

## ENTERPRISE RESOURCE PLANNING SYSTEM IMPLEMENTATION: INVESTIGATING THE PROCESS OF CHANGE

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Changes associated with Enterprise Resource Planning (ERP) system implementation are investigated through system user interaction, system work practices, organisational culture, and different aspects relating to organizational change. Based on a multi-disciplinary literature review, several approaches, models and variables for managing change were identified as being vital when implementing ERP systems. Primary data was collected with a survey administered to respondents directly affected by ERP implementation. Data analysis which included descriptive and inferential statistics revealed that respondents perceive ERP system implementation to have been managed fairly well and that system implementation does produce benefits towards the work environment. However several change variables were often neglected when implementing ERP systems. Conclusions and recommendations follow the empirical findings and it is suggested that employees be empowered when implementing new systems such as ERP which bring about substantial change initiatives.

*Key phrases: Enterprise resource planning, change management, implementation, organisational culture*

### 1 INTRODUCTION AND RATIONALE OF STUDY

By all accounts, it seems the pace, magnitude and direction of change will continue to accelerate in this 21<sup>st</sup> century, with organisations adapting to these changes, assuming a more powerful and prominent role in many countries and economies around the globe. One of the most important lessons of the past decades is that adaptability and knowledge management are the fuel for global competitiveness and firm growth. Developing, nurturing, sustaining, and cultivating this knowledge are among the most important ways societies can achieve economic growth and social development (Whetten & Cameron 2005:491).

One of the pillars of effective and efficient management is based on useable information for decision-making. This activity falls in the realm of information management and is considered one of the critical management focus areas in any organization. Organizations, currently operating in the knowledge economy will be familiar with the characteristic shift in value from technology and physical assets to information and knowledge management. Well-conceived information management that integrates people with processes and technology often allows for a breakthrough in creativity and improves levels of productivity (Erasmus 2002:2). Enterprise Resource Planning (ERP) systems are part of information systems which organizations depend on when conducting their business. ERP systems offer useful

functionality in the smooth running of an organization (Simpande & Jakovljevic 2003:16).

ERP is broadly conceptualised as an accounting oriented information system for identifying and planning the enterprise resources required to take, make, ship and account for customer orders. Moreover ERP is defined as "a total software information system consisting of one common database which serves the common needs of all the departments or facets of an enterprise, operating as far as technologically possible, on real time Electronic Data Information (EDI) feedback" (Smit 1999:7).

ERP evolved from Material Requirements Planning (MRP) and Manufacturing Resource Planning (MRP II), in order to meet the needs of industry and was named by the Gartner Group of Stamford, Connecticut, USA, in 1990. Since then, the ERP market has expanded worldwide reaching in excess of about \$70 billion (Yu 2005:115).

Once adopted within and across organizations, ERP systems achieved the integration of such business functions as accounting, sales and marketing, operations and logistics, and human resources. ERP systems are built on a single database that enables modules to share data, thus speeding up the information flow within organizations.

Technology applications such as ERP, e-Procurement and data warehouses allow for optimisation of operations by improving efficiency and effectiveness in an economical manner (Scott 2000). ERP provides organizations with integrated manufacturing operations, placing a new emphasis on customer satisfaction involving quality, speed of system response, flexibility, agility, and local content (ERP-TWR 2004:6). Today's ERP systems integrate various levels of functionality within an enterprise, expanding from back-office to front office to integrated supply chain management.

Some of the factors driving organizations to consider the use of ERP systems include the need to service customers in a more personal and individual way, the pace of technological development, and striving to achieve a sustainable competitive advantage (Daft & Marcic 1998:43; Erasmus 2002:3).

The critical question this study investigates is which organisational change variables facilitate or hinder ERP implementation. This paper proceeds as follows. First a brief literature review on the major variables under investigation is conducted. Then the

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research design which includes sampling and measurement issues is discussed. Following empirical investigations, data is analysed using descriptive and inferential statistics. Lastly the empirical findings are integrated with the theoretical analysis and recommendations and implications are made based on the study's findings.

## 2 ERP IMPLEMENTATIONS

Based on empirical evidence on ERP implementations in South Africa, such initiatives have been largely unsuccessful (Das Neves *et al* 2004:46), as they appear to neglect change management principles, which are advocated to help implement ERP systems and overcome employee resistance to change. Similar findings (Scott 2000) have also indicated that change management initiatives could improve the implementation process, successful implementations can provide real business benefits and sustained performance, whereas an unsuccessful implementation may have disastrous consequences.

Reasons are typically offered as to why ERP systems fail, and include: (1) Education - not understanding what the new system is designed to achieve. (2) Lack of top management commitment - management being involved but not dedicated. (3) Inadequate requirements definition - current processes are not adequately addressed. (4) Poor ERP package selection - the package does not address the basic business functions of the client. (5) Inadequate resources employed by the client. (6) Internal resistance to changing the "old" processes. (7) A poor fit between the software and users procedures. (8) Unrealistic expectations of the benefits and the ROI. (9) Inadequate training - users do not properly know how to use the new tool. (10) Unrealistic time frame expectations. (11) A bottom up approach is employed - the process is not viewed as a top management priority. (12) The client does not properly address and plan for the expenses involved (ITtoolbox 2004). Das Neves *et al.* (2004:48) describes the major problem areas in selecting and implementing the correct ERP system as: (1) Inadequate financial research, (2) Functionality constraints, (3) Time constraints, (4) Skill constraints, (5) Complacency, (6) Selection committees, (7) Scalability, (8) Role of consultants, (9) Vendor influence.

Not only must obstacles to ERP implementation be successfully overcome but as Calitz and Calitz (2000:98) recognise that implementation of ERP systems in an organisation are a large investment and entails change in current business processes and practices.

Moreover the initial costs include the cost of the ERP itself, the training of personnel for the new procedures, the development and debugging of the systems and programs, the design of forms, the development of a data base, and the cost of electronic data processing equipment. Other costs which are often neglected are costs that need to be considered for more mundane items, such as file cabinets, card holders, and wall-mounted charts. Operating costs as those associated with forms administration, data capturing, computer processing, report preparation, report utilization, report storage, and system and software surveillance, are all necessary considerations in ERP implementation. Associated costs with personnel time required to reduce the confusion that is often commensurate with implementation and to overcome the resistance to change, also need serious consideration. The ability to estimate these costs grows exponentially with experience in change evaluation and implementation (Fogarty *et al* 1991:728). Simpande and Jakovljevic (2003:17) find that the people aspects of implementation of ERP systems, i.e., executive sponsorship, change management and user participation, have a significant impact on the implementation process.

Developing dynamic organisational fitness (DOF) has been advocated for both adaptive and proactive change processes. DOF is described as a range of organisational capabilities driven by purposeful goals (Voelpel, Leibold & Habtay 2004:42). However substantial trade-offs are involved in trying to simultaneously develop fitness capabilities and outstanding performance - as is the case with ERP system implementations. Nonetheless it is argued through the DOF approach implementing capabilities is less about trade-offs and more about leaders strategic thinking.

It has been suggested that the success of an ERP implementation can be evaluated against a set of key performance indicators and critical success factors. Success factors identify possible implementation problem areas and allow for successful implementation criteria to be established. Five critical success factors for ERP implementation have been identified, these include: the executives of the firm, environmental and cultural assessment, nine-process change enablers, a structured methodology and a change management program. The nine-process enablers are people, education, communication and marketing, organisation structure, organisation culture, funding, information, information and technologies. By most accounts people are by far the most important process change enablers, and organisations implementing ERP need to consider changing from a functional approach to a process based approach, which means the role people play in this process is critical (Calitz & Calitz 2000:97).

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Typically during implementation of ERP systems, much more time is spent on the non-human aspects of the development and implementation of technological change than on the employees, who are, after all, responsible for the operation of such systems. This neglect of the human aspect with regard to change can be improved by means of research into the behavioural sciences and how individuals, teams and organisations respond to change during implementation of new systems (Gerber *et al* 1998:490).

### 3 CHANGE MANAGEMENT RELATED TO ERP

The change management literature is voluminous and the purpose of this section is not to provide a generic review, but instead to focus on change as it relates to ERP implementation.

Change management has been described as the process which requires tools and techniques to manage the people-side of business in order to achieve the required business outcomes and to realize that business change fits effectively within the social infrastructure of the workplace (Hiatt & Creasey 2006:7). Succinctly, Recklies (2001:1) defines change management as the “means to plan, initiate, realize, control, and finally stabilize change processes on both the corporate and personal levels”. Hiatt and Creasey (2006:9) view the change management process as allowing practitioners to separate change management as a practice area from business improvement techniques. So whether one is practicing techniques such as the Six Sigma, Business Process Reengineering (BPR), or Total Quality Management (TQM) to improve business performance, change management can be viewed as an essential managerial competency when implementing any such systems.

Van Tonder (2005:40) considers organisational change based practices from the perspective of several change management models, which may be used as a means of structuring and guiding ones thinking and actions during organisational change. Change is always daunting but if organisations keep up with the fast pace of the technology implementations they may be one step ahead of competition (Brits 2006:64). Organisational culture in a culturally diverse context such as South Africa has also been identified as integral in terms of how management aligns people's beliefs, culture and values (Sales 2006:76). Laudon and Laudon (1996:56) express similar sentiments when they assert that enterprise-wide computing is an opportunity to re-engineer the organization into a more effective unit and that it will only create problems or chaos if the underlying organizational issues are not fully addressed. IT-based change is about process change. It involves people doing different things in

different ways with different inputs and different outputs. New or improved information technology systems are brought in to either increase efficiency or allow innovation to occur, not to simply automate what is already there, so process change almost always occurs (Cameron & Green 2004:256). Such new systems are more suited to an emergent strategic approach as advocated by Weeks (2007:116), where culture needs to facilitate participation and enable employees to make sense of contextual conditions that arise at the peripheral edge. Employees interpret organisational change in terms of cultural determinants which are largely entrenched in the past. Visionary leadership is proposed by Tsosa (2004:98), as the solution to ensuring an interactive role between culture and strategy.

Cameron and Green (2004:256) describe the two different approaches to process change as the Business Process Re-engineering (BPR) and Socio-technical design. The latter model views organisations as entities with complex relationships within their social systems. This model emphasizes grouping jobs by team when the reciprocal and/or sequential interdependence among jobs can not be reduced. Hellriegel and Woodman (2001:463) further describe the social system of an organisation as comprising of aspects in terms of its "human side" that can influence how individuals and teams perform tasks and their attitudes toward work and the organisation, i.e. if employees characterise their organisation as one marked by distrust, backstabbing, and infighting, the creation of work teams or implementation of systems is likely to be counterproductive until some degree of trust and cooperation can be established.

The introduction of IT-based business solutions for dealing with the complexities of evolving business realities within a global economy does not come without unintended consequences. These consequences are often reflected in resistance by members of the organisation to change as people need to move from well-entrenched methods to adopt new procedures, processes and practices. Business process redesign may well embody drastic changes in a work flow process, an automation of activities, or even a redesign of established organisational structures, all of which translates into change (Weeks 2002:97).

Despite the widespread adoption of ERP systems and corresponding benefits, Aladwani (2001:266) finds that many ERP systems fail and face implementation difficulties because of workers' resistance to adapt to changes. Hammer (2001:3) asserts that over the years innumerable technology projects fall short of their goals because they fail to grasp the reality of managing change and selling the concept inside the company. In many instances, the critical problems were not technical, but

rather the 'software' or people side, which has been neglected and the implemented system is resisted.

Human resources play a major role when business tools such as an ERP systems are implemented, more so in an environment where companies have to adapt to cutting-edge technological changes. Since both firms and employees invest a large amount of time and effort in acquiring relevant skills and capabilities to cope in a modern knowledge intensive environment, pressure to change and adapt to new system requirements are often viewed as infractions to the employee's identity and reality, especially when the changes are forced upon externally by top management (Schabracq *et al* 2003:34).

#### **4 RESEARCH DESIGN**

The design of the study was largely exploratory and cross-sectional, where data was collected from a survey of structured questionnaires. Exploratory studies are a valuable means of finding out what is happening and to ask questions and assess phenomena in a new light (Saunders *et al* 1997:78). The theoretical foundation established during the literature research allowed for a frame of reference to emerge and significant factors leading to successful implementation of the ERP systems were identified and categorised into a structured instrument.

##### **Sampling and Data collection**

A judgemental sampling method was employed, referred to as non-probability sampling and is used when a sample is selected and certain judgements are made on the overall population. The frame selection process for this study can be viewed as a trade-off between practical considerations on the one hand and the demands of randomization and generalizability on the other. This method allowed for a judicious selection of respondents where participants were willing to be involved in the study (Saunders *et al* 1997:145). The sampling frame was the entire staff complement ( $n= 183$ ) at SAAB Avitronics Technopark. Not all employees were affected by the ERP system implementation, and subsequently a sample of 77 personnel that were directly and/or indirectly affected by the ERP system implementation was selected as the final sample.

Sometimes the case for representativeness of judgmental sampling may be strengthened by explicit comparison of sample characteristics with those of defined population, and under such circumstances, the most feasible course of action is to describe the sample characteristics in detail with reference to those factors that may

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impact the results of their interpretation. Hence, what follows is a brief rationale as to why the selected sample is relevant to this study.

An organisation that typifies knowledge intensive systems and has extensive reliance on ERP systems is SAAB Avtronics (Pty) Ltd; a company specialising in the designing, development and production of self-protection electronic warfare systems and associated products for air, sea and land based applications. It is a firm with a varied customer base in Europe, the Middle East, and Africa, and has been supplying specialised equipment to the ever increasing and fast changing technological demands of the modern warfare world market.

Investigating this company's business model reveals that the company invests heavily in imported inventory and manufactures equipment in advance of projected sales to maintain a healthy position in the market. The market it serves depends on the abilities to conceive, design and manufacture specialised design, development and manufacturing systems. To optimise the company's profitability, it needs to conduct accurate costing of the manufacturing processes and to make the right decisions regarding capital investment in inventory, and forecast market trends to anticipate changing needs. The solution to handle this has led to a greater need for flexibility to allow for expansion and to empower staff with correct answers during periods of rapid exchange rate fluctuations. The application system that SAAB Avtronics (Pty) Ltd utilised in the past indicated that management had very little idea of what the real cost of the assembly process was. The same problem was evident in the inventory costing, where the application was unable to accurately calculate standard cost values for all the product ranges. The company was also faced with the challenge of delivering the systems on time and at the right price and quality. This meant manual planning would be very difficult and a requirement for a system that would resolve these issues and also assist with planning became a compelling requirement.

### **Measuring Instruments**

The questionnaire was designed with the purpose of determining the extent to which change management factors have been employed to facilitate a transition from the old ERP system to the new ERP system implemented. Based on the variety of items surveyed the scales employed to measure the concepts, provided both an absolute measure of importance and a relative measure (ranking) of the various items rated. As gleaned from the literature review, these variables are delineated by several items, which include: system and work practices, organisational culture, and company strategic direction. This wide based approach allowed the researcher to

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gain understanding with respect to respondents' attributes, attitudes, beliefs and behaviours towards the process of ERP system implementation and related change management practices.

A self-administered questionnaire was sent to the respondents to complete anonymously and return to the researcher. All ratings and responses were kept confidential. In order to ensure the instrument had face and content validity, a preliminary analysis via a pilot test was undertaken. This process allowed the researcher to refine the questionnaire design to maximise responses. Saunders *et al* (1997:269) describe the purpose of the pilot testing essential, so that respondents will have no difficulties in answering the questions and there will be no problems in recording the data.

## 5 RESULTS AND INTERPRETATION

Frequencies and descriptive statistics were calculated for the different instrument sections which yielded the following results. Demographics indicate that 62% were male and 38% were female respondents; age groups indicate that 9% were less than 25 years, = 52% were 25-40 years, and 39% were older than 40 years. Moreover many of the respondents (70%) have acquired a tertiary qualification which is in line with the organizational technical expertise requirement. The sample was representative with respect to participation of different company departments - production, quality, marketing, development, configuration and finance, indicating that ERP implementation is a company wide initiative (refer to table 1). The majority of responses stemming from the production department indicated that the production department is most affected by the implementation of the ERP systems. The production department is the main driver for organisational output and the other departments play a supportive role in ensuring these performance outcomes. Table 2 indicates the number of respondents per job level, which indicates that the majority (61%) of respondents are classified as under-skilled and semi-skilled employees.

Table 1: Number of respondents per department

Functional area	Count	Percentage
Marketing	2	3
Configuration	3	4
Program Office	6	8
Research & Development	7	9
Finance	13	17
Production	45	60
Total	77	100

Table 2: Number of respondents per job level

Job Level	Count	Percentage
Senior Management	4	5
Junior Management/Supervisor/Foreman	5	6
Program Office	7	9
Mid-management /professionally qualified/Specialist	14	18
Skilled Technical/Academically qualified	22	29
Semi-skilled	25	32
Total	77	100

Table 3: Descriptives for ERP system and work practices

Variable description	Rank Count	Mean	Std Deviation	Two-low	Two-top
ERP system has fulfilled its purpose	40	3.15	0.14	24%	28%
The system is an important part of your work	40	3.90	0.14	5%	67%
The way you initiate/facilitate a task has changed significantly	37	3.73	0.13	5%	65%
Your work practices are deeply ingrained in ERP	39	3.67	0.15	10%	57%
ERP implementation generated role expectations in your work practices	37	3.05	0.14	30%	16%
The change to MRP system benefited your work practices	38	3.42	0.18	21%	53%
The change to MRP system will benefit your work practices in the future	39	3.79	0.15	8%	66%
The transition/change has been managed by the company successfully	37	3.19	0.15	16%	43%
The company has been always emphasizing the importance of this change	38	3.13	0.16	26%	42%

Based on table 3, the mean scores for all the variables were above the midpoint on the 1-5 Likert scale, which indicates that respondents perceive the ERP system implementation has been managed fairly well and that the implemented system does yield benefits towards the work environment. Although respondents indicate they have confidence with respect to the implementation process, not all were totally convinced that the system was working to its full potential and thereby fulfilling its purpose within the organization (only 28% of the respondents using the system rated this item as relatively high). However in terms of the ERP system as being essential to overall work practices, the majority (68%) of the respondents rated this item as highly relevant.

Table 4: Descriptives for organizational culture as a change factor

Variable description	Count	Mean	Std Deviation	Two-low	Two-top
You regard yourself as a team player	73	4.34	0.80	4%	92%
You feel that your department has your best interests at heart	67	3.03	1.17	28%	38%
Company employees (admin/engineers/production/mgmt) share a common culture	67	2.87	1.06	31%	31%
Company employees (admin/engineers/production/mgmt) share a common goal?	69	3.07	1.08	22%	36%
Your department (admin/engineers/production/mgmt) share a common culture	69	3.33	1.23	26%	52%

Based on table 4, with reference to organizational culture having an effect on system implementation, a high percentage of respondents indicate they share a common purpose and act as team players. Nonetheless, respondents are divided on the issue of a shared common culture within the organization. There is support for the notion that strong sub-cultures exist in the organisation, with respondents scoring relatively moderate-high (36% and 52% respectively) on the shared common goals and culture within their respective departments.

Table 5: Descriptives for shifting objectives as a change factor

Variable description	Count	Mean	Std Deviation	Two-low	Two-top
Change in goal setting influenced the way you work	28	3.57	1.17	15%	64%
Change in objectives impacted the way you approach things at work	45	3.16	1.04	25%	44%
Change in objectives impacted negatively on the way you perceive the role you are playing at work	42	2.29	0.89	74%	12%

With reference to table 5, for shifting objectives, respondents seem to confirm previous literature findings in that the implementation of such a system within the organization impacts on the employee work performance and attitudes. This is demonstrated by a high rating of 64% on employee changes in goal setting as a result of the ERP system implementation, and the 44% on the way employees are now approaching things differently in their work environments.

Analysis of variance (ANOVA) was used to determine any significant differences on the change variables, with the respondent's different age groups (18-25, 25-40, and 40-55) used as the dependant variable. Generally age is a relevant indicator in

system implementations since the level of experience and maturity of employees would determine responses to ERP changes.

ANOVA results indicate the respondents have different opinions with regards to the negative impact that ERP system implementation had on them, particularly with regard to the way they perceive their new roles within the system. For the organisational culture and work practices variables no differences were detected. Based on tables 6-8, the ANOVA tests indicate no significant differences, apart for the shifting objectives. It seems the respondents have different opinions with regards to the negative impact that the ERP system implementation has on them, particularly in relation to the way they perceive their new roles within the reconfigured system.

Table 6: ANOVA for system and work practices based on age groups

Variable description	F	F crit	P-value
MRP system has fulfilled it's purpose	0.26	3.25	0.769
The system is an important part of your work	0.73	2.86	0.536
The way you initiate/facilitate/ approve a task has changed significantly	2.69	3.27	0.081
Your work practices are deeply ingrained in MRP processes	0.86	3.25	0.429
MRP implementation generated vague role expectations in your work practices	0.04	3.27	0.957
The change to MRP system benefited your work practices	0.94	3.26	0.399
The change to MRP system will benefit your work practices in the future	0.1	3.25	0.901
The transition/change has been managed by the company successfully	1.04	2.891	0.383
The company has been always emphasizing the importance of this change	1.62	3.267	0.211

Table 7: ANOVA test for organizational culture based on age groups

Variable description	F	F crit	P-value
You regard yourself as a team player	0.06	3.12	0.937
You feel that your department has your best interests at heart most of the time	1.86	3.14	0.163
Company employees (admin/engineers/production/mgmt) share a common culture	0.05	3.14	0.948
Company employees (admin/engineers/production/mgmt) share a common goal?	1.07	3.13	0.346
Your department (admin/engineers/production/mgmt) share a common culture	1.42	3.13	0.248

Table 8: ANOVA test for historical research based on age groups

Variable description	F	F crit	P-value
Change in goal setting influenced the way you work	0.52	3.38	0.599
Change in objectives impacted the way you approach things at work	2.22	3.21	0.120
Change in objectives impacted negatively on the way you perceive the role you are playing at work	4.48	3.23	0.017

## 6 CONCLUSIONS AND RECOMMENDATIONS

Based on the overall empirical findings it may be concluded that change management initiatives are pertinent to an organization that is implementing IT-based solutions that have a business process re-engineering effects, such as ERP systems.

Based on the survey results, generally the respondents indicate that, with ERP system implementation, the organization under investigation has managed change fairly and that the system implementation does yield some beneficial results towards their own work environment. Respondents had confidence in the overall implementation process, and scores reveal that the implementation process has been managed satisfactorily. Nonetheless not all respondents were totally convinced that the system was working to its full potential and thereby fulfilling its purpose within the organization, since approximately only a third of the respondents using the system rated these as successful. Generally the results reveal that the majority of respondent's rate ERP systems are an essential part of work practices.

Even though the results from the empirical study indicate that involvement of employees in the change management process is vital to introduce and sustain ERP system implementation, many respondents are divided on the issue of shared common culture within the organization. Similarly with the issue of the strategic direction of the company being linked with the operational goals of the organisation, the results reveal that nearly half of the respondents are not aware of company strategic directions. Additionally, 84% of the respondents felt that the organisation should communicate these company strategic directions more often.

The importance of the study is clear in that investigation into this under-researched – yet crucial – aspect of ERP implementation and related change issues, can assist firms in considering the significant factors influencing this change process. Although majority of companies focus on technical aspects and skills required in ERP implementations, this study will help to highlight that companies need to recognise change management as pivotal when evaluating or implementing ERP systems.

Practitioners can benefit from these findings in terms of implementing an ERP system. Specifically it is recommended that employees be empowered by being involved in establishing new processes and procedures. This strengthened involvement will positively contribute to the implementation process, and allow for employees to add value and participate in decision-making processes.

### **Study limitations and further research**

Based on the study's restricted sample size and the limited representativeness of the sample, definitive conclusions cannot be extrapolated across industries and/or similar change initiatives. Furthermore the use of a survey as a primary data collection method implies certain limitations, such as self-reporting may have resulted in over inflated responses in some instances. Future research could possibly develop a model for ERP change implementation by empirically testing variables which have direct and indirect effects on change implementation issues.

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