Research Article

Measuring the Impact of Integrating ABC and ERP: Evidence from the Egyptian Pharmaceutical Sector

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Abstract: In the mid-1980s, several HarvardBusinessSchool cases and articles introduced Activity-Based Costing (ABC). Developed by Robert Kaplan and Robin Cooper, ABC offered therapy for uncontrollable overhead. By using costing systems based on activities and cost drivers, it became easy to assign overhead to specific activities (Kaplan and Anderson 2003). The plausibility for an integration between ABC with other systems became popular in an attempt to develop it. The study by Shaw (1998) discussed the move by giant ERP vendors like SAP, Oracle, and PeopleSoft of investing in ABC Technologies. Kaplan and Anderson (2003) introduced time-driven ABC that can be data fed from ERP systems, a model of ABC that is easier and can be extended to many company-wide applications. According to Somers and Nelson (2001), ERP systems attempt to integrate all departments and functions of a company into one single computer system. Beheshti (2006) explains how ERP systems enable organizations to analyze the value chain as a system, from suppliers to firm to customer and identify, improve, or eliminate poor and most costly areas of operation, as a result, increase the value of the processes in the value chain. Empirical work done during the current study, upon the pharmaceutical industry in Egypt in general and upon the Nile Company has supported our hypothesis regarding the necessity and importance of the integration between the ABC and ERP.

Keywords: ERP, ABC, BSC, SAP, Regression, Correlation.

Introduction

Activity based costing (ABC) has been described in the late 90s as the most significant managerial accounting development within the five decades before that decade. The traditional volume based costing systems used to group all overhead costs in one cost pool. Cost accounting systems allocate overhead expenses, such as rent, utilities, and indirect labor, based on direct labor costs or hours. These systems group all overhead costs into one cost pool and divide the total amount of overhead cost by a volume based cost driver such as direct labor hours (Nachtmann and Needy 2003).

On the other hand, the developed system suffered from many problems that becamedisadvantageous for itsimplementation. Some of these issues were discussed by many studies in an attempt to improve ABC system's performance.

Kaplan and Anderson (2003) address the issue of cost and time and conclude that ABC is costly and time consuming to initiate and update as well as its use of subjective estimates. They explain the process where the designers have to make interviews with employees and surveys to identify what resources are consumed by which activities. Rayburn (1996) argue that ABC is misleading when it comes to decision making, which was the reason that made it important for ABC to be presented in the management accounting environment. The study explains that ABC may render misconceptions about lowering sales order handling costs by eliminating small orders that generate lower margins a thing that could lead to profitability shrinkage in the long-run if other companies were willing to handle these small orders.

Another research by Liu and Pan (2007) describes ABC information by being obsolete and inaccurate. The study explains that the analyzed data revealed that the company needed to change its product design specifications and processes to suit customer needs, a thing that created a difficulty to keep the ABC model up-to-date that activities and cost drivers identified in the system design stage became obsolete during the system implementation stage.

Major and Hopper (2005) addressed the staff resistance issue with ABC system and argued that effective implementation of ABC is often linked to behavioral rather than technical factors. Effective implementation relies upon employee consent because employees play an important role in operating the system. They continue explaining the reasons behind that and argue that workers may resist because they are afraid that ABC might be threatening to autonomy and job security. Even managers may render a system unworkable by biasing and manipulating data, a thing that leads to unreliable decisions.

Nachtmann and Needy (2003) argue that data used to develop the ABC systems are uncertain due to a heavy reliance on parameter estimation.

Clarke et al. (1999) suggest that companies that adopt ABC have certain characteristics. Gosselin (1997) suggests that the organizational structure and its strategy affect the adoption and implementation of ABC. So, the need for ABC to integrate with other systems became popular in an attempt to develop it. The study by Shaw (1998) discussed the move by giant ERP vendors like SAP, Oracle, and PeopleSoft of investing in ABC Technologies. Kaplan and Anderson (2003) introduced time-driven ABC that can be data fed from ERP systems, a model of ABC that is easier and can be extended to many company-wide applications. According to Somers and Nelson (2001), ERP systems attempt to integrate all departments and functions of a company into one single computer system. Beheshti (2006) explains how ERP systems enable organizations to analyze the value chain as a system, from suppliers to firm to customer and identify, improve, or eliminate poor and most costly areas of operation, as a result, increase the value of the processes in the value chain.

Brodeur (2000) discussed that the degree of integration within a given ERP system environment impacts the amount of benefit received from integrating ABC with an ERP system. The amount of data available to the ABC model from within an ERP system will vary depending upon how integrated the ERP system is with all the information systems of the organization.

Integrating the ABC model with the ERP system can furnish the ABC model with much of the data contained in the ERP system in an efficient and economical manner, as discussed previously. This will indicate to decision-makers that the ABC results are systematically generated from a serious or credible data source within the organization, the ERP system. As well, the ABC results can then be made available using the ERP system's reporting tools, which many decision-makers will already be familiar with (Brodeur 2000).

According to the above discussion, it was important for the researchers to explore the extent to which companies that apply ABC in Egypt were using it along with ERP and how well they benefited from this application. We choose the drug market to measure the application process of both systems because of its importance in the business market. The Egyptian drug market is the largest market in the Middle East estimated at 12 billion EGP in 2008 (AfDB 2010) and 20.5 billion EGP in 2011 (IDA 2012). Pharmaceutical products have been one of the most competitive and profitable sectors of Egyptian manufacturing. Egypt is the supplier in the Middle East, accounting for 30% of the MENA region in 2004 (AUC 2005). Local manufacturing of drugs satisfies 92.56% of local demand based on 85% importation of raw materials.The Egyptian drug industry is a drug-formulation one as opposed to a research-based one. Moreover, companies operating in the field run high risk of exposure to foreign currency exchange risk embedded in the pharmaceutical ingredients importation bill (AUC 2005).

Three categories of companies with different strategies - Egyptian private companies, multinational companies and public sector companies which are subsidiaries of Drug Holding Companies are operating in Egypt. Private sector companies, both Egyptian and multinationals, dominate this sector. The Egyptian private sector has the lion's share of the local market with production covering over 70% of the market in 2009 (AfDB 2010) and more than 89% by the end of 2011 (IDA 2012).

Domestic manufacturers meet a high volume of Egypt's pharmaceutical needs, but their focus on basic low-cost medicines is highlighted by their relative market share: 93% of the country's needs by volume, yet only 56% by value (AfDB 2010).
Multinational companies active in Egypt account for 37% of total private sector sales. Novartis (6.7%), Glaxo (7.5%), BMS (4.2%), and Pfizer (4.2%) are the key players in the market. Others like EIPICO and Pharco are also active in the market. Their approach is to produce - with no

competition products from their mother companies even if they have to import raw materials which will erode their net profit margin (AfDB 2010).

Public sector production and market share have been reduced mainly because of inefficient distribution and high operating cost. Main public companies are: Nile, CID, Misr and El Nasr Chemicals. Currently, the public sector is trying to upgrade its production facilities, focusing on exports to compensate for loss of internal market, and changing its product mix to secure a higher margin (AfDB 2010).

According to the above, the researchers viewed that it was important to measure the degree to which companies applying ABC are using ERP and the degree to which this integration benefited the organization. So, the researchers conducted interviews, sent questionnaires and performed profitability analysis to reach conclusions.

2- The Research Hypotheses

- **The First Hypothesis:**

Ho: ERP system does not affect the Activity based costing system nor improve its efficiency

HA: ERP system affects the Activity based costing system and improves its efficiency

- **The Second Hypothesis:**

Ho: ERP system when integrated with Activity based costing does not affect the company's position or its operating efficiency

HA: ERP system when integrated with Activity based costing affect the company's position and its operating efficiency

- **The Third Hypothesis:**

Ho: ERP system when integrated with Activity based costing does not affect the Decision makers' reliance on the outputs of that system when making their decisions

HA: ERP system when integrated with Activity based costing affect the Decision makers' reliance on the outputs of that system when making their decisions

Data Collection:

Data was collected using multiple sources, ranging from interviews with managers and accounting staff to questionnaires and case study. The researcher went through the majority of the pharmaceutical companies in Egypt. The market is composed of about 52 companies that practice production, in addition to companies that provide raw materials or offer support services and products. According to interviews with managers and staff inside some of the public sector companies, it was found

that El Gomhoria Company was the only one that applies ERP system but it is not in the field of production. The company's mission is to provide other public companies with raw materials for production purposes. So, this sector entirely was excluded from the potential companies for research.

Moving to private and multinational sectors, there were many scientific offices of companies that only import the drugs and distribute them in the Egyptian market. These offices had to be excluded from the tested sample. Accordingly, the search was for companies who are involved in producing the drugs rather than distributing them only. Many of these companies refused to cooperate entirely. They didn't answer phones, hung up when informed that we are interested in the current area ,or refused to give information about either their costing system or their information system in interviews.

So, the sample had to be composed of all companies that showed cooperation to make interviews or fill-in questionnaires. They explained their attitude and the reason behind their refusal was because the ERP system is extremely expensive and how their managers assumed that information about this system is like a military secret to them. The companies that showed cooperation accepted only to make interviews and sometimes only to fill-in questionnaires. Accordingly, the sample was the 10 companies of the private and multinational sectors who showed cooperation.

We delivered from 10 to 12 statements to each of ten companies, which were our sample units. The companies were pharmaceutical companies of the Egyptian private and multinational sector that are applying the ERP system and were using ABC as their costing system. Companies in the sample were:

1. EIPICO
2. Sanofi Aventis
3. Delta Pharma
4. MINA Pharma
5. ADWIA
6. Novartis
7. SIGMA
8. SEDICO
9. Servier
10. October Pharma

The total distributed statements were 110 and the companies sent back from 7 to 9 statements as responses. Total collected statements were 80 of them three were excluded from analysis because they lacked answers to the demographic questions. As a conclusion, the response rate was about 73% and the valid response rate is 70%.

Data Analysis:

The questionnaire was composed of two parts, the first part was constituted of 11 questions about the company's size and the nature of the person answering the questionnaire and the company's costing system. So the analysis will include demographic analysis to the companies responded including their size measured by number of products and production lines, responders relation to the costing system, number of years the company applied the ERP system, reliance on ERP in decision making, spectrum or scope of ERP spread inside the organization, and change in the structure of the cost system.

Demographic Analysis:

- How many products does the company produce

Table 1: Frequency Distribution for question 1

x1_1

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<100	8	10.4	11.9	11.9
	100-199	35	45.5	52.2	64.2
	200+	24	31.2	35.8	100.0
	Total	67	87.0	100.0	
Missing	System	10	13.0		
Total		77	100.0		

8 responses were in the less than 100 product category constituting about 12% of total valid responses, 35 responses were between 100 and 199 products category constituting 52%, and 24 responses were in the over 200 products category constituting about 36%.

- How many production lines does the company have?

Total responses to the question were 49 and they were as follows:

15 responses have 4 production lines constituting 30% of total valid responses; 11 responses have 10 product lines constituting 22% of total valid responses; 8 responses have 13 product lines constituting 16% of total valid responses; 2-7 responses have 6-1 product lines constituting about 31% of the valid responses.

Table 2: Frequency Distribution for question 2

X2

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.00	7	9.1	14.3	14.3
	4.00	15	19.5	30.6	44.9
	6.00	2	2.6	4.1	49.0
	8.00	6	7.8	12.2	61.2
	10.00	11	14.3	22.4	83.7
	13.00	8	10.4	16.3	100.0
	Total	49	63.6	100.0	
Missing	System	28	36.4		
Total		77	100.0		

- Do you interact directly with the company's costing system?

Table 3: Frequency Distribution for question 3

X3

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	58	75.3	84.1	84.1
	no	11	14.3	15.9	100.0
	Total	69	89.6	100.0	
Missing	System	8	10.4		
Total		77	100.0		

Total responses to the question were 69, 58 of them said they interact directly with the company's costing system; a response represented about 84% of total valid responses.

The other 16% of responders said they don't interact directly with the costing system, a total of 11 responses.

- When did the company start using the ERP system?

Table 4: Frequency Distribution for question 4

X4

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1984.00	1	1.3	1.5	1.5
	1985.00	1	1.3	1.5	2.9
	2000.00	11	14.3	16.2	19.1
	2001.00	2	2.6	2.9	22.1
	2002.00	21	27.3	30.9	52.9
	2003.00	3	3.9	4.4	57.4
	2004.00	11	14.3	16.2	73.5
	2006.00	5	6.5	7.4	80.9
	2008.00	4	5.2	5.9	86.8
	2009.00	1	1.3	1.5	88.2
	2010.00	6	7.8	8.8	97.1
	2011.00	2	2.6	2.9	100.0
	Total	68	88.3	100.0	
Missing	System	9	11.7		
Total		77	100.0		

Here we can group the responses into three categories:

Responses adopting the system before the year 2000 which represented 13 responses out of 68 with a percentage of about 19%. From 2000 up to 2005 are 37 responses representing 54.4% of responders. After 2005 are 18 responses with a percent of 26.5 of valid responses.

- Do you rely on ERP outputs when you make decisions?

Table 5: Frequency Distribution for question 5

X5

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	61	79.2	91.0	91.0
	no	6	7.8	9.0	100.0
	Total	67	87.0	100.0	
Missing	System	10	13.0		
Total		77	100.0		

Out of 67 responses 61 responders said they rely on ERP outputs when they make decisions, representing 91%.

- Does the company apply any other modules than Financials? What are they? HR, Inv. Mgt, Capital acquisitions?

Table 6: Frequency Distribution for question 6

X6

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	yes	28	36.4	90.3	90.3
	no	3	3.9	9.7	100.0
	Total	31	40.3	100.0	
Missing	System	46	59.7		
Total		77	100.0		

90% responded as they have other modules than Financials in their companies. The other modules were HR, Inventory Management, Capital Acquisitions, and sometimes Supply Chain Management.

Testing the Research Hypothesis:

To test the research hypothesis, the researcher used some statistical techniques to analyze data collected through questionnaires. These techniques are as follows:

1. Descriptive statistical techniques that include frequencies, percentages, means, standard deviation, and coefficient of variation

2. Pearson Correlation Matrix to assess the significance of relationships among the research variables, dependent and independent.

3. Simple and Stepwise Multiple Linear Regression to explore the most significant variables of the model.

4. Cronbach's Alpha Coefficient of Reliability and Intrinsic Validity for all variables.

The researcher used the Statistical Package for Social Science (SPSS) to do the statistical analysis.

Descriptive Statistics:

The researchers carried out descriptive statistics including frequencies, percentages, means, standard deviation, and coefficient of variation for all independent and dependent variables. They were based on a Likert scale and are as follows:

The Mean	Direction
1.00 – 1.79	Tend to Strongly Disagree
1.80 – 2.59	Tend to Disagree
2.60 – 3.39	Tend to be Neutral
3.40 – 4.19	Tend to Agree
4.20 – 5.00	Tend to Strongly Agree

The following table shows the result of the first group of questions that address the first hypothesis "ERP system affects the Activity based costing system and improves its efficiency":

Table 7: H1 responses Coefficient of Variation

Descriptive Statistics

	cv	Mean	Std. Deviation
q1.1	14.62	4.0000	.58490
q1.2	17.25	4.0390	.69664
q1.3	18.52	3.9610	.73344
q1.4	14.38	3.9870	.57339
q1.5	13.85	3.9610	.54872
q1.6	16.13	4.0649	.65570
q1.7	15.17	4.0000	.60698
q1.8	12.23	3.9740	.48596
q1.9	14.30	3.8312	.54778
q1.10	25.93	3.3636	.87222
q1.11	29.95	3.3896	1.01509
q1.12	16.52	3.9870	.65882
d1	10.97	3.8877	.42642
Valid N (listwise)	77		

The average mean for the 12 questions is 3.9, which lies in the Agree interval. The Coefficient of Variation (CV) varies from 12.23 for the 8th question to 29.95 for the 11th question.

Questions from 13 to 18 address the second hypothesis "ERP system when integrated with Activity based costing affect the company's position and its operating efficiency":

Table 8: H2 responses Coefficient of Variation

Descriptive Statistics

	cv	Mean	Std. Deviation
q2.13	22.54	3.8571	.86928
q2.14	17.96	3.8701	.69492
q2.15	16.61	3.9610	.65778
q2.16	18.02	3.7792	.68101
q2.17	18.81	3.7922	.71336
q2.18	13.75	3.7922	.52158
d2	14.33	3.8674	.55404
Valid N (listwise)	77		

The Mean for the second group of questions is about 3.9, and this lies in the Agree interval as well. The CV is highly represented in the 18th question at 13.75 and has a low in the 13th question with 22.54.

Questions from 19 to 28 address the third hypothesis "ERP system when integrated with Activity based costing affect the Decision makers' reliance on the outputs of that system when making their decisions":

Table 9: H3 responses Coefficient of Variation

Descriptive Statistics

	cv	Mean	Std. Deviation
q3.19	14.17	4.0390	.57220
q3.20	12.24	4.1039	.50222
q3.21	12.24	4.1039	.50222
q3.22	11.25	4.0519	.45584
q3.23	16.23	4.1688	.67673
q3.24	11.86	3.9870	.47277
q3.25	12.44	4.1169	.51232
q3.26	14.11	4.1558	.58636
q3.27	11.47	4.0000	.45883
q3.28	11.47	4.0000	.45883
d3	10.22	4.0903	.41794
Valid N (listwise)	77		

The group of questions has a Mean of about 4.1, which lies in the Agree interval with a CV of 11.25 for question 22 and 16.23 for question 23.

Reliability and Intrinsic Validity of the Research Variables:

The research independent variable is the ERP system which affects the company's three dependent variables; cost system (ABC), Position and Operating Efficiency, and Decision Making. According to the table, the reliability coefficient and intrinsic validity all variables are 0.938 and 0.969 respectively which reflects high consistency and relation among the variables. The variable with the highest reliability coefficient is Decision making at 0.947, followed by the Company's Position and Operating Efficiency variable at 0.894, and coming last is the Cost System (ABC) at 0.858.

Table 10: Reliability and Intrinsic Validity

o	Variable	Reliability coefficient	Intrinsic validity
	Cost System (ABC)	0.858	0.9263
	Company's Position and Operating Efficiency	0.894	0.946
	Decision Making	0.947	0.973
	Total	**0.938**	**0.969**

The First Hypothesis:

To test that hypothesis the researcher used simple regression at a time and multiple and stepwise regressions at another time.

The researcher used responses to the third questions to be a reference to the effect that ERP has on the ABC system.

Accordingly, putting this into the regression equation, it would be as follows:

$Y = a + bX$

Where Y represents the effect on the ABC system represented by responses of the 3rd question in the questionnaire and X is the ERP system.

Table 11: Regression Analysis H1

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-1.057	.546		-1.937	.057		
	x1.1	1.296	.140	.730	9.243	.000	1.000	1.000

a. Dependent Variable: q1.3

$Y = -1.057 + 1.296\ X$

Table 12: Simple Regression Analysis H1

No	Independent Variables	Estimated coefficient	t test		F test		R²
			Value	Sig.	Value	Sig.	%
1	Constant	-1.057	-1.937	0.057	85.434	0.000	53.3
2	X	1.296	9.243	0.000			

According to the above table, 53.3% of total variation in Y (effect on ABC) can be explained by the association of Y and X as estimated by the regression model. As for the multiple and stepwise regression model, the analysis shows that the most influencing questions on the model are questions number 2, 12, and 11 respectively. So, the regression equation could be as follows:

$Y = a + b\ X1 + bX2 + BX3$

Where Y represents the change in the cost system and its efficiency after using ERP system, X1 is the results for the second question, X2 is the results of the 12th question, and X3 is results for the 11th question.

Table 13: Regression Analysis H1

No	Independent Variables	Estimated coefficient	t test Value	t test Sig.	F test Value	F test Sig.	R² %	VIF
1	Constant	-0.387	-1.017	0.313	49.437	0.000	67	----
2	Q2	0.600	6.503	0.000				1.701
3	Q12	0.363	3.746	0.000				1.672
4	Q11	0.141	2.874	0.005				1.023

According to the above table, the regression model is:

$$Y = -0.387 + 0.600 X1 + 0.363 X2 + 0.141 X3$$

The model's coefficient of determination is 67%, which means that any change in the components of costing a product after the company applied ERP, the change in the company's number of products produced after using ERP compared to the number before using it, in addition to the change in the costs of one or more products after using ERP represents 67% of the change in the cost system (ABC), which leads to the conclusion that the null hypothesis should be refused and the alternative one should be accepted.

The Second Hypothesis:

To test that hypothesis the researcher used simple regression at a time and multiple and stepwise regressions at another time. The researcher used responses to the 18th question as a reference to the effect the integration between ERP and ABC on the company's position and its operating efficiency. So, the simple regression model would be:

$$Y = a + bX$$

Where Y represents the change in the company's position and operating efficiency and X represents the integrated ERP and ABC system.

Table 14: Simple Regression Analysis H2

No	Independent Variables	Estimated coefficient	t test value	t test Sig.	F test value	F test Sig.	R² %
1	Constant	1.853	5.954	0.000	39.762	0.000	34.6
2	X	0.503	6.306	0.000			

According to the above table, the regression model would be:

$$Y = 1.853 + 0.503 X$$

In addition, the model's coefficient of determination is 34.6% meaning that the integration of ERP and ABC represents 34.6% of the change in the company's position and operating efficiency.

As for the multiple and stepwise regression, the analysis shows that the model is much related to answers to questions number 14, 15 and 17. And the equation is as follows:

$$Y = a + b X1 + bX2 + BX3$$

Where Y represents the change in the company's position and operating efficiency, X1 is the results of the 14th question, X2 is the results of the 15th question, and X3 is results for the 17th question.

Table 15: Regression Analysis H2

No	Independent Variables	Estimated coefficient	t test value	t test Sig.	F test value	F test Sig.	R² %	VIF
1	Constant	1.670	6.642	0.000	40.633	0.000	62.5	----
2	Q14	0.212	2.540	0.013				2.420
3	Q15	0.236	2.477	0.016				2.821
4	Q17	0.530	8.488	0.000				1.419

According to the above table, the regression model would be as follows:

$$Y = 1.67 + 0.212 X1 + 0.236 X2 + 0.53 X3$$

The model's coefficient of determination is 62.5%, which means that ERP ability to control resource waste, more efficient use of resources, and increased sales interpret 62.5% of the change in the company's position and its operating efficiency.

The Third Hypothesis:

To test that hypothesis we used simple regression at a time and multiple and stepwise regressions at another time. We used responses to the 28th question as a reference to the effect the integration between ERP and ABC on the company's decision makers' reliance on outputs from that system when making their decisions. So, the simple regression model would be:

$$Y = a + bX$$

Where Y represents the decision makers' reliance on outputs and X represents the integrated ERP and ABC system.

Table 16: Simple Regression Analysis H3

No	Independent Variables	Estimated coefficient	t test value	t test Sig.	F test value	F test Sig.	R² %
1	Constant	0.469	1.663	0.101	158.68	0.000	67.9
2	X	0.856	12.597	0.000			

According to the above table, the regression model would be:

$$Y = 0.469 + 0.856 X$$

In addition, the model's coefficient of determination is 67.9% meaning that the integration of ERP and ABC represents 67.9% of the change in the decision makers' reliance on outputs from the system. As for the multiple and stepwise regression, the analysis shows that the model is much related to answers to questions number 20, 23, 25, 26 and 27. And the equation is as follows:

$$Y = a + b X1+ bX2+ bX3 + bX4 + bX5$$

Where Y represents the change in the decision makers' reliance on outputs from the system, X1 is the results of the 20th question, X2 is the results of the 23rd question, X3 is the results for the 25th question, X4 is the results of the 26th question, and X5 is the results of the 27th question.

Table 17: Regression Analysis H3

No	Independent Variables	Estimated coefficient	t test value	t test Sig.	F test value	F test Sig.	R² %	VIF
1	Constant	0.343	1.722	0.089	81.381	0.000	85.1	----
2	Q20	-0.195	-2.205	0.031				4.461
3	Q23	0.225	4.164	0.000				3.033
4	Q25	0.400	4.067	0.000				5.728
5	Q26	-0.269	-3.659	0.000				4.221
6	Q27	0.748	11.434	0.000				2.044

According to the above table, the regression model would be as follows:

$$Y = 0.343 - 0.195\ X1 + 0.225\ X2 + 0.4\ X3 - 0.269\ X4 + 0.748\ X5$$

The model's coefficient of determination is 85.1%, which means that decision support features of ERP, fastness and inclusiveness features of ERP, and easier information flows interpret 85.1 % of the decision makers' reliance on the system, which leads to refusing the null hypothesis and accepting the alternative one. In other words, the integration between ERP and ABC affects the decision makers' reliance on outputs from the system when making their decisions.

The Case Study:

The second part of the study conforms of a profitability analysis of EIPICO, one of the largest private sector manufacturers in Egypt. We are going to investigate the effect of the ERP system use by the company on its operating effectiveness. Profitability Analysis for the company over 10 year period is made using the company's financial reports from 2000 up to 2010. According to the interviews with the company's accounting staff, they started applying ERP to the company's accounting system on 2004.

Gross Profit Ratio:

This rate tends to be steady over the period from 2000 until 2010; meaning that the company had the ability to produce and sell efficiently over the time span, with an increase in 2005 to 36%, 41% in 2007, and to 40% in 2010. This increase could be attributed to a decrease in the cost of goods sold due to the precision added through the integration of the ERP with the accounting system. Relating these rates to the statistical analysis of the first hypothesis and the descriptive statistics that shows a 3.9 mean for the improving cost system efficiency analysis, and CV range from 12.23 to 29.95. In addition, it could be attributed to increase in sales due to a better decision making regarding the sales forecasts or the market share data available by the timely system.

Table 18: Gross Profit Ratio

Gross Profit Ratio										
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
37	37	39	37	34	36	39	41	38	38	40

Gross Profit Ratio

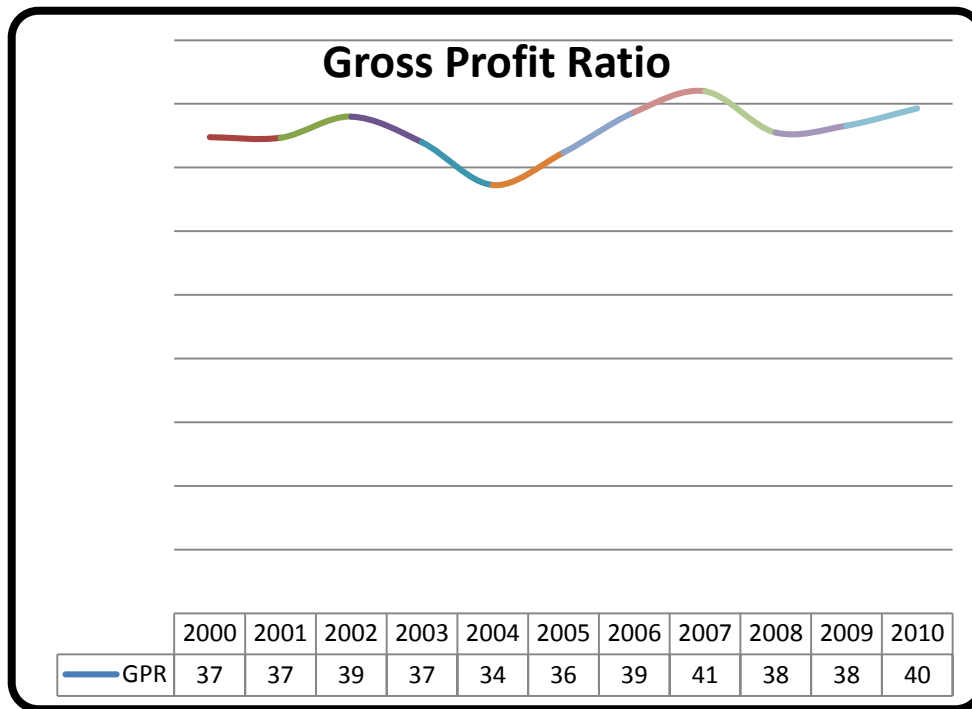|	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
GPR	37	37	39	37	34	36	39	41	38	38	40

Fig. 1: Gross profit ratio

Operating Expenses Ratio:

The ratio reflects management's ability to control expenses. It is stable for the time span with decreases in 2003, 2006, and 2009. The ERP gives the enterprise a huge advantage over controlling the expenses. Accordingly, this decrease could be attributed to the company's huge and timely database connection through the ERP and, again, it could be said that there is a control over and a decrease in the company's costs. Management accountants may have had the required cost information in the most suitable time for making their decisions, leading the company to be more precise in expense control.

Table 19: Operating Expenses Ratio

Operating Expenses Ratio										
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
2.93	2.19	2.15	1.83	1.87	2.00	2.09	2.36	2.2	2.07	2.26

OE

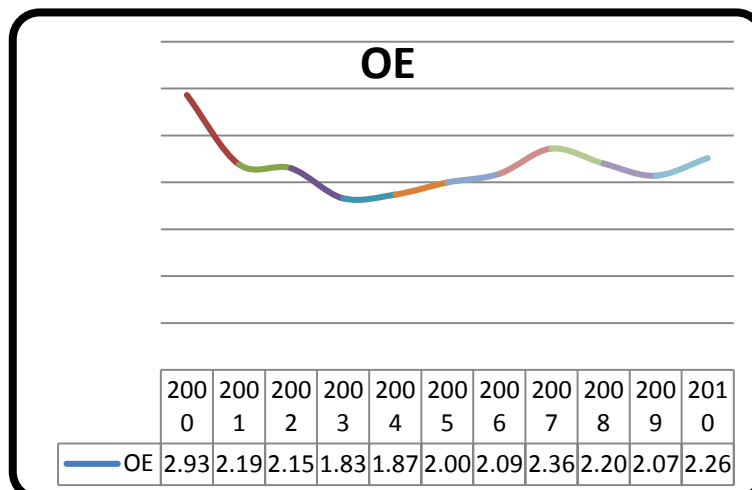|	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
OE	2.93	2.19	2.15	1.83	1.87	2.00	2.09	2.36	2.20	2.07	2.26

Fig. 2: Operating Income

Operating Income:

The company's profitability from operations is reflected by Operating Income (OI). OI increased by 23% in 2005 compared to 2004 and continued increasing over the time span to reach about 411 million EGP in 2010. With controlled and reduced expenses, the OI increased as shown. It could be said that it's a reflection of the integration of the ERP and the cost system. The increased OI is a reflection of the decreased expenses.

Table 20: Operating Income

Operating Income (in million EPG)										
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
134	150	177	188	187	230	277	328	323	363	411

Fig. 3: Operating Income

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
OI	134	151	177	188	188	230	278	328	323	363	411

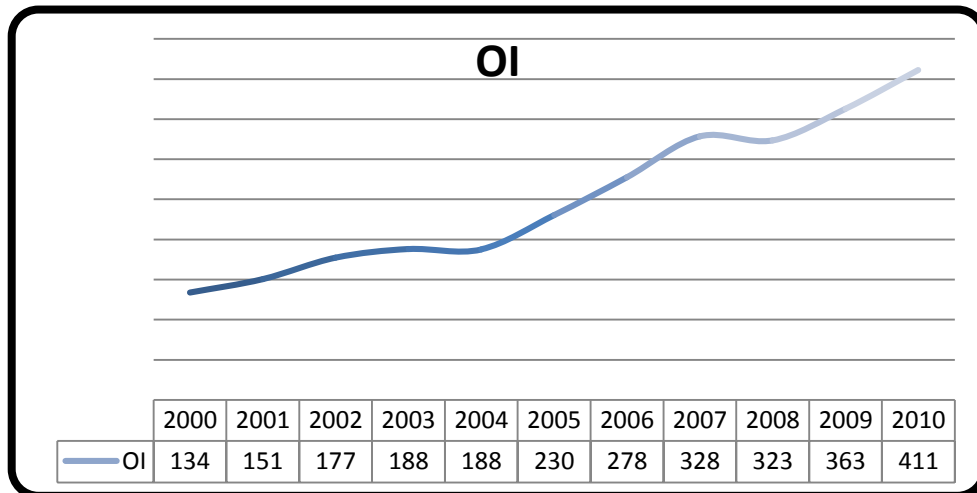**Net Income as a % of Net Sales:**

This ratio provides an indication of how the company's management was able to control expenses and in the same time keep a portion of its revenues as profit. It was a decreasing function in the years from 2000 up to 2004 when it started increasing again in 2005 reaching 24% and continued to increase to reach 29.62% in 2010. It could be said that the system helped decision makers to be more timely and precise in making their decision towards expenses as well as towards selling plans and marketing plans. As discussed before, the system integrates all the departments on the company on the computer screen.

Table 21: Net Income as a Percentage of Net Sales

Net Income as a % of Net Sales										
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
25.08	23.52	21.27	21.60	20.67	24.03	26.37	26.94	27.23	28.48	29.62

Net Income as a% of Net Sales

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
NI%	25.08	23.52	21.27	21.60	20.67	24.03	26.37	26.94	27.23	28.48	29.62

Fig. 4: Net Income as Percentage of net Sales

Earnings per Share (EPS):

Table 22: Earnings Per Share

EPS										
2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
1.35	1.40	1.42	1.60	1.69	2.25	2.73	3.18	3.44	3.96	4.11

EIPICO shows a great increase in EPS from 1.69 EGP in 2004 to 4.11 EGP in 2010. The company's highest increase was in 2005 with more than 33% increase than 2004 to become 2.25 EGP reflecting an increase in profitability in 2005. The improve continues over the couple years following 2005 by percentage increase of about 21%, 16%, 8%, 15%, and 3% in 2006, 2007, 2008, 2009, and 2010 respectively. The EPS reflects the increased power of earning for the company in the second five years. The ERP system cost control and timely decisions could be said to be the cause of this increase.
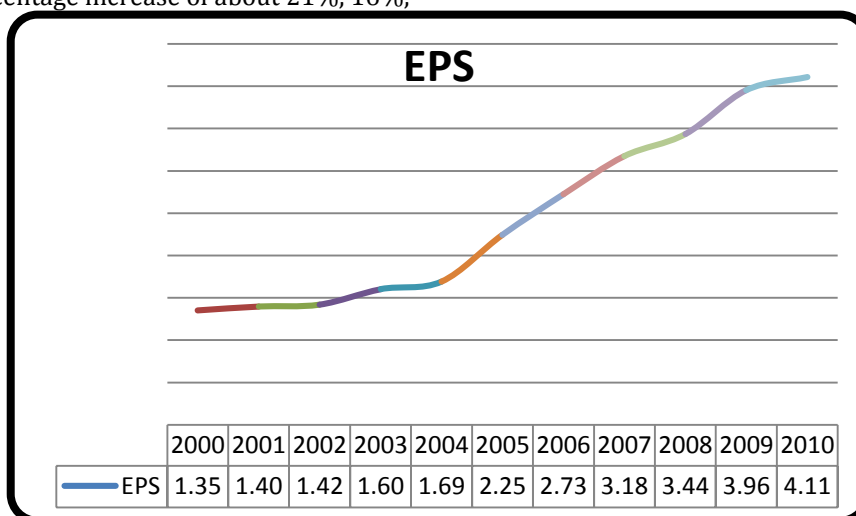

EPS

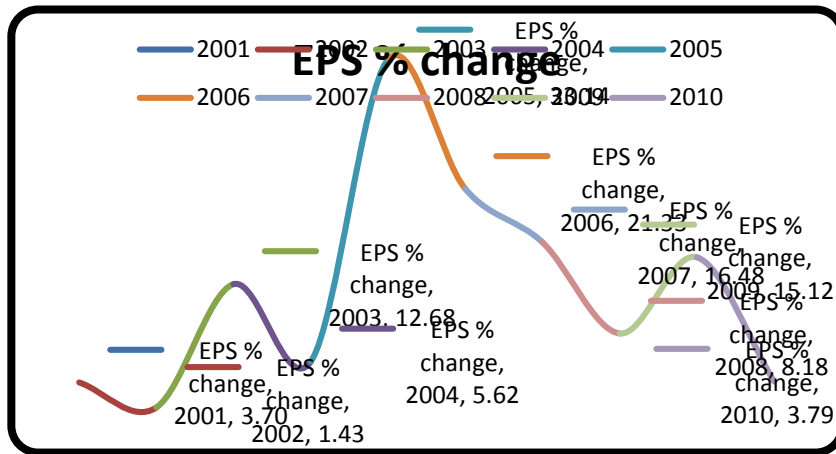|	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
EPS	1.35	1.40	1.42	1.60	1.69	2.25	2.73	3.18	3.44	3.96	4.11

Fig. 5: Earnings Per Share

Fig. 6: EPS percentage change

Return on Assets (ROA):

The ratio is concerned with measuring productivity of the company's assets regardless of the way those assets are financed. ROA was around 15% before 2005 then increased in 2007 to reach 21% and 20% in 2010. The increase could be attributed to the ERP system's assistance in decreasing and controlling costs and its information's instant availability for decision makers in the company.

Table 23: Return on Assets

ROA								
2002	2003	2004	2005	2006	2007	2008	2009	2010
15.49	15.51	14.82	17.32	19.47	21.24	18.68	19.70	20.10

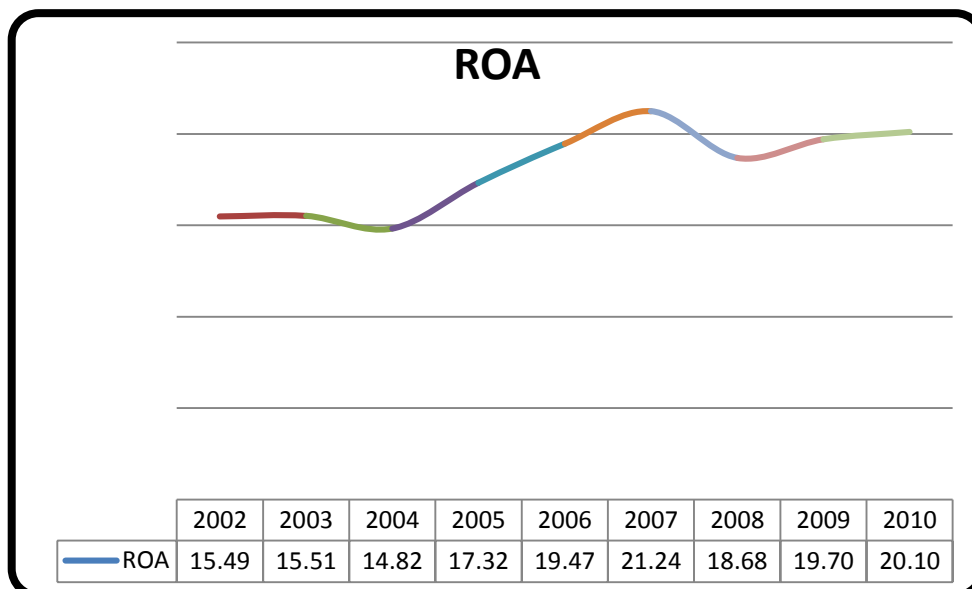|	2002	2003	2004	2005	2006	2007	2008	2009	2010
ROA	15.49	15.51	14.82	17.32	19.47	21.24	18.68	19.70	20.10

Fig. 7: Return on Assets

According to the above analysis, it could be concluded that the company's overall performance enhanced with great percentages during the period under analysis.

That enhancement is attributable to the application of the ERP system alongside the existing costing system.

Results and Conclusions:

According to the statistical analysis of the responses and the case study, we found out that the analysis leads to refusing the null hypothesis and accepting the alternative ones which support our view in the research problem and its importance to the accounting field.

The research conclusions would be:

1. Using ERP system affects the ABC system in a positive way. It helps ABC users make better product costing decisions and it changes the structure of the ABC system so that ABC would have less uncertainty issues.

2. The use of ERP system increased the availability of decision support information for decision makers.

3. The use of ERP system with ABC made it easier for accounting information users to be more precise in costing one or more products because the integration of both systems made cost information more accurate and specific.

Research limitations and Recommendations:

Due to the events that the country has been going through and the revolutions of the 25th of January and the 30th of june, it was quite hard for us to get the required type of research data. Many companies have refused to cooperate in giving the data. No single company from the whole population of the companies applying the ERP system in Egypt agreed to cooperate in a case study. Some companies agreed just to fill the questionnaires without conducting interviews with the staff.

Accordingly, the research has limitations that could be phrased as follows:

1. The case study was based on a company's analysis using sources ranging from other case studies, financial reports, to the online website and did not include any observations.

2. We didn't have an opportunity to view or discuss any actual data related to the ERP application on the accounting system.

Therefore, it could be said that the research would have more results that are precise if there was an opportunity to observe, view, or discuss actual ERP/ABC data. We could have solid results if a company accepted to conduct a case study over a certain time span for the research to have real conclusions from operations.

In addition, future research should address a specific module of the ERP applied in certain company. Research may also address the issue of how willing organizations are to integrate their ABC system with other systems such as ERP.

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