

Critical Challenges in Enterprise Resource Planning (ERP) Implementation

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Abstract

This research paper explores critical challenges in Enterprise Resource Planning (ERP) implementation based on insights from an exploratory qualitative single case study in the Canadian Oil and Gas Industry. The study was conducted in a Canadian case organization using twenty interviews from members of four project role groups of senior leaders, project managers, project team members, and business users. The study further collected and reviewed project documents from the ERP implementation for triangulation. The research evoked a comprehensive list of sixty critical challenges and out of which, the top twelve challenges discussed in detail were drawn from the responses of participants from all four project role groups. The study findings indicated that critical challenges were significant during ERP implementation. This research is one of first case studies in the Canadian oil and gas industry that focuses on critical challenges in ERP implementation projects.

Keywords: Enterprise Resource Planning, ERP, implementation, exploratory qualitative study, critical challenges, critical success factors

1. Introduction

The challenges that face global organizations continue to grow increasingly severe and complex. Operating businesses in a highly competitive environment is challenging; to enhance competitiveness and to satisfy customer needs, organizations seek to improve efficiency and agility (Erkan & Rouyendegh, 2011; Motwani, Subramanian, & Gopalakrishna, 2005; Stanciu & Tinca, 2013). Information technology is capable of fundamentally changing the way business works; many organizations use the solution of Enterprise Resource Planning (ERP) systems to improve their competitiveness (Davenport, 1998; Erkan & Rouyendegh, 2011). ERP systems provide a holistic view of an organization's operations using business intelligence and analytics (Gartner, 2011; Motwani et al., 2005; Parr & Shanks, 2000). Unfortunately, ERP implementations cost a significant amount of time, money, and professional services, and do not always produce measurable results (Motwani et al., 2005). Therefore, understanding and applying critical challenges during an ERP implementation is crucial for ensuring organizational success (Momoh, Roy, & Shehab, 2010; Laukkanen, Sarpola, & Hallikainen, 2007; Stanciu & Tinca, 2013).

Research findings indicate that despite high costs and lengthy timeframes, ERP implementations do not perform to expectation (Davenport, 1998; Tarn, Yen, & Beaumont, 2002; Ehie & Madsen, 2005; Momoh et al., 2010; Stanciu & Tinca, 2013). This is in part due to a lack of understanding about how to address critical challenges during implementations, which can lead to cancellations, large cost overruns, and project failures (Momoh et al., 2010; Stanciu & Tinca, 2013). However, potential opportunities exist for global firms to improve ERP implementation success.

1.1 Dimensions Related to Critical Challenges in ERP Implementations

The foundational and seminal literature summarizes three dimensions related to critical challenges for this study, as described in Table 1. The critical factors affecting ERP implementations were grouped as human,

technological, and organizational dimensions, also detailed in Table 1. (Sumner, 2000; Themistocleus et al. 2001; Ehie & Madsen, 2005; Momoh et al., 2010; Stanciu & Tinca, 2013).

Table 1. Critical Challenges in ERP implementation as found in the literature

Dimensions	Critical challenges	Findings					
		Sumner	Themisto cleus et al	Ehie & Madsen	Momoh et al.	Stanciu & Tinca	
Technological	Excessive customization		X		X		
Organizational	Dilemma of internal integration				X		
Organizational	Poor understanding of business implications and requirements				X		
Human	Lack of change management				X		
Technological	Poor Data Quality				X		
Organizational	Misalignment of IT with the business				X		
Organizational	Hidden costs				X		
Human	Lack of senior management support	X		X	X	X	
Organizational	Failure to redesign business processes to fit the software	X					
Human	Insufficient training and reskilling / Limited Training	X		X	X	X	
Human	Lack of ability to recruit and retain qualified ERP system developers	X					
Human	Insufficient training of end-users	X					
Organizational	Inability to obtain full-time commitment of 'customers' to project activities and management	X					
Organizational	Lack of integration	X	X				
Organizational	Lack of a proper management structure	X					
Human	Insufficient internal expertise	X					
Human	Lack of a champion	X					
Human	Lack of business analysts	X					
Human	Failure to mix internal and external personnel	X					
Technological	Failure to emphasize reporting, including custom report development	X					
Human	Insufficient discipline and standardization	X					
Human	Ineffective communications	X					
Technological	Avoid technological bottlenecks	X					
Organizational	ERP vendor selection				X		
Human	Internal implementation team				X		
Human	Project opposition				X		
Human	user training				X		
Organizational	Project management principles			X			
Technological	Feasibility/evaluation of ERP project			X			
Human	Human resource development			X			
Organizational	Process re-engineering			X			
Technological	IT infrastructure			X			
Human	Consulting services /Client consultation			X			
Human	Employees resistance to change		X				
Human	Conflicts with Consultants		X				
Human	Internal Conflicts		X				
Human	Conflicts with Vendors		X				
Organizational	Conflicts with business strategy		X				

Note. The list is based on the research findings from foundational literature (Sumner, 2000; Themistocleus et al., 2001; Ehie & Madsen, 2005; Momoh, Roy, & Shehab, 2010; Stanciu & Tinca, 2013).

1.2 Critical Success Factors in ERP

Rockart (1979) was the first author to apply the critical success factor approach in the information systems area. The CSF method helped organizations to specify their own critical information needs. Rockart (1979) defined critical success factors as the limited number of areas in which results, if satisfactory, will ensure the organization's successful competitive performance (Esteves & Pastor, 2001). Researchers of seminal and recent studies have identified several success factors, which are outlined in Table 2.

Table 2. Critical success factors in ERP implementation

Research Study	Critical Success Factors
Holland and Light (1999)	Strategic: legacy systems, business vision, ERP strategy, top management support, project scheduling and planning. Tactical: client consultation, software configuration, client acceptance, monitoring and feedback, communication, troubleshooting.
Parr and Shanks (2000)	Management support, best people full-time, empowered decision-makers, deliverable dates, champion, vanilla ERP, smaller scope, definition of scope and goal, balanced team, commitment.
Nah, Lau, and Kuang (2001)	Top management support; business plan and vision; business process re-engineering with minimum customization; project management; monitoring and evaluation of performance; effective communication; software development, testing, and trouble-shooting; project champion; appropriate business and IT legacy systems.
Somers and Nelson (2001)	Top management support, project champion, user training and education, management of expectations, vendor-customer partnerships, use of vendor's development tools, careful selection of the appropriate package, project management, steering committee, use of consultants, minimal customization, data analysis and conversion, business process re-engineering, defining the architecture, dedicated resources, project team competence, change management, clear goals and objectives, interdepartmental communication and cooperation, ongoing vendor support.
Finney and Corbett (2007)	Top management commitment and support, visioning and planning, build a test case, project champion, implementation strategy and timeframe, vanilla ERP, project management, change management, managing cultural change, balanced team, project team composed of the best and the brightest, communication plan, empowered decision makers, team morale and motivation, project cost planning and management, BPR and software configuration, legacy system considerations, IT infrastructure, client consultation, selection of ERP, consultant selection and relationship, training and job redesign, troubleshooting and crisis management, data conversion and integrity, system testing, post-implementation evaluation, and analysis of ERP literature.
Jayaraman and Bhatti (2008)	Project management, business process re-engineering, user training and education, technological infrastructure, change and risk management, top management support, effective communication, balanced team, users' involvement, consultants' involvement, clear goals and objectives.

Note. The list is based on the findings on critical success factors from Holland and Light (1999), Parr and Shanks (2000), Nah, Lau, and Kuang (2001), Somers and Nelson (2001), Finney and Corbett (2007), and Jayaraman and Bhatti (2008).

1.3 Historical Perspective of ERP

Organizations need to connect the information supplied by each department into a common entity to remain competitive. There is a strong need for a seamless flow of data within and between functional units to increase efficiency in areas such as procurement, distribution of goods and services, managing stocks, and to help decision making. A capability to obtain the right information at the right time can usher enormous benefits to an organization (Rashid, Hossain, & Patrick, 2002). ERP software systems that emerged in the late 1970s continue to offer large organizations out-of-the-box solutions for complex needs. ERP systems are not projects that someday end; they are a way of life that require a high degree of alignment between business strategies, informational technology strategies, and organizational processes (Davenport, 1998; Esteves & Pastor, 2001).

1.4 Defining ERP

American Production and Inventory Control Society defined ERP as "a method for the effective planning and controlling of all the resources needed to take, make, ship and account for customer orders in a manufacturing, distribution or service company" (Rashid et al., 2002, p.3). Other definitions of ERP include: "One database, one application and a unified interface across the entire enterprise" (Tadger, 1998); "ERP systems are computer-based systems designed to process an organization's transactions and facilitate integrated and real-time planning, production, and customer response" (O'Leary, 2001). Davenport (1998) illustrated the concept of ERP systems as explained in Figure 1 (Rashid et al., 2002). This concept is still true, with modules such as sales, distribution, and service applications at the front office supporting customers, while inventory, procurement, manufacturing, and finance applications support suppliers at the back office. A central database interacts with both front and

back offices and with human resources and corporate reporting.

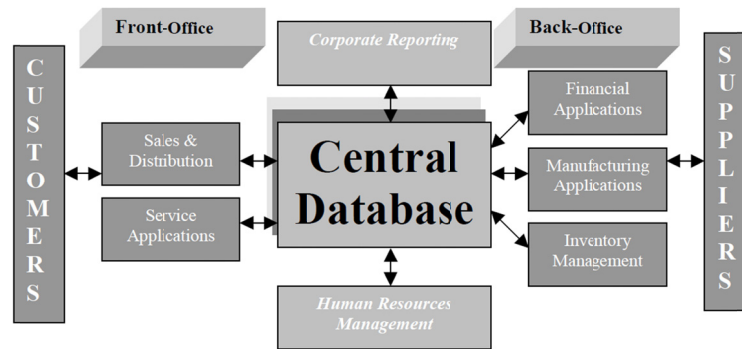


Figure 1. ERP concept

Reprinted from “The Evolution of ERP Systems: A Historical Perspective” by Rashid et al., 2002. Reprinted with permission.

1.5 Evolution of ERP

As outlined in Figure 2, and posited by Rashid et al. (2002), inventory control packages, written using programming languages such as COBOL and FORTRAN, were used by organizations in the 1960s for automating systems. In the 1970s, material requirement and planning (MRP) systems were used to plan parts and product requirements within a production process. However, in the 1980s, MRP II was developed to optimize the production process; it added components such as human resources, finance, shop floor, engineering, and distribution. Expanding these concepts, ERP systems appeared in the 1990s, capable of integrating business processes throughout an enterprise (Rashid et al., 2002).

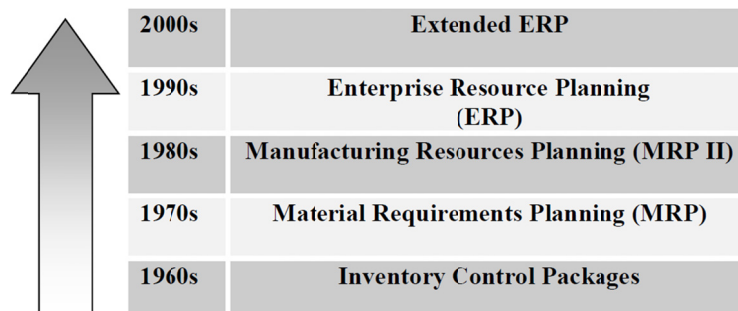


Figure 2. ERP evolution

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There were some significant changes that impacted the use of ERP software in this decade. ERP vendors introduced new functions or add ons, such as customer relationship management (CRM), supplier relationship management (SRM), and advanced planner and optimizer (APO), which resulted in extended ERP in the 2000s. Besides the on-premise ERP solutions, which accounted for 56% of ERP software used in 2015, ERP diversified into software as service (SaaS) (17%), and to cloud ERP systems (27%), which have the capability of hosting and managing from off-site locations (Panorama Consulting, 2016b).

1.6 Major ERP Systems

According to the Clash of Titans 2016 report by Panorama Consulting [59], among the major ERP system vendors, SAP has a market share of 23%, followed by Oracle with 16%, Infor with 16%, and Microsoft Dynamics with 9%. Tier II vendors have a total of 12%, and Tier III have a total of 26% of market share.

SAP. Started by five former IBM employees in 1972, SAP (Systeme, Anwendungen, und Produkte in Datenverarbeitung, or Systems, Applications and Products in Data Processing), leads the ERP market (SAP, 2016;

Panorama Consulting, 2016a). SAP launched its first ERP software in 1979 as R/2, then redesigned the software in 1992 using client server architecture. The resulting software, R/3, became an instant hit. SAP offers ERP solutions, as described in Figure 3, to all industry segments, including small and midsize businesses. SAP applications run on the technology platform of NetWeaver alongside SAP Business Suite, an integrated application capable of providing industry-specific solutions such as retail, banking, real estate, oil and gas, and aerospace (SAP, 2016; Panorama Consulting, 2016a).

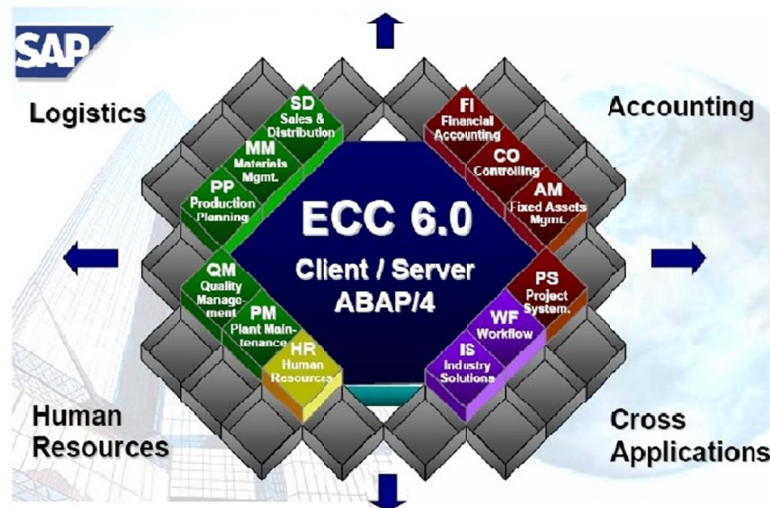


Figure 3. SAP module overview: The list of SAP functional modules

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Oracle. Oracle expanded into the ERP market after the high-profile acquisitions of JD Edwards (JDE), Seibel CRM, and PeopleSoft. Oracle E-Business Suite (EBS) has more than 10 product lines, offering several modules with one single database and supporting a variety of business processes. JDE is an integrated suite that supports the manufacturing industry and uses an open platform. PeopleSoft has a web-centric design, with eight application solutions including financials, supply chain, HR, and CRM. PeopleSoft is ideal for financial and public-sector companies, according to Panorama Consulting (2016a). Oracle EBS has a well-built architecture, a complex pricing module, and strong accounting and finance functionality.

Microsoft Dynamics. In 2000 Microsoft acquired Great Plains, a US accounting package. Microsoft then acquired Navision, a company with its own eponymous accounting and ERP solution and Axtapa, a strong ERP solution with CRM, distribution, and manufacturing capabilities. Microsoft's offerings include Microsoft Dynamics GP, an out-of-the box solution for small and midsize businesses; Microsoft Dynamics NAV, a broader solution for small and midsize businesses; and Microsoft Dynamics AX, for larger businesses with industry-specific solutions and cloud-enabled capabilities in its latest version (Panorama Consulting, 2016a).

2. Methodology

The research used a qualitative exploratory single-case study design to understand perceptions of four project role groups about critical challenges in ERP implementation. Exploratory case study research investigates a phenomenon by understanding perceptions and is usually focused on a small sample population to arrive at in-depth and rich data (Hewlett, 2005; Yin, 2014). These case studies typically involve small heterogeneous samples, which offer in-depth investigation. Such a case study is an appropriate tool for undertaking research in ERP implementation (Mishra & Mishra, 2011; Yin, 2009). Characteristics applicable to exploratory case study research were aligned with this study's objectives: enabling deep focus on scope; generating hypotheses rather than testing them; and exploring a heterogeneous population instead of a homogeneous one (Gerring, 2007). This research also involved collecting documentation and archived records (Denzin, 2012; Howe, 2012; Nickson, 2014).

The case setting used for the current study is a Canadian oil and gas company involved in ERP implementation.

Three oil companies in Canada were identified as having integrated refining capabilities such as upstream, downstream, and retail business capabilities. All three had significant staff size and ERP implementation project history. For general guidance toward site selection, examples were drawn from the literature (Mishra & Mishra, 2011). These organizations typically employed more than 5000 employees, and each has a good IT presence. The inclusion criteria required that participants have experience in ERP project roles and have worked in ERP implementation projects in the Canadian oil and gas industry. One of these three companies agreed to participate in the study and helped solicit employee participation; however, participants were selected based on inclusion criteria and on a first-response basis.

2.1 Data Collection

Stratified sampling was used due to the small sample size and the desire to obtain data from each stratum or participant group (Gerring, 2007). Twenty participants were selected using stratified purposive sampling from the chosen company. The sample represents four participant project team roles that consisted of three senior leaders, four project managers, six project team members, and seven business users, for a total of 20 subjects. Noted characteristics that were not used for selection criteria included project-team member age level, overall employment experience, and educational level. McLeod (2010) advocates for participants to be knowledgeable about the phenomenon in its context, which was required for participant inclusion in this study. The draft interview guide questions were compiled based on research for the current study. The research was field-tested using subject matter experts (SMEs) and role-players. All interviews were held in a public place and further document review facilitated data triangulation, which provided another source of data beyond the semi-structured interviews (Denzin, 2012; Howe, 2012; Nickson, 2014; Yin, 2009).

2.2 Data Analysis

The researcher conducted a total of 20 face-to-face interviews with participants from the four project team role groups. In-person interviews were voice-recorded, and audio files were transcribed. The collected data was entered in NVivo software for data coding and analysis and data analysis was conducted. Further, document review facilitated data triangulation such that it provided another source of data (Denzin, 2012; Jonsen & Jehn, 2009; Yin, 2009).

3. Discussion of Results

The research study generated 60 critical challenges, as described in Appendix A. Based on highest frequency count across the four groups, 12 challenges emerged as listed in Table 3, Figure 4. Disbanding the project team very quickly after implementation was the most important challenge (identified by six, or 30%, of participants), followed by interface issues, lack of proper testing, time zone limitations, stress, offshoring, people's resistance to change, a short hyper-care period, data cleansing, excessive customization, and leadership that didn't understand the complexities.

Based on demographic information, respondents from the senior leader and project manager groups had an average experience of 22 years in the organization; project team members had 14 years; and members of the business user group had 20 and a half years of total experience in the organization. Triangulation of responses showed that all four groups responded to the critical challenges in ERP. The generation of this large list of 60 critical challenges (Appendix A) was the result of this response from the participants. The researcher also analyzed all 60 challenges for future research not discussed in current literature. The four groups were overwhelmingly certain about the existence of critical challenges and maintained that these challenges were significant. However, senior leader and project manager role groups did not respond with the critical challenges of stress on people, interface issues, and quick disbandment of the project team; the researcher did not anticipate this omission from these role groups.

Table 3. Critical Challenges in ERP implementation as reported by project role groups

Critical Challenges: Top Themes	Senior Leader	Project Manager	Project Team Member	Business User
Project team was disbanded very quickly	—	—	4	2
Interface issues	—	—	—	5
No proper testing	—	1	3	1
Time zone limitations	—	2	—	3
Implementation causes stress on people	—	—	3	1
Offshoring causes delays	—	1	—	3
People are resistant to change	1	—	1	2
Short hyper-care support period	1	—	2	1
Lack of business buy-in from internal stakeholders	—	1	2	1
Data cleanse	—	1	1	1
Excessive customization is sub-optimal	1	—	2	—
Leadership didn't understand the complexities	—	1	2	—
Total	3	7	20	20

Note. The table highlights the top 12 critical challenges encountered by the case organization during ERP implementation. This is based on a high-frequency count across all four project role groups. A dash indicates that no member of the group reported that critical challenge.

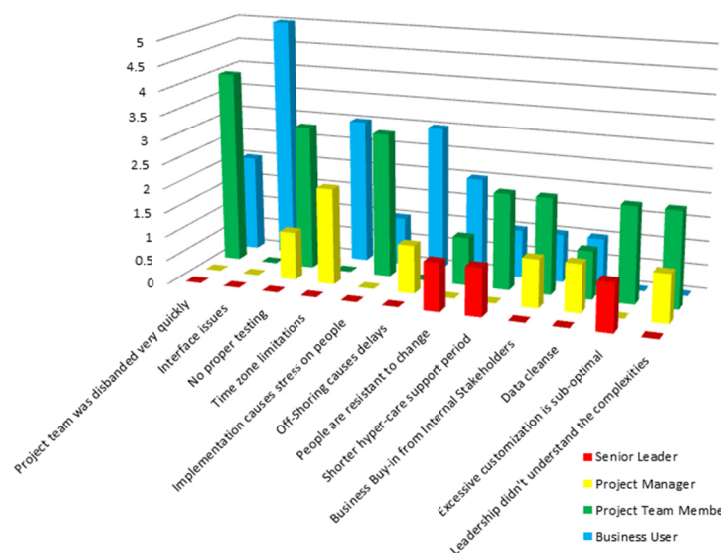


Figure 4. Critical challenges in ERP implementation, as answered by the four project role groups.

Furthermore, the researcher was surprised by the extent to which all four ERP project role groups identified the critical challenges. Out of 60 challenges, 29 had two or more participant responses, and 31 challenges had only one response. Although the current study highlighted only the top 12 challenges, the research identified a large number of responses about critical challenges across all role groups, particularly the project team member and business user groups. The top 12 critical challenges identified from interview responses are:

3.1 Project Team Was Disbanded very Quickly

Quick disbandment of the project team means that soon after the project went live, consultants left, and employees had to find new roles within the company, eventually losing all knowledge. One comment from a business user epitomizes the challenge: “It was extremely high pressure. We lost a few players. I remember on one morning at a meeting, we were missing out of ten, we were missing three persons.” One team member commented, “I think one other challenge that we felt down the road, was how quickly the project team basically disbanded after [go-live].” Another team member was critical:

At go-live, I think the fact that the deploy teams disappeared so quickly was a huge challenge because so many things were going wrong, and it was just kind of the business left to deal with it.

One team member explained this concept well:

Shortly after the project [was] rolled out, the project teams were dismantled [and] they lost all this knowledge, right. So the consultants were gone, the people who rolled out on the project, the company employees who had done other roles or couldn't succeed in finding other roles, so you lost all this knowledge.

3.2 Interface Issues

The challenge around interface issues (Yen & Sheu, 2004) was raised by several business users. One remarked, "there were some system interfaces that didn't work as expected even after all that testing [and] there were some interfaces that just didn't do what we expected [of] them." Another commented: "so we had all those things designed like as model [interfacing with SAP, connected applications, terminal systems], we took part of it, so how to fit in was difficult." Another business user clarified that "there were some system interfaces that didn't work as expected even after all that testing. There were some interfaces that just didn't do what we expected them to do." Yet another business user said: "the challenges were interfacing; interfacing like [multiple systems], and interfacing [was] a big, big issue."

3.3 No Proper Testing

Lack of proper testing during implementation was another frequently mentioned critical challenge (Finney & Corbett, 2007; Nah et al., 2001). Five participants gave examples such as that there was no regression testing, no flexibility to include additional test cycles, and that scenarios were tested and passed without correct data. A project team member explained, "We had a hard time getting our testing done properly because of issues, data not converted yet." Another team member said:

that's far [sic] is the biggest piece is just being so inclusive, um, and that's where the standard structure sort of in my mind failed us a little bit, well. There wasn't the flexibility to include additional test cycles or additional test scripts though we did that as much as possible.

3.4 Time Zone Limitations

Another critical challenge was time-zone limitations. One project manager stressed that: "time was another specific challenge which we hadn't encountered in previous countries really, there are six different time zones here [in Canada], so you are going live six times *per se*, [and] that was new for Canada [the case organization]." These limitations can be a critical challenge in ERP implementations taking place in an area encompassing multiple time zones.

3.5 Implementation Causes Stress

Another critical challenge raised is that implementation causes stress on people. One team member said: "But I feel there was something lacking where people didn't, I don't know, it was stress, was definitely stress-related, people were stressed out, you know we were in short, you know, timeframe we had to get it done."

Another team member explained:

I think there was there was too much pressure to want to show that you were meeting the targets and on track and the worry that red is bad and that; I mean, red means you failed, whereas red should really be used as, you know, to show that okay there's an issue here we need to deal with.

3.6 Offshoring Causes Delays

How work was handled from offshore and the associated delays was another critical challenge mentioned by several participants. One project manager stated: "we had to reorganize hand-offs to offshore, [and this] was a challenge."

One of the business users explained:

In the beginning, it was even worse because we had to do a part send it [sic] to [one Asian country], and they send it to [a second country], back to [first country], so it could take like two days.

3.7 People Are Resistant to Change

People resisting change is another highlighted critical challenge (Finney & Corbett, 2007; Kemp & Low, 2008; Somers & Nelson, 2001). One senior leader explained "initial resistance [to change], why do we want to do this, why do we want to allow ourselves to become distracted with, you know, with this type of activity the business is enjoining," ... "because you know how people are, they resist change". Some business users, which are also

project stakeholders, felt that workers resisted change. One business stated:

I think the biggest challenge is people, people absolutely. People are resistant to change. They're good at their jobs and it's uncomfortable to be doing something new. So I think the initial reaction is oh no, I don't like this system, it's no good. Sometimes they haven't been into the system yet, and they've decided the system's no good.

One of the senior leaders emphasized:

[Challenge] we encountered, I would characterize as organizational, so, that initial resistance, why do we want to do this, why do we want to allow ourselves to become distracted with, you know, with this type of activity.

3.8 Short Hyper-Care Support Period

Business users, senior leaders, and team members all criticized the reduced brief hyper-care period after go-live to support the business. One team member's perspective was:

We let go of everybody very quickly, within 6 weeks everybody was gone. So between, I think it was 4 to 6 weeks, we were so worried about the cost of the implementation, we got rid of everybody who had any knowledge. Before we really understood there was an issue, because we only had really, we had even went through a full month yet [*sic*] to really understand [the impact].

One team member said, "we were so worried about the cost of the implementation, we got rid of everybody who had any knowledge." Another said, "I would have done a lot longer hyper-care period, so, it would have been probably a minimum six months; six months to a year."

3.9 Lack of Business Buy-In from Internal Stakeholders

One team member stated, "When you start impacting people the way they worked, you know these are key people in key roles so if they are not on board and if they are not supportive, it's going to be a huge barrier." Another added, "I think some of the challenges that I can think of [*sic*] is getting the buy-in from the business." The users argued that "if the current system is working, why do we need to move to another ERP?" However, one project manager said: "ensuring that you keep your stakeholders, laid out all the benefits, [and] that's to me is the biggest challenge is to get buy-in from the end users to a new system."

3.10 Data Cleanse

The importance of "data cleanse" as a critical challenge (Doom et al., 2010; Finney & Corbett, 2007; Somers & Nelson, 2001) was underscored by a project manager's response: "part of the challenge was understanding how the system works in a lot of detail, [and] if you don't do that properly and you don't educate the business, it is very hard for them to cleanse." Except for senior leaders, members of all groups stressed the importance of data cleansing. One business user emphasized, "it is hard to actually articulate in some ways, but the data cleanse [*is*] really, really important."

3.11 Excessive Customization Is Sub-Optimal

Several participants stated that excessive customization is sub-optimal (Momoh et al., 2010; Themistocleus et al., 2001). One team member explained, "where you are heavily customized because then [*sic*] they can really take lot of run maintain costs and individual specific skill sets that you need to be able to support."

Another team member said:

[When] you are heavily [excessively] customized, because then they can really take lot of run maintain costs and individual specific skill sets that you need to be able to support, so I think you can take out-of-the-box install and minimize customization as much as possible.

3.12 Leadership Didn't Understand the Complexities

One project manager observed:

I think going in to the process early on, the leadership had assumed that Canada would be a very simple solution. So of course they missed really understanding the complexities that were involved.

One team member said, "leaders don't have a good understanding [and] sometimes complexity involves in [*sic*] some of the implementations [which] underestimate the efforts, and then it puts pressure on the people and on the team, [which] is also demotivating."

Response triangulation showed that all groups had critical challenges. The participants' responses generated 60 critical challenges (Appendix A). Out of these, an analysis of the top 12 challenges (Table 3; Figure 4) indicated that both project team members and business users (77% in total) overwhelmingly discussed them all. Senior

leaders and project managers discussed the remaining 33% (three and seven challenges, respectively). The findings show that the groups' responses give perspective to challenges both before and after implementation and therefore are valid. The ERP implementation at the research site was similar in size and depth to that of any other large organization. With the strength and experience the organization had in similar country rollouts, this large number of critical challenges is a cause for concern. The seven new challenges identified from the top 12 responses not discussed in the literature are: (a) project team disbanded very quickly, (b) time zone limitations, (c) lack of business buy-in from internal stakeholders, (d) implementation causes stress, (e) offshoring causes delays, (f) short hyper-care support period, and (g) leadership didn't understand the complexities. Among the critical challenges identified from participant responses, any challenges missing from the existing literature should be part of any future study.

3.13 Significance of Critical Challenges

Eighteen out of 20 participants (90%) across all groups overwhelmingly indicated that the critical challenges were significant during ERP implementation. Only one project manager participant and one project team member argued that critical challenges were not significant (Table 4; Figure 5). All groups were overwhelmingly certain about the existence of critical challenges and maintained that these challenges were significant during ERP implementation.

Table 4. Significance of critical challenges as reported by members of the project role groups

Significance of challenges	Senior Leader	Project Manager	Project Team Member	Business User
Significant	3	3	5	7
Not Significant	—	1	1	—
Total	3	4	6	7

Note. The table highlights the significance of critical challenges during ERP implementation. This is based on high-frequency count across all four project role groups. A dash indicates that no member of the group reported that critical challenge as significant.

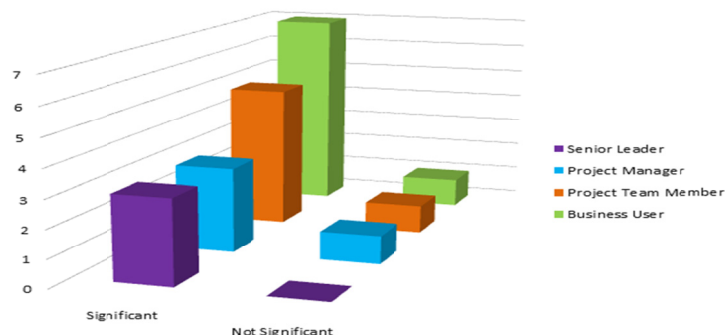


Figure 5. How significant critical challenges were, as answered by the members of the four project role groups

The responses highlighted significant challenges encountered during ERP implementation (Momoh et al., 2010; Peci & Važan, 2014; Sar & Garg, 2012; Shaul & Tauber, 2013; Stanciu & Tinca, 2013; Yazdi & Salajegheh, 2011). While looking at the triangulation, only 10% (two out of 20) argued that the critical challenges were insignificant overall. However, both these participants did respond with explicit critical challenges during their interviews. When looking at the triangulation, all four groups displayed an equal degree of confidence regarding the significance of critical challenges. Addressing this organization's critical challenges provides increased visibility into the problems faced by organizations during implementations (Momoh et al., 2010; Mishra & Mishra, 2011; Stanciu & Tinca, 2013). Also, correcting critical challenges, which represent failure factors as opposed to success factors, can ensure better project performance and project success (Kimberling, 2011; Momoh et al., 2010; Stanciu & Tinca, 2013; Shaul & Tauber, 2013).

4. Implications and Limitations

One of the major implications is that the critical challenges in this ERP study are related to the Canadian oil and gas industry. The case organization chosen was a global oil and gas company with strong regional presence in the local Canadian market. The critical challenges generated based on the responses from the project role groups belonging to the case organization highlighted the significance of the study. In particular, Mishra and Mishra (2011) pointed out that one of the main challenges specific to oil and gas is that the design, development, testing, and building of such complex interfaces are time-consuming (Smith, Meade, Wolf, & Song, 2013; Yen & Sheu, 2004). One of the significant challenges among the top 12 was interface issues, which highlighted this critical challenge in the oil and gas industry.

Another implication is that critical challenges were significant during the ERP implementation (Table 4; Figure 5). 90% of responses from all project role groups clearly indicated that the critical challenges were significant during ERP implementation. There was minimal difference to this viewpoint during triangulation, with only 10% (two out of 20) arguing that the critical challenges were not significant. However, both these participants had responded strongly to critical challenges during the interview. Also, all four participant project role groups evenly pointed out the significance of critical challenges.

The third implication of the study is that, although theories other than complexity theory were not part of the study's theoretical framework, the study findings specifically considering the critical challenges of people's resistance to change, lack of business buy-in from stakeholders, and interface issues suggest that there may be implications to the theories of system and change management (Buckle Henning & Chen, 2012; Kotter, 2012; Lucas, 2005; Malek & Yazdanifard, 2012; Poti, Bhattacharyya, & Kamalanabhan, 2010; Tambovcevs & Merkurjev, 2009).

Although the selected sample size was appropriate and within norms, the sample size was not significant enough that study population findings can be generalized (Marshall, Cardon, Poddar, & Fontenot, 2013; Yin, 2011). If the study were to be replicated, it would be necessary to avoid having a general senior leader group and instead add a business leader group, and an IT leader group to get senior leadership perspective from both business and IT. Participant's time constraint is another limitation to this exploratory single case study. Some interviewees have to rush to other appointments to accommodate daily engagements, which may have affected data collected. Another study limitation is the utilization of semi-structured questionnaire used as the main instrument for collecting data. Although participants were able to share their perceptions, they may have been unwilling to fully express their experiences as the researcher has to rely on participant honesty, which may have affected the depth of the study (Gerring, 2007).

5. Future Study

This study was conducted in a case organization that implemented SAP as its ERP system. Therefore, a similar study should use another major ERP system, such as Microsoft Dynamics ERP or Oracle ERP. By gaining the perspective of a similar implementation in the oil and gas industry using another major ERP system, the new study could offer similarities and differences as compared with SAP project implementation results.

The second recommendation is to conduct a quantitative study using the list of the top 12 critical challenges (Table 3; Figure 4) as well as the full list of 60 challenges (Appendix A), many of which are missing from the existing literature. By doing so, these critical challenges could be correlated to other industries; it would also be possible to establish correlations between project performance and critical challenges during ERP implementation. Also, using such a quantitative, descriptive, non-experimental design and using a survey method, it would be possible to validate many responses in senior leader, project manager, project team member, and business user groups across multiple organizations to support the findings from the current study (Denzin & Lincoln, 2008). Another recommendation is to conduct a multiple-case study. This could employ two or more organizations so that contrasting or similar results could be predicted (Yin, 2014). By repeating or replicating this study, results from the present study could then be compared with the results from multiple cases within each setting and across settings (Yin, 2014).

6. Conclusion

Addressing critical challenges in an ERP implementation can provide increased visibility of the problems faced by organizations (Momoh et al., 2010; Mishra & Mishra, 2011; Stanciu & Tinca, 2013). Correcting critical challenges, which represent failure factors as opposed to success factors, can ensure better project performance and success (Kimberling, 2011; Momoh et al., 2010; Stanciu & Tinca, 2013; Shaul & Tauber, 2013). The literature has identified critical challenges based on several studies (Ehie & Madsen, 2005; Momoh et al., 2010). However, no

comprehensive list of challenges has been compiled for the use of organizations undertaking ERP implementation. Specifically, the current study explored critical challenges method and compiled a comprehensive list of critical challenges that can affect an ERP implementation. Therefore, organizations undertaking future implementations can review the full list of critical challenges, which can be added to the body of knowledge.

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Appendix A. Full List of Critical Challenges in ERP Implementation

Critical Challenges in ERP	Senior Leader	Project Manager	Project Team Member	Business User
Bad feelings about how employees were dealt with	–	–	1	–
Change management	1	–	1	–
Change request controls are very strict	–	–	–	1
Changes to strategy and direction	1	–	–	–
Communication	–	1	1	–
Consultants did not share knowledge	–	–	1	–
Consultants lack of knowledge of other systems	–	–	1	–
Cultural differences	–	2	–	1
Data cleanse	–	1	1	1
Data migration across different systems	–	–	0	1
Data quality issues	–	–	1	1
Data readiness	–	–	2	–
Data validation without understanding the data	1	–	–	1
Engagement with users didn't provide a whole lot of detail	–	–	–	1
Ensuring external stakeholders are aware of the change	–	1	–	–
ERP implementations are not cheap	1	–	–	–
Excessive customization is sub-optimal	1	–	2	–
Implementation causes stress on people	–	–	3	1
Inconsistent KPI reporting across the organization	–	1	1	–
Interface issues	–	–	–	5
Issues after go-live were like a tsunami	–	–	–	1
Lack of access to people who know the information	–	–	1	1
Lack of access to the system	1	–	–	1
Lack of business ownership	–	1	1	–
Lack of business buy-in from internal stakeholders	–	1	2	1
Lack of experienced subject matter experts	2	–	–	–
Lack of integrated testing & real live simulations	–	–	2	–
Lack of integration	–	–	1	–
Lack of resources	–	–	1	–
Lack of training	1	–	–	1
Lack of understanding of business requirements	–	–	1	–
Leader has to champion stability	–	–	–	1
Leadership changes during project	1	–	–	–
Leadership commitment to the standard global template was lacking	1	–	–	–
Leadership didn't understand the complexities	–	1	2	–
Learning new system was challenging to end users	–	–	–	2
Local management didn't pull the right people	–	–	–	1
Management did not want to hear bad news	–	–	–	1
Manual interventions	1	–	–	1
Massive re-organization before an ERP implementation	1	–	–	–
Misunderstanding of scope	–	–	1	–
No accountability or checks in place to get the right data	–	–	–	1
No knowledge transfer from project team to business	1	–	–	–
No proper testing	–	1	3	1
Offshoring causes delays	–	1	–	3
People are resistant to change	1	–	1	2
People are not working towards the same goal	–	–	1	–
Perception that new system should behave like old system	1	–	–	–
Personality issues	–	–	1	–
Pressure to be "green" on the dashboards	–	–	1	–
Project team was disbanded very quickly	–	–	4	2
Project was too long	1	–	1	–
Respecting no-fly zone	–	–	–	1

Short hyper-care support period	1	–	2	1
Thin line on budget	–	1	–	–
Time zone limitations	–	2	–	3
Took long time to address the backlog	–	–	–	1
Unable to deploy resources back to business	–	1	2	–
Use of too many templates	–	–	–	1
Zero experience with SAP	1	–	–	–
Total	19	15	43	40

Note. The table shows 60 critical challenges encountered by the case organization during ERP implementation. This is based on high-frequency count across all role groups. A dash indicates that no group member reported the critical challenge.

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