Critical Success Factors in the Implementation of ERP Systems in Public Sector Organizations in African Developing Countries

Marie-Douce Primeau
Management and Technology Department
École des Sciences de la Gestion (ESG), UQAM
Montréal, Canada
Email : primeau.marie-douce@uqam.ca

***Abstract*—In the wake of budget restriction and increased pressure for transparency and accountability, more and more Public Sector Organizations (PSO) have opted to implement Enterprise Resource Planning (ERP) systems. PSO of developing countries have also followed this trend, pressured not only by the demands of accountability and efficiency from their own citizens but also from the multinational and binational development agencies that fund a majority of the development projects and programs that they deliver. ERP is also seen as a way to foster organizational transformation, though best practices adoption and process harmonization. Yet, success rate of ERP systems implementation, adoption, as well as their perceived results are less then optimal. This paper aims to explore the Critical Success Factors (CSF) in the implementation of an ERP system in PSO in African developing countries, in hope to give practitioners and decision-makers tools to increase the chances of success of these initiatives.**

Keywords-Enterprise Resource Planning – ERP; public sector organizations; Critical Success Factors – CSF; developing countries.

I. INTRODUCTION

An increasing number of Public Sector Organizations (PSO) has opted to implement Enterprise Resource Planning (ERP) systems. This trend is also followed by developing countries, pressured not only by the same demands from their own citizens but also from the multinational and binational funding development agencies.

ERP system implementation is still in its early stages in developing countries, with Asia-Pacific and Latin America accounting for most of its expansion, and Africa trailing behind [1]. Yet, today it is estimated that developing countries account for 10% of all ERP sales [2]. In North America and Europe, the private sector is the main client of ERP systems. In developing countries, ERP are mainly deployed in large organizations, rather than in SMEs. The public sector being the largest employer in developing countries [3], the main proportion of ERP systems is implemented in PSO. This specificity adds an additional level of complexity to an already complex project, since funding usually comes in part from external single or multiple donors, with their own interests in the project, and their own procurement, management and monitoring processes. Success rate of ERP systems implementation, adoption, as well as their perceived results in PSO in developing countries are less then optimal. Yet, little research has been undertaken to understand the specific Critical Success Factors (CSF) of the implementation process of ERP in PSO in developing countries.

Based on secondary data analysis of CSF collected through four professional workshops with key stakeholders, this paper aims to explore this gap. Section 2 presents a state of the art on ERP systems. Section 3 presents the Methodology of this paper, while section 4 presents the main Results. Section 5 reviews the Conclusion and before the discussion in section 6.

II. CONTEXT

In this section, we will define the main terms used in this paper such as ERP, PSO and developped/developping countries; describe the reasons why PSO would implement ERP systems; and explore main CSF in ERP systems implementation, both in general and specific to PSO in developping countries.

A. What is an ERP?

An ERP system is an "adaptable and evolutive software system that supports real-time and integrated management of a majority – if not all – processes of an organization" [4, p. 70]. ERP systems are an integrated, modular, customizable and uniform (database, management and interface) software [5][6].

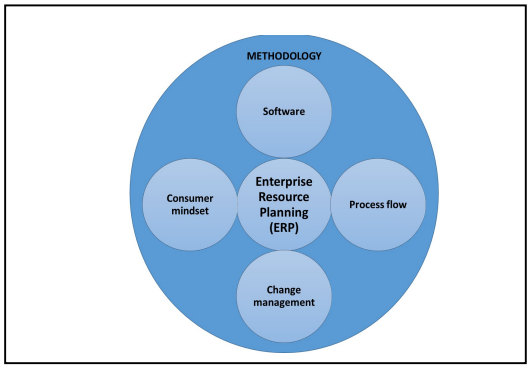

Figure 1. Conceptual model for Enterprise Resource Planning (ERP), Marnewick and Labuschagne [24].

ERP systems are highly complex [24]. Marnewick and Labuschagne [24] postulate that ERP systems can be conceptualize as a combination of four main components: Software (Product), Process Flow (Performance), Change Management (Process) and Consumer Mindset (People; Figure 1 below). All four components are implemented through a Methodology, which underlines each ERP life-cycle phases (pre-implementation, implementation and post-implementation phases [7]).

Conceptual model components: The Software component refers to the ERP product itself, such as its main features, choice of interface, and other technical aspects, as well as its development, testing and troubleshooting. The Process flow component refers to the way the different ERP modules flow within and between them. This includes both the processes themselves and the data they store and process. The Consumer mindset component refers to the need for stakeholder management at the user, team and organizational levels. Lastly, the change management component covers all factors pertaining to the planning, managing and controlling of changes. Change management is divided in four subcomponents, namely: user attitudes changes, project changes, business process changes, and system changes. Methodology refers to the "systematic approach to implement an ERP system" [24, p.153]. All together, these components help better approach ERP system's complexity.

B. Why would PSO want to implement an ERP system?

PSO consists of "governments and all publicly controlled or publicly funded agencies, enterprises, and other entities that deliver public programs, goods, or services", and exists at any level – international, national/federal, regional or local) [3].

Public and private sectors have "different goals and motives and are governed by somewhat different principles, with unique groups overseeing their actions and procedures". Organizations in the private sector have "more freedom to operate, while public organizations are governed by laws, rules, traditions, and structural bureaucratic checks and balances"[8].

Although very different, benefits sought during ERP system implementation seem consistent among public- and private-sector organizations [9]. These benefits include improvements in:

Financial performance: improves financial management; creates value; maximizes investments; and reduces costs;

Functional performance: increases productivity, quality of services, and functional efficiency; improves management of resources; enables automation of operational procedures; eliminates redundant data and operations; and reduces cycle times;

Organizational performance: increases organizational performance; enables the centralization and delocalization of maintenance services; increases adaptability; facilitates harmonization around best practices; enhances support to organizational activities; and changes nature of work in various units and departments;

Communication management: centralises and harmonizes information; improves management and organization of internal and external information flux, and improves security and information access management;

Internal audit, monitoring and control: improves controls and institutional accountability; enhances organizations regulatory compliance; achieves accuracy in management information system; enables real-time access to performance information, which in turn fosters better strategic analysis and decision [5][10][11].

Furthermore, a study on the impact of ERP systems in small and midsized PSO suggests that implementing an ERP system helped PSO improve services to customers and suppliers; enhance knowledge of primary users and increase shareholders confidence in organization [11]. With all those potential benefits, we have to ask ourselves: why are not all PSO implementing ERP systems?

C. Is ERP implementation in PSO successful?

As discussed below, ERP system implementation can have important benefits for PSO. Nevertheless, ERP system implementation can be cost and time consuming [12]. As example, the cost of ERP implementation in UN organizations is estimated at 712 millions United States Dollar (USD). This does not include recurring maintenance costs (at least 66 millions USD per year), nor the off-budget associated costs (between 86 and 110 millions USD per year).

Furthermore, failure rate, both in private and public organization, is high. The 2016 ERP Report [13] states that less that 10% of all ERP projects sampled in 2015 were implemented on time, within budget and in respect to the planned scope. More than a third (35%) was stopped or (indefinitely) differed. The remaining 55% were completed with an average of 178% cost and 230% schedule overruns. In fact, ERP implementation projects lasted 1 to 3 years, with an average of 21 months, while most projects had been planned around an 8-14 months timetable.

Although data on the subject is scarce, ERP systems implementation failure rate in PSO in developing countries is believes to be even higher. In his study of ERP implementation in Egyptian organizations, Abdelghaffar [14] argued that 75% of ERP implementation attempts can be classified as failures. Another study found schedule overruns in 67% and cost overruns in 33% of all ERP implementation projects in United Nations organizations [10]. Reasons frequently mentioned to explain these schedule overruns were: changes in project scope; delays in personalization of software; users resistance to change, delays in data conversion, changes in initial project strategy, and redefinition of operating procedures. As for cost overruns, they were attributable mainly to unplanned personalization costs; inadequate definition of functional needs; unforeseen delays in the implementation process, and unrealistic cost estimation planning. No data was found on ERP implementation success in African developing countries, even if failure rates are though to be higher than in developed countries [5].

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D. Are all PSO the same? or How do PSO from developing countries differ from PSO from African developed countries?

United Nations divides countries into two categories: developed and developing countries. This classification is mainly based on economic indicators and indices such as Gross Domestic Product (GDP), Gross National Product (GNP), per capita income, unemployment rates, industrialization and standard of living [15]. The developing countries categories include both developing and least developed countries, most of which are in Africa.

Contrary to developed countries, most PSO in African developing countries are funded (partly of entirely) by external funding. These funds usually come from multidonors/multilateral aid agencies, and with an obligation to prove the results of PSO's initiatives (result-based management). ERP implementation projects are often imposed by the donor agencies as a way to increase transparency and guarantee accountability of PSO.

Considering the important costs – both financial, social and political – associated to ERP implementation failures in PSO in African developing countries, it is important to understand the CSF that could hinder or facilitation this process.

E. What are the CSF in ERP systems implementation in PSO in African developing countries?

In order to support organizations in their implementation efforts, practitioners and researchers have come up with CSF that facilitate or hinder implementation. CSF are defined as "factors needed to ensure a successful ERP project" [16]. This includes both factors that facilitate and hinders the implementation of an ERP system. These factors vary depending of the nature and environment of the organization [17]. Yet most research on ERP success factors have been done in developing countries, in the context of private-sector organizations.

Through their literature review of CSF in ten different countries/regions, Ngai, Law and Wat identified 18 CSF, with more than 80 subfactors for the successful implementation of an ERP. The CSF are: appropriate business and IT legacy system; business plan/vision/goals/justification; business process reengineering; change management, communication; data accuracy; ERP strategy and implementation; ERP project team; ERP vendor; monitoring and evaluation performance; organizational characteristics; project champion; project management; software development, testing, and troubleshooting; top management support; fit between ERP and business/process; national culture; and country-related functional requirements [17]. This typology has been used by many other scholars to guide their analysis of the influence of CSF in phases of an ERP implementation process.

In the last years, a few studies have tried to identify CSF specific to ERP implementation in PSO of developing countries.

In its assessment of ERP implementation projects in its organizations, the United Nations identified 11 CSF, namely: project planning and software selection; governance of the project, risk management, change management, project team, end users training and assistance; ERP system hosting and infrastructure; data conversion and systems integration, ERP upgrade, and project audit [10].

Another study from the World Bank identified eight CSF from its experience implementing ERP systems, namely: capacity building and training, close supervision and control from the donor agency, favorable political context and leadership; pre-existing favorable environment (IT, HR, Accounting); adequate preparation and clear conception; good project management and coordination, and external environment factors [18]. It also identified main failure factors, which were: inappropriate training/education of project teams; institutional/organizational resistance; inadequate project preparation and planning; complex conception/high number of procurements; organizational structure adapted to integration efforts; inadequate IT infrastructure; absence of leadership/engagement and ambiguous attitude of authorities, regarding implementation; inappropriate technology; inadequate project coordination; and external factors (political troubles, natural disasters). These failure factors are consistent with other studies on ERP implement issues in developing countries [5][12].

These studies offer some insight on perceived CSF in ERP implementation from the point of view of donor agencies. Yet, these highlight the need to further explore the Critical Success Factors (CSF) in the implementation of an ERP system in PSO in African developing countries, in hope to give practitioners and decision-makers tools to increase the chances of success of these initiatives. This paper will try to address this gap.

III. METHODOLOGY

This work uses secondary data collected through professional workshops with key stakeholders that have direct experience either in the planning, managing or implementing of an ERP in PSO in developing countries. A description of the initial data collection process and methods, as well as a overview ot the data analysis techniques and conceptual model used for secondary data analysis follows.

A. Data collection – primary data

Primary data was collected through four 1 ½- 2 hours professional workshops. In total, 140 participants took part in the workshops. The workshops took place in Abidjan (Ivory Coast), Rabat (Morocco) and Marrakech (Morocco). The following subsection offers an overview of the composition of each of the workshop groups.

- Workshop no1: 15 participants from a multilateral development bank institution working as Task team Leaders, Procurement and Monitoring and Evaluation

Specialists, and Managers. Languages: English and French.

- Workshop no2: 85 participants from public and parapublic organizations. Participants worked as directors, project or program managers, procurement or monitoring and evaluation sectors on single or multidonors initiatives. Two came from the academia. Language: French.
- Workshop no3: 26 participants from public organization sector or project and programs funded through single or multidonors development aid. Languages: French and Arabic.
- Workshop no4: 14 participants from West Africa working as either project or program managers or Monitoring and Evaluation Specialists on single donor or multidonors projects or programs. Language: French.

The diverse composition of the different groups was one of the main difficulties facing the workshop facilitators (english/french/arabic languages, professional status, type of organizations, and number of participants per session). To increase participation and create cohesion between participants of the workshops, facilitators used World Café as a data collection method.

World café is a collaborative approach that aims to "to engage [participants] in constructive dialogue around critical questions, to build personal relationships, and to foster collaborative learning [21, p.28]", helping creative new ways to address problems emerge from the initiative. Simple and flexible, the approach can be used both in small and large heterogeneous groups to foster open dialogue and collaboration [22].

World café follows seven integrated design principles, namely:

- Set the context;
- Create a hospitable space;
- Explore questions that matter;
- Encourage everyone's contribution;
- Connect diverse perspectives;
- Listen together for patterns and insights;
- Share collective discoveries [22].

At the end of each of the workshops, participants drafted a list of factors that facilitated and hindered the implementation of an ERP. All entries of the four lists were then combined by the facilitators. This final compilation was sent to all workshop participants in the conference proceedings by the event organizers. These conference proceedings are the basis of our analysis.

B. Data analysis

To facilitate understanding, subthemes were then organized using a modified version of Marnewick and Labuschagne [24]'s ERP Conceptual Model. This modified version includes all four main components (Software, Process Flow, Change Management, Consumer Mindset), Methodology, and adds a last component - external environment. This component was added to take into account the influence of national culture [17] and other macroeconomic factors, on the implementation of ERP systems in African developing countries. The ERP project financing will also fall under this category, as it has a major impact on ERP implementation in developing countries [10].

IV. RESULTS

The following section presents our results, namely the CSF identified and categorized, using the adapted conceptual model. In total, forty CSF were identified through this process. To facilitate understanding, results are presented per components, namely: Software, Process flow, Consumer mindset, Change management, Methodology, and External environment.

A. Software

In total, five CSF were identified by participants for the Software component, namely: software development, testing and troubleshooting; ERP vendors/suppliers relationships; country-related functional requirements; local infrastructure; ERP infrastructure and hosting; and IP maturity of organizations.

Software development, testing and troubleshooting: participants underlined the importance of the choices made through theses phases, and the need for user participation in the process to facilitate adoption.

ERP vendors/suppliers relationships: Participants highlighted that the lack of local vendors gives disproportionate power of international vendors, and hinders optimal selection of ERP systems by PSO.

Country-related functional requirements: Participants also discussed the fact that ERP often didn't meet their specific PSO requirements, e.g., integration of performance indicators at the result level, reporting formats that do not fit the donor requirements, etc.

Local infrastructure: Access to electricity, telecommunications and Internet remain problematic, especially when outside urban agglomerations, though significant improvements have been made in recent years. This has a major impact not only on ERP implementation but adoption by users.

ERP infrastructure and hosting: More and more ERP systems are cloud-based. Because of the lack of access to basic amenities in many parts of African countries, many ERP options are not feasible. ERP hosting is also a problem, not only because of security but also because of access to electricity.

IT maturity of organizations: Participants also underlined the low IT maturity in most African PSO, which hinders their ability to facilitate ERP implementation.

B. Process flow

The Process flow component includes two subcategories: Process and Data. In total, seven CSF were identified by participants for the Process flow component.

1) Process

In total, three CSF were identified by participants for the Process subcomponent, namely: Fit between ERP and an organization's procedures; Harmonized practices, procedures and processes; and Communication.

Fit between ERP and an organization's procedures: PSO in developing countries, because of their funding and organizational structure, have specific procedures (e.g., burdensome administrative and procurement procedures, strict monitoring and evaluation requirements, etc.). ERP systems are created around private-sector (occidental) best practices. Therefore, the product offered is often than not difficult to adapt to African PSO's needs

Harmonized practices, procedures and processes: ERP systems aims to limit the possibility or errors by limiting the number of times a same information has to be entered in the system. Yet, because of the lack of harmonized procedures, users still have the obligation to enter information on multiple software.

Communication: participants highlighted the need for communication and information, sharing management plan, in order to maximize the probability of successful implementation.

2) Data

In total, four CSF were identified by participants for the Data subcomponent, namely: data quality control, data collection (aka presence of a Monitoring and Evaluation System), data management (including Security, Access, Traceability), and data conversion.

C. Change management

The Change management component can be divided into four subcomponents, namely: User attitude, Business process change, project change and System change management. In total, nine CSF were identified by participants in the Change management component.

1) User attitude management

Participants identified three CSF pertaining to user attitude management, namely: Need for communication, Need for training and education, and User active participation in ERP implementation.

2) Business processes change management

Participants identified two CSF pertaining to Business process change management, namely: Need for real-time information; Need for harmonization of practices and processes.

3) System change management

Participants identified three CSF pertaining to System change management, namely: Management and Corporate culture change, management of Interests, and Communication.

4) Project change management

Participants identified one CSF pertaining to Project change management, namely : Need for effective change control management processes and procedures.

D. Consumer mindset

The Consumer mindset component includes three subcategories, namely: User mindset, Team mindset, and Organizational mindset. In total, fifteen CSF were identified by participants for the Consumer mindset component.

1) User mindset

In total, five CSF were identified for the User mindset subcomponent, namely: User attitudes/Resistance to change, Technical level of competencies and knowledge of users; Qualified personnel; Stability of teams (attrition rate), and Access to training.

2) Team mindset

In total, four CSF were identified for the Team mindset subcomponent, namely: Team composition (status/treatment, multidiscipline, and employment), Collaboration, Leadership, and Competencies.

3) Organization mindset

In total, six CSF were identified for the Organization mindset subcomponent, namely: Prior experience in ERP implementation, Change management competences, Organizational commitment, Presence of a champion, Shared Vision, mission and organizational goals, Ownership of project by stakeholhers.

E. Methodology

In total, two CSF were identified by participants for the Methodology component, namely: Clear ERP implementation strategy, and Good project management.

Project management: Participants stressed the importance of good project management in ERP implementation, namely the need for clear planning, project division in multiple steps; realistic performance demands and deadlines, and collecting of lessons learned; planning of implementation costs and maintenance.

Clear ERP implementation strategy, and its communication to stakeholders, were also seen prerequisite for success.

F. External environment

In total, two CSF were identified by participants in the External environment component, namely: National culture and Donor-Recipient relations

V. CONCLUSION

Our results highlight the specific nature of ERP systems implementation in PSO in African countries. Certain CSF seem to be only found in this context, e.g., External environment CSF, such as national culture and donor-recipient relationships, ERP vendors/suppliers relationships; country-related functional requirements; local infrastructure; ERP infrastructure and hosting). But even when general categories of CSF were observed in both PSO in African countries and in developed countries (e.g., Change management, Consumer mindset), the way the materialize and that they influence the process differed. For instance, Team composition, collaboration, leadership and competencies were found to be CSF in both contexts. Yet, ERP project teams in developing countries are a combination of consultants, who are often lent by the PSO themselves (not always for their competencies), and that are paid in a day what the rest of the teammates will do in a month. This hinders the collaboration and leadership of the team leaders. Another example of CSF's specificity is the Organisational commitment, as in African PSO, high management is often the one who benefits from the lack of transparency and accountability, and therefore are the main opponents of these type of initiatives.

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VI. DISCUSSION

ERP implementation projects are often wrongly considered IT projects, when in fact they are major organizational transformation initiatives [22] that will significantly change the processes, structure, even the culture of an organization [10]. In line with current research [12], the need for training and education, top management support and multilevel change management were most cited CSF by participants.

Our results also highlights that CSF' influence vary depending of many factors, such as organizational and national culture, type of implementation process chosen (one time or gradual implementation), etc. This converge with Zouagui and Laghouag's findings [17]. Yet, these specificities are rarely taken into account in ERP implementation in PSC in African developing countries projects. Still, further research is needed to better understand and conceptualize the CSF in ERP implementation in PSO in the African developing countries.

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