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The Role of ERP in Advanced Managerial Accounting Techniques: A Conceptual Framework[1]

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Abstract: *In the business literature many studies done to shed light how ERP system and advanced managerial accounting techniques team up. For quick and accurate managerial decisions and effective implementation of advanced management techniques, firms need a strong information technology infrastructure. The purpose of this paper is to search theoretically how ERP system and advanced managerial accounting techniques collaborate.*

Keywords: ERP, Advanced Managerial Accounting Techniques, Managerial Accounting Systems

JEL Classification: M10, M40

1. Introduction

Today's business environment has made inevitable for firms to have comprehensive, daily and detailed information of both market and their own operational processes. In other words, to be obtained by using emerging technologies holistic comprehensive, flexible and real-time financial and operational information is indispensable for firms high performance. ERP is precisely one of the information technologies for this purpose.

As an enterprise information technology, ERP demonstrated the rapid spread and development across the World from the 1990s to now. In this process, the system that meets the specific needs of different users (in particular to increase the effectiveness and profitability of resources) and has become a complex set of computer application which integrates all processes and functions in the company and offers a holistic and integrated view by using a common database sharing.

Because ERP makes data sharing in to an accurate and real-time form, operational processes are also automated in whole business. In this context, the nature of the accounting practices in this context has changed radically. With the change, the operational coordination between departments has got easier, and thus efficiency has obtained in areas such as strategic planning and management control. Efficiency is observed as increased flexibility in providing information, increased integration in accounting practices, and increased quality of financial status report and also seen as quick decision-making process, the harmonization of conflicting objectives and to standardize business processes (Colmenares, 2009: 5-6); and finally seen in areas such as an increased efficiency in commercial enterprises, facilitating the access to information, increased quality of information and supporting temporary reporting (Booth, 2000: 2).

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With these features the ERP can offer important contributions to Managerial Accounting Systems (MAS). Thanks to ERP, MAS facilitate budgeting applications and tracking responsibility on prepared reports. So, in our opinion, MAS effectiveness has increased dramatically by ensuring interdepartmental integration. This article examines how management accounting applications become effective and productive with the support of an ERP system and how this interaction increases firm performance.

2. Literature Review

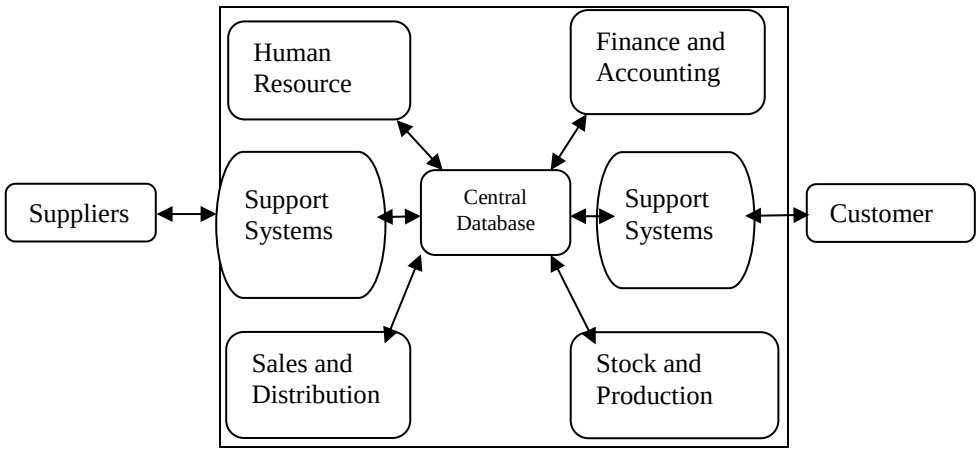
The problem of determining cost and cross-functional data reliably and quickly, particularly in manufacturing enterprises (Lea and Min, 2003: 2880), hampers the effectiveness and credibility of both traditional and modern managerial accounting (MA) applications. To eliminate this obstacle, enterprises increasingly adopt ERP systems. The integrated, flexible and real-time financial and operational data offered by ERP systems, which could be defined 'a change agent', extend the usefulness of managerial accounting techniques (Granlund and Malmi, 2002: 305). In this article, we show that how ERP and advanced managerial accounting methods are highly complementary systems based on literature review. In this regard we will explain how ERP system interact with total quality/quality cost, just in time production, activity based costing, balanced scorecard, business process reengineering, benchmarking, product life cycle costing, value engineering and costing.

2.1. ERP System

ERP was developed to establish control over complicated operations, increase efficiency and productivity within enterprises, decrease production and transaction costs (Davenport, 1998: 123-124) and build full and flexible information systems for all of these processes. ERP becomes a milestone of the use of effective, fast and comprehensive information by integrating enterprises' inside and outside operational processes.

ERP is a software system aimed at corporate resource planning. This system is based on establishing effective control and coordination of resources in different geographic regions in parallel with companies' strategic goals, purposes and customer needs. Viewing data from all departments and making it generally available when employees enter data into systems once is the attractiveness of ERP. Consequently, information flow among fundamental processes becomes easier, and full, smooth integration will result. The figure 1 summarizes how this integration is achieved.

Figure 1. Infrastructure of ERP Systems



Source: Mabert, V.A, Soni, A & Venkataramanan, M.A. (2001). Enterprise Resource Planning: Common Myths Versus Evolving Reality'. Business Horizons, May-June, p.71.

As shown in the figure 1, companies manage supply and demand electronically via ERP. In this situation, companies can effectively plan production processes by monitoring stock, resources needed for production and receiving information from suppliers (cost, capacity, and quality). In this context, Shang and Seddon (2000) classified the benefits of ERP systems into five main headings. These headings are operational (the automation of business processes, quality improvement, and development of customer service), managerial (better planning and management of business resources, performance improvements and improved decision-making), strategic (the ability of ERP to support business growth and competitive advantage, configuring the Innovation and regulation of external links), IT infrastructural (business flexibility, savings on IT cost, and strengthening of IT infrastructure) and organizational benefits (organizational learning, empowerment, and formation of common vision).

2.2. Relationship Between ERP and Managerial Accounting

Managerial accounting, which fundamentally focuses on historical cost reporting, has become unresponsive to companies' needs primarily because technological development changes production style and management and organization structure. Consequently, fundamental enterprise notions such as cost structure and performance become multidimensional and complex.

The firm environment, which affects the processes of all management applications (planning, control, decision making and communication), has inevitably expanded the mission of MASs. A MAS is a system not only to generate enterprise-wide financial control but also to realize cost reduction in line with value creation. Hence, MAS is a process of defining, measuring, obtaining, analyzing, preparing, interpreting and transmitting information. This information is used by management (both financial and operational) for planning, evaluating and controlling processes, ensuring accountability and the effective and efficient use of resources in the enterprise (IFAC). Based on the definition, management accounting should offer a systematic and structural point of view to managers, supporting the understanding of related costs and increasing operational efficiency. Management accounting also should support the forecasting of costs, opportunities and resources before making a decision. Thus, a MAS should support fundamental functions such as the correct determination of product cost, effective control and clearing the way for the innovation of identified goals, ensuring employees' productive work, improvement of processes, elimination of waste, and the planning, managing and controlling of operations for establishing strategies.

ERP can offer important contributions to MASs for fulfilling these functions. In our opinion, MASs' effectiveness has increased dramatically by ensuring interdepartmental integration, thus facilitating budgeting applications and tracking responsibility on prepared reports. However, based on the literature, this effect is scarce (Booth, 2000: 4; Granlund and Malmi, 2002: 299; Scapens and Jayazeri, 2003: 201). This article examines how advanced managerial accounting applications (total quality/quality cost, just in time production, activity based costing, balanced scorecard, business process reengineering, benchmarking, product life cycle costing, value engineering, target costing) become effective and productive with the support of an ERP system and how this interaction increases firm performance.

2.2.1. Relationship Between ERP and Total Quality/Quality Cost

Companies should establish an optimum balance between quality and low cost. Total management quality is a management philosophy for achieving this goal. Enterprises which embrace this philosophy understand the need to bring employee participation in all stages, teamwork and continuous improvement to the forefront to increase product or service quality, eliminate waste, decrease cost, and raise productivity and customer satisfaction (Zbaracki, 1998: 602).

ERP, which is an important tool of Total Quality Management (TQM), addresses not only a product-based quality concept but also enterprise-wide successful organizational operation. ERP can provide logistic support to TQM to improve the customer and supplier relationship, enhance process control, facilitate teamwork, provide interdepartmental information flow, develop the design process and simplify preventive maintenance (Bhatt, 2000: 1331; Dewhurst et al., 2003: 360-361; Martinez, 2004:80).

This support facilitates the implementation of TQM's essential principles. Customer satisfaction is the first of these principles (Li et al., 2008: 572). Companies should present timely and adequate products or services in line with customers' needs and expectations. Thus, complete and current information is needed. By observing the customer and market systematically with an ERP system, clear information is obtained about what the customer wants and about the correct and rapid responses required to meet the customer's needs.

The second principal of TQM is the control and improvement of process. Companies should remain open to innovation and track their operational processes well for quality durability. ERP helps managers display innovative/progressive behavior within the total quality philosophy by obtaining real-time financial (e.g., field service expense, prevention costs and other quality cost factors) and operational (failure rates, productivity, malfunction time, and idle capacity) data from all departments, from the manufacturing of products to service and delivery. The harmony of ERP and TQM can be seen in areas such as estimation of raw material quality, determination of defects and momentarily specifying invalid production (Gupta and Kohli, 2006: 693).

The third principle is employee participation-based management. The purpose of TQM is ensuring that employees perceive the enterprise as a whole, focusing on quality. Thus, employees' sense of empathy, loyalty to the company and working motivation should be increased by educating them. Enterprise-wide procurement facilitates improved plans and effective change management. ERP's effective and instant communication through departments is a good context for transforming TQM philosophy into reality. In this context, all departments understand better their needs and potential solutions. Additionally, accounting, management, marketing and production departments completely support quality management strategy at the same time.

TQM facilitates the application of ERP systems. TQM is a management philosophy that includes all dimensions of an enterprise's aims to accomplish problem-solving techniques and continuous improvement. With the support of employee and upper management, TQM has increased the chance of a successful ERP application within the enterprise. Moreover, TQM can decrease the ERP application cost by generating desired and adequate human resource requirements. When an organizational culture is established based on quality, not only are resources used at an optimal level but also it is possible to improve operational processes by building upon a qualified workforce. As seen, these systems harmoniously process together, and they positively affect firm performance (Schniederjans and Kim, 2003: 422-423). Without such TQM culture and its methods, the chance for an ERP system to succeed is very slim (Jha and Joshi, 2015: 11).

2.2.2. Relationship Between ERP and Just In Time Production

Just in time production (JIT), which was initially used by the Japanese, is a production system based on required quantity when needed. The aim of this system is production with minimum stock, which naturally requires an overall evaluation of the design, production and supply chain. Thus, the success of this system is based on elimination of operations that do not add value and that focus on quality, efficient and instant communication with suppliers and making correct moves and decisions. ERP is considered a catalyst for JIT applications because it creates an updated database with real time information for planning, controlling and stock management (Powell et al., 2013: 324). ERP makes it easier to standardize continuous integration of enterprise functions, which is the system's main goal, and to apply a JIT system with advanced data flow. In fact, the most important change of JIT is the simplification of production processes (Foster and Horngren, 1987: 19).

The importance of simplification can be seen in the timely inclusion of different parts and ingredients into a production process that is based on demand diversification. For instance, manual Kanban is sufficient for zero stock if demand is predictable and stable, but use of an ERP system is essential if the demand is diversified and changeable. ERP can automate this process by creating a self-regulated traction system and thereby accelerating elimination of stock (Halgeri et al., 2010: 64-65). Via electronic Kanban, a rapid stock provider ERP system can remove most problems caused by manual Kanban (e.g., everyday losses over 1%, lower traceability and higher cost because it is labor-intensive).

The activator effect of ERP on JIT can be seen in processes such as bulk data management of supply-demand, monitoring the stock information of raw materials, parts and components and timely delivery of distribution (Li et al., 2008: 571-572). ERP activates and accelerates supply process transactions from demand to the production line via real-time monitoring and overall coordination (Powell et al., 2013: 406; Kelle and Akbulut, 2005: 42).

The support of ERP to a supply chain is not limited to internal processes. This support includes partners who are components outside of the company. ERP can help improve the stock management process, ensure instant and effective receiving of customer orders, accelerate the payment cycle, and provide cost savings by means of facilitating information sharing with partners about orders. Consequently, communication becomes easy between all links of the supply chain, and stock management is accomplished quickly and efficiently.

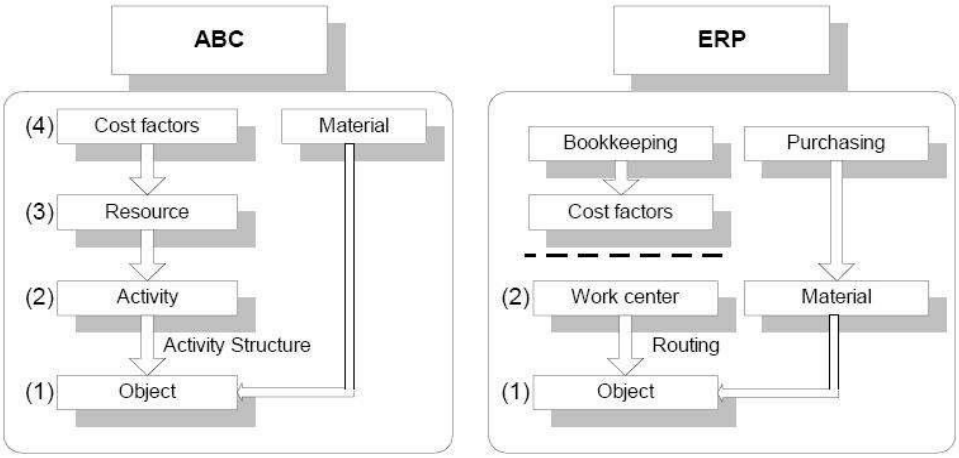
With efficiency of stock management, perfection of the production flow is an indicator that a JIT system's suppression of waste principle has been transformed into practice. Traditionally, value stream mapping[2] has been used to specific the disposition of waste in design, planning, production and distribution departments. ERP can make important contributions to these maps, enabling them to be more accurate (Halgeri, et.al., 2010: 65; Riezebos et al., 2009: 242; Tenhiälä and Helkiö, 2015: 147-148). In conclusion, ERP and JIT can work harmoniously, and this situation positively affects firm performance.

2.2.3. Relationship Between ERP and Activity-Based Costing

Activity-based costing (ABC) is a strategic system that directs managers and evaluates companies' operations performance in terms of cost. The purpose of the system is increasing profit consistently by annihilating activities that are increasing the cost of the products and services that are offered to meet customer expectations. With the help of ABC, management can identify which operations are performed in the production of products and services, why they are performed and how they can be optimized (Turney and Stratton, 1992: 47). ERP can facilitate this identification process.

There are three fundamental distinctions between ERP and ABC system functionalities. The first distinction is that ABC defines cost based upon noncurrent standard cost allocation ratios, whereas ERP always employs updated data. The second is that in ABC, every costing object has a unique activity structure, whereas in ERP systems, the same idea is performed by routing (Lahikainen et al., 2000: 165). The third differentiation is that in ABC, product and service identification of costs for various cost polls can be done by using allocation keys with respect to utilization degree and causality relationship, whereas for ERP resources, unit costs are tied to hours (Lahikainen et al., 2000: 165). Figure 2 demonstrates these distinctions.

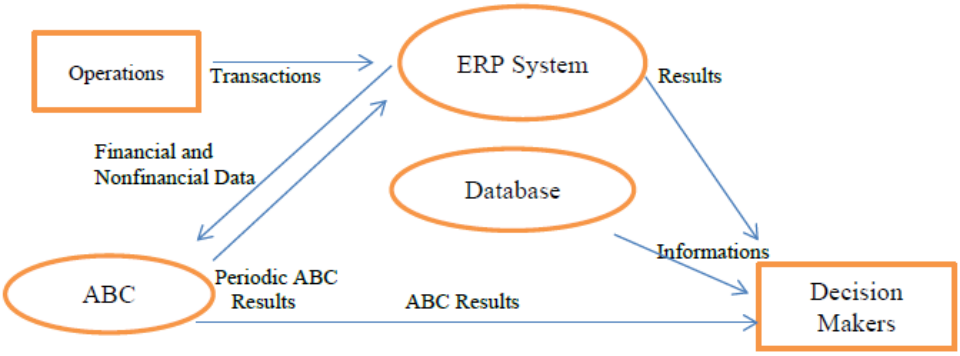
Figure 2. Structures of ABC and ERP Compared with Each Other



Source: Lahikainen, T., Paranko, J. & Seppanen, M. (2000). Implementing Activity-Based Costing in an Enterprise Resource Planning System", *11th International Working Seminar on Production Economics*, 1, p. 158

Figure 3 below shows the results when systems are integrated. As shown in the figure, the main obstacle for an ABC system application is gathering too much non-financial data about a resource and activity allocation key. Thus, it is important for companies to use an ERP system that increases ABC reliability and obtains current data about a non-financial resource and activity allocation key (Baxendale, 2003: 55; Xinxin and Weiping, 2010: 181-182). This association can bring more accurate determination and evaluation of product and customer costs because it enables direct loading of some indirect cost to a cost object that demands it. Conversely, data that were gathered and entered into the system manually will be a waste of time because of the usage of non-current data. Consequently, decision-makers' reliance on ABC could be decreased.

Figure 3. Relationship Between ABC and ERP



Source: He, Ying (2007). A Research on the Integration Between ERP System and ABCM. *IFIP International Federation for Information Processing*, Volume 254. *Research and Practical Issues of Enterprise Information Systems*" Volume I. eds.1.. Xu. Tjoa II .. Chaudhry S. (Boston: Springer), p.785

The confidence-building nature of ERP and ABC integration comes from smoothing decision makers' task to effectively manage improved information flow, shortening operations that not add value, specification of process improvement chances and an increase in product and customer profitability (Kudyba and Vitaliano, 2003: 3). Timely and effective activity analysis ensures origin monitoring of fact and events, rational distribution of limited resources, more rapid and less error-prone process management and the consequent procurement of sustainable cost reduction (Hou et al., 2013). Undoubtedly, providing democratic employee participation in the cost management process cannot be ignored in this success. Thus, through ERP, firm members can more easily share individual interpretations of cost information, thereby making consensus development more efficient (Maiga et al., 2014: 79).

2.2.4. Relationship Between ERP and Balanced Scorecard

Balanced Scorecard (BSC) can be described as a management tool or mechanism that transforms an enterprise's organizational strategy into operations (Kaplan and Norton, 1992: 72). On the one hand, BSC is a strategic guide that steers employee behavior in line with the strategy defined by top management. On the other hand, it is a strategic planning and communication tool that establishes a bond between financial and non-financial measures; this bond is instructive for enterprises (Atkinson et al., 2004: 356; Kaplan and Atkinson, 1998: 367-375).

Improvement of information technologies facilitates the retrieval of instant and reliable information and detailed monitoring of enterprises' inside and outside processes in terms of an information web (Silk, 1998: 38-42). BSC's harmony with information technologies has been a current issue because enterprises' need for an integrated structure with shareholders (e.g., employees, customers and suppliers) continues. Currently, one of the solutions that it offers in practice is to implement BSC with ERP. The general benefits of practicing BSC and ERP together are to distribute instant and reliable information enterprise-wide to

decrease competition pressure and, based on this information, create a transparent, integrated information system for monitoring firm performance, making correct decisions and taking action.

Thus, in summary, the following three fundamental reasons justify BSC's use together with an ERP system:

1. Provide data integration and diversification
2. Expand data analysis and storage's scope to include all financial and non-financial data
3. Increase the efficient interdepartmental hierarchical transmission and feedback of performance data

BSC, which has been nourished by ERP, can instantly report firm unit performance to management; thereby, a company's position compared with the strategy can easily be monitored, understood and acted upon (Edwards, 2001: 8). Today, it is extremely important for companies to determine issues and offer solutions instantly, expand precautions and evaluate the enterprise-wide effect of a unit's decisions, obtain feedback and share information about such decisions to take advantage of opportunities. Integration of ERP and BSC offers a competitive advantage to companies concerning these vital topics.

ERP's positive contribution to BSC can be examined under four sub-headings.

ERP's effect on financial performance

An ERP system can create a significant cost advantage by decreasing stops at work, creating instant data flow and enabling general control of operational processes. This advantage naturally means increased enterprise-wide workforce productivity, an increase in profit and increased evaluation of new investment opportunities (Shen et al., 2016: 131). The functionality of ERP, which is a real time and reliable critical information provider, can be seen explicitly when considering answers to vital questions that are fundamental for enterprises, particularly on the process of searching for new investment opportunities such as the following: which products and services are the most profitable? Which products are the most work-intensive, and which products can be sold together? ERP is one of the most important corporate-level logistic tools for developing enterprises' performance.

ERP's effect on customer performance

Financial success is closely associated with customer satisfaction (Cebeci, 2009: 8901). Therefore, it is important to ensure a precise information flow that directs customer needs to firms, completely gathering pleasures and complaints about products and services whenever making contact with customers. Thus, the entire relationship structure should be based on communication. Building and sustaining such a structure becomes easier via ERP. In fact, it is possible to acquire correct and timely detailed information on every process of a sales order (confirmation, stocking and en route) with the use of ERP.

It is possible to see ERP's positive effect on customer performance when comparing ERP with a traditional system. Four to five weeks are required to collect quality control and customer satisfaction reports and prepare a cause-and-effect analysis. However, with the use of ERP, reports and analyses about quality control and customer satisfaction are generated on a daily basis. On the one hand, this change makes it possible to react to customer relations management and market opportunities; on the other hand, the change increases market share and the sales growth ratio (Shen et al., 2016: 132).

ERP effect on internal business processes

An ERP system has an important effect, particularly on BSC internal business processes (Fang and Lin, 2006: 260-261). It is difficult to make decisions reliably based on data that are weeks old and based on experience and predictions concerning the current production environment. An ERP system's transparent, fast and easy information flow about production processes makes it possible to make more-effective strategic, operational and tactical decisions. Accordingly, businesses that acquire timely access to accurate and consistent data become better equipped concerning topics such as fulfilling orders, shortening the transaction process, monitoring the occupancy rate of production resources, and monitoring required work

order start and end dates. If businesses make changes, the effects are known concerning the pursuit of other activities that are affected by these changes, thus facilitating better capital expenditure choices.

ERP effect on learning and growth

Employee training and the harmonizing of their abilities with companies' goals become important to allow benefiting from maximal technological development. An ERP system brings employees into one piece of a company's vision and points them in the direction of what must be done as part of this vision (Edwards, 2001: 7). Employees who obtain information about completed products and services via this system can correct systematic errors and have a chance to practice or maintain development programs to eliminate wastes of time and over/unnecessary cost in the value creation process (Srivardhana and Pawlowski, 2007: 52).

2.2.5. Relationship Between ERP and Business Process Reengineering (BPR)

In the 21st century, enterprises should assign importance to quality, cost, customer satisfaction and information technologies (IT) to survive under tough economic circumstances. Many IT systems exist where globalization and technological advancement are experienced intensely. Many studies in the literature about the relationship between ERP and BPR show these systems' strong correlation. According to Hammer (1990), 'We should ''reengineer'' our businesses: use the power of modern information technology to radically redesign our business processes in order to achieve dramatic improvements in their performance. Also he said that reengineering is a tremendous effort that mandates change in many areas of the organization. According to Komiya et al. (2000), the introduction of an ERP package would be a type of BPR because work habits are tuned to the functions of the ERP package. Therefore, the ERP package must be selected to meet the company's BPR themes. They proposed the method of setting BPR themes by using Business Sheets. In this method, project members can discuss the management environment and the reality of business functions in a short period. After discussing, they can easily extract the BPR themes from the Business Sheets (Komiya et al., 2000: 2109).

Cheng and Wang (2006) used a research model that shows the relationship between BPR process assessment and ERP benefits. They divide BPR process assessments into three phases, including the organization's decision to pursue reengineering, the situation of new process development and project implementation and results. ERP includes operational, managerial, strategic, IT infrastructure and organizational benefits. The authors reported that if an organization wants to implement BPR effectively to increase ERP benefits, applying Business Process Management tools might help. They also suggest that companies adopt advanced Business Process Management Systems to implement BPR rather than using the traditional BPR approach because doing so most likely would also bring potential ERP benefits.

Another study done by Jiang and Ruan (2008) showed the strong interaction of the systems. They report, 'To ensure successful application of ERP and achieve the desired effect, we must first redesign our business processes.' Conversely, the successful implementation of BPR and the improvement of enterprise management performance systems must lie in ERP systems as technology means and management tools. This study shows the relationship between BPR and ERP in the implementation process, interacting and supporting one another. In the implementation process, each is a prerequisite for the success of the other. The realization of transforming BPR from thought to reality is inseparable from ERP systems, and only through ERP can we support and solidify new business processes. Only under the guidance of BPR will it be easy to apply ERP to achieve expected results. Through the integration, implementation and applications of BPR and ERP, enterprises can be effective in optimizing their resources and processes (Jiang and Ruan, 2008: 5).

Subramoniam et al.(2009) found that simultaneous implementation of BPR and ERP is the most effective method in redesigning business processes. Bac and Erkan's (2013) research also demonstrates the ERP and BPR connection in Supply Chain Management (SCM). Their findings show that using either BPR or ERP strategies has positive effects on SCM's overall performance; it has been found that successful implementation of ERP has a greater probability of improving performance. Furthermore, it has been proved that using both BPR and ERP together further improves SCM performance to a point that neither the BPR

application nor the ERP implementation might reach individually. Thus, BPR acts as a success factor for ERP systems, which improves the chances of successful ERP implementation (Bac and Erkan, 2013).

On the literature there studies showed that why ERP fail and what are the connections of these failures with BPR.

One major reason why the ERP system has not been implemented successfully is the inappropriate use of the design and implementation methodology employing the modern BPR concept (Ng et al., 1999: 2093). Ng et al. (1999) propose a Hierarchical Design Pyramid (HDP) model to design and implement an ERP system under the macroscopic context of business process re-engineering with a total quality approach.

Paper et al.'s (2003) research shed light on the relationship between ERP and BPR and why the examined project failed. In their case study, top management based the software investment decision solely on vendor promises, market share of the software in its market niche, name recognition, and CEO endorsement. No effort was made to obtain opinions and/or feedback from employees at the process level or those engaged in existing systems development and maintenance. Moreover, the state of legacy systems and processes was never considered as a factor in the decision. Additionally, management did not attempt to analyze existing processes and systems to see whether they were fluid. That is, they failed to obtain feedback and opinions from people along the process path and from legacy system experts (Paper et. al., 2003: 57).

In 2005, Bosilj-Vuksic and Spremic investigated a pharmaceutical company in Croatia. Overcoming employee resistance can be a critical factor for the successful completion of a project. Top management must provide leadership for all changes, efforts, objections and disagreements that arise in the process of reengineering and ERP implementation. Indifference and a lack of support from top management, in addition to the high cost of a BPR Project implementation, are considered the major barriers to the initiation of BPR or business process innovation projects. They concluded that 'the implementation of a new ERP system will not bring the expected benefits if it is not accompanied by a change in human behavior and in organizational regulations.' Their case study shows that successful implementation of the ERP system must be accompanied by an appropriate BRP project (Bosilj-Vukšić and Spremić, 2005: 20). During the implementation process, ERP would enable business reengineering and a BPR initiative's commencement. BPR is supposed to be done as a required preceding step for the implementation of ERP.

As seen in the literature, using both ERP and BPR at the same time has a positive effect on management's and systems' success. However, initiating ERP systems is not sufficient to achieve the desired goals. In order to achieve the desired benefits of ERP, companies should reengineer their business processes.

2.2.6. Relationship Between ERP and Benchmarking

Benchmarking is a frequently mentioned subject in the business literature. There are many definitions of this topic in the literature. Benchmarking is a positive, proactive process to change operations in a structured fashion to achieve superior performance and gain competitive advantage (Camp, 2003: 12). Daniels (1996) defines benchmarking as the process of comparison of a particular organization, plant or process with its "peers", i.e., an attempt to discover whether performance is good or bad compared with others performing the same activities. Knowing how you compare (quantitatively and in detail) with your competitors can help you understand the factors that make a successful organization, identify your problem areas, and see what you must improve (Daniels, 1996: 18). The essence of benchmarking is the process of identifying the highest standards of excellence for products, services or processes and then making the improvements necessary to reach those standards—commonly called 'best practices' (Bhutta and Huq, 1999: 254). Benchmarking enables enterprises to determine their capabilities by comparing them to those of the 'best' enterprise.

Systems used by enterprises are important factors and these factors affecting their place in the market. Enterprise resource planning systems are significant factors in positioning a firm's location. Before initiating ERP systems, firms should analyze their current situation. Consequently, enterprises conduct

analyses to answer the following questions: Are their financial and technological elements sufficient to establish an ERP system, and, if gaps exist, how can they be filled. As with ERP systems, Benchmarking also reveals enterprises' present situation, provides a comparison and facilitates the determination of whether there are gaps or not. Aberdeen Groups' report in 2006 about Benchmarking ERP in Small Medium Business (SMB) shed light on enterprises' current situation.

Table 1. ERP Competitive Framework

LAGGARDS		INDUSRTY AVERAGE	BEST IN CLASS
PROCESS	Business benefits not measured; success is measured on time to first 'go live' milestone; commitment lags after first milestones are achieved.	Business benefits are measured and some quantifiable gains have been achieved but significant additional opportunities exist for further payback.	Significant and quantifiable business benefits achieved from ERP implementation. Milestones achieved within reasonable timeframes; Upon completion of milestones, new objectives are defined.
ORGANIZATION	IT drives ERP decisions with little or no involvement or commitment from Line of Business.	Both IT and Line of Business involved in ERP initiatives, but IT owns the project.	Both IT and Line of Business collaborate on ERP initiatives, with Line of Business owning the success of the project.
KNOWLEDGE	Limited visibility into manufacturing operations and the order to fulfillment process.	Some visibility into manufacturing operations and the order to fulfillment process.	Real-time visibility into manufacturing operations and the order to fulfillment process.
TECHNOLOGY	Less than the fundamental mental basics of ERP modules implemented, using less than %50 of functionality in those modules implemented; ERP implementation based on older technology.	Basic fundamental modules of ERP implemented, using more than %50 of functionality in those modules implemented. Beginning to wrap existing technology with web services and first steps taken towards upgrading technology infrastructure.	All fundamental basic modules of ERP implemented along with other specialty functions, employing more advanced technologies such as event management and workflow technologies and using more than 70% of functionality in those modules implemented.

Source: Aberdeen Group. (2006). Benchmarking ERP in SMB., p.11

A literature examination shows that there are studies about the relationship between benchmarking and ERP.

ERP can improve the global vision of the company and collaborative work, permit master-data harmonization, considerably reduce information redundancy and work in real-time. In the application phase, lacks in training, planning, communication and implication management, or underestimation of the importance of the choice of ERP will be the traps in the process. The consideration of ERP operational, strategical and technical factors is very important (Botta-Genoulaz and Millet, 2005: 586). The aim is to achieve the best possible implementation when establishing an ERP system. According to Perçin (2008), vendors were asked to evaluate the quality of their services using checklists to benchmark themselves against

other authorities. Setting up an ERP system is a strategic decision; the system should be functional, flexible, user friendly and reliable. Moreover, vendors' financial capability, implementation ability, research & development capability, and service support should be substantial (Perçin, 2008: 636). Various methods are available when selecting the best ERP application. Kılıc et al. (2015) performed a study on selecting the best ERP system for SMEs proposes the combination of an analytic network process and the PROMETHEE method.

ERP and Benchmarking applications complete each other. With the use of ERP, enterprises will have central information flow and thus will have a competitive advantage. Via benchmarking, firms analyze the best applications and adopt them. The choice of an ERP system should be appropriate to the firm's structure and resources. As with other strategic decisions, ERP and benchmarking help firms to gain competitive advantage, more profit than average and sustainable growth. It is crucial for firms to analyze which ERP system fits their organizational structure and how it will do so. To complete the entire process and gain an advantage in tough situations, management support, employee education, giving importance to the process and making this process sustainable are significant.

2.2.7. Relationship Between ERP and Product Life Cycle Costing

Knowing the product's life cycle is very important for enterprises to survive in today's tough economic conditions. However, having information about the product's phase in its life cycle is not sufficient. Another crucial point is determining the cost of the product. ERP systems can facilitate the process of investigating the cost of a product.

Product Life Cycle Costing (PLCC) tries to optimize and identify a physical product's cost over its economic life by using the present value method (Elitaş et al., 2010; Güneş and Aksu, 2003; Lindholm and Suomala, 2007; Woodward, 1997; Yilmaz and Arı, 2011). According to Lindholm and Suomala (2007), the core of Product life cycle costing lies in understanding the nature of the product life cycle and products' performance in the cycle. Product life cycle costing can be considered from different perspectives, for example, from those of the consumer and producer.

According to Artto (1994), consumers use PLCC as a part of Market Analysis to answer the question, 'How much do the product's capabilities cost the consumer over its life cycle?' Conversely, a producer uses PLCC to discover the product feature's effects on cost. PLCC is a decision-making tool. Its application fields are mentioned below (Güneş and Aksu, 2003: 45):

1. Choosing between two or more alternatives
2. Evaluation of past decisions and their results
3. Determining probable costs
4. Assisting decision makers

Different definitions of the dimensions of a product life cycle can be seen in the literature. Levitt's 1965 model consists of four stages: Introduction, growth, maturity and decline. In another study, the ERP Life Cycle (ERPLC) product was identified. Its framework consists of 6 phases and 4 dimensions. The dimensions of the ERPLC include change management, people, process and product. Its phases include adoption decision, acquisition, implementation, use & maintenance, evolution and retirement. These six phases also have sub-factors. The adoption-decision phase includes type of solution and requirements definition. The acquisition phase includes product selection, consultant selection, contractual agreement and return on investment. The implementation phase includes methodologies, time period implementation, project team, training, adaptation and data conversion and risk management. The use and maintenance phase includes functionality, usability, maintenance and maintenance outsourcing. The evolution phase includes extended applications such as supply chain management, advanced planning and scheduling, customer relationship management, business intelligence strategic management, business to business and workflow. Finally, the retirement phase briefly includes cost analysis and technology trends (Esteves and Pastor, 1999: 368).

Shao et al. (2009) performed a study on charismatic leadership and its effects on the ERP implementation life cycle. They used a conceptual model that shows an interaction between charismatic leadership dimensions and the ERP implementation life cycle. The ERPLC contains primary adoption, secondary adoption and assimilation (Shao et al.,2009: 4). The ERP life-cycle stages cover initiation, contagion, control and integration, and these stages have a direct relationship concerning maintenance and support success, implementation success and overall ERP success (Law et al., 2010: 300). In Ara and Al-Mudimigh's (2011) study, initiation, planning, execution, control, and closing are the phases of a project management methodology. They find that in the ERP project life cycle, project management plays a key role; hence, a proper emphasis must be placed on selecting the project team to ensure proper decision making. Such care results in timely project completion (Ara and Al-Mudimigh, 2011: 9). Hasibuan and Dantes (2012) performed a broad study comparing ERP life cycle implementations.

Table 2. Comparison of ERP Implementation Life Cycle

Literature	Pre-Implementation	Implementation	Post-Implementation
Esteves&Pastor (1999)	Adoption Stage Acquisition Stage	(3) Implementation Stage	Use & Maintenance Stage Evolution Stage Retirement Stage
Markus&Tanis (2000)	(1) Chartering Stage	(2) Project Stage	Shakedown Stage Onward & Upward Stage
Ross&Vitale (2000)	(1) Design Stage	(2) Implementation Stage	Stabilization Stage Continuous Improvement Stage Transformation Stage
Shanks,Parr,Hu, Corbitt,Thanasankit&Seddon(2000)	(1) Planning Stage	(2) Implementation Stage	Stabilization Stage Improvement Stage
Parr&Shanks (2000)	(1) Planning Stage	(2) Project Stage	(3) Enhancement Stage
Somer&Nelson (2004)	Initiation Stage Adoption Stage	(3) Adaptation Stage	(4) Acceptance Stage (5) Routinization Stage (6) Infusion Stage
Peslak, Subramanian& Clayton(2007)	(1) Planning Stage	(2) Transition Stage (3) Performance Stage	(4) Enhancement Stage

Source: Hasibuan, Z.A. & Dantes, G.R. (2012). Priority of Key Success Factors (KSFS) on Enterprise Resource Planning (ERP) System Implementation Life Cycle. *IBIMA Publishing Journal of Enterprise Resource Planning Studies*, 2012, p.3

Hasibuan and Dantes (2012) found that teamwork, business process reengineering, top management support, project management, communication, culture readiness, determining ERP implementation strategy and methodology, a strong ERP product and user training are significant factors of the ERP life cycle. In parallel with Hasibuan and Dantes's study, Hustad and Olsen mentioned that the pre-implementation phase has central activities such as selection of project leader and project team, development of requirements specification, reviewing the market, evaluating different systems, vendors, resellers and consultants, and negotiating a contract with the vendor. Important activities during the implementation phase were project management, user training, cleaning and conversion of data, testing of the system, and customization of the

system. In the post-implementation process, the training of users continued, and the companies were dependent upon support from the vendor (Hustad and Olsen, 2013: 187).

Lindholm and Suomala's (2007) research shows that developing life-cycle costing in an organization is a long-term project in itself. Only by actually practicing long-term cost accounting and management can an organization learn more about the behavior of product cost. For useful life cycle costing at the beginning of a product's life, the most important factor seems to be a realistic product utilization plan. It is important to recognize also in life cycle costing (LCC) that the cost of producing the data must not exceed their value. The authors determined that the implementation of LCC is feasible even in uncertain environments and that LCC can be a good tool in attempting to decrease uncertainty once it has been quantified.

Support was a major source of conflict between customers and the vendor; without proper support and life cycle-wide implementation, management and support of the system can be derailed (Chang, 2004: 7). Another study was performed in China. In that study, the life cycle of ERP includes the introduction, implementation, crisis and decline stages. The authors find that building learning organizations, business process reengineering and advanced management thought are important for ERP success (Wu et al., 2007: 109).

In the light of the above, it is important to understand the important factors affecting the ERP implementation life cycle. Determining these success factors facilitates calculation of the cost of ERP during its life cycle. Based on the literature, identifying the success factors of an ERP life cycle affects the PLCC process. Thus, factors related to cost will be defined, and if there is a conflict on process, corrective actions will be taken.

2.2.8. Relationship Between ERP, Value Engineering and Target Costing

Value engineering is a process which aims to decrease product innovation cycle cost, gain competitive advantage, increase the value of a product and analyze all competitors to determine price without sacrificing anything with respect to product quality or the needs of the customer (Elias, 1998; Fang and Rogerson, 1998; Öğüt et al., 2007; Örnek, 2003; Yükçü, 2000). Value Engineering was developed by Lawrence D. Miles, a member of the General Electric (GE) engineering staff. After World War II, many of the materials used by industries were in short supply and difficult to obtain. Companies such as GE were forced to seek substitute materials. In many cases, the substitute materials performed as well as, if not better than, the original ones. That finding led GE officials to conclude that in some cases, they could actually improve productivity by changing materials (Borkenhagen, 2010: 2; Elias, 1998: 382). Value engineering is employed to implement projects, increase performance and reduce costs in all phases of research and operational projects (Fang and Rogerson, 1998: 47; Tohidi, 2011: 917).

Enterprise resource planning systems and Value engineering have a strong relationship. A literature review on this relationship sheds light on how these systems affect each other. In Ragowsky et al.'s (2005) study, how organizations can use ERP to add value to their primary activities with respect to organizational characteristics is mentioned. The authors adapt and extend the work of Barua and Tallon by examining how, and under what circumstances, individual ERP applications add value to organizational primary activities. As stated in their work, some organizational characteristics result in a stronger direct relationship in which the value of ERP systems can add more to primary activities than do others, such as the following. (1) Parallel production lines have the most influence on how ERP systems can help in reducing inventory-holding costs. (2) Parallel production lines are a strong predictor of how ERP systems can reduce unit production costs. (3) The average number of customer orders per month strongly affects how ERP systems reduce the cost of after-sales service. (4) The service percentage of cost in the final product has the most effect on customer retention through differential advantage. The authors concluded that information systems applications commonly found in ERP systems add value to an organization's activities when that organization's particular operational characteristics are considered (Ragowsky et. al., 2005: 381-393).

Ruivo et al. (2012) used Diffusion of Innovation to explain 'ERP use' and Resource-Based View to explain 'ERP value'. Their findings show that concerning 'ERP value', the main conclusion is that analytics and collaboration are important factors for 'ERP value' in SMEs, demonstrating that ERPs are used not only as a transaction processing system but also as front-end applications in SMEs (Ruivo et al., 2012: 361). The Resource-based view was also used in another study. The purpose of the mentioned study is to shed light on the ERP value paradox. In line with the Resource-Based View, the study proposes an integrated model to investigate with what organizational resources and by building what firm-specific capabilities an investment in ERP systems can generate competitive advantage. In their Resource-Based View-based study, it was found that business integration capability built from ERP, e-Business technologies, and organizational resources represent important mechanisms explaining how resources are picked, combined, and transformed into a differential competitive advantage. By building a firm-specific business integration capability, ERP systems will be not merely a commodity but will bring firms competitive advantage (Hsu, 2013). May et al. (2013) used several criteria as values in the case study which are: maximize system process effectiveness, business process effectiveness, customer relationship effectiveness, system use, organizational IT performance, information security, trust, information dispersion and information richness (May et al., 2013: 106).

In 2014, Ram et al. used antecedent factors to explain how they interact with ERP and competitive advantage. The results showed that an assessment and understanding of system quality, organizational readiness, business environment and an assessment of the strategic value of adopting ERP can be crucial for generating the desired competitive advantage after ERP adoption (Ram et al., 2014: 130). Ruivo et al. (2014) used the technology, organization and environment (TOE) framework on Portuguese SMEs in their study. Their study reveals that among Portuguese SMEs, management control is the most important indicator of ERP value, which is linked to the ERP embedded logic. That is, ERP is being used as the management control system to track competitive advantages. Moreover, both transactional efficiency and best practices are important determinants of ERP use; collaboration and business analytics are important determinants of ERP value (Ruivo et al., 2014: 180).

Target costing also plays an important role in enterprise resource planning systems.

The target costing approach helps a firm integrate its accounting function with operations management and effectively support the firm's competitive strategies (Lee et al., 2002: 111). Lee et al. (2002) argued that there are four types of processes and decision support requirements in the target costing (TC) strategy. The process of TC consists of market strategies, target costing reengineering, increased competitiveness and improved market share. Decision-support requirements include general strategic decision support, activity-based management support, business process reengineering and product and process (re-) design. They concluded that a target costing-based strategic decision support system integrates transactions with strategies and therefore provides an excellent model for enhancing the decision-support capabilities of enterprise systems. Zhang (2010) stated that, the model of Target Costing Management in the ERP analysis and control environment focuses on product cost planning and designing stages. Zhang suggests that Target Costing= Target Price- Profit Margin and mentions that target cost management starts with reducing cost in the product design phase or even at the initial stage of the product development cycle. Zhang finished the study by indicating, 'The two models (activity based costing and target costing) should be integrated in an ERP system to form a new model of the cost control management in an ERP environment.' (Zhang, 2010).

Target costing, value engineering and ERP systems have a close interaction with each other. Integrating management accounting systems with one another has positive effects on ERP systems. By achieving this integration, companies fulfill their objectives and gain competitive advantage.

3. Conclusion

Today, the developments in competition and manufacture environments forced firms to change their mentality of market, quality and time. Thus, firms have used new cost management techniques and got many advantages to track and control the effects of changings.

Firms applying new cost management techniques need holistic and transparent information system providing instant and comprehensive information about basic managerial functions (departments) and basic processes. This is realized clearly, when we think especially manufacturing enterprises. In this kind of firms, obtaining adequate cross-functional data for healthy and effective application of both traditional and modern MA techniques, is difficult. So, today, lots of firms use ERP system to overcome this difficulty.

ERP is a system providing effective communication and integration by using necessary data and information, for modern management accounting applications. Thanks to ERP system, elimination of non-value creation activities, definition of process improvement opportunities, increasing product and customer profitability and getting easier the work of decision-makers is possible. In other words, timely and effective analysis of the activities, monitoring down to the origin of facts and events, rational distribution of limited resources, faster and fewer errors process management and sustainable cost reductions are important earnings providing by ERP.

In short, we can see ERP as a democratizing factor for cost management, as it opens management process to all employees. ERP presents opportunities for all firm's members to share easily their individual interpretations of cost information and find their best consensus. So, ERP is compatible with all advanced managerial accounting techniques (Eker and Aytaç; 2016: 187). It can be expressed theoretically that high interaction between ERP and advanced managerial accounting techniques is associated with high financial and non-financial performance.

End Notes

1. *This study was carried out with the support of BAP Project in Uludağ University.*
2. *Value stream mapping is a lean-management method for analyzing the current state and designing a future state for the series of events that take a product or service from its beginning through to the customer.*

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