

A Review: Enterprise Resource Planning Impacts On Innovation Types In SMEs

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ABSTRACT

In today's unpredictable business environment, enterprises face the challenge of innovatively expanding markets and meeting customers' requirements and expectations. Innovation is the one concept which is fundamental for economic growth and can lead to competitive advantage to enterprises. Therefore, in its larger scale, innovation plays a significant role in economic development. Purposes of this paper are to: 1) Review innovation types in manufacturing sector, 2) Review innovation enablers, 3) Identify ERP system as an innovation enabler, 4) Study ERP system and KM interactions and, 5) Present a theoretical model of ERP systems' impacts on innovation types.

Keywords: innovation types; enterprise resource planning system; knowledge management

1. INTRODUCTION

Innovation is a fundamental concept for economic growth and can lead to competitive advantage to enterprises. In today's competitive environment, innovation plays a significant role in increasing competitive advantage of an enterprise. Concept of innovation originated in 1934 based on Schumpeter's studies (Schumpeter, 1934), who emphasized significant role of innovation in economic development [5, 11, 13]. "Innovation is a dynamic process" (Richard Walker, 2007). Considering the managerial perspective, innovation creates change in the enterprise (Drucker, 1985).

In 1992, OECD (Organization for Economic and Cooperation and Development) published first version of a manual named "Oslo Manual" [13]. This manual consisted of guidelines for gathering and compiling data on technological innovations. Based on Oslo manual, innovation is defined as: implementing new product and processes and major technological improvements in products and processes (Nizar Becheikh & et al, 2006). Oslo manual and confirmation of recent studies also define other particular characteristics, for innovation in service sectors [4].

This paper aims to discuss innovation concept in detail and consider most common innovation types, particularly in manufacturing sector with focus on SMEs such as Process innovation, Product innovation, Technological innovation, Market innovation and, Organizational innovation. These innovation types are resulted by several viewpoints such as those of suppliers, customers, research centers, competitors, society, universities, employees and stakeholders. Afterward, we explain role of enablers which affect on innovation types. Here most common enablers such as innovative culture, environmental factors, customer orientation, organizational learning and strategic orientation [14] are taken into account. Thanks to information and technology infrastructure as one of the most promising enablers, Enterprise Resource Planning systems (ERP) could be used in particular, to support all kind of innovation types [21]. ERP system is a generic term for a board set of activities supported by multi-module application software that helps organizations manage their own resources (Teltumbde, 2000). ERP has been proved to enable acquiring of scientific improvements in efficiency, productivity and service quality and to lead to reducing costs as well as reaching more effective decision (Ngai & et al, 2008). An ERP project is a process which consists of: 1) Pre-implementation, 2) Implementation and, 3) Post- implementation stages. We consider ERP as the most important ICT tool that acts as an enabler to enterprises innovation [21]. Moreover, based on many researches [14, 21], knowledge management has interaction with lifecycle of ERP implementation.

This paper emphasizes innovation and common innovation types with regard to manufacturing sector, and presents a conceptual model which focuses on ERP system post-implementation based on knowledge management phases as an ICT tool for supporting innovation in the enterprise[30].

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2. BACKGROUND

2.1. Innovation concept

Innovation is a fundamental concept for economic growth and can lead to competitive advantage to enterprises. In today's competitive environment, innovation plays a significant role in increasing competitive advantage to enterprises. Early concept of innovation was originated in 1934 based on Schumpeter's studies (Schumpeter, 1934), who emphasized significant role of innovation in economic development [13]. "Innovation is a dynamic process" (Richard Walker, 2007) [33]. Considering the managerial perspective, innovation creates change in an enterprise. There have been several definitions in different literatures for innovation concept, mentioned as follows:

- "The new combination of factors of production made by the entrepreneur" (Schumpeter, 1934).
- A process, through which new ideas, objects and practices are created, developed or reinvented and are new and novel to the unit of adoption (Aiken and Hage 1971; Kimberly and Evanisko 1981; Rogers 1995; walker & et al. 2002).
- "Developments and new applications for launching newness into economic area" (Gunday & et al, 2011)
- "New consumable product or service generated by use of technological and market knowledge" (Afuah, 1998)
- "A firm's technology-related activities as it develops new processes or brings new products to market" (Cumming, 1998)
- "Newness of an idea to improve organizational performance" (Comison, Zornoza & et al., 2004)
- "The adoption of an idea or behavior pertaining to a product, service, device, system, policy or program that is new to the adopting organization" (Damanpour and Galpakrishnan, 2001)
- "Policy, structure, method or process or any product and market opportunity that the manager of an innovating unit perceives to be new." (Nohria and Gulati, 1996)
- "Implementing new/product and processes and major technological improvements in products and processes" (Nizar Becheikh & et al, 2006)

In organizational level, innovation types are defined both in manufacturing sector and service sector. Next section has an overview of these types. There are three major approaches about innovation types in organizational level as follows (Coombs and Miles, 2000) [5]:

- Assimilation: This approach states that, there are similar issues for service and manufacturing innovation;
- Demarcation: This approach states that service innovation is different from manufacturing innovation because of dynamic features of service innovation;
- Synthesis approach: this approach indicates that service innovation and manufacturing innovation are not completely different, but only some aspects of service activities are distinct. This approach is in the initial stages of development.

In next section, innovation types in manufacturing sector, with focus on demarcation approach, is discussed [7, 8, 24].

2.2. Innovation types

Innovation types are organized into five major categories, namely as: 1) Technological innovation, 2) Process innovation, 3) Product innovation, 4) Market innovation and, 5) Organizational innovation. Innovation types have different characteristics [8]. In next sections, these types and their main associated factors are discussed in detail [1, 3, 13, 23].

2.2.1. Technological innovation

Most literature reviews of innovation have emphasized technological innovation as a major innovation type in their researches [13]. Technological innovation is a complex subject consisting of creative activities such as research, design, production, marketing and dispatching. Though, these elements together form a very complex process, they have close relationship with each other too. There are many qualitative and quantitative factors used to evaluate technological innovation capabilities. These factors are categorized as follows [16, 22, 35]:

- R&D capabilities: Such as success rate of development, R&D investment intensity, rapid feedback from manufacturing to design, ...;
- Investment capabilities: Such as investment intensity in science and technology, and human resource, ...;
- Management capabilities: Such as top manager's support, risk evaluation, ...;
- Marketing capabilities: Such as knowledge over different market segments, environmental analysis, market demand, distribution techniques, ...;
- Finance capability: Such as monetary capabilities for technology innovation, payoff period of investment, interest rate of investment, profit margin of new products, ...;

- Manufacturing capabilities: such as departments' ability to convert R&D results to products, applying advanced manufacturing methods,....;

2.2.2. Process innovation

Process innovation is implementation of new/improved production or delivery methods, such as modifying techniques, equipments and/or software. Process innovation has a cost-cutting nature [13]. Main factors for evaluating process innovation are:

- Customer relationship
- New products ideas
- Increasing quality of manufacturing process, tools, machinery and techniques
- Increasing quality of logistics processes
- New product launches/improvements
- Standardizations
- Patent products
- And,....

2.2.3. Product innovation

Product innovation is introduction of a good service that is new or improved in characteristics such as technical specifications, components and material, user friendless or other functional specifications [13]. Product innovation is a complex process which is affected by customer requirements and new technologies. There are factors for evaluating product innovation which are mainly known as follows:

- Being pioneer in market
- Flexibility to market demands
- Flexibility to customers' needs and orders
- Improved product quality
- Reduced manufacturing costs
- New marketing approaches
- New products offered
- And,....

2.2.4. Market innovation

Market innovation involves implementation of new marketing methods and creates changes in product design and packaging, product placement, product promotion and pricing [13,33]. Marketing innovation aims to meet customer needs better, and increase market share. The main factors which evaluate market innovation are recognized as:

- New marketing approaches
- New distribution channels
- New product pricing
- New general marketing management
- And,....

2.2.5. Organizational innovation

Organizational innovation involves implementation of new organizational methods in the enterprise business activities, workplace or external relations [13]. Organizational innovation could be promoted with all the administrative practices such as procedure, human resource, systems, and especially procedure regarding society such as social responsibility, etc. The main factors which evaluate organizational innovation are:

- Organization capabilities: Such as modifying procedures for producing in innovative manner, modifying human resource systems, modifying organizational structure, modifying SCM system, modifying QMS system, etc.
- Strategic planning: Such as running SWOT analysis, strategy identification, clearing roadmap, etc.
- Innovation culture: Such as encouraging innovative proposals and ideas, employees' freedom to think of new methods for doing functions, etc.
- Management support: such as risk evaluation capabilities, personnel satisfaction, personnel productivity, etc.
- Learning culture: such as team working, access to knowledge, knowledge sharing, employees' involvement, teams encouragement to identify opportunities, etc.
- Social responsibility: such as product liability, reducing energy consumption, environmental standards, etc.

There are some enablers which lead to form innovation types. The major enablers are customer orientation, innovative culture, organizational culture, organizational learning, leadership, strategy orientation, market orientation, enterprise systems such as ERP, SCM, etc. In the next section, major enablers are reviewed.

2.3. Enablers (drivers)

All innovation types are derived by some enablers briefly defined as follows:

- **Innovative culture:** Innovative organization encourages innovative culture [17]. These kinds of organizations encourage employees to contribute ideas for new/improved products.
- **Customer orientation:** Enterprise's focus on customer requirements could lead them to be pioneer in the market. This can be done by paying enough attention to Customer Relationship Management [10, 37].
- **Organizational Culture:** culture is not a new phenomenon and almost all managers are aware of important role of culture in organization [23]. Culture can be an obstacle to new ideas. Culture is defined as an interpretative framework in which individuals make sense of their own behavior as well as collectivists in their society [23].
- **Organizational Learning:** is defined as organizational believes, values, and assumptions of a group in organization which is applied for solving external and internal problems [13, 17]. Organizational learning can be accomplished by sharing Knowledge between teams which consequently increases organizational memory [19, 29].
- **Leadership:** leadership is a process that transforms organizations from what they are to what leaders would like them to be [12]. Leadership style is very important for improving innovation. Global competition, more efficient and effective resource utilization and increasing innovation depends on management abilities [2].
- **Strategic orientation:** Strategy plays important role in firms to attain competitive advantage. Enterprises with strategic orientation are more innovative.
- **Market orientation:** Marketing orientation is necessary for organization growth [2, 18]. Market research, market demand, predicting uncertainty conditions of environment [28].
- **Enterprise systems:** enterprise systems have influence on innovation types and are used as enablers of innovation. Some of these systems are ERP, SCM, CRM,... . These systems can accelerate innovation. In the next section, one of these systems known as Enterprise Resource Planning (ERP) is reviewed.

3. ERP AND KM PERSPECTIVES

3.1 ERP concept

During the last decade, global economy entered a new phase where survival of enterprises in the future depends on their ability to use knowledge power. In this economy, SMEs play a significant role and should focus on improving their knowledge capital to innovate. On the other hand, Information and Communication Technology (ICT) infrastructure allows enterprises to access external sources of knowledge. ICT infrastructure consists of some tools and ERP system is one of these tools. Early concepts of ERP were developed in 1960s as Material Requirements Planning (MRP) was introduced as an outgrowth of early efforts in bill of material processing [29]. ERP system is a generic term for a board set of activities supported by multi-module application software that helps organizations to manage their own resources (Teltumbde, 2000). ERP has been proved to enable acquiring of scientific improvements in efficiency, productivity and service quality and to lead to a reducing costs as well as reaching more effective decision (Ngai & et al, 2008). ERP is increasingly important in modern business because of its capability to integrate flow of material, finance and information and to support organizational strategies (Yusuf & et al, 2004, Yurong and Houcun, 2000).

3.2. Knowledge Management (KM) Concept

In order to defining knowledge management, we first refer to knowledge concept. Knowledge is defined as "information plus the casual links that help to make sense of this information"[21, 34]. There are two types for knowledge: explicit and tacit knowledge. Explicit knowledge is communicable in systematic languages via IT infrastructure, whereas tacit knowledge resides in person's minds and habits, and is therefore hard to codify and transfer[20]. Nevertheless, tacit knowledge can be transferred by means of personal interactions, either in groups or in virtual space provided by an IT infrastructure[9, 20, 31]. These two categories of knowledge are acquired through two sources known as internal and external sources of knowledge. Organizational culture, employees' skills, product and process specifications and capabilities, technology capability and leadership can be referred to as internal sources of knowledge, while knowledge of market, competitors, and customer needs are examples of external sources of knowledge[12, 26, 31]. Through examination of internal and external knowledge, changes occur within the organization as well as those taking place in the environment will be identified in the shape of problems, opportunities and threads. Since knowledge is verified information and information is processed data[25], taking advantage of a process composed of gathering, selecting, analyzing, synthesizing, weighing and evaluating, data and information input could be transformed into knowledge inflows[31, 36]. Knowledge concept

has attracted a lot of attention from scholars for a long time[21]. Consequently, it has become the focal point of many researches during the last two decades[25]. Knowledge exploitation can lead to innovation, which provides enterprises with competitive advantage in today's unsustainable business environment. Businesses can solve confronting problems and take opportunities by means of managing knowledge[25]. In fact, as stated by Francis Bacon, "Knowledge is power". Knowledge management concerns some cultural change in Bacon's statement which involves a broader context. That is to say, Knowledge management intends to switch people's attitude from "my knowledge is power" to "sharing knowledge is power"[25]. Many definitions of knowledge management exist in different literatures. According to Hibbard [25]; knowledge management is "the process of capturing the collective expertise of the organization from different sources (i.e. databases, paper, people) and utilizing that knowledgebase to leverage the organization". As Davenport and Prusak [9] stated "knowledge management is concerned with the exploitation and development of the knowledge assets of an organization with a view to further the organization's objectives". Knowledge management is a systematic process comprising numerous phases to manage a combination of knowledge, information and data with the aim of linking people who need to know knowledge of right ones in a timely manner [21, 27]. As Sedera and Gable [27] argued, there are four salient phases that can be considered for knowledge management in accordance with the literature on KM process: 1- Creation, 2- Retention, 3- Transfer, and 4- Application.

3.3. ERP and KM Interaction

ERP can extract information in the organization and we can name it as an innovative KM tool [32] that facilitates knowledge transfers. As mentioned earlier, knowledge is divided into two categories: explicit and tacit. Explicit knowledge can be transferred by ICT solutions and one of these solutions is ERP system[32]. Tacit knowledge, which is in persons' mind, can be effectively transferred through interaction in people groups. Such transfer could occur using ICT infrastructure and ERP systems in particular. Many organizations apply ERP systems as their ICT backbone. ERP reduces management efforts for gathering, storing and applying data and information[32] and helps management to analyze information and to convert it into knowledge. ERP allows management to focus on knowledge-based tasks and to acquire knowledge advantage to solve problems. ERP as an enterprise system has a lifecycle which falls within: 1-ERP adoption (pre-implementation); 2-ERP implementation and 3-ERP post-implementation. Our focus is on ERP post-implementation. Furthermore, ERP systems as IT tools can facilitate knowledge management through provision of functional interaction and enhanced control of information and data in organization[30, 31, 32]. Providing electronic repositories, information retrieval mechanisms, and technologies for knowledge sharing, ERP systems can facilitate each of KM phases and promote KM capabilities as a whole [6, 26]. These two concepts result in improved capability of organizational memory. In the next section, conceptual model regarding ERP-KM interaction is presented.

4. THE PROPOSED CONCEPTUAL MODEL

In this section, we introduce a theoretical conceptual model for the relationship between ERP system in its post-implementation phase and innovation types. As shown in figure 1, based on Sedera & et al, ERP success model [27], user satisfaction viewpoint[15, 38], experts opinion, and ERP post-implementation success factors are presented. These main factors include:

- Group impact; which means impact of ERP on work group in organization. This category consists of sub-indicators such as Knowledge transfer and improvements in group responsibility, group coordination, group communication, group involvement and group learning.
- Service quality; refers to ERP system features and provides support and contains sub-indicators such as interface user friendliness, meeting users' requirements, having right solutions to requests, technical support, training support, up-to-date facilities;
- Information quality; refers to type of information which ERP system provides and consists of sub-indicators such as having access to timely, understandable brief/concise, relevant, usable, available and, up-to-date Information;
- User's satisfaction; involves impact of ERP system on user tasks and user capabilities. Sub-indicators include: individual learning, enhanced user creativity, improved personnel productivity, user involvement, improved individual decision-making capabilities, reduced tasks accomplishment time;
- Product quality; determines ERP system functional qualities and contains sub-indicators such as system accuracy, improved system response time, system completeness, system reliability, system stability, etc[34].
- Enterprise impact; determines ERP system impact on the organization in whole. There are sub-indicators such as reduced costs, overall productivity, service quality, customer satisfaction, better use of data source, improved top managers' decision-making.

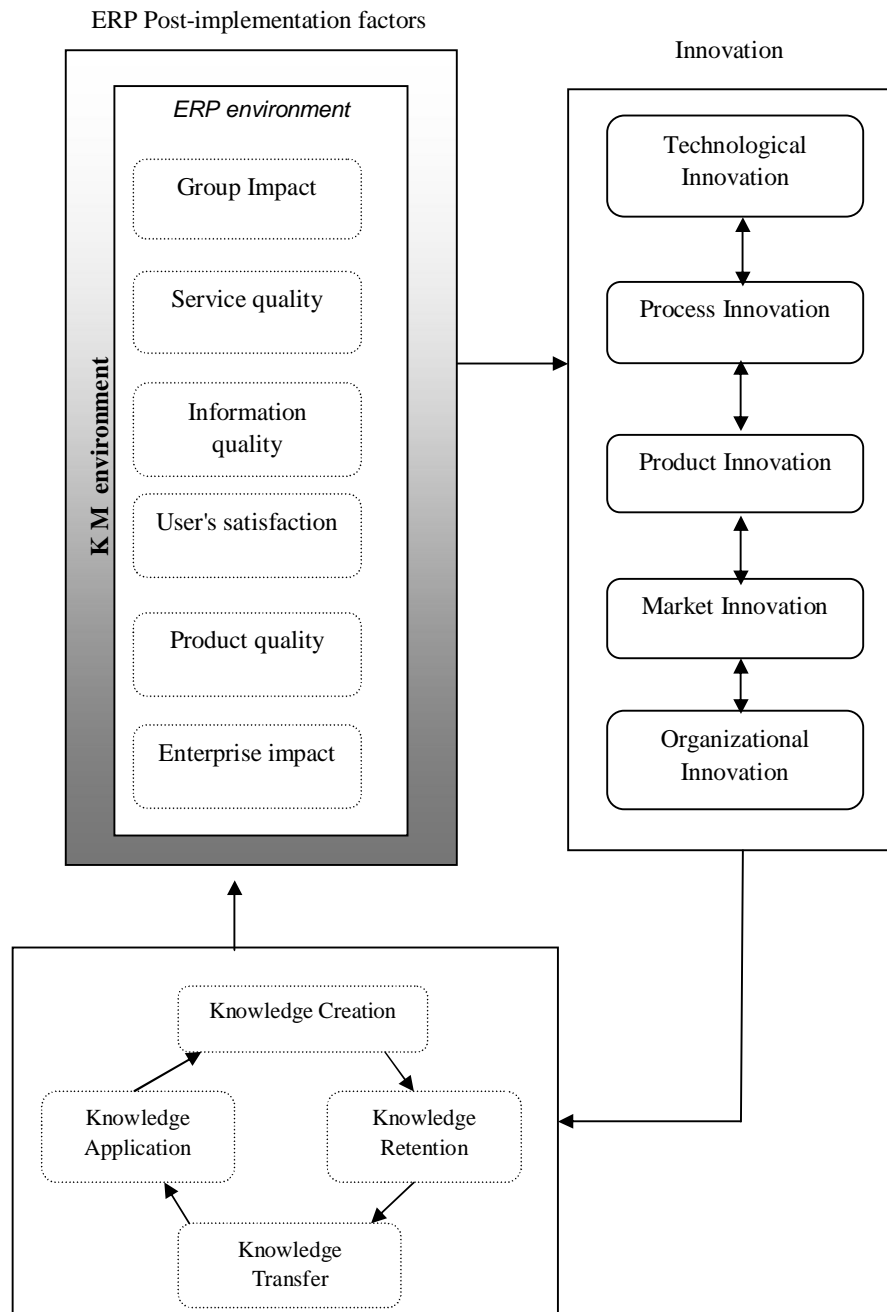
4.1. ERP system and Technological innovation

As mentioned earlier, ERP environment has interaction with KM process and ERP as a KM tools can facilitate KM phases to occur. Since technological innovation in major factors such as R&D capability, needs an

external source of knowledge such as universities, research institutions; ERP system can transfer this knowledge in all levels of the organization and improve usage of knowledge between work group and leads to rapid technological innovation and as a result, it leads us to proposition1.

Proposition 1: Knowledge embedded in ERP system has positive impacts on technological innovation.

Figure 1: Conceptual model of ERP and Innovation



4.2. ERP system and Process innovation

Process innovation involves internal processes of an organization and as mentioned before, it is affected by factors such as increasing quality of manufacturing process, tools, machinery and techniques, increasing quality of logistics processes, new product launched/improved, standardizations etc. These factors demand knowledge sharing in the organization. ERP system facilitates explicit and implicit knowledge transfer among individuals and

gives access of right information to right person. Hence quality of processes related to process innovation will be increased and proposition 2 can be composed as follows:

Proposition 2: knowledge transfer provided by ERP system has positive impacts on process innovation.

4.3. ERP system and Product innovation

Product innovation promises being pioneer in market, flexibility to market demands and to customer orders, following of new marketing approaches and offering new products. These are possible only if there is good source of knowledge available in the organization that experts can analyze trends and use knowledge in the way to achieve goals. ERP systems can provide deep and up-to-date knowledge for this purpose. Thus, ERP system can lead to form proposition 3.

Proposition 3: Knowledge usage provided by ERP system has positive impacts on product innovation.

4.4. ERP system and Market innovation

Market innovation emphasizes on new marketing approaches, new distribution channels, new product pricing, and new general marketing management which all require external knowledge from external resources such as competitors, environment and so on. ERP system can help the organization apply organizational knowledge and organizational memory capabilities to identify what market innovation promises. That is to say, ERP system leads us to form proposition 4.

Proposition 4: Enhancing organizational memory using ERP system has positive impact on market innovation

4.5. ERP system and organizational innovation

Organizational innovation involves routine tasks, procedures, systems, human resource, strategies, learning culture, management support etc. These tasks require intensive knowledge from external and internal sources. This knowledge should be accessible by all levels of organization via a repository for better decision making. The knowledge should be also timely, up-to-date and dynamic and must be used by right person in the right manner to increase organizational learning and consequently organizational innovation. ERP can provide this kind of knowledge in form of proposition 5.

Proposition 5: Deep knowledge provided by ERP system has positive impacts on organizational innovation.

5. CONCLUSION

This paper emphasizes innovation and common innovation types regarding manufacturing sector, and presents a conceptual model which focuses on ERP system post-implementation based on knowledge management phases, as an ICT tool for supporting innovation in the enterprise. The framework presented in this paper offers a theoretical perspective over ERP systems in post implementation phase and innovation types. We seek to present overall ERP system impacts on innovation. Interaction between ERP systems and KM can enable enterprises to create and deploy knowledge for improving innovation. Obviously, new perspectives should be employed regarding ERP complexity and constraints.

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