

The Effect of ERP System Implementation on Business Performance: An Exploratory Case-Study

Ahmed A. Elragal and Ayman M. Al-Serafi

German University in Cairo (GUC), New Cairo City, Egypt

Abstract

There is currently plenty of research concerning the effect of Enterprise Resource Planning (ERP) Systems on business performance. Previous research has shown a mixed relationship between ERP and business performance where some suggested that ERP improves performance and others found that it does not.

Previous research was mainly based on quantitative methods which don't give important insightful knowledge and details. A case-study on the other hand can help identify the important contributing factors for the relationship between ERP and business performance. This paper therefore, investigates this topic by analyzing a critical case-study consisting of an Egyptian SME branch of a multinational company. The results indicate that in general many benefits in business performance were achieved after implementing the ERP as reported by the business users, but have also shown that a few benefits previously linked to ERP were not fully achieved. This indicates the positive contribution of ERP on business performance but also suggests the limited applicability of this positive relationship according to specific factors to be researched.

Keywords: Enterprise Resource Planning (ERP) system, business performance, case-study analysis

Introduction

The use of enterprise resource planning (ERP) software has become increasingly more common in a lot of today's businesses. It is adopted in many firms in attempts of improving business performance. The concept of business performance can be operationalised as financial gains by the organisation, operational improvements for the organisation or intangible gains for the organisation. The focus of this paper will be on the operational and intangible gains resulting from ERP implementation (which will be operationalised by many variables tested in this study). The reason for this

selection is that the financial benefits have been analyzed many times before and do not give a direct contribution of the effect of the ERP system in specific. An example of this would be the study by Hitt et al. (2002). The reason for the insufficiency can be seen in that the financial benefits are measured quantitatively; however, a qualitative approach focusing on operational and intangible benefits can better outline the direct relationship between the ERP system and the business performance (Velcu, 2007).

The benefits of ERP systems are usually overestimated by ERP vendors. Promises are made about performance such as fast

return on investment (ROI) and fast decision making but such claims need to be researched and tested in order to establish their degree of correctness (Trott & Hoecht, 2004). The aim of this paper is to review the current research surrounding the benefits of implementing ERP systems and to explore this relationship using a selective case-study based on successful ERP implementation and stabilisation.

The importance of this topic lies within the wide-spread of ERP systems while there are clearly many examples of unsuccessful ERP effects on business performance. For examples see Gupta et al. (2004, 599-600). Investing into ERP systems which are very costly and which don't return business value will waste business resources. Therefore, it is important to clarify the vagueness surrounding the relationship between ERP and business performance.

To further investigate the relationship between ERP adoption and business performance this paper will provide a literature review of the relationship between Information Technology (IT) utilization and business performance then some applications of the concepts from IT to the more specific variable of ERP. The applications covered in this paper will discuss how ERP is affecting business performance. This will be followed by a case study to test the theories and will start with the methodology, data collection, and case details followed by the results, discussion, and finally conclusion.

Theoretical Considerations: ERP Systems

The following sub-sections will discuss the unique reasons why ERP is implemented by each organization and the issues associated with ERP implementation projects. This is necessary to help us select an appropriate case-study by assessing the degree of correctness of ERP implementation carried out in the case study discussed in this paper.

Why Firms Invest in ERP?

Why do firms invest in ERP given the different alternatives for information integration in a business? The answer for this question lies between either technical gains e.g. replacing legacy systems, or for business reasons e.g. improving operational performance and efficiency (Nicolaou, 2004).

Many technical reasons exist including the replacement of disparate systems into a single integrated system (Hitt et al., 2002). The replacement of legacy systems was very important for the boom of ERP during the late 1990s when companies wanted to replace their legacy systems during the year 2000 (Y2K) with a more Y2K compliant solution so they have invested into ERP systems (Anderson et al., 2003). ERP also provides a tested system security basis which promises to keep the organization up to security standards and for providing data security (Fuß et al., 2007).

Business reasons also exist. This includes automation and reengineering of business processes (Hitt et al., 2002). Other business reasons provided by Federici (2009) are better management, better operations, better information availability and reengineering procedures, which are all reasons for acquiring ERP. Other business reasons include enhancing cooperation and teamwork between employees in the company. In addition, benefits expected from implementation of ERP systems include tangible benefits like reducing costs, reducing operations time, and a lean organization, while intangible benefits like information integration, better information quality, and increase in customer satisfaction also exist (Loh et al., 2006; Nicolaou, 2004). Such perceived benefits are expected because ERP help make production inside manufacturing companies more efficient by integrating information from other departments like sales and procurement into the production

system, which as a result helps eliminate costs and improve production schedules (Matolcsy et al., 2005).

This discussion leads to the observation that measurements of business performance should accurately match the reasons behind ERP implementation unique to each specific organization.

ERP Projects

ERP systems are usually implemented as projects. ERP implementation projects usually involve selecting the ERP vendor, establishing business process reengineering, implementation, and evaluation of the adopted system (Wei, 2008).

ERP implementation projects normally involve internal IT & business personnel from the adopting firm as well as external consultants from implementation partners in order to be successful. This shows how human resources intensive ERP projects are. It is also worth mentioning that a good implementation partner is considered one of the most important factors for the success of ERP projects, and is another addition to the complexity of ERP implementation projects (Dai, 2008).

Due to the complexity of ERP projects it will be important to discuss ERP project implementation issues and ERP project failures in the next sections to further understand the introduction of ERP into organizations and how it contributes to the relationship between ERP and business performance.

ERP Implementation Issues

There are different utilization issues that face business that decides to go forward and implement ERP. ERP requires a big portion of time, personnel, and capital (Laukkanen et al., 2007). Most of this cost is not associated with the ERP software package itself but with its implementation, including customizations, configurations, and consultation services to implement it (Hitt et al., 2002). The time needed to establish an ERP system is at an average of

21 months. A Sample study of Taiwanese firms also found that it takes about 11 months on average to implement the ERP system (Huang et al., 2009). A similar period was suggested by Nicolaou (2004) who stated that ERP implementation projects take on average 8 months. In all cases, Gupta et al. (2004) mentioned that ERP projects frequently require more time and capital than what was planned due to the heavy integration needed on the technical and business sides.

It can be said that ERP projects frequently involve business process reengineering (BPR), can include customizations, and require good budgeting and time management in order to lead to successful business performance gains (Velcu, 2007).

ERP Project Failure

Most of the implementation failures for ERP were early ERP adoptions which did not have strong business justifications (Gupta et al., 2004). This was attributed to the misalignment between the objectives from the ERP implementation and the strategic organizational and IT goals. If such a misalignment exists, it can cause the business to lose the advantages of ERP systems. On the other hand, investing into ERP systems without any objective other than following the market or industry trend might also cause an ERP project to fail (Kang et al., 2008).

In addition, ERP failure can be associated to internal or external aspects to the organization. Internally, failure is associated to the insufficient business knowledge, while externally failure is associated to the weak technical skills of the consultants helping in the ERP implementation. Miscommunication between the teams involved can also result into failure (Hitt et al., 2002). Another issue raised was that resisting BPR activities associated with ERP can lead to ERP project failure or a huge loss of benefits (Velcu, 2007). Insufficient training of end-users is also a reason attributed to ERP failures (Gupta et al., 2004; Häkkinen & Hilmola, 2007; Loh et al., 2006). As a result to measure the overall effect of ERP on a

business, sufficient training should first be provided to the end-users to make the results more accurate.

Activities like organizational integration, user acceptance testing, accurate scope planning, and successful communication management between project members are also important factors of ERP project success or failure and all contribute to the relationship between ERP and business performance (Loh et al., 2006).

Theoretical Considerations: IT and Business Performance

Information technology is a general term which includes many technologies. ERP systems can be thought of as a specific instance of information technology. Therefore, in the following sections a discussion of the impact between IT and business performance will be discussed.

Business Performance and IT

In this section, an exploration for the relationship between information technology and business performance will be reviewed. One of the most important business performance gains to consider is productivity. Rei (2004) discussed the increase in labour productivity by implementing software.

On the other hand, Pilat (2004) has refuted such claims because they were mainly macro-economic improvements found in nation-wide productivity studies as this of Rei (2004). Such findings had great variations between countries and have also been criticized as being too aggregate to give an accurate picture. Therefore firm-level analysis was executed by researchers. Pilat (2004) reported that a study on Canadian firms in 1998 shows that as a company adopts IT involving software, hardware, and communication technology, the relative labour productivity, as compared to non-IT users, gets better. However, software was found to have the least effect when compared to hardware and communication technology (which is relevant to ERP as it is mainly software). When many IT technologies are combined,

it was found to generate greater positive effects on labour productivity.

Hamilton and Asundi (2008) also reported benefits from IT investment in SMEs. In one of the food industry companies, they found that an increase in sales and an increase in inventory turnover were achieved after adopting IT. Such payoff from IT was said to be achieved after a period between 3 to 6 years (Hamilton & Asundi, 2008). Such delays in benefits of IT were supported by many research e.g. (Pilat, 2004), who also added that studies also suggest that the greatest improvements in business performance happen in the early years of adoption and then slows down later.

In the end, it could be said that previous research suggest that a mixed result exists when analyzing the effect of IT on business performance where some studies supported a positive relation while others suggested that companies adopting ERP did not perform financially better than non-adopting companies (Nicolaou, 2004). It can be also said that the effect of IT on business performance differs from country to country (Pilat, 2004) and should be considered when measuring business performance gains due to IT adoption.

The IT Productivity Paradox

Some of the research conducted before, said that IT investments had no or slight effect on the business performance (Ross, 2002). In the time between 1980 and 1990, research findings indicated that companies which adopt IT technologies had no additional gains in productivity, and it was claimed later that IT adoption actually slows down the growth in productivity. However, lately, research indicates that IT can actually contribute to productivity improvements (Anderson et al., 2003; Pilat, 2004; Rei, 2004).

This phenomenon of vanishing returns on IT investments was called the productivity paradox and can be described as Pavlou et al. (2005) stated: "previous literature has not conclusively shown that IT investments have a positive effect on either firm or process performance." This phenomenon

was named as a productivity paradox because the findings on productivity contradicted the expectations of IT investors who thought that IT investments would improve business performance (Anderson et al., 2003).

Researchers have added that specific factors facilitate the positive relationship between IT and business performance like organizational change, innovation and increased employee skills (Pilat, 2004).

Such factors which contribute to the phenomena of the IT paradox were also pointed out by Hamilton and Asundi (2008) and include the false measurements of output to measure productivity, measurements done before the long payoff time until when returns on IT investments accrue, economy-wide measurements errors due to rearrangements of output, and mismanagement. False measurements were supported by other research like Almutairi (2007) and Rei (2004).

In addition, the research which was involved in the productivity paradox usually measured the effect of IT on the services sector (Pilat, 2004). IT investments in the services sector may be misleading because their IT contributes to better customer-service quality (which is their main business goals required for them from adopting IT) more often than administrative and internal efficiencies. Another issue is that in the early days of IT, the full adoption of the technology was slow with little activities towards development of employee skills to use the technology and with business process reengineering. This has been defined by (Pilat, 2004) as the process of "IT diffusion". In addition, the studies pertaining to the productivity paradox have been measuring the IT effect on business performance too early after adoption before benefits materialized. The paradox was also attributed to management strategies that prohibit the efficient usage of IT technologies, and is currently heavily refuted and found to be incorrect (Pilat, 2004).

Application: ERP and Business Performance Benefits

This section will discuss the relation between ERP systems as a specific example of IT with business performance and productivity.

ERP was found to save costs (Huang et al., 2009; Kang et al., 2008; Loh et al., 2006; Wieder et al., 2006), facilitate business processes (Gattiker & Goodhue, 2005), and provide better information management (Federici, 2009). Operational aspects like lead time can also be shortened by utilizing ERP systems (Cotteleer & Bendoly, 2006; Gupta et al., 2004; Kang et al., 2008). According to Velcu (2007), faster fulfilment of customer orders can be achieved using ERP systems. Gupta et al. (2004) and Matolcsy et al. (2005) also agree that ERP systems provide more customer satisfaction by reducing time of delivery of products.

Although literature seemed to agree with the hypothesis that ERP improves performance, there were still some concerns expressed by some scholars that there might be reverse causality between pre- and post- implementation with a drop in some performance indicators (Hitt et al., 2002). Some researchers tried to give reasons for this. For example, Fuß et al. (2007) suggest that services-sector business (like banks) adopting ERP usually anticipate and utilize ERP systems for effectiveness more commonly than efficiency, therefore cost reductions and productivity might not be as important for them as better quality business processes and better information quality. For such ERP adopters making efficiency and productivity measurements is inaccurate and can have negative causality.

Therefore, previous research has found contradicting findings regarding the effect of ERP systems on business performance. While some researchers have found that ERP systems can affect overall business performance positively, others have only found ERP systems to affect specific areas

and not the overall business performance. This can then suggest that ERP systems do not always affect business performance positively and some contributing factors affect this relationship (Kang et al., 2008).

In addition, some studies also contradict that sufficient financial benefits are achieved after ERP implementation. This can be seen for example when Kennerley and Neely (2001) concluded that return on sales in specific was found unaffected after implementing ERP systems. The study by Wieder et al. (2006) also stated that some research found that specific financial benefits of ERP systems were not accumulated when comparing between ERP users and non-ERP users. Nicolaou (2004) stated that the ration of G&A expenses to sales for ERP adopters showed a worse ratio than non-adopters indicating a fall in financial performance from this aspect. Wei (2008) added that some researchers found long-term positive effects of ERP on financial performance, while other researchers only suggest that ERP can help keep performance as-is and does not improve it from the financial aspect. This suggests that further investigations using such financial analysis are important.

The Stages of ERP Benefits

ERP system implementation projects have got different phases which need to be considered when analyzing the benefits achieved by ERP adopting companies.

According to Esteves (2009), it takes between 1 to 2 years for business benefits to start materializing. It was also stated that an ERP project does not mature except after 3 years. ERP benefits are expected to be achieved on a continuous basis after implementing the system and not all at once (Esteves, 2009; Wei, 2008).

This was agreed upon by Gattiker and Goodhue (2005) and Matolcsy et al. (2005) when they said that benefits start to appear after the “shakedown” phase taking duration of 2 years or more.

Similarly for Häkkinen and Hilmola (2007) the “shakedown” phase is between 4 to 12 months after implementation. The reason for accumulation of benefits after the “shakedown” phase is attributed to employee learning resulting into more usage and experience with the ERP system (Cotteleer & Bendoly, 2006).

Generally and as a result of the possible delays of ERP benefits after implementation during the “shakedown phase”, it is recommended not to measure business performance during this period heavily quoted by literature. The reason for this is that it would be inaccurate to measure productivity and impact as the business wouldn't have stabilized yet (Häkkinen & Hilmola, 2007). This was actually done by researches like Matolcsy et al. (2005) when they made their measurements for 3 years before ERP adoption and 2 years after adoption.

Factors of ERP and Performance Benefits

Beside the factor of the stage of measuring business performance other factors also exist. For example, Hitt et al. (2002) stated that there might be an effect caused by the industry status and shocks that might occur in the market when measuring business performance. This might lead to incorrect measurements and therefore misconceptions. Velcu (2007) agreed that business performance might be affected by the industry of the business.

Proper management of IS implementations like the ones involved in ERP can also be reported as an important contributing factor that affects performance gains from the system (Nicolaou, 2004). Management should also set objectives from ERP implementations. On the other hand, things like “ERP size” can be a contributing factor of its effect on business. This means the number of implemented modules according to the context of the research by Kang et al. (2008). Kang et al. (2008) also mentioned that the alignment between strategic business goals and ERP objectives is an important factor for generating business benefit from the ERP system.

While it was commonly believed that ERP implementations based on business goals are more successful, Nicolaou (2004) found that business oriented ERP implementations do not necessarily result into better financial performance; however technical driven implementations were found better performing in terms of Return on Assets (ROA).

Huang et al. (2009) found that companies implementing ERPs from multinational vendors had better performance improvements than companies implementing local vendor ERPs. It was stated that local Taiwanese ERPs can actually diminish performance after implementation. This was said to be more significant with companies involving international business where multinational ERP vendors can provide better functionality to cover such needs. This is another indicator that factors like the ERP vendor and specific usage of the ERP system can lead to different outcome concerning business performance.

Research Gap

The research so far has investigated performance gains due to ERP adoption under specific conditions and with specific measurements. This included research in many countries around the world testing this effect in a random sample of companies, however, there are limited approaches done by researchers for only concentrating on successful examples. In addition, analyzing publically available financial data was also conducted but has its shortcomings in giving details of the perspective of the internal managers in the company. Therefore, this research paper will only target a single successful case of ERP implementation and from the point-of-view of the managers in the company. Success of the ERP implementation will be compared to the factors discussed by previous researchers as listed in *section 4*.

It also remains however quite vague as for the exact benefits to be expected from ERP implementations, therefore, an exploratory approach is required to try and reach a clear understanding. As an alternative to

the quantitative analysis conducted with publically available financial data, more specific and detailed case studies can be studied to give a deeper look at the effect of ERP on business performance. Therefore, for this paper, the main objective is to find an appropriate case study which has correct ERP implementation procedure and an alignment between organizational goals and ERP implementation objectives. The paper will therefore, triangulate research of the effect of ERP on business performance by an analysis of a detailed case study in Egypt. This will also be the first exploratory approach for measuring this effect in developing countries of the Middle East.

Research Methodology

There are many previous quantitative research conducted about the relationship between ERP and business performance. Such research involved surveys and large amount of quantitative data e.g. (Gattiker & Goodhue, 2005; Hitt et al., 2002; Huang et al., 2009; Laukkanen et al., 2007; Wieder et al., 2006).

However, it is recommended that the effect of ERP on business performance should also be researched by a qualitative study. This was recommended by Wieder et al., (2006) when they have recommended a field study as the form of future research. As a result, for this research paper a single case study was chosen and qualitative methods were used.

The case study was carefully chosen by the authors with the goal of selecting a successful example of ERP implementation. This was done by taking a theoretically critical case study of successful ERP implementation. In addition, the company was selected so that it would have implemented and stabilized with the ERP since a sufficient period of time, the company has maintained a successful business performance before ERP implementation, and the market of the company was stable to limit market fluctuations effects on business performance. In order to do this, an interview was initially conducted with one

of the major ERP system-integrators in Egypt with the objective of identifying a successful ERP project they have worked on. Three companies were short listed. One of the companies was a local Egyptian manufacturer of plastics. Another company was a local hypermarket retailer however still in progress of business process alignment with the ERP. The last company was a multinational branch of a chemicals manufacturer who has finished the ERP implementation since 8 years ago. The last company was selected because it showed a positive reaction from the initial interview with the ERP project manager and also met all the selection criteria as stated above. This case was also selected for the convenience of the authors (further details about the company will follow in *section 7*).

In order to explore the effect of ERP systems on business performance in the case study, an interview was completed with the IT manager (also the project manager of the ERP implementation project) and 3 interviews were planned with the financial, operational and logistics manager. As the managers were collocated in Alexandria, Egypt and not in the area of the authors and as they were unreachable at the time of executing the study, a questionnaire was sent to them by e-mail instead of a face-to-face contact. All three managers responded to the questionnaire. The details of the data collection are given in details in the next section.

Data analysis then followed the data collection phase. In order to do so the 3 responses of the managers were compared together. Each question response was compared between all 3 managers and similarities or differences were reported. When the managers seemed to agree on a certain aspect of the business performance effects as was shown from their response this was reported as heavily supported. When there were some differences in opinion from the managers or rejections of the existence of a business performance improvement by any of the managers this was also noted and reported. The results and discussion will follow in *sections 8 and 9*.

Date Collection

First an operationalisation of business performance was obtained by noting performance indicators from previous literature to be used in the questionnaire. For example, Häkkinen & Hilmola (2007) has mentioned that measurements of IT projects usually involve considering the financial benefits like ROI, the organizational benefits, users' satisfaction, and efficiency-related measurements such as labour productivity. This was used as a guideline to look for specific indicators of business performance from ERP. This included indicators for organizational change and BPR, increasing the employee knowledge asset in the enterprise, having better service and finally better information quality (Hitt et al., 2002). Wei (2008) has also stated that assessing the decision making improvements, lead time, and the degree of facilitation for management activities as a result of ERP adoption are also indicators of business performance from ERP. In addition, the time needed to produce a single item and errors of shipping and the costs of holding inventory were used before. Supply chain management measurements can also be used such as: cost of logistics & distribution, maintenance costs, rework costs, speed of order fulfilment, percentage of deliveries on time, stock-out probability, time required to produce a single item, percentage shipping errors, percentages of customer complains, ease of changing output levels, product variety, and capability to produce new products (Wieder et al., 2006).

Finally, it was discussed by Almutairi (2007) and Pilat (2004) that there are a variety of methods used by researchers to measure IT productivity at the firm-level. The variety of methods is considered a positive attribute of research in this field because not all measures are accurate and using many measurements increases validity and provides stronger support.

As Esteves (2009) have said, SME managers are more suitable for interviews concerning ERP usage because they are

more involved and affected by the ERP system. Therefore, the financial, operations, and logistics managers were included in this study.

The above indicators of business performance were used to construct 2 set of structured questionnaires. The first set is targeting general business performance and included questions for the financial manager (see *Appendix I*) and the second set included more operational questions and was used with the logistics and operations manager (see *Appendix II*).

In addition, an interview with the IT manager has been conducted in order to gather background information about the company, ChemCo Egypt (will be discussed in the following section), and in order to gather information about the ERP system, the ERP implementation project, and the degree of usage and success from the ERP system. The IT manager was with the company since 1984 before merging in 1997 to become part of ChemCo. He was also the project manager of the JD Edwards ERP implementation. This made the information gathered more accurate and relevant.

The summary of the case study is given in the next section according to the information provided by the IT manager of ChemCo Egypt. The results obtained from the logistics, operations and the financial managers were contrasted and will be shown in *section 8*.

Case Details

To further clarify the case under study, the following sections will be dedicated for describing the background of the company in focus, the IT in the company in focus, and the ERP adoption in the company.

Case Background

The company selected as a case study is a multinational company branch located in Egypt. The multinational company is headquartered in Europe and is a manufacturer of speciality chemicals. The company will be referred in our paper as

"ChemCo" to protect the company's identity.

ChemCo is competing worldwide with more than 100 branches and in over five continents. It produces specialty chemicals including: emulsions (non-metallic), glues (for cigarettes, cartons, etc...), cleaning function chemicals ("Fun chemicals"), paper treatment chemicals, textile chemicals (colourings, bases for textiles, agents, etc), and non-textile chemicals (e.g. plastic and wood colourings). ChemCo produces raw materials only which are provided to manufacturing firms as supplies to their production lines. The global sales of ChemCo reached about \$6.5 billion in 2009.

As far as the Egyptian branch of ChemCo under study in this paper, it started in 1997 after a merger between a chemicals company and a pharmaceuticals company took place creating ChemCo Egypt. The administration and headquarters of the Egyptian branch is located in Cairo while the production plant is located near the Egyptian city of Alexandria. The headquarters in Cairo consist of the IT department, business units, and sales force teams. The production plant in Alexandria is responsible for production, dispatch and handling customs.

ChemCo's branch in Egypt was bigger in the past with 150 employees but currently it only has 83 employees (with 30 other employees outsourced). During the ERP implementation the company had 164 employees but this was reduced to 83 because some non-profitable production lines were shut over the years after ERP implementation. In all cases, the Egyptian branch is considered an SME company when we take the number of employees in mind.

ERP Adoption in ChemCo Egypt

The IT of ChemCo Egypt before implementing the ERP consisted of legacy systems running the business based on IBM AS400 infrastructure (with 4 business modules acquired from software providers and 1 module for sales order and analysis

was developed locally inside the company). As for the ERP system, ChemCo is globally using SAP ERP system as their main system. However, the Egyptian branch in Egypt is using a different solution which is more appropriate for SMEs in Egypt: Oracle JD Edwards World. This ERP system has replaced all other legacy systems except few applications in the production plant.

Many reasons made ChemCo Egypt choose JD Edwards World. This includes that this ERP system was compatible with the IBM AS400 infrastructure ChemCo Egypt already had. It was also less expensive than SAP, yet included all required modules in an integrated package which was appropriate for the SME. The IT manager from the company has also mentioned that the implementation of the ERP was mainly for technical reasons involving the replacement of legacy systems which had no further support, more integration and preventing the problems associated with the Y2K issues.

ERP Implementation in ChemCo Egypt

The ERP implementation project started in April 1999. This was very close to the year 2000 and required the team to be very quick and rushed in order to transform quickly before the Y2K problem hits the company. Implementation was based on the Conference Room Pilot (CRP) approach, which implemented the foundation, Financial, Sales and receivables, purchasing and payables, fixed asset & budgeting, and production modules of JD Edwards. A specific (customized) reporting subsystem for JD Edwards World was also implemented to support daily business activities.

Implementation was a full-module one which used 13 out of the available modules in JD Edwards. The modules not used were not related to the business which included applications such as contract management, project costing and budgeting, etc... Those applications are not required for ChemCo Egypt which produces batches of products (in a process production and not job shops) and does not depend on such things. The only exception to this was the material

requirements planning system which is not used by the company.

The material requirements planning system (an important component of the production modules of ERP) was not implemented for political reasons (the plant managers do not want to use it) and for mismatch to the way of business in developing countries where they produce to stock with fixed quantities. Another reason mentioned by the IT manager was the unavailability of accurate sales forecasts from the sales division to run the material requirements planning application which depends on such data. This is a big difference from other companies and case studies covered in the ERP literature. It elaborates the situation of SMEs in developing countries.

Other modules which were not implemented include human resources modules (which were implemented as small Oracle applications integrated to the ERP), shipment tracing (also implemented as a separate development integrated to the ERP), production ordering (which the plant uses another application or manual system for), job costing (those business processes do not exist in the company), and shop floor management. Those areas were not essential or had alternatives keeping in mind that ChemCo Egypt is an SME. All the other modules were implemented normally such as: General ledger, order processing, sales, receivables, purchases, payables, stock, production modules, budgeting and fixed assets.

Some customizations were developed including some functionality in the production modules. All developments did not touch the main code and were developed on a separate library (with a pointer inside JD Edwards pointing to the new code). But most other suites and modules were not customized including financial modules which were implemented as they are provided by JD Edwards. The IT manager have said that the business have reengineered itself to a large extent than customized the application.

According to the IT manager, the implementation project of the ERP was very successful although there were some challenges. Those challenges involved the pressure on the manager to finish the project before the end of 1999 and the limited availability of experienced consultants while implementing the project. However, this was said not to affect the outcomes expected from the project. In addition, ChemCo Egypt did not implement any updates from the original ERP version implemented. This assures that no manipulation to the stability of the firm has taken place which could have been due to an ERP upgrade, making the results from this case-study more accurate.

The ERP Implementation Team & Training

The implementation team involved a project management board from the company, employees and external consultant. The project management team consisted of the IT manager, accounting manager, and a production specialist from the production plant in Alexandria. The main burden of implementing the ERP system was put on the IT manager's side. He acted as project manager, IT consultant, and end-user trainer (this was acceptable as the company is an SME with a limited project scope when compared to huge enterprises). The project management team was involved in general project management activities in addition to setup and CRP of the ERP system with the external consultants. The project management team was also responsible for agreeing on the final JD Edwards based ERP solution.

The project management team conducted weekly meetings where employees and top management were invited in order to communicate the project activities executed and how much was completed. This was conducted every Wednesday. The project management relationship with consultants was very good which made the implementation very successful.

The IT department was mainly responsible for sales and receivables modules while the

production department in Alexandria was mainly responsible for the production modules. In addition, 12 extra employees were trained on the JD Edwards system and were involved in the ERP implementation.

The project management team received direct product training from external consultants and learned about the application from the JD Edwards manuals provided with the product. The project management team was then responsible for training the end-users of the ERP system, which was sufficient training according to the IT manager (part of the project management team). The reason that it was sufficient is because the end-users in ChemCo Egypt already had a background of using applications to run the daily business processes from the legacy systems they used to have. This made training considerably easier. This training was also sufficient as employees already had a good solid background about business processes from experience with the previous legacy systems they had. All this indicates the success of ChemCo Egypt in managing the ERP implementation project leading to successful effects on business performance.

ERP Implementation Schedule

In January 2000 an initial Go-live with a few modules took place ending a semi-finished implementation in a year. The phased Go-live (continuation of implementation sub-projects) schedule was: Foundation, Sales & Receivables and Financials (GL) in January 2000 (those are the essential most important modules), production in March 2000, and Purchasing, payables, Fixed assets and budgeting in June 2000.

The IT manager explained the reason for this phased Go-live as to minimize risks and not cause distraction to the business as much as possible. According to the IT manager cutting the Go-live process means more stability.

From September 2000 till May 2001, continuous development of reporting

interfaces and solutions linked to the ERP system was done by consultants. This was needed as the employees discovered that some of the reports they required were not available with the ERP package.

It could be said that the “initial Go-live” was on January 2000 when all data was transferred and entered on the new system and the “final Go-live” was on May 2001 when the reporting based

on the new data input was realized. Therefore total implementation duration was nearly 2 years. This indicates that sufficient time for the ERP implementation was allocated.

Challenges & Results from ERP Implementation

Initially employees found a challenge to transfer from the old legacy systems to the new ERP system; heavy change management was needed. The phased Go-live approach according to the IT manager helped reducing this problem.

Some minor changes were also needed after implementation like changes in the tax setup and budgeting changes to fit quarterly planning instead of yearly planning. It was also needed to have simultaneous actual accounting beside standard accounting methods. This was partially supported by the ERP system but required some customizations to the accounting system. Developing an add-on to the ERP system to handle currency differences was also needed.

As for some accomplishments and results from the ERP system, from 2000 (Date of Go-live) till 2010, the company has never failed to successfully close accounting balances and accounts using the ERP system. This is considered a success by the IT manager of ChemCo Egypt.

Results

After analyzing and contrasting the response of the financial, operations and logistics managers to the questionnaires

(see *Appendix I & II*) this section will describe the results found.

The general business performance improvements according to the financial manager were met successfully by the ERP system. The financial manager said that the information in the ERP is very important and the ERP system in general has a great effect on business performance.

Concerning integration with other business units and teams, the financial manager has agreed that the ERP has helped. However, the ERP system did not substantially help the financial manager communicate with the top management board of the company (chief executive officer and vice presidents).

The financial manager has agreed that the ERP helps saving a lot of time doing tasks and jobs by eliminating the number of tasks needed to finish the business processes. The ERP has also helped the manager reduce routine on the job.

The ERP system was very successful in providing more knowledge to the financial manager about business processes, however, only reduced the number of errors doing tasks a little with no substantial effect.

As for the operational benefits both the logistics and operations managers have agreed that the ERP has shortened the time needed to deliver products to the customer, has a great effect on the capability of the company to produce or provide more products and services, has reduced the amount of inventory, improved greatly the capability to respond to customers, has reduced the number of errors in shipping and sales returns, and has a great effect in improving communication with customers and integration with partners.

However, both the operations and logistics managers have stated that the ERP system did not decrease time needed on the long-run to produce a single item of production. The logistics manager have agreed that the

ERP system has increased customer satisfaction, however, the operations manager said that only sometimes customers became satisfied after implementing the ERP.

The results are summarized in the *Table: Business Performance Indicators & Results*. The first column gives the groupings of the business performance indicators, the second column lists the business performance indicators, the third column extracts the question in *Appendix I & II* which gives the indication of business performance, while the fourth column describes if the business performance indicator showed a positive relationship (a tick ✓), a slight relationship (shown by the Tilde ~ symbol), no relationship (a line —) or had a negative effect (a cross X). This was repeated for each manager.

Discussion, Limitations & Future Research

The choice of ChemCo Egypt as the case study has been justified. Firstly, it involved a company which has implemented ERP successfully (with correct project management activities and ERP users training as described in the *section 7: Case details*), has a stable ERP system for almost 8 years (putting the company outside the “shakedown” phase and in the maturity phases), and has also involved an example of a successful manufacturing company. This means that the factors leading to successful ERP implementation have been achieved. The results of this study are therefore, expected to accurately relate the ERP to business performance under a successful ERP implementation environment.

The results indicate that ERP implementation has helped ChemCo Egypt improve its business performance. According to the replies by the SME’s managers it was clear that their experience with the ERP was mostly positive. Many of the benefits found in previous research, have been achieved in the case of ChemCo

Egypt including: improved production lead times, reduced time and routine to do work, better information availability, better information quality, improved business-wide integration, improved production capabilities, reduced errors in shipping, improved customer service and improved external communication.

However, top management communication was not highly supported in this study. This might indicate that ERP does not connect different managerial levels together as it does not serve as communication tools but rather as operational systems. The number of errors doing a job was also not found to be improved with the ERP system. A reason for this might be due to the fact that ERP helps in capturing information rather than in working with information, or due to the fact that ERP automates a process so it eliminates tasks all together rather than reducing errors in them. The time needed to produce a single item was also not strongly supported which might indicate that it is not related to ERP adoption. As for the customer satisfaction, it was not concluded that ERP generally improves customer satisfaction but this might be due to the lack of CRM capabilities and modules in JD Edwards World implemented at ChemCo Egypt!

As for whether ERP affects business performance after the business stabilizes (the lapse of 2 or more years as indicated in the literature), the study supports previous claims that ERP does have a positive effect on business performance. The study was conducted in an attempt to triangulate previous research surrounding the topic of ERP and business performance, while also introducing new ways of analyzing this effect. Instead of quantitative approaches conducted on publically available data about enterprises and measuring overall effects, this study aimed at exploring the effects of ERP on business performance in a single case-study of an SME and which included more direct data from the managers of the company.

Table: Business Performance Indicators & Results

Groupings	Business Performance indicator	Questions	Achieved?
General	Overall Business Performance	Appendix I: Does the ERP system affect business performance inside the company?	Financial Manager: ✓
	Customer satisfaction	Appendix II: Was there an effect by the ERP system on customer satisfaction?	Logistics Manager: ✓ Operations Manager: ~
	Customer Orientation	Appendix II: Was there an effect by the ERP system on your capability to respond to customer needs?	Logistics Manager: ✓ Operations Manager: ✓
Operational Efficiency	Task Time	Appendix I: Did the ERP system help save you time doing your job?	Financial Manager: ✓
	Number of tasks on job	Appendix I: Did the ERP system affect the number of tasks you need to finish your work?	Financial Manager: ✓
	Lead Time	Appendix II: Was there an effect by the ERP system on the time needed to deliver products or services to customers?	Logistics Manager: ✓ Operations Manager: ✓
	Time per item	Appendix II: Was there an effect by the ERP system on the time required to produce a single item of production?	Logistics Manager: ~ Operations Manager: ~
	Inventory levels	Appendix II: Was there an effect by the ERP System on the amount of inventory you keep?	Logistics Manager: ✓ Operations Manager: ✓
Operational Effectiveness	Number of errors on job	Appendix I: Did the ERP system reduce the number of errors you make on your job?	Financial Manager: ~
	Shipment Errors	Appendix II: Was there an effect by the ERP system on the amount in errors in shipping and sales returns?	Logistics Manager: ✓ Operations Manager: ✓

Table: Business Performance Indicators & Results (Continued...)

Groupings	Business Performance indicator	Questions	Achieved?
Operational Effectiveness	Shipment Errors	Appendix II: Was there an effect by the ERP system on the amount in errors in shipping and sales returns?	Logistics Manager: ✓ Operations Manager: ✓
	Job Routine	Appendix I: Did the ERP system affect the routine of your work?	Financial Manager: ✓
	Production Capability	Appendix II: Was there an effect by the ERP system on your capability to produce or provide more products and services?	Logistics Manager: ✓ Operations Manager: ✓
Communication	Internal communication	Appendix I: Did the ERP system help make you more integrated with other departments and teams?	Financial Manager: ✓
	External Communication	Appendix II: Was there an effect by the ERP system on your capability to integrate with suppliers?	Logistics Manager: ✓ Operations Manager: ✓
		Appendix II: Was there an effect by the ERP system on your capability to communicate with customers?	Logistics Manager: ✓ Operations Manager: ✓
	Top management communication	Appendix I: Does the ERP system help you communicate with top management?	Financial Manager: ~
Information	Information richness	Appendix I: How important do you find the information you collect in the ERP system?	Financial Manager: ✓
	Business Process clarity	Appendix I: Did the ERP system provide more knowledge to you concerning the company and business processes?	Financial Manager: ✓

The focus here was on the perspectives of the managers instead of analysis of public financial data. The study is also aiming at starting this investigation in developing countries and the Middle East. The case selection procedures which guaranteed successful ERP implementation were also a key contributing factor for this study. In general, the study indicates that investments into ERP can be correctly justified as having positive business returns. Although this is said, further research is required to support this paper's results.

The study of ChemCo has successfully showed that ERP systems can help improve business performance, however, some limitations exist. Only financial, logistics, and operations managers were involved in the study. Those were selected as they are the most important managers for the manufacturing SME (ChemCo Egypt) and who were available to answer the questionnaire. It might have led to further insights if a face-to-face interview was conducted instead, however, the closed-response approach seemed to help better in comparison and contrasting of different managers' point-of-views.

While some business performance indicators were supported, other indicators were not found to have full support. Those indicators should be investigated in details by quantitative analysis while controlling factors like different ERP vendors (local, multinational, in-house development), different company sizes, different industries, and different ERP modules. This is to be established while still maintaining a sample of only successful ERP implementers, as was conducted in the selection of this case study.

In the future, a longitudinal case study could be also used to further examine the effect of ERP on business performance in a successful ERP implementation company, but in addition, financial analysis could be done. Financial analysis can measure the effect of ERP on costs and profit making, but must also benchmark with the market and pre-ERP business performance (see

Hitt et al., 2002; Huang et al., 2009 for more details of some good financial and quantitative measures which can be used).

A quantitative survey of all employees of the company and not just managers could be also used to support the qualitative research findings. Such a survey can be organized by functional area (like production, accounting, human resources, marketing etc.) to check if ERP has different effects on specific business functions. The modules implemented will have to be kept in consideration as they will affect results (for example, human resources modules from the ERP must be implemented before surveying the human resources department).

Conclusion

This paper has started by summarizing the relationship between IT and business performance. The gains in productivity from utilizing IT were discussed and the "productivity paradox", made popular between the 1980s and 1990s, was described. The common measurements of business performance were illustrated. The relationship between ERP adoption and business benefits was also reviewed. It was found that some financial and operational benefits can be achieved and measured; however, there is still debate over the exact effect of ERP on performance at the financial and operational level. Different factors affecting this relationship between ERP systems and business performance were discussed such as the factors of the stage of ERP implementation and ERP issues.

In order to investigate the relationship between ERP and business performance a case study identifying the benefits, achieved after implementing ERP system in an Egyptian company, was presented. The company was identified as having successfully implemented the ERP system. Results showed that many benefits have been achieved after ERP adoption. However, few benefits which were reported by other researchers were not supported and should be further investigated. More investigation of the

factors which contribute to the relationship between ERP and specific business performance outcomes should be also studied to help make a clear vision and roadmap of the benefits of ERP.

References

Almutairi, H. (2007). "Information System and Productivity in Kuwaiti Public Organizations: Looking Inside the Black Box," *International Journal of Public Administration*, 30, 1263–1290.

Anderson, M., C., Banker, R., D. & Ravindran, S. (2003). "The New Productivity Paradox," *Communications of the ACM*, 46 (3), 91-94.

Cotteleer, M., J. & Bendoly, E. (2006). "Order Lead-Time Improvement Following Enterprise Information Technology Implementation: An Empirical Study," *MIS Quarterly*, 30 (3), 643-660.

Dai, Z. (2008). "Supply Chain Transformation By ERP For Enhancing Performance: An Empirical Investigation," *Advances in Competitiveness Research*, 16 (1&2), 87-98.

Esteves, J. (2009). "A Benefits Realisation Road-Map Framework for ERP Usage in Small and Medium-Sized Enterprises," *Journal of Enterprise Information*, 22 (1/2), 25-35.

Federici, T. (2009). "Factors Influencing ERP Outcomes in SMEs: a Post-Introduction Assessment," *Journal of Enterprise Information*, 22 (1/2), 81-98.

Fuß, C., Gmeiner, R., Schiereck, D. & Strahringer, S. (2007). "ERP Usage in Banking: An Exploratory Survey of the World's Largest Banks," *Information Systems Management*, 24, 155–171.

Gattiker, T. & Goodhue, D. (2005). "What Happens After ERP Implementation: Understanding the Impact of Inter-Dependence and Differentiation on Plant-Level Outcomes," *MIS Quarterly*, 29 (3), 559-585.

Gupta, O., Priyadarshini, K., Massoud, S. & Agrawal, S. K. (2004). "Enterprise Resource

Planning: A Case of a Blood Bank," *Industrial Management & Data Systems*, 104 (7), 589-603.

Häkkinen, L. & Hilmola, O.-P. (2008). "ERP Evaluation during the Shakedown Phase: Lessons from an After-Sales Division," *Information Systems Journal*, 18, 73-100.

Hamilton, L., C. & Asundi, R. (2008). "Technology Usage and Innovation: It's Effect on the Profitability of SMEs," *Management Research News*, 31 (11), 830-845.

Hitt, L. M., Wu, D., J. & Zhou, X. (2002). "Investment in Enterprise Resource Planning: Business Impact and Productivity Measures," *Journal of Management Information Systems*, 19 (1), 71-98.

Huang, S. Y., Huang, S.-M., Wu, T.-H & Lin, W.-K. (2009). "Process Efficiency of the Enterprise Resource Planning Adoption," *Industrial Management & Data Systems*, 109 (8), 1085-1100.

Kang, S., Park, J.-H. & Yang, H.-D. (2008). "ERP Alignment for Positive Business Performance: Evidence From Korea's ERP Market," *Journal of Computer Information Systems*, Summer 2008, 25-38.

Kennerley, M. & Neely, A. (2001). "Enterprise Resource Planning: Analysing the Impact," *Integrated Manufacturing Systems*, 12 (2), 103-113.

Laukkanen, S., Sarpola, S. & Hallikainen, P. (2007). "Enterprise Size Matters: Objectives and Constraints of ERP Adoption," *Journal of Enterprise Information Management*, 20 (3), 319-334.

Loh, T., Koh, S. & Simpson, M. (2006). "An Investigation of the Value of Becoming an Extended Enterprise," *International Journal of Integrated Manufacturing*, 19 (1), 49-58.

Matolcsy, Z. P., Booth, P. & Wieder, B. (2005). "Economic Benefits of Enterprise Resource Planning Systems: Some Empirical Evidence," *Accounting & Finance*, 45, 439-456.

- Nicolaou, A. (2004). "Firm Performance Effects in Relation to the Implementation and Use of Enterprise Resource Planning Systems," *Journal of Information Systems*, 18 (2), 79-105.
- Pavlou, P. A., Housel, T. J., Rodgers, W. & Jansen, E. (2005). "Measuring the Return on Information Technology: A Knowledge-Based Approach for Revenue Allocation at the Process and Firm Level," *Journal of the Association for Information Systems*, 6 (7), 199-226.
- Pilat, D. (2004). The ICT Productivity Paradox: Insights from Micro Data, *OECD Economic Studies*, 38, 37-65.
- Rei, C. M. (2004). 'Causal Evidence on the "Productivity Paradox" and Implications for Managers,' *International Journal of Productivity and Performance Management*, 53 (2), 129-142.
- Ross, A. (2002). "A Multi-Dimensional Empirical Exploration of Technology Investment, Coordination and Firm Performance," *International Journal of Physical Distribution & Logistics Management*, 32 (7), 591-609.
- Trott, P. & Hoecht, A. (2004). "Enterprise Resource Planning and the Price of Efficiency: The Trade Off Between Business Efficiency and the Innovative Capability of Firms," *Technology Analysis & Strategic Management*, 16 (3), 367-379.
- Velcu, O. (2007). "Exploring the Effects Of ERP Systems on Organizational Performance: Evidence from Finnish Companies," *Industrial Management & Data Systems*, 107 (9), 1316-1334.
- Wei, C.-C. (2008). "Evaluating the Performance of an ERP System Based on The Knowledge of ERP Implementation Objectives," *The International Journal of Advanced Manufacturing Technology* (39), 168-181.
- Wieder, B., Booth, P., Matolcsy, Z. P. & Ossimitz, M.-L. (2006). "The Impact of ERP Systems on Firm and Business Process Performance," *Journal of Enterprise Information Management*, 19 (1), 13-29.

Appendix I

1/10

1. What department do you belong to?

2/10

2. How important do you find the information you collect in the ERP system?

1. Very Important
2. Can be important sometimes
3. Not important; just another copy of data

3/10

3. Does the ERP system affect business performance inside the company?

1. No, it just stores data
2. Just a little bit
3. Yes, it had a great effect

4/10

4. Did the ERP system help make you more integrated with other departments and teams?

1. Yes, very much!
2. Yes, a little
3. Not at all
4. It caused problems with others!

5/10

5. Does the ERP system help you communicate with top management?

1. No, it caused problems
2. No, it had no effect
3. Yes, a little
4. Yes, very much

6/10

6. Did the ERP system help save you time doing your job?

1. Yes, a lot!
2. Sometimes
3. No, it didn't

7/10

7. Did the ERP system affect the number of tasks you need to finish your work?

1. No it didn't
2. It requires more tasks
3. It requires less tasks

8/10

8. Did the ERP system reduce the number of errors you make on your job?

1. It made errors worse
2. No, it had no effect
3. Yes, a little
4. Yes, a lot

9/10

9. Did the ERP system provide more knowledge to you concerning the company and business processes?

1. No it didn't
2. Only a little
3. Yes, totally

10/10

10. Did the ERP system affect the routine of your work?

1. No, it had no effect
2. Yes, it reduced routine
3. Yes, it increased routine

Appendix II

1/10

1. What is your position and what department do you belong to?

2/10

2. Was there an effect by the ERP system on the time needed to deliver products or services to customers?

- 1. No, it had no effect
- 2. Yes, it made it worse
- 3. Yes, sometimes it made it better
- 4. Yes, it improved

3/10

3. Was there an effect by the ERP system on the time required to produce a single item of production?

- 1. No, it had no effect
- 2. Yes, it made it worse
- 3. Yes, sometimes it made it better
- 4. Yes, it improved

4/10

4. Was there an effect by the ERP system on customer satisfaction?

- 1. No, there was no effect
- 2. Yes, they are less satisfied
- 3. Yes, sometimes they are more satisfied
- 4. Yes, more satisfaction

5/10

5. Was there an effect by the ERP system on your capability to produce or provide more products and services?

- 1. No, there was no effect
- 2. Not very much
- 3. Yes, sometimes
- 4. Yes, a great effect!

6/10

6. Was there an effect by the ERP System on the amount of inventory you keep?

- 1. No, there is no effect
- 2. Yes, we keep more inventory now
- 3. Yes, sometimes we have less inventory
- 4. Yes, we keep less inventory now

7/10

7. Was there an effect by the ERP system on the amount of errors in shipping and sales returns?

- 1. No, there is no effect
- 2. Yes, now there are more errors
- 3. Yes, sometimes there are less errors
- 4. Yes, there are less errors and returns

8/10

8. Was there an effect by the ERP system on your capability to respond to customer needs?

- 1. No, there was no effect
- 2. Not very much
- 3. Yes, sometimes
- 4. Yes, a great effect!

9/10

9. Was there an effect by the ERP system on your capability to integrate with suppliers?

- 1. No, there was no effect
- 2. Not very much
- 3. Yes, sometimes
- 4. Yes, a great effect!

10/10

10. Was there an effect by the ERP system on your capability to communicate with customers?

- 1. No, there was no effect
- 2. Not very much
- 3. Yes, sometimes
- 4. Yes, a great effect!