the extent to which implementing an EIS contributes to achieving the expected organizational goals and benefits [25]. In the context of EIS, effectiveness is the accuracy and completeness with which users achieve agreed goals [6]. Implementation of EIS has become increasingly important as companies become more competitive or come under heightened regulatory scrutiny. The advent of EIS, also known as Enterprise Systems, allowed companies to automate procedures and support their activities and decision making processes. As a result of growing concerns about the effectiveness of EIS, there is a need to evaluate them to demonstrate real benefits to the operational performance inside organizations. Many organizations that dedicate resources to information systems expect productivity to improve [14], however, adopting EIS to meet organizational objectives is not easy. Identifying the organizational objectives that can improve performance requires an understanding of the firm's core capabilities as well as its market needs and how they are aligned with the so called strategic triangle [17].

This research explores the nature of the balance between system effectiveness and operational effectiveness that needs to exist in any organization after the implementation of an EIS. In addition the influence of organizational factors in balancing system effectiveness and operational performance is explored. In particular, the research addresses the following questions: which performance objectives and systems dimensions do organizations take into consideration when implementing EIS? What are the organizational factors that influence the balance between operational effectiveness and systems effectiveness?

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II. BACKGROUND

An enterprise information system is an organization-wide system that enables people to communicate with each other and access appropriate data through the whole enterprise [27]. Most EIS are commercial software packages that can be used, when successfully implemented, to manage and integrate all business functions of all departments into a single computer system that can serve the entire enterprise's needs [27]. An EIS system can consist of a number of integrated functions such as manufacturing, logistics, distribution, accounting, marketing, finance, and human resources. EIS and in particular ERP (Enterprise Resource Planning) systems were initially applied in supply chain networks by helping to reduce cycle times and, they have been expanded beyond manufacturing and introduced to the finance, health care, hotel chains, education, insurance, retail and telecommunication sectors [27].

The implementation of EIS such as ERP systems is problematical because of the generic off-the-shelf nature of most systems. EIS including ERP systems have changed the process of analysis, design, implementation and operation, as companies have to adapt their business to the characteristics of the ERP applications [1]. Sumner [26] suggests that in some cases, it is better to fit business processes to the ERP package rather than try to customize the package. Another alternative is to analyze what is needed in the EIS system and then choose the applications that would support the requirements [1]. However, firms face the risk of automating obsolete processes or developing marketing processes for which there is no software. Furthermore, many multinationals restrict their business to only those companies that operate the same ERP system [22]. It is the vendor who defines the requirements of the business as they claim to have analyzed similar business characteristics and written a system solution that can be adapted to other businesses just by changing the configuration or some parameters [1]. In essence the company can choose the modules that will fit their needs and then the organization can configure the module to their particular requirements [1]. By making changes to fit an EIS managers do not realize that they are impacting other areas or functions of the system that were not designed for that particular process. Changes in the system can also affect the organizational culture. When organizations are innovative and flexible, it is very likely that staff will attempt to modify the system as they improve processes (operational effectiveness) in the organization. This can harm the overall operability of the system, if the system is not flexible enough to effectively incorporate these changes.

The paradigm for investment in EIS has changed; it used to be that a business would invest wholly in system effectiveness by designing a unique system for themselves based on their own requirements. However, through the availability of packaged EIS, enterprises must find the balance between redefining their operations (managing operational effectiveness) and changing the packaged EIS (examining system effectiveness).

System Effectiveness

System effectiveness can be described as the extent to which information systems contribute to achieving organizational goals and benefits [2]. Companies deriving the greatest benefits from their systems are those that, from the start, viewed them primarily in strategic and organizational terms. These companies stressed the importance of the enterprise not the system [1]. Case studies reported by Masini [14] show the EIS adoption as successful as they brought the expected benefits, but also induced important modifications to the firm. Some of the expected benefits identified by Masini [14] are: homogenization of information and its timely availability, significant reduction of data entry points with a consequent decrease of potential inconsistencies and errors, and better utilization of resources. According to Hesseldenz & Morefield [7], many organizations report new organizational capabilities and a considerable improvement in different operational areas. The new EIS has also helped the institution to enhance its ability to adapt to change, create new knowledge and performance measures, and even identify a new strategic horizon.

The high failure rate in implementing such systems is a major concern [1]. Failure rates for large-scale system development projects are extremely high and many information system projects are failing to achieve their advertised outcomes [9]. However, as it is difficult to quantify, the real level of information system failure could be far greater than is reported [9]. An EIS project has failed if the solution does not integrate well with the business environment, if there is a lack of consistency between the initial requirements and final solution, or if the project simply does not make business sense [9].

The issue of how to measure success or failure is not easy as the success or failure of a system is subjective and is seen as a matter of interpretation and that interpretation can change over time [15]. Success depends on the point of view from which you measure it. People often mean different things when talking about EIS success [13]. Different groups or cultures inside an organization may interpret success in different ways. People whose job was to implement EIS, for example, often defined success in terms of completing the project plan on time and within the budget. However, people whose job it was to adopt EIS and use them, in achieving business results tended to emphasize having a smooth transition to stable operations with the new system, thereby achieving intended business improvements such as inventory reductions and gaining improved decision support capabilities [13]. Another issue arises when measuring success at different points in time.

Larsen and Myers [11] found that an EIS implementation could be an early success and a later failure. Also, Parr and Shanks [16] reported a case study that was initially unsuccessful and later successful. Furthermore, there is a need for organizations to be successful in all the different phases of an EIS implementation [13]. Measuring success of information systems has been a concern for those within the information systems discipline. Although success is complex, and therefore difficult to measure, researchers have made efforts to identify dimensions and measures that facilitate the process of understanding information systems success. Note that, due to the multitude of different approaches to the measurement of information systems success, it is unlikely that a single measure of EIS effectiveness can be agreed upon and, therefore there is a need for multiple measures.

The revised DeLone and McLean's model [3] includes six interrelated dimensions of information systems success: information quality, system quality, service quality, intention to use, user satisfaction, and net benefit as dimensions to measure the dependent variable IS effectiveness. In essence in the DeLone and McLean [3] success model: System quality measures technical efficacy – the desired characteristics of the system. This assessment is based on the performance and productivity of the system [3]. Information quality is the measurement of output from EIS. It measures semantic success – characteristics of the information and its desired form [3]. Use and user satisfaction measure effectiveness success – studies that attempt to analyze and measure the interaction of the information product with its recipients; user satisfaction is defined as the user's response to the use of the output of an EIS, and is the psychological state after the use of an EIS [3]. Individual impact is the effect the information has on the behavior of the user including improving personal or departmental performance, and relates to the influences the information product has on management decisions [3]. This impact occurs when the information is received and understood by the users, and applied to their jobs. Organizational impact derives from research that investigated the effect of the information product on organizational performance [3]. However, in measuring performance it is important to have a clear understanding of the outcomes from the investment of a significant amount of human and economic resources in EIS solutions that cannot always be properly adapted to particular circumstances. EIS effectiveness should be measured in terms of the real operational benefits rather than through the achievement of information systems outcomes only. In attempting to address these questions we need to understand key elements of its relationship to system effectiveness and the links between operational effectiveness and system effectiveness, but it is also important to consider how organizational factors and strategies affect this relationship or linkages.

Operational Effectiveness

An increasing number of factors are prompting organizations to seek to operate more efficiently and to ensure they have effective operational processes [8] [24]. This involves the need to deliver value-adding products or services of exceptional quality, on time, at a competitive price. Thus, organizations attempting to meet these objectives need to pay attention to their operational effectiveness as this is a primary driver of business performance [24]. Operational effectiveness refers to the ability of setting processes, based on core capabilities within the organizations, which work well [18]. Operational effectiveness involves improving process performance by leading and controlling the processes within the firm as well as measuring and improving the processes. A better use of resources through these core processes enables the organization to eliminate waste, adapt more appropriate technology and therefore perform better than competitors [18].

The five performance dimensions or objectives an organization seeks to fulfill to attain operational effectiveness include cost, quality, flexibility, speed and dependability [8]. Creating competitive advantage is not an overnight task, thus excelling in some of the objectives and being competitive in each of the others give an organization an edge in the market. Competing on cost means that a firm seeks the elimination of waste which comes from efficiencies attained in processes such as purchasing, production, and staff performance. An appropriate disaggregation of the cost components impacting on the total cost performance of an organization gives the opportunity to identify the areas for improvement [24]. Furthermore, competing on quality provides an opportunity to bridge the gap of what organizations are capable of offering and what customers demand. That is, viewing quality as a consistent provision of products and services that satisfy customers rather than only minimizing defects and conforming to specifications without any clear market orientated continuous improvement. The third operational performance objective concerns being flexible which includes an organization's ability to adjust (what it does, how it does and when it does) to changes to respond to customers [23]. Additionally, competing on speed prompts an organization to be able to shorten the time between the service or product requesting and service or product reception and to deliver a product or service with the frequency and at the time that a customer requests [8]. Finally, reliability suggests that firms' processes consistently perform as expected over time. That is, customers being satisfied by organizations that produce goods that do not fail over a period of time or with services that are delivered as has been agreed [18].

Once an organization has identified what needs to be measured, it needs to answer the question, how will it be measured? This concerns the incorporation of some steps that look at different stakeholders of the organization as sources for improving performance which leads to competitiveness. The first component relates to the need for measuring performance from data available at the interior of the firm as well as from more valuable and richer data outside the organization including customers, suppliers and competitors. For instance, flexibility can be measured internally by the ability to change a procedure

for a service whereas flexibility can be measured through external measures as the ability to offer more customized services. Type of data is the second step of how performance will be measured and focuses on whether the data to be collected will be based on opinions and perceptions, usually external to the company, or based on observable facts, most likely more objectives and from inside the organization [29]. Source and type of data is followed by the establishment of benchmarks, that is, comparing with the competitors or comparing with other areas within the organization. Benchmarking provides a systematic way of setting targets for improvements based on best practices [8]. The final step suggested by White [29] encompasses measuring both process inputs and process outcomes.

Some of the reasons for measuring performance encompass the improvement of productivity, identifying if planned improvements actually happened [8], encouraging a long-term thinking perspective, and supporting and enhancing improvements, as well as better resource allocation. Other research suggests that due to factors impacting on organizations during the last decade such as the increasing changes in the business environment, increasing competition, changing organizational roles and changing external demands have been prompting organizations' need to have a more holistic and proactive approach to performance measurement. This holistic approach involves the setting of performance measures by considering not only the shareholders and customers needs, which to a great extent is included in by Kaplan and Norton's [10] balance score card framework, but also by taking into consideration other stakeholders.

The framework (shown in Figure 1) of Santa, Ferrer and Hyland [19] emerges from the reviewed literature and depicts the balance that should exist between system effectiveness and operational effectiveness. The framework links the two parent theories of information systems and operations management.

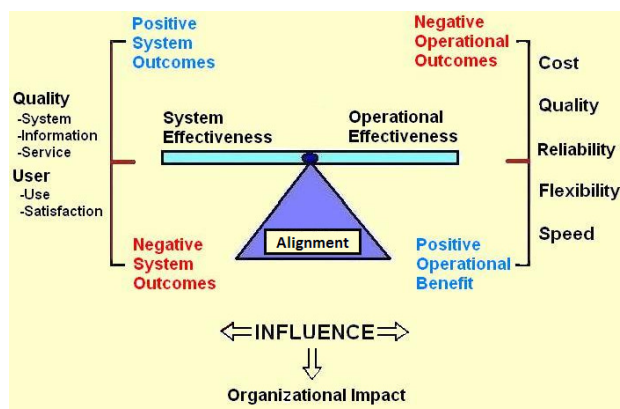


Figure 1: Aligning system effectiveness and operational effectiveness

RESEARCH ISSUES AND METHODOLOGY

Given the exploratory nature of this research, case study was adopted as it is useful for studying a contemporary phenomenon in a real world context and creating and refining theory [5]. Case research moves away from rigor towards practicality, which may suggest more relevance for practitioners. This research uses the interpretivist philosophical perspective and its particular implications for data collection and analysis methods and research outcomes [30]. The interpretivist approach is commonly used by social science as its emphasis is on empathetic understanding of human behaviour and actions [28], and it attempts to understand phenomena through meanings that people assign to them through processes where the information system influences and is influenced by the context [21].

To ensure the rigor and accuracy of information, this case study research uses unstructured interviews to identify preliminary issues and variables that were then investigated in more detail using semi-structured interviews. To provide triangulation, companies' documentation related to the information strategy and post implementation reports were analyzed [20] [21], and semi-structured interviews were conducted to gather data required for the discussion process. The interviews were conducted with 8 stakeholders including 3 managers, 2 engineers and 3 general staff employees. The sample was purposive and was selected in order to cover a range of possible view points and all of the interviewees are users of EIS applications [20] [21]. Thematic analysis was used to identify factors relevant to the research [21].

THE CASE OF AN ELECTRICITY DISTRIBUTOR AND ENERGY RETAILING COMPANY

The organization consists of an operating electricity distribution business, and a subsidiary which operates the energy retailing business. The distribution business's primary focus is on meeting the increasing demands of customers, regulators and shareholders in relation to the electricity network, which consists of around one million poles and 150,000 kilometers of power lines, covering over one million square kilometers. This work includes the implementation of significant programs to improve the quality and reliability of electricity supplies across the region where the company is established. With a total asset base of \$5.6 billion, and more than 3,500 employees, the case study organization services around 600,000 customers across its vast service area.

In the mid 1940s the federal government conducted an inquiry into the electricity industry. At that time they promoted the concept of regional authorities which were then established in 1947. In the 90s the Government again reviewed the industry resulting in the introduction of the national grid requirements. Their purpose was to fundamentally centralize the smaller generating authorities that were involved. With this

centralization the case study organization has assumed the responsibility of being the overall umbrella for all of those regional authorities and is now the state's mayor electricity distributor and energy retailing business.

RESULT

The fact that the study organization has evolved from several small regional authorities, raises some issues that have affected the normal development of a standard business as each regional authority has their own infrastructure and organizational factors. This makes it difficult to develop a synchronized merger. The interview process revealed that different cultures are operating at the moment in the organization. Also the use of legacy systems makes it difficult to ensure the total integration of processes in the implementation of the EIS. The predominant culture is a technical culture as the organization has large numbers of engineers and technical staff. There is also a managerial culture that focuses on cost reduction and financial issues. An operational culture exists across all regions amongst staff in the field. Each of the different cultures or subcultures has different values, views and beliefs about what is important to the business and their group.

The literature argues that the forced amalgamation dictated by the federal government was expected to bring benefits such as economies of scale, because they usually refer to a decrease in average cost as the quantity of outputs rises [4]. With the merger of several regional authorities, the umbrella organization has evolved into a bureaucratic territorial departmentalization where a grouping of subunits bring services according to the geographical area [4]. Other issues that arise with the amalgamation are: poor managed synchronization and coordination of the transition from regional authorities to a single organization. Equally, there is evidence of miscommunication due the wide area covered by the new organization and the difference in cultures, poorly defined corporate and information systems strategy. As a manager with an engineering background claimed, "there is a corporate and IS strategy but some functional areas are more developed than others, and there is a disconnection and lack of understanding between functional areas." (Respondent E). This miscommunication has resulted in a lack of consideration by managers of the link between EIS and organizational performance. From interviewees comments it is apparent that the impact of EIS implementation on organizational performance is rarely considered. Also, the literature discusses that if the company's EIS fails to support its organizational system, the result is a misalignment of the resources needed to achieve its goals. Successful firms have an override business strategy that drives both organizational strategy and IS strategy, also known as strategic triangle [18]. Successful organizations carefully balance these strategies. The case study organization has

failed in setting the three strategies together. Moreover, the implementation of IS strategy is itself problematic and should be dependent on organizational characteristics; it should support business goals. Before moving to establish IS strategy, it is essential that the role of IS in the organization is defined from the perspective of the multiple key stakeholders. Key stakeholders have different perceptions of what role EIS plays in the organizations. Moreover, risk management issues associated with multiple EIS, confused EIS ownership, IS policies poorly defined and articulated are identified as important issues by the interviewees.

The interviews and analysis of some organization's documents confirms the existence of the dimensions for systems effectiveness and operational performance described in the Figure 1 framework [20]. The respondents identified a linkage between the quality of information and quality of operational service, for example, "I suppose the challenge to our organization, is to actually provide the best benefit for the usage of our EIS application, by actually improving the quality and accuracy of our data and in this way we can speed up the decision making process which will improve the quality of the network maintenance." (Respondent D). Likewise, some issues like lowering transaction costs and poor quality of information emerged from the conversation. For example, "The implementation of the new system is helping in decreasing the cost because you only have to fix the data up in one system once, whereas before we had 3 or 4 systems to have to fix the data in. We can't yet rely on the quality of the information, but at least it's in one place. We've got an initiative we call a data quality framework that's intended to improve the quality of our information." (Respondent E). Similarly, the subject respondents indicated that there is an ineffective asset utilization of the systems as there is lack of trust on what the new centralized system is giving to some users: "The system falls back a little bit on the fact of our accuracy and the quality of the data is pretty shocking at the moment, in some areas, like in completeness or being able to get the right data. My role is sitting back looking at everything that we have in the secondary systems and trying to see where we may have an aging population of equipment and I can specifically hone it down to where each and every one of those pieces of equipment is located. At the moment that's not as clear, it's a bit fuzzy, simply because the original organization was being formed from all of the Electricity Boards; not everyone had accurate information. So, we've inherited that sort of level of accuracy ... or they could have no data at all. In some cases, no data is probably not as bad as misinformation or having the wrong data." (Respondent D). The interviews in addition reveal the need to incorporate organizational factors like culture, politics, strategies and structure in the model. In this regard, a manager of the organization pointed out that "Unfortunately, politics has always made a big impact because we have a big impact on politics. As we are a government owned organization, we depend on the decisions of politicians and on what they think is the best option for our organization". Both the internal

organizational politics and the external government politics impact on organizational performance.

The Figure 1 framework [20] used in the study organization, reflects that the implementation of the new EIS has failed to deliver good quality of information, and stakeholders at different levels are concerned with this issue as they cannot rely on the information provided by the system in the decision making process. We also identified poor reliability and user dissatisfaction with the EIS application. The operational effectiveness of the organization is also seen as having negative outcomes. Firstly, the organization is operating at high cost as it is not possible for stakeholders to rely on the quality of information in the decision making process and also that inaccuracy of information affects negatively the maintenance of the network. Some interviewees pointed out that the operations of the case organization are not cost effective. Nevertheless, there are some positive outcomes such as the decrease in the number of transactions as the data is in one repository. In addition to high cost, figure 2 [20] reveals other issues like: the quality of services needs to be improved, poor reliability, poor flexibility and poor speed. Figure 2, also demonstrates that an imbalance between system effectiveness and operational effectiveness, results in negative operational outcomes to the case study organization.



Figure 2. The impact of organizational factors on an aligned system.

The organizational factors identified in figure 2 results in negative system outcomes that lead to imbalance and negative operational outcomes.

III. CONCLUSIONES Y RECOMENDACIONES

Las The interviews and analysis of the organization's documents on one hand, reveals a lack of performance measurement by the organization. There is no evidence that the organization could demonstrate a linkage between the EIS and organizational performance. However, the research also reveals that stakeholders are aware of the performance objectives depicted in the framework used to analyze the organization. On the other hand, the most

influential organizational factors in the balance between system effectiveness and operational effectiveness were culture, strategies, politics and structure for the organization. The organization has started the process of implementation of the new EIS. Nevertheless, it seen as a negative experience because the implementation process was undertaken incorrectly and resulted in many unexpected problems due to the influence of politics, the lack of appropriate IS strategies, and differing cultures. The organization was not prepared for the change that the new EIS brought during the adoption; also it is not using the EIS correctly or successfully.

Information systems must support business goals, and also the organizational systems. There are a number of steps that need to be performed before IS strategic policy is investigated and implemented. If the EIS is to have a strategic role as discussed above, those setting IS strategies must begin by understanding how other stakeholders see the role of IS. Key stakeholders include: senior executives, board members, the government, senior departmental managers, users, engineers, field staff, and IS department. Based on the current view of key stakeholders, the IS department must define the role that IS must have and achieve in the organization, if the organization is to grow and improve its performance. The IS strategy must be linked to the organizational strategy and performance indicators. Strategy begins by defining what the role must be of EIS, at present, in 5 years and in 10 years. Beyond scoping roles, a bottom-up definition of core IS a function is required. Once the role and functions of IS have been identified, it is essential that objectives are identified and performance targets defined that will allow IS to demonstrate its strategic value and importance to the organization. In setting objectives, IS has to determine the role that it will play and what functions need to be delivered to achieve the performance targets set. The research and analysis of documentation indicates an awareness of this by top managers of the organization. However, it is important to emphasis that results indicates that in uncertain environments subject to ongoing change, a phased information strategy implementation is more successful (or less risky) than single-step organizational change. As part of this process, the organizations needs an overall business strategy that drives both organizational strategy and IS strategy, and carefully balance these three strategies.

This research has demonstrated that the relationship between operational effectiveness and system effectiveness is important, because an optimal balance has a positive influence on the bottom line. The main concern for the organization is to reduce and control increasing cost and allocating resources. However, the identification of appropriate systems dimensions and performance objectives becomes essential for continuous improvement. Competition is constantly increasing so business and corporate strategies should be supported by this balance. Furthermore, organizations need to understand their operations, and adapt the systems to the operational requirements. Also, causes of user dissatisfaction should be estimated, information

outcomes should be properly assessed and finally, the performance of operations and systems should be properly evaluated, because if organizations do not pay attention to these issues, they are more likely to continue allocating resources on EIS that do not make business sense. The solution is based on enhancing the effectiveness and efficiency of operational and system processes in a balanced approach.

This exploratory study reveals the need to incorporate new constructs in the framework which influences the optimal balance between system effectiveness and operational effectiveness when implementing any EIS. Also it is important to explore more confirmatory interviews and statistical analysis to test the different linkages among system effectiveness, operational effectiveness, and the organizational factors that influence them.

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