Implementing ERP through SAP R/3: A Process Change Management (PCM) Perspective

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Abstract. Enterprise resource planning (ERP) systems are increasingly considered as the technical platform for many business process change and improvement projects. Current research theories that have been adopted to understand the ERP phenomenon do not directly and comprehensively address the change issues involved in ERP implementation. This paper suggests the use of a process change management (PCM) perspective to explore the ERP phenomenon. A framework is therefore adopted to highlight the various PCM constructs in the context of SAP R/3 implementation. Evidence on how these constructs are operationalized in practice is drawn from a large collection of R/3 case studies representing various organizational experiences. The paper provides foundation and recommends several ideas for future research and investigation.

1. Introduction

The recent development of enterprise resource planning (ERP) systems (e.g., SAP R/3, BAAN and Oracle) has taken both the academic and business community by storm. ERP systems are described [1, p.22] as:

> "...configurable information systems packages that integrate information and information-based processes within and across functional areas in an organization."

ERP systems provide a completely integrated and competency-centered, multifunction and global business tool. In particular, SAP R/3 has been the leading vendor in the ERP market. Its application has spread across various industries like agriculture, oil, gas, mining, education, chemicals, clothing and textiles, automotive, communication and electronics. Large companies like Microsoft, General Motors, Nestlé

IBM and Lucent Technologies are operating on R/3. However, reported organizational experiences and market statistics relating to ERP have been contradictory. For instance, FoxMeyer Drug claims that its SAP R/3 initiative led its business into bankruptcy [2], while Chevron Corp. experienced a drop in purchase cost by 15% with hopes for a further 10% [3]. On the other hand, while the total ERP market was estimated to reach $35 billion in 1997 [4] and is expected to reach $94 billion by 2002 [5], some recent figures show that more than 70% of ERP implementations do not achieve their estimated benefits [3]. A recent survey also reveals that popular ERP packages fall short of expectations in their levels of increasing turnover, recruitment and training [6].

This mixture of results makes the issue of ERP implementation of particular importance. ERP systems have great potential for providing an integrated application environment with a fast and seamless access to single unified information business-wide. However, it is clearly a risk-involving approach merely to consider the merits of such systems away from realizing the complexity associated with unifying both the technical and the business imperative, and the huge organizational changes that this process entails. This is evident in the experience of Applied Materials which found itself overwhelmed by the organizational changes involved, and therefore gave up on its ERP system [2].

2. ERP and Process Change Management (PCM)

This research paper aims to investigate the ERP phenomenon through the lens of the organizations and people who have lived with it. As ERP is a relatively new phenomenon, the research related to it is still sparse. However, current research in this field shows a use of diverse theoretical frameworks and perspectives to address various ERP issues. For instance, in evaluating and analyzing SAP R/3 implementation, Slooten and Yap [7] apply a contingency factors' model, Volkoff [8] uses a structurational model, Sieber and Nah [9] adopt an improvisational change model, Taylor [10] embraces a sociotechnical systems' design, Ezingeard and Chandler-Wilde [11] seek theories on sustainability and competitiveness, while Scott [12] uses a software project risks' framework.

In viewing SAP R/3 as an enabling tool for business process change, these theories fall short of covering the multi-dimensional changes involved. Changes involved in R/3 deployment are results of the shift in a business design from a fragmented, function-based organizational structure combined with inefficient, costly, slow and complex operations, to a process-based one served by an integrated cross-functionally, standardized, customer-focused and competency-centered system [2, 13]. Studying such a shift entails taking a broader approach towards uncovering the multi-facets of process change management (PCM) in the R/3 context. These can be based on Grover's [14] PCM framework, which embodies five groups of facets, as follows:

- *Change management* – representing various human-related change activities,
- *Project management* – relating to organizing and monitoring project team relations and activities,
- *Continuous process management* – concerning the ongoing business processes' evaluation and improvement,
- *Strategic planning* – referring to the set-up and planning of change goals and directions, and
- *Technology management* – covering the technology selection and development tasks.

These groups are interdependent, as strategic planning directs the entire change efforts enabled by IT (technology management), human (change management) and process (continuous process management) through a well-disciplined project management. This framework is adopted in this paper to provide a structure for the analysis and discussion of the data [15], which have been gathered from various reported case studies and articles. This framework also facilitates the triangulation at both the data and theoretical levels [16] to enrich the study and expand its scope [17]. Constructs of PCM in the R/3 context are identified, and representative examples of organizational experiences are also cited to illustrate the successful or otherwise practices relating to each construct. The five dimensions of the framework and their applicability to the R/3 context are discussed in the rest of this paper.

3. Change Management

Drawing on the views of Carr and Johansson [18] and Cooper and Markus [19], change management in the R/3 context can be thought of as involving all human, social-related and cultural change techniques needed by management to ease the transition to and minimize organizational resistance of the new R/3 environment. The empirically-validated, best-practice model developed by Clarke and Garside [20] consolidates change management activities into five major groups. These are commitment, people, communication, tools and methodology, and interactions.

3.1. Commitment
This construct covers recognizing the level of change needed, ownership, and the provision of adequate resources [24]. For example, Anheuser Busch Companies [21] establish top-management support, ensure the leadership from a business perspective, and activate the role of championship in the efforts. Owens Corning [22, 23] ensures top management commitment to the company's plan to exceed customers' expectations, achieve growth targets and maintain industry leadership. Monsanto [21] succeeds in securing management commitment and approval for the project, as well as creating a championship role to sell the change to all concerned.

3.2. People

This dimension relates to the social and cultural aspects of change. Battco's [27] experience illustrates the lack of trust between people when some managers were reluctant to share information with each other for fear of losing control over their jobs. Du Pont & Co. [25], for example, follows a careful transition process for its people, aiming to reduce anxiety resulting from possible layoffs. In another example, a Canadian food manufacturer [8] succeeds in changing the mindset of users from focusing on their functional domains to understanding a wide range of information and operations belonging to other departments.

3.3. Communication

Communication covers issues related to internal and external communication. Monsanto [21], for instance, communicates project scope, objectives and activities to all people involved. GTE [26] gets its employees updated through organizing focus groups, publishing newsletters, and making use of e-mail messaging systems and web technologies. Cable Systems International [27] increases the amount of information-sharing and exchange through establishing "cross-lateral" teams representing various functional areas.

3.4. Tools and methodology

This construct relates to training, education and other tools necessary to ensure effective and smooth change. Kodak [28] establishes a competency center responsible for knowledge management and transfer, as well as creating a common and global configuration and standards. On the other hand, Monsanto [21] puts a huge investment into training and re-skilling its employees on the R/3 environment and methodology.

3.5. Interactions

The interactions construct deals with the synchronization of changes with other operations happening in the organization. For example, Du Pont & Co. [25] manages to play the role of integrator and leader of a major strategic alliance initiative bringing together suppliers, customers and consultants. It follows a shared alliance-management process to develop collectively an overall process architecture. Samsung Heavy Industries [23] develops a partnership model, in the UK, with the employees of the parent company, in South Korea, to set up the R/3 environment.

4. Project Management

In process change programs, effective project management is characterized with proper team formation and development [29], clear definition of roles and responsibilities [30], management of external entities (customers and consultan s) [31], and measuring and monitoring progress [32].

4.1. Team formation and development

Team members of an ERP implementation initiative should hold sufficient expertise and knowledge about the organization's processes as well as the best business practices, and maintain them through a disciplined training program [33]. IMC Global [34], for example, adopts the "superusers" concept by forming a team of specially trained managers from various departments to meet regularly and share developments on all aspects of implementation.

4.2. Roles and responsibilities

In ERP implementation, it is important to have formal and clear descriptions of all jobs and responsibilities that the new designed processes bring along with them. Jo-Ann Stores Inc. [35] coordinates the roles of Siemens and SAP, which together provide technical guidance on implementation, with the Lake West Group which takes care of the BPR side of the project.

4.3. External entities

ERP implementation involves the participation of different external entities such as software vendor, consultants [33], and possibly suppliers, customers and benchmarks. Textiles Plc [36] brings together internal and external expertise into a partnership with top management from all business units.

4.4. Measurement of progress

In ERP implementation, it is important to identify a set of progress measures through which teams' performance can be audited, and any managerial problems can be identified early on. For instance, information management shared services at Bristol-Myers Squibb [37] schedules its R/3 systems' implementation into a number of releases to measure the response of users as well as to maintain control of the system.

5. Continuous Process Management

Based on the Elzinga et al. [38] definition, business process management refers to the systematic and structured approach to analyze, improve, control and manage processes with the aim of improving the quality of products and services. In the R/3 context, three process management activities are particularly important, namely process redesign, process performance measurement and continuous process improvement.

5.1. Process redesign

This constructs covers appropriate identification of core processes [39], process orientation [40], and documentation [41]. An ERP system can be configured effectively using properly redesigned business processes models [42]. Textiles PLC [36], for example, models its business processes, and redesigns them according to those within the global system. It aims to achieve 90% global processes and 10% local ones. Geneva

Pharmaceuticals [43] follows a different approach and categorizes its business processes into supply and demand groups, where processes in each group were redesigned and the two groups were integrated.

5.2. Process performance measurement

This involves the evaluation of effectiveness of current processes [31] and the adequate identification of process gaps [41] using a set of performance indicators. For example, Alevo [44] defines a measurement procedure which monitors and identifies any deficiencies in processes performance.

5.3. Continuous process improvement

This construct deals with sustaining the improvement gained from R/3-enabled redesign [23] through establishing a strategic improvement program that synchronizes ongoing initiatives in a progressive and incremental manner. Alevo [44] sets up a number of well-planned, post-implementation projects aiming to keep the momentum of improvement.

6. Strategic Planning

The strategic planning process aims to define both the business and IT strategy, and to reconcile them together. Main activities involved in this process are carrying out performance gap analysis, justifying change, and setting out and deploying project strategies.

6.1. Performance gap analysis

This works at comparing performance measures with those of competitors. This process uncovers performance deficiencies, captures leading practices in various business aspects, and helps identify attributes for R/3-related process change. Organizational experiences in this respect are various. Farmland Industries Inc. [45] carried out a gap analysis exercise to examine how other companies (agricultural or from other industries) were managing their business and IT. Lucent Technologies [46] examined its financial processes in comparison with those of several large companies in different industries, and found that inefficiencies were primarily focused in the systems and staffing areas.

6.2. Change justification

This construct ensures a continual interaction and reconciliation between the business imperatives and the IT imperatives. This process involves the development of taxonomies of benefits that reflect not only the technical merits of the R/3 system, but also its positive and negative impacts on the whole business. For example, the University of Newcastle-upon Tyne in the UK [47] defines a set of qualitative statements specifying the targeted benefits in each of its business units. Monsanto   [21] justifies its

implementation from an operational excellence perspective, focusing on cutting the cost of core transactions-processing systems like order processing and inventory management. On the other hand, a consumer products' company [48] defines its case for change as building an integrated material planning and production control approach which enables on-line access to data, reduction of product costing, and a holistic view of the business.

6.3. Project strategies

Project strategies define goals and objectives; guiding principles, approaches and scope of implementation; project plan; and strategies for change management, process management, project management and R/3 management. These strategies draw the path for all R/3 activities and ensure their top-down deployment. ETH Zurich [13], for instance, develops a clear vision and a set of strategic goals such as increasing user-friendliness, stabilizing staff cost accounting, and using the PCs for all activities. The University of Nebraska [49] creates guiding principles and a strategic vision relating to the integrity, flexibility and effectiveness of the business environment. Lucent Technologies [7] defines a set of implementation assumptions relating to its approaches to thinking, working, controlling and modeling during the R/3 implementation. Bay Networks [3] develops its strategy along four major dimensions, namely growth, global ordering administration, financial reporting and process redesign.

7. Technology Management

Drawing on Grover's [14] definition, technology management in the R/3 context can be seen as embodying three major tasks, namely software selection, technical analysis and design, and installation.

7.1. Software selection

This process involves investment evaluation, and contracting with supplier and consultants. For instance, a consumer products' company [48] selects an implementation partner based on its track record of implementing similar projects, project management skills, technical skills, support capabilities, and cost effectiveness of the quotation. The University of Nebraska [9] makes its decision to select the R/3 system based on a recommendation of replacing current financial and human resource systems which results from the feedback of an assessment activity carried out at each campus. The State of Kentucky [50] bases its selection on realizing the need to leverage its existing PCs and LANs, conduct on-line transactions and queries, and implement Electronic Fund Transfer, EDI and Internet capabilities.

7.2. Technical analysis and design

This covers analyzing the current system infrastructure and the design of the new R/3 architecture. ComputerCo [51], for example, places an emphasis on designing

business processes rather than on systems by making use of interactive business processes' modeling techniques for configuring the R/3.

7.3. Installation

This construct relates to customizing and configuring the R/3 modules, transitioning to the new system environment, and maintaining and supporting the system on a continual basis [52]. RTL Television   [23] replaces its accounting, assets management, cost control and payroll systems with one integrated system and interfaces for master data.

8. Recommendations

The ERP is a developing multidiscipline phenomenon that calls for a multifaceted approach towards understanding its complexity. The mature field of PCM exhibits a matching character, and thus represents an ideal theoretical basis for comprehending such a phenomenon. This research is an evidence of the validity of PCM as a theoretical source suitable for guiding ERP research and practice.

SAP-Related PCM Constructs

The paper provides taxonomies of PCM constructs in the case of R/3 implementation (Fig. 1). The framework presented provides a road map that can be useful in guiding the implementation process. It also illustrates that, along the vertical dimension, the orientation of the implementation issues range from the soft side to the hard side of change, depending on the nature of the PCM activities covered. Furthermore, along the horizontal dimension, the implementation efforts progress to more operational kinds of tasks. However, there are interdependencies among the various constructs, and their adequate management results in superior performance and complete implementation rollout.

One major observation that this paper can provide is that existing ERP literature is so far largely dominated by anecdotal cases and comments, and the need for theoretically grounded and methodologically sound empirical research has never been more urgent. This paper has opened up ample opportunities for future research. For instance, the framework can be subjected to empirical testing using a large-scale survey A number of critical success/failure factors can be developed using the framework, and their criticality can be assessed. Furthermore, a set of dependent and independent variables can be derived to construct a testable model that provides statistical measurements on the relationships between project success and various situational and contextual factors. It would also be interesting if the framework and taxonomies presented are extended to embrace more broadness, representativeness and generalizability. Each construct can be explored further using a micro-type of research that identifies internal elements, uncovers their working and relationships, and measures
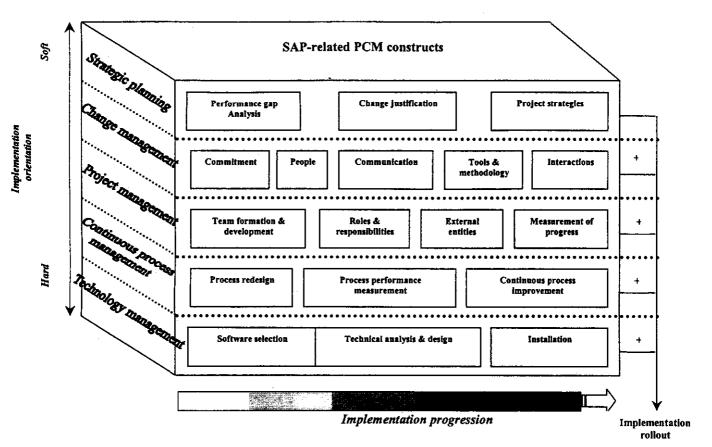
Fig. 1. Taxonomies of PCM constructs in SAP R/3 implementation .

their two-sided effects on the deployment process. Longitudinal case research appears to be particularly appealing in the ERP field, since it allows for more research patterns and rigorous evidence to emerge. A cross-cultural model of research is another approach that helps uncover the global and regional issues and their interactions in specific organizational settings.

9. Conclusion

As we embark on a new era of digital economy, it is no longer sufficient for organizations to rely on the use of piecemeal technologies, working in isolation and superimposed on rigid structures and systems. Furthermore, the new information-based economy requires a real departure from a functionally-based modus operandi to one which is based on agility, flexibility, responsiveness and mass customization. The concept of process change management (PCM) is an overdue major re-alignment of the ethos of value-adding principles. It ensures that activities are integrated to provide high levels of synergy and focus. PCM seeks to optimize the various capabilities that exist in business organizations, and has the potential to eliminate the various impediments from which organizations tend to suffer. However, the challenges that organizations face when considering the use of the PCM approach are numerous. They encompass hard and soft elements:

a. *Hard issues* - Although there is a wide array of tools, techniques and IT-based technologies, documented failures of IT-based change programs tend time and time again to point out the lack of consideration of a thorough, systematic and progressive approach in appreciating the powerful usefulness and impact the following hard issues can have:
    -   IT strategic planning.
    -   IT investment appraisal and decision.
    -   Process-oriented IT infrastructure development.
    -   IS integration.
    -   IT effectiveness measurement.
    -   Business process modeling, analysis and design.
    -   IT outsourcing, and strategic alliances' management.
    -   Legacy systems reengineering and migration.
    -   Role of IT function in PCM.
    -   IT risk management.
    -   PCM tools: total quality management (TQM), business process improvement (BPI), business process reengineering (BPR), process innovation (PI).

b. *Soft issues* - An umbrella of issues covering aspects ranging from behaviors towards continuous improvements to cultural. For instance:

- Understanding the power of PCM.
- Poor strategic consideration of IT-enabled change introduction.
- Cultural resistance to continuous improvement.
- Training and people competencies' development.
- Core competencies/capability of organization to handle change.
- Lack of emphasis on measurement.
- Lack of teamwork culture.

Using a PCM framework, this paper has explored the aforementioned issues in the context of the SAP R/3 deployment process. Various PCM constructs were identified, and extensive supporting examples on the practice of a wide range of organizations embarking on R/3 implementation were used to demonstrate how these constructs can contribute to the success of the overall transformational efforts (Fig. 2).
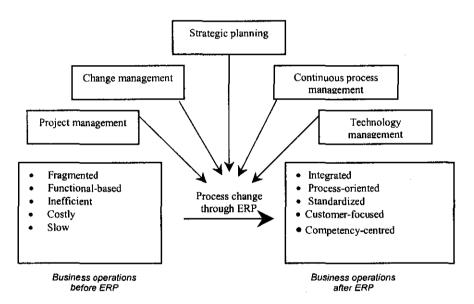

Fig. 2. Business transformation through ERP.

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تنفيذ تخطيط موارد الأعمال من خلال نظام ساب آرثري: منظور إدارة تغيير الإجراءات

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ملخص البحث. تتمتع أنظمة تخطيط موارد الأعمال باقبال واهتمام متزايد لكونها تعتبر مرتكزا تقنيا لكثير من مشاريع تغيير اجراءات الأعمال وتحسينها. وتعتبر النظريات البحثية المتعددة المتبعة حتى الآن في دراسة ظاهرة تطبيق أنظمة تخطيط موارد الأعمال المتزايدة قاصرة عن الالمام بنواحي التغيير المتشعبة والتي يشتمل عليها هذا الاجراء. هذه الورقة تعرض أسلوبا جديدا لدراسة هذه الظاهرة من منظور نظرية ادارة تغيير الاجراءات الشاملة. ولتحقيق هذا الغرض، سيقوم هذا البحث باستخدام اطار هيكلي لتحديد وتعريف البنيات الأساسية لادارة اجراءات التغيير في حالة تطبيق نظام الـ ساب آر ثري، وهو أشمل وأكثر أنظمة تخطيط موارد الأعمال انتشارا. كما ستعرض هذه الورقة شواهد كثيرة و متنوعة من قطاعات مختلفة تبين كيفية تفعيل هذه البنيات في واقع مشروعات تم تنفيذها في العديد من الشركات والهيئات العالمية. ومن خلال ذلك فان هذه الورقة تسهم في وضع لبنة تنظيرية بحثية مهمة لعديد من الدراسات المستقبلية في هذا المجال، كما أنها تقترح عددا من الاتجاهات المستقبلية للبحث والتقصي العلمي.