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Accounting Information System Lessons from Implementing Enterprise Resource Planning in a Saudi Case Study

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ABSTRACT

The main purpose of this study was to present lessons in relation to Accounting Information Systems (AIS) resulting from the implementation of Enterprise Resource Planning (ERP) systems. The study adapted an interpretive case study method using 65 semi-structures interviews from 2010-2013 to collect rich and in-depth data about the effect of ERP on AIS. The study identified 45 lessons that were categorized in eight groups namely AIS legacy systems motivations for change, ERP-AIS selection and ERP-AIS implementation, accounting process and embedded internal controls, maintenance cost saving, inventory optimization, continuous improvements and accountants new job requirements. The study in ERP-AIS applied in Saudi Arabia is still rare and more studies are needed. This study is one of the most rare studies that provide valuable lessons to learn from ERP-AIS implementation in its natural setting of Saudi Arabia.

Key words: Accounting information systems, business, case study, enterprise resource planning, lessons, Saudi Arabia, system implementation

INTRODUCTION

Implementation of Enterprise Resource Planning (ERP) systems was the most important and substantial Information Technology (IT) that interacted with the Accounting Information System (AIS) functions in the last two decades (Kanellou and Spathis, 2013). The ERP systems are designed to address the problem of fragmentations by integrating and streamlining business processes using a suite of software modules. These modules cover all functional areas of an enterprise to improve and simplify internal organizational processes to provide real-time information for better decision making (Amid *et al.*, 2012). The idea is to combine various disintegrated systems into a single and common database. This study enables the enterprise to have a single view of its business through ensuring the systems that support different functionalities such as accounting, marketing, human resource, productions, maintenance, supply chain and others within the enterprise are integrated and combined (Maguire *et al.*, 2010).

Organizations that implemented ERP systems successfully gained many benefits. These benefits include an improve in transaction processing, flexibility of information generation, time based decision-making, reliable accounting information, quality of financial reporting, along with cash and other assets internal controls. In addition, a decrease in time, effort of data entering errors and documentations, time for annual closing of accounts and costs due to improving efficiency through computerization was also detected (Spathis, 2006; Spathis and Ananiadis, 2005; Spathis and Constantinides, 2004). Although ERP systems can bring competitive advantages to organizations, the high rate of failure of ERP implementation is a major concern. According to some studies, about

70% of ERP implementation fails to deliver anticipated benefits while three quarters of these systems were unsuccessful. On average, 178% of them were over budgeted, took 2.5 times longer than planned and achieved only 30% of promised benefits (Amid *et al.*, 2012; Kanellou and Spathis, 2013).

Recent studies indicated that organizations implementing the ERP systems must be aware and careful to realize that these systems are different from other traditional IT in the market today (Kanellou and Spathis, 2013). These ERP systems are promising to bring global and massive changes to all organizational levels in terms of structure, functions, processes, users' professions, or in the way financial and non-financial data are collected, stored, disseminated and used. These global changes will have dramatic effects on the level of AIS as well as in other organization levels (Sutton, 2006). Nevertheless, the focus of relevant literature has been on ERP systems in general and there is limited information with sufficient scientific evidence on the effect of ERP implementations especially on AIS in particular (Kanellou and Spathis, 2013).

AIS can help organizations in costing, expenditures and cash flow by providing information to support monitoring and controlling (Ismail and King, 2005). Unfortunately, traditional AIS has been criticized for having a narrow scope, focusing on events within internal organizations, providing only financial-related information and having a historical orientation (Liu, 2012). The initial IT introduction was not only to replace the traditional AIS, as they were the base for early computerized accounting development, but also to make traditional AIS more powerful to be the main and core enterprise information processing systems. New IT such as ERP systems provide new ways to get rid of simple and complicated accounting functions and data processing to give more attention to on depth analysis of accounting data. ERP will enable enterprises to detect problems or opportunities and to process more accurate traditional information instead of new non-financial, external and future up-to-date information for better decision making (Ismail, 2009; Liu, 2012).

This study presented a serious attempt to fill the gap and to enhance general understanding of ERP systems and their effects on AIS to determine the lessons in accounting information systems that could be learned from implementing ERP system in a case study from Saudi Arabia.

Enterprise Resources Planning (ERP) systems: According to McGaughey and Gunasekaran (2007) and Jacobs and Ted Weston (2007), ERP systems development could be traced back to the 1960's when the early computers of reorder point (ROP) systems were introduced and then the early introduction of material requirements planning (MRP) systems in 1970's. It was a state of the art software to plan and schedule materials for manufacturing purposes. In 1970's, the primary competitive thrust was shifting towards marketing and planning resulting in the introduction of Manufacturing Resources Planning (MRP II) in 1980's. The main goal of the new software was to integrate all organizational functions which could be spotted as far as the mid-1970 through the establishment of companies such as SAP in 1972, Lawson software in 1975, J.D. Edwards and Oracle Corporation in 1977 and Baan in 1978.

In USA, the Enterprise Resource Planning (ERP) systems were introduced in the early 1990's. The ERP system is an information system that integrates business processes to create value and reduce the cost by making the right information available to the right people at the right time to help them make good decisions in managing resources productively and proactively (Chen *et al.*, 2012; Kanellou and Spathis, 2013). An ERP system consists of multi-software applications called modules to support all organizational functions including financial modules (FI), Project

Management Module (PM), Human Resource (HR) module and others that are linked to one common database as they interact with each other in cross-functional bases in responses to users' commands and requirements.

Unlike traditional and legacy AIS, in ERP-AIS accounting data entries have been shifted from accountants in the accounting department to different users in the organizations as ERP system automatically captured such entries from its origin places. This data was then stored and processed in ERP central and common database (O'Leary, 2000). The processed data then become available to all the end users in an organization through their departmental modules to be used differentially. Spathis and Constantinides (2004) claimed that the accounting module in the ERP environment was considered by many authors to be the heart of ERP systems that typically incorporates applications such as general ledger, account receivable and payable, fixed assets, cash management, cost control, inventory management and control, and budgeting and other sub-accounting functions.

ERP in Saudi Arabia: Saudi Arabia is a leading economic force in the Middle East, particularly with reference to petroleum and petrochemicals industries (Al-Turki, 2011). Early ERP implementation in Saudi Arabia dates back to implementing the SAP software in Saudi Basic Industries Corporation (SABIC) in the nineties. Since that time, several Saudi organizations started to implement ERP systems. The Y2K, insufficiency of legacy systems, lack of IT support, improving companies performance and implement up to date systems were among many reasons that encouraged Saudi organizations to implement ERP systems (Al-Muharfi, 2005). The most common modules implemented by the Saudi organizations based on the findings of Al-Turki (2011) were Financial (FI), Costing (CO), General Ledger (GL), Human Resource (HR) and sales and distribution (S and D) modules.

The Saudi ERP market is the largest in the Middle East where SAP and Oracle are clearly leading the ERP market in Saudi Arabia with a total market share of around 70% and the remaining share of the market distributed for BAAN, Great Plains, Orion and J. D. Edwards (Al-Muharfi, 2003; Al-Turki, 2011). Alzahrani (2013) and Al-Turki (2011) reported high rate of successful ERP implementation among Saudi organizations as 70-75% of ERP implementations finished on time and within the estimated budget. Management commitment and support, clear strategic objectives, change management, training and software selections were among the main reasons that affect ERP success or failure in Saudi Arabia (Al-Turki, 2011; Aldammas and Al-Mudimigh, 2011; Alzahrani, 2013; Lyytinen *et al.*, 2009).

ERP systems and AIS: Many studies investigated the relationship between ERP and AIS in many aspects such as accounting process (Spathis and Constantinides, 2004), accounting professional and accountant role (Chen *et al.*, 2012; Kwak *et al.*, 2012), internal control (Madani, 2009), accounting benefits, barriers and challenges (Kanellou and Spathis, 2013; Momoh *et al.*, 2010). Some researchers also investigated accounting changes as a result of ERP implementation using a process approach (Williams *et al.*, 2013), factor approach (Aldammas and Al-Mudimigh, 2011) and a hybrid approach (Al-Hinai *et al.*, 2013). Some of the studies shed light in some important areas such as internal control (Madani, 2009) or in customization failure and accounting practice (Kholeif *et al.*, 2007). However, Sutton (2006) called for a comprehensive research effort that should combine investigations to understand ERP systems relationship with AIS professions. Unfortunately, studies related to ERP and AIS in Saudi Arabia are rear (Al-Mashari and Al-Mudimigh, 2003; Al-Muharfi, 2010; Al-Turki, 2011).

The primary function of AIS is to operate data gathering, processing, categorizing and reporting accounting activities with the objectives of providing relevant information for storing information keeping, inventories records and decision making and also provides financial reports whatever needed in timely basis (Awosejo *et al.*, 2013). However, such services appear to be inadequate within the new business environments, where automation, effectiveness and efficiency in operations and real-time data are important factors for business success. Liu (2012) claimed that ERP systems can optimize organizational AIS in four ways as below:

- Minimizing the time delay of previous information management as all business data is tightly integrated to achieve centralized data storage to enable the accounting module to timely collect and process the relevant information
- Enhancing strong internal control to promote organization efficiency and development by embedding complete detailed organization rules and regulations and guidelines as well as standardizing business processes and management controls methods
- Reducing and changing accountants' workload for book keeping and manual work towards more review and analysis throughout automatic record, process and report organization information using account module
- Providing rich data with no duplication or fragmentation through complete integrated and logical data which interlink all business-related financial and non-financial data

Many empirical studies attempted to identify reasons behind enterprises' decision to replace their traditional and legacy AIS to implement advanced AIS within ERP environment (Kamhawi, 2008; Kanellou and Spathis, 2013; Spathis, 2006; Sutton, 2006). Many important reasons motivate going for the new ERP-AIS. These reasons include demand for real-time information, information generation for decision-making, integration of applications, increase business flexibility, respond to competitive and pressures, standardized business database and process, reduce cost of operation, enhance external parties cooperation, empower internal users, redesign organization for better performance, optimize inventory, reduce time for financial reporting cycle, support globalization, reduce manpower and maintenance cost and replace old main frame with client-server architecture.

Some studies also have identified reasons behind discouraging enterprises from replacing their traditional and legacy AIS with the new ERP-AIS (Al-Muharfi, 2005; Kamhawi, 2008; Kanellou and Spathis, 2013; Spathis, 2006). Some of the most popular reasons are that the new ERP-AIS requires large capital investments. It also, demands too much training for employees, enterprises priorities other than ERP, lack of experience and knowledge to develop and support the new ERP systems. Other considerations are the risk of new project, lack of resources or awareness of the new ERP-AIS, not realizing the need for improvement, not believing in the system benefits to the enterprise, unfit between the enterprise exiting environment with ERP-AIS new environment and the believe that ERP-AIS will not be valuable or will not be better than the existing systems.

However, selecting the right ERP-AIS combination could be complex, costly and lengthy process as there are many strategies and criteria that could be followed by the enterprise (Denrell and March, 2001; Liao *et al.*, 2007). On the other hand, the enterprises could select the system based on sale's person or vender recommendations, external consultant project, internal experts' team or even in a more comprehensive approach of bits and pieces of the above approaches. Previously,

Bernroider and Koch (2001) 27 criteria identified to select the new ERP system categorized in four groups that include organizational, decisional, psycho-sociological and information systems criteria. Adhikari *et al.* (2004) investigated the relationships among four characteristic (size and degree of internationalization) international feature of accounting software (multicurrency, multi-reporting and multilingual) and general selection criteria (support and security, hardware and operating platforms and flexibility and cost) in order to select international ERP-AIS.

In another study, Adhikari *et al.* (2004) investigated the firm characteristics and selection of international accounting systems. Stefanou (2000) studied the ERP selection and implementation cross cultural. Bernroider and Koch (2001) investigated the selection process of ERP in midsize and large organizations in particular. Al-Mashari *et al.* (2003) introduced three stages of ERP implementation process namely setting up, implementation and evaluation. Shaul and Tauber (2012) introduced four stages model that includes planning, implementation, stabilization of the ERP system into normal operation and the enhancement in which the business process is continuously improved. Al-Hinai *et al.* (2013) suggested five phases of implementing covering the initiation, adoption, adaptation, acceptance and use. Haddara and Elragal (2012) proposed six steps which include adoption, acquisition, implementation, use and maintenance, evaluation and retirement.

Many studied investigated the role of accountants within the emergency of ERP system environment before, during and after the implementation. Scapens and Jazayeri (1998) concentrated in studying some of the implications of ERP system in the role of managerial accountants. Besides, the role of accountant has changed dramatically in the ERP environments to cover new roles and skills that encouraged some researchers to describe the new accountant as a "hybrid accountant (Burns and Scapens, 2000). Also, the topic of knowledge transfer between developer, consultant and accountants was investigated by many researches (Lee and Lee, 2000; O'Leary, 2002). Al-Muharfi (2010) investigated different forms of accountants participating in ERP implementation. Kwak *et al.* (2012) studied the acceptance of end users to ERP systems. Meanwhile Chen *et al.* (2012) examined the impact of ERP system implementation on the overall changing role of accountants. Kanellou and Spathis (2013) studied the accountant satisfactions and benefits resulting from ERP implementation.

Granlund and Malmi (2002) and Balzli and Morard (2012) claimed that ERP-AIS implementation can result in changes in the scope of accountant job profiles, skills, function, educational backgrounds, knowledge and experience to work within ERP-AIS environment. In addition, the accountants must have good understanding of enterprise processes and must be able to work in teams and to communicate clearly and concisely. The participation of accountant in ERP-AIS implementation made the accountant as evaluators in the evaluation stage, as communicators, coordinators and implementers during the implementation and as marker of financial statement from data recorders and provider not financial and nonfinancial information for more and better analysis and interpretations to enhance management decision making (Chen *et al.*, 2012; Kanellou and Spathis, 2013).

Little and Best (2003) presented a framework that separates the users such as accountant duties in ERP environment for efficient management and controlling. Under the ERP-AIS operational environment, computer control and audit are embedded into the system and replaced the traditional internal control (Debreceeny *et al.*, 2005). Other studies also pointed out that it is unnecessarily that organizations must implement all ERP-AIS. In fact whether ERP-AIS technology fits the organization or should not be the criteria to support implementing the whole or

some parts of the system or not (Al-Muharfi, 2005). Madani (2009) introduced a theoretical model that deal with the role of internal auditors in the ERP based organizations. Many studies also highlighted other issues relating to AIS such as the level of customizations that should be kept as minimum as possible which will help AIS for future upgrades and improvements (Lyytinen *et al.*, 2009).

Research methodology: The quality of a research exercise has been demonstrated in one of its aspects to be directly related to the research method adapted (Amaratunga and Baldry, 2001; Yin, 1981). The specific aim of this study was to describe and explain valuable lessons related to AIS resulting from the implementation of ERP systems in Saudi Arabia. To achieve this goal, several researchers pointed out the usefulness and importance of using case studies (Haddara and Elragal, 2012). Consequentially, case study approach has been adapted in this study based on the following reasons: (1) Case studies are appropriate to investigate a complex phenomenon such as ERP implementation and its effect on AIS in their natural settings, (2) Case studies enable researcher to collect rich and in-depth data that could be analyzed in order to reach excellent understanding about the phenomenon under investigation and (3) Case studies approach is especially valuable in areas in which few previous studies have been carried out which is the situation regarding ERP-AIS in Saudi Arabia (Benbasat *et al.*, 1987; Benbasat and Zmud, 2003).

Many researchers have recommended to use qualitative method to investigate the complex phenomenon such as AIS lessons learned from ERP implementation. The kind of qualitative research obtained in this study are responses to a very open-ended questions through semi-structures interviews (Balzli and Morard, 2012). Interviews were conducted between 2010 until 2013. All interviews were taken in SABIC affiliates in Al-Jubail Industrial City in the Eastern Province of Saudi Arabia. Accountants, financial managers, internal controllers, IT managers and some other personnel who have participated in ERP project implementation or who are using the system especially in the accounting department. A total of 65 interviews lasted between 20-45 min which were all in Arabic language. Most of the interviews were face to face and some were conducted by telephone. Out of these, 41 face to face were tape-recorded and transcribed for further review and analysis.

This study followed the interpretative way of analysis as part of the case study and on subjective interpretations as derived from the case data not as testing to predefined hypothesis in order to formulate the research findings and conclusions (Walsham, 2002). This study takes a particular case of SABIC affiliates and come to know it well, not primarily as to how it is different from others but what it is?, what it does? as mentioned by Stake (1995). One difficulty observed with open-ended questions was to organize and analyzes the huge data gathered, as the respondents were not guided into their answers. To deal with this difficulty, the study adapted the following analysis steps (Al-Muharfi, 2010):

- Looking for patterns or themes to categorize related lessons that could be learned as a result from ERP implementation
- Some of the themes used in the analysis were accounting motives for change, accounting system process, accountant participation in the implementation, closing entries and reporting and accountants' team selection
- Linking interviews analysis with ERP-AIS demonstrations and some documents and printed reports
- Presenting the case analysis back to some of the interviewers to validate the research findings and conclusion

SABIC affiliates' case study was selected for three reasons: (1) Company generated an almost open access to interview participants in the study besides attending demonstration of ERP system demonstration and reviewed some of the printed reports, (2) To some extent, this case study represents fair sample of the Saudi petrochemicals industry as a whole and (3) SABIC affiliates have implemented ERP systems to cover almost all their functions such as accounting thus making such affiliates excellent examples to ERP implementation. However, the case study method adapted in this study does not aim to generalize its findings but to gain in depth understanding, to comprehend the complexity and to identify lessons that could be learned from ERP implementation in its natural settings which relatively few studies have worked on especially in Saudi Arabia.

Saudi case study: SABIC's (the Saudi Basic Industrial Corporation) ranked among the world's largest petrochemicals manufacturers. SABIC is a public company based in Riyadh, Saudi Arabia with major industrial operations in the industrial city of Al-Jubail on the Arabian Gulf, as well as in Yanbu on the Red Sea. The Saudi Arabian government owns about 70% of the company's shares with the remaining 30% held by private investors in Saudi Arabia and other countries of the Gulf Cooperation Council. A Royal Decree established the SABIC in 1976 and its growth has been a miracle. Today, the company is operating in over 40 countries with a global work force of over 40,000 talented individuals. The SABIC foresee great opportunities for growth by working with universities, international research centers and other partners from the public and private sectors to develop research capacities in order to remain at the forefront of technology such as ERP system issues in business.

The SABIC business is grouped into five core sectors namely basic chemicals, Intermediates, polyolefins, PVC and polyester, fertilizers and metals. The concept of partnership was at the core of SABIC growth and business strategies. In addition, SABIC entered into joint venture with industrial leaders from around the world, offering a share in the Saudi resources for their technology, support in human resource, development and global marketing. This study was performed using some of SABIC affiliates in the petrochemical sector based in Al-Jubail Industrial city, Eastern Province, Saudi Arabia. Neither the name of SABIC affiliates nor the identities of the interviewee have been eliminated due to affiliate's requests. The ERP system played an important role to integrate SABIC affiliate inside Saudi Arabia and around the world.

Although SABIC affiliates started implementing ERP systems since the late nineties, a significant development took place in 2005 when SABIC successfully completed its business change program, named FANAR (Arabic word for lighthouse). The program involved implementing a new enterprise resource planning to make the company's business more consistent. A centralized and process review was also completed regarding structural changes that solidified SABIC's leadership position for the future. SABIC, through its affiliates, was the first company in the Middle East to introduce ERP systems aiming to improve efficiency and effectiveness and strengthen its competitive edge by operating as a single, cohesive and coordinated unit in the global market place. Since the late nineties, SABIC affiliates have been implementing so many updates to their ERP systems to guarantee continuous leadership and growth in their businesses.

RESULTS

AIS lessons from the case study: The findings obtained from SABIC affiliates' case study were discussed and reported. These findings were combined into themes in relation to AIS as follows.

Legacy AIS and motives for change: SABIC understood and realized the need to change its information technology systems dated back to the late nineties. International and Saudi business environments were competitive and almost all the enterprises were looking for any opportunity to enhance their businesses share in the market. SABIC was also going through many expansions in most of its affiliates. Enterprises accounting information systems were to extend the only technological system that SABIC affiliates have specifically in the administrative level, while the rest of SABIC departments function using manual and traditional systems. At that time, AIS was probably the main aspect that SABIC affiliates looked for possible upgrades or even complete replacement. Many of the existing accounting legacy systems were fragmented and no integration existed among them. The work in AIS was tedious and redundant using old technological systems based on double entries with vast amount of paper work without value-added processes and procedures. The legacy accounting system also needed huge number of accountants' workforce and work time and effort.

Many of SABIC affiliates expressed great concerns because of technical support and maintenance shortage needed for their legacy accounting systems. Many of such legacy accounting systems' vendors are either gone out of business, stopped producing the same accounting systems, or did not offer any technical support. This condition placed SABIC affiliates in a very uncomfortable situation fearing the claps of their AIS especially with several freighting news about the Y2K bug. Therefore, internal SABIC affiliate's users such in Information technology and accounting departments start looking for alternatives to their legacy information technology systems not only in relation to accounting departments but also in all SABIC affiliates departments. Consequentially, some of the lessons drawn from the previous description to motivate organizations to replace their legacy AIS are as follows:

- Strong external competitions
- Internal and local organizations expansions
- Lack of technical support
- Lack of system maintenance
- Internal users realizations to the need for change
- Looking for more functions and system integrations
- Reduce accounting workload and manpower
- Enhance business market share
- Overcome existing technical and information systems weaknesses

ERP-AIS selection: Information technology department in one of the SABIC affiliates that started looking for upgrade or replacement to the existing legacy information systems. The selection criterion at the beginning was simple as stated by the IT manager "to overcome the existing system weaknesses". Other criteria were developed as the time passes. Some of the criteria were to look for the information technology that can cover all SABIC departments with possible integrations, look

for vendors that are working or have branches nearby in the Saudi market and look for a system within the estimated budget and time effort assigned to implement and use the system. The manager of AIS department was a member of the team to look for possible new system. The team then developed a list of 50 vendors which was reduced to five possible vendors later. The list of selection criteria was classified in three categories such as fully integration, possible integration and unavailable for integration.

The five selected vendors were asked to come to Saudi Arabia and to present their enterprise resource planning systems. A consultant was hired to help SABIC affiliate to select their new information technology system. While the consultant pushed for a system they are experts at, SABIC affiliate selection team favored another system namely SAP system. The SAP system is one of the best and the largest ERP system in the market. The team then submitted a report with their recommendations to get top management support. However, the team did not anticipate the massive changes that ERP system could bring to the company as it was considered a similar traditional information technology system. Such wrong anticipation causes SABIC affiliates to face lot of difficulties in the future. The following lessons were learned from ERP systems selection:

- Search local and international market
- Develop criteria based on internal and external environment
- Seek help from the right consultant
- Demonstrate new system qualifications and abilities
- Need to obtain top management support
- Selection team members must be represented from all departments
- Document the work and result of the selection team
- ERP systems are different from traditional information technology systems.
- Avoid unanticipated and unrealistic results

ERP-AIS implementation: SABIC affiliates went through a long and costly ERP implementation process. Some of the affiliates either faced partial or complete system failure even though most of the affiliates adapted the consultant suggested implementation plan or worked closely with the project steering committee. The manager of each department was asked to appoint some employees to work in the new system implementation. Accounting department like other departments was not aware of the value and the importance of the new system. The manager of the accounting department was not so careful to appoint qualified accountants to be part of the implementation team. In fact, most of departmental managers thought of ERP long implementation process which may last for one or two years, as a good opportunity to get rid of bad accountants. The project start up time was not successful either because the team started working in the Holy month of RAMADAN based on consultant recommendations. Most of team members were busy with their religious tradition or wanted to take a vacation.

Therefore, the start of the implementation project was not so successful for many reasons such as bad team members selections, bad timing of the project start up and finally not preparing the team members enough to realize the importance of the new system to the affiliates. In the meantime, IT manager equipped the company with all hardware and tools needed to implement ERP-AIS. Unfortunately, the knowledge was not successfully transferred from vendor to SABIC

affiliates due to accountants' resistance to adapt ERP-AIS best practice and insisting in customizing the new ERP system based on their own requirements which was the same way they were accustomed to do in the legacy accounting system. The cash management module was excluded for implementation due to unsuitable technology. The module was so precise in cash exchange variations. The SABIC affiliate cash regulations accept up to 5000 Saudi Riyals difference in cash exchange because of exchange rate variation. This problem was then solved in systems further upgrades.

SABIC affiliate accounting departments were responsible for financial reporting. The accounting departments and accountants were blamed when one of SABIC affiliate reported overall lose while the sales of such affiliate was in its peak. SABIC affiliate expenses were recorded as usual but sales revenue was not recorded. That happened in a period span of six months of reporting lose which made SABIC headquarter interfere and order for the new ERP-AIS system to stop and to go back working in the legacy accounting information system. The final investigation revealed that Sales Distribution (S and D) module was not integrated with the ERP-AIS module. Thus, integration with other departments module such as purchasing and human resources allows ERP-AIS record expenses and not integrating the sales and distribution module did allow the affiliate ERP-AIS record the sales revenue which ended up with reporting the overall lose result.

Not integrating and recoding sales problems forced the top management to involve more into the project. Team implementation members were filtered and only the qualified accountants and other members were still be in the team. It was until then when almost all the affiliates realized that they are implementing a new and different technology system that affect all enterprise aspects. Parallel testing however made everybody, including accountants, very upset as they had to do everything twice using the legacy accounting system and the new ERP-AIS. Top management involvement, accountants' motivations and believing in the system were among many reasons the affiliates were determined to implement and go with the new ERP-AIS successfully forever. The following lessons that could be learned from the previous implementation case study:

- Select appropriate time to start the project
- Select qualified accountant to be members of implementation team
- Introduce and convince the team with the new ERP system
- ERP technology fit must be a factor to select a module for successful implementation
- Accountant requirement should adapt system best practice to minimize customization as much as possible
- Make all hardware, tools and equipment ready for the implementation
- Top management, user involvement, believing into the system and other social aspect are as important as technology aspect
- Integration is a key component for successful ERP-AIS implementation

AIS process change and embedded internal controls: SABIC affiliates' AIS mainly processes were data gathering, processing, categorizing and reporting accounting information to decision making. Accountants used to have the burden to prepare the company-consolidated budget. The requests usually sent to department managers to submit their departmental budget to the accounting department. Accounting department is responsible for preparing the final master

consolidated budget. Accountants then became under other department mercy to receive their budgets in time. Accountants will be blamed for any delay in producing the master budget. After implementing ERP-AIS, the burden to upload departmental budgets was shifted from the accountants to the departmental personnel. The ERP-AIS opened the budget module for budget upload and closed in certain time and who ever missed the assigned date will receive the blame. This system of study gives other departments freedom to think and prepare their own budget. It also changes the accounting department and accountants' job to be more in review and analysis of uploaded budgets.

Unlike legacy accounting system, in ERP-AIS environment, transactions are reordered once they occur at their origin. Debit and credit entries are initiated from users who conduct the transaction in any part of the company ERP end automatically. This system releases accountants from too much work and responsibilities. Their job now became more a sort of reviewing, monitoring and internal controlling. However, this way of studying was not flawless either. The General Ledger (GL) module accountant in one of the SABIC affiliates noticed a huge amount for unusual expense account during a routine review of GL entries. The ERP-AIS allows the transactions to be traced back to its source. It was found out that the user who initiated the transaction used an Arabic decimal comma (72,00) instead of an English decimal period (72.00) to separate the numbers. The system then multiplies (7200) expenses per employee by another mistake of (10000) not (100.00) employees and the total expenses became (7,200,000) instead of (7200). An internal control technique was built and embedded into the ERP-AIS which was not to accept the decimal Arabic comma as it is interpreted differently by the system.

The SABIC headquarters require many periodic and up-to-request accounting and financial reports. Each SABIC affiliate partners and the Saudi government might also have the same requests. Therefore, accounting system must provide such reports in time and in acceptable form of clarity and disclosures. Account closing and reporting in accounting legacy system used to take up to fifteen days which is clearly not sufficient for timely decision-making. Account closing books and the financial reporting cycle after ERP-AIS implementation in most of the SABIC affiliate were reduced to one or two days. Accountants also were able to produce many managerial reports as requested. Reporting in ERP-AIS was rich in data but was poor in the final form appearance. Many accountants used Microsoft Excel or other software to improve the way for final reports presentation. Some lessons that could be learned from what has been mentioned are as follows:

- Reduce accounting workload
- Reduce accountant manpower
- Reduce reporting cycle
- System integration provide accountants with more data to be disclosed
- Transfer accounting job from bookkeeping to more reviewing, analyzing and controlling
- Make other users involve in accounting profession by increasing the accounting scope in the enterprise such as in budget preparation
- Internal control techniques could be embedded into the system
- ERP-AIS can integrate with other software such Excel

Maintenance cost saving: The SABIC affiliates are industrial and petrochemical organizations built over large areas and contain many factories and administrative buildings. Due to this,

maintenance activities and cost are usually one of the highest in the affiliates. Many reasons prevented accountants from evaluation and analyzing such a high maintenance cost. Accountants in SABIC affiliates accounting legacy system used to deal only with monetary figures such as the cost amount and there was not linkage to almost any non-financial data. Additionally, accountants did not have enough time, effort and data to investigate such monetary figures to attempt to minimize such costs. Therefore, the cost of maintenance remains the same representing one of the highest burdens on SABIC affiliates. It was until the introduction of ERP-AIS that gives one of SABIC affiliate's financial managers the opportunity to use ERP financial and nonfinancial data to save the enterprise huge amount of money.

The ERP made data available in one single screen. The financial manager in one of SABIC affiliates was able to gather non-financial data related to the number of Maintenance Job Order (MJO) and the amount of time spent in such job orders. Surprisingly, the results revealed that Saudi maintenances employee performance were very low and that in fact justifies low, not high, maintenance cost. The ERP maintenance module integration with AIS module revealed that the affiliates signed four high cost-outsourcing contracts to provide maintenance work to the affiliate. Saudi maintenance employees are without real work and transfer most of (MJO) to be performed by expatriates maintenance workers in the contracted companies. The financial manager then recommended cancelation of three maintenance contracts which was then done. The Saudi maintenance performance quality then increased and the cost of maintenance became less than before. The previous cost saving case could provide the following lessons:

- ERP-AIS allow more integration and data offering to enhance accountant work
- Financial and nonfinancial data could enhance decision making more efficiently and effectively
- ERP-AIS enhance accountants ability to improve organization and employee work performance such as in cost saving

Inventory optimization: To improve overall business processes and to minimize total cost, SABIC initiated an inventory optimization project. The project aimed to reduce total inventory cost and improve inventory ordering and controlling systems. Even though, SABIC affiliates retain their separate inventory warehouse, all affiliates inventories are owned by SABIC parent company. The process of item request was not sufficient and it cost SABIC a lot of money. When an affiliate requests an item, this item is first checked only in the affiliates owned inventory categories based on specific item code. If this item was not located in the affiliate inventory, the purchasing departments in this affiliate orders the item from outside vender. Because of separate affiliates' inventories, there was no ability to check the existence of this item in another affiliate inventory before ordering such item from outside vender. The same inventory items might exist in another affiliate warehouse but with different code which made impossible to locate such item. This increases inventory cost and poor inventory controlling system performance.

Inventory optimization project started by SABIC headquarter to optimize the inventory cost and management system. Financial and non-financial data was gathered to evaluate inventory items turnover. Surprisingly, the results revealed that only 10-15% of the inventory items were considered have fast movers in and out of the inventory, 5-10% was labeled as medium movers and the rest of the items (60-70%) are described by slow or never moved. That result meant that almost 60% of the inventory cost is never moved and should be eliminated. The SABIC affiliates inventory

integration process was however, a big failure. Unifying the items codes in all SABIC affiliates' inventories was near impossible. Many reasons caused problems for the project in item coding, thus inventory integration failed because of items vast volume and different descriptions sometimes to the same items. The huge amount of work made many employees resist participation in such a project. Some of the lessons that could be learned from that are:

- ERP-AIS ability to provide financial and non-financial data can provide great ability and opportunity for better decision making such as in inventory optimization
- Social resistance is one of the main reasons not to implement ERP-AIS systems

Continuous improvements: The SABIC affiliate's successful ERP-AIS implementation encourages them for more and continuous improvements. SABIC monitors and evaluates any ERP upgrade in relation to current business environments. Among the motives for system's upgrades were either to implement new ERP system function or improve existing ERP system function. The decision for ERP-AIS upgrades is then taken after upgrade team recommendations. Customization, however was a big issue in early upgrades. SABIC affiliates who customized ERP-AIS had a lot of work to fit the existing work process in the early system implementations and had to customize every upgrade to fit the previous customized system. SABIC affiliates then faced customization cost, effort and workload in every upgrade. To minimize such costs, the decision was taken to adapt ERP work process or 'best practice, as much as SABIC affiliates can which was done. The later upgrade then became so easy to implement. Some lessons learned from that are as follows:

- ERP-AIS allow accountants to learn from previous experiences
- ERP-AIS customization should be at minimum for better upgrades
- Accountants role in AIS improvements is important and continuous

Accountants new job requirements: Accountants participated in legacy system decision for the change, new system selection, ERP implementations, ERP upgrades and continuous improvements. Participation in ERP-AIS has gained accountants new skills, duties and responsibilities that set through understanding accounting and business processes, ability to be selected and worked in teams and act as team leaders, better and more effective communication, less book keeping and more analysis ability. SABIC starts hiring highly qualified accountants with higher degrees in business and in accounting. SABIC hiring policy has also changes in response to new ERP required skills. Therefore, SABIC affiliates intend to hire accountant with more knowledge in information technology and ERP-AIS in particular and with more skills in accounting review, analysis and decision making support.

Considering the lessons have been mentioned before, ERP systems implementation and their effects on AIS will transform traditional accountants to become more "hybrid accountants". Accountants' effective participations in ERP-AIS implementation in motivating the changes, selecting and implementing ERP-AIS, saving maintenance cost, or optimizing SABIC affiliates inventories are all examples of some knowledge and skills that accountants should obtain in the new ERP-AIS environments. The previous explanation of the new accountant job requirements could provide the following lessons:

- Accountants new job requirements have changed to fulfill ERP-AIS new knowledge and skills
- New accountants graduate should obtain ERP system knowledge and skills for better job offering
- New ERP-AIS will transfer traditional accountants to become 'hybrid accountant'

DISCUSSIONS

The effect of Enterprise Resource Planning (ERP) systems implementation in organization as a whole and in Accounting Information Systems (AIS) in particular has been investigated in many studies (Al-Hinai *et al.*, 2013; Chang *et al.*, 2011; Chen *et al.*, 2012; Kanellou and Spathis, 2013; Kwak *et al.*, 2012; Ram and Corkindale, 2014; Ram *et al.*, 2013; Williams *et al.*, 2013). ERP systems brought massive and comprehensive changes to organizations in almost all levels and functions. AIS function is no difference and will not be away or a part from such expected changes. In fact, the nature of AIS function in the organization to collect and to process almost all organization transactions data to produce organizational final reports places AIS in the center of organization activities. Therefore, it is very important to learn some lessons that related to AIS as a result from ERP implementation.

Based on the study interpretative analysis to the rich data collection, the general tone for almost all interviewees were positive which indicate successful and positive ERP-AIS implementation. This study then reflects such a positive and successful tone in drawing the study findings. The result of the study was categorized in eight lessons categories that listed in a logical way starting of the condition before ERP implementation to identify some lessons that might motive organization to change their accounting legacy systems towards ERP systems. Other lessons related to ERP new systems selection and implementation listed afterwards. The studies then provides lessons in relation to the use of ERP system with respect to AIS activates in some issues such as AIS process and embedded internal control, maintenance cost saving, inventory optimization. Lastly, ERP continuous improvements lessons mentioned before listing overall lessons the new accountant could learn beside what has been mentioned previously.

Table 1 summarized this study's 45 lessons that could be learned in AIS as a result from implementing ERP systems as they grouped in eight categories. This study findings are in consistent with many other studies that were performed in different countries such as (Al-Hinai *et al.*, 2013; Al-Turki, 2011; Chen *et al.*, 2012; Kanellou and Spathis, 2013; Lyytinen *et al.*, 2009; Maguire *et al.*, 2010; Ram and Corkindale, 2014; Ram *et al.*, 2013; Spathis, 2006). Even though this study's findings are similar to what has been reported in other countries studies, it will not be possible to claim and guarantee that such findings will exist in every ERP-ASI implementations because of unfitness of every natural setting. As an example of that, accountant resistance to ERP-AIS implementation in religious month of Ramadan could not be applicable in other countries for instance.

This study is unique to provide better understanding of complex ERP-AIS implementation with respect to the distinctiveness of the Saudi natural settings. This way of understanding provides the basis to investigate other cases and to place them in their natural settings to see how such settings might affect the study results and findings. This study more importantly opens a wide range of issues, topics and areas for more investigations and analysis such as studying any one of this study finding in more details. An example of that is looking at the selection ERP-AIS process in Saudi

Table 1: Summary of the study findings

Lessons categories	Research findings
Legacy AIS and motives for change	Strong external competitions Internal and local organizations expansions Lack of technical support Lack of system maintenance Internal users realizations to the need for change Looking for more functions and system integrations Reduce accounting workload and manpower Enhance business market share Overcome existing technical and information systems weaknesses
ERP-AIS selection	Search local and international market Developm criteria based on internal and external environment Seek help form the right consultant Demonstrate new system qualifications and abilities Need to obtain top management support Selection team members must be represented from all departments Document the work and result of the selection team ERP systems are different from traditional information technology systems Avoid unanticipated and unrealistic results
ERP-AIS implementation	Select appropriate time to start the project Select qualified accountant to be members of implementation team Introduce and convince the team with the new ERP system ERP technology fit must be a factor to select a module for successful implementation Accountant requirement should adapt system best practice to minimize customization as much as possible Make all hardware, tools and equipment ready for the implementation Top management, user involvement, believing into the system and other social aspect are as important as technology aspect Integration is a key component for successful ERP-AIS implementation
AIS process change and embedded internal controls	Reduce accounting workload Reduce accountant manpower Reduce reporting cycle System integration provide accountants with more data to be disclosed System integration provide accountants with more data reviewing, analysing and controlling Make other users involve in accountants profession by increasing the accounting scope in the enterprise such as in budget preparation Internal control techniques could be embedded into the system ERP-AIS can integrate with other software such excel
Maintenance cost saving	ERP-AIS allow more integration and data offering to enhance accountant work Financial and nonfinancial data could enhance decision making more efficiently and effectively ERP-AIS enhance accountants ability to improve organization and employee work performance such as in cost saving
Inventory optimization	ERP-AIS ability to provide financial and non-financial data can provide great ability and opportunity for better decision making such as in inventory optimization Social resistance is one of the main reasons not to implement ERP-AIS systems

Table 1: Continue

Lessons categories	Research findings
Continuous improvements	ERP-AIS allow accountants to learn from previous experiences
	ERP-AIS customization should be at minimum for better upgrades
	Accountants role in AIS improvements is important and continuous
Accountants new job requirements	Accountants new job requirements have changed to fulfil ERP-AIS new knowledge and skills
	New accountants graduate should obtain ERP system knowledge and skills for better job offering
	New ERP-AIS will transfer traditional accountants to be hybrid accountant

industrial companies or in small and mid-sized organizations or compare such selection process in two natural settings and to see how they differ. Another example is investigating how ERP systems affect in more details the role of AIS accountants, or internal controllers.

CONCLUSION

Implementation of Enterprise Resource Planning (ERP) systems remains as the most important and substantial Information Technology (IT) that interacts with Accounting Information System (AIS) functions over the last two decades. Many studies have investigated the effect of ERP systems on AIS in many aspects such as accounting process (Spathis and Constantinides, 2004), accounting benefits (Kanellou and Spathis, 2013; Spathis, 2006; Spathis and Ananiadis, 2005), motivations and barriers (Kamhawi, 2008) and accountant role (Al-Muharfi, 2003; Chen *et al.*, 2012) and many other topics. Unfortunately, studies that summaries lessons might help academic and practitioners to understand more such a complex phenomenon of ERP systems and its effect on AIS in depth and in its natural setting especially in countries lacking similar studies such as Saudi Arabia will bring more value to this study.

This study adapted an interpretive single case study that covered SABIC affiliates located in Al-Jubail industrial city in Saudi Arabia. The aim was not to use the case study to generalize its findings applicable to natural settings other than obtaining deep understanding of research findings that might not result from the same study in different time or in different natural settings. The study finding was significantly valuable and covered comprehensive issues in many areas of the Accounting Information Systems (AIS). Academic and practitioner might benefit from these study findings especially to enrich general knowledge and understanding of ERP system implementation and their effect on AIS in a natural setting. The research in ERP-AIS applied in Saudi Arabia is still rare and more studies are needed to provide more lessons to learn from about AIS changes as a result form ERP implementation.

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