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Modeling the effectiveness of electric energy quality of knowledge management strategy by the systematic approach

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Abstract: Knowledge management is considered to be a critical success factor in today's organizations. Knowledge management strategy enables employees to carry out their activities more effectively than before. Regarding power quality it should be noted that it is very important in today's worlds and the efforts to improve it make its importance more clear. In this regard, this paper, from a systematic view and using system dynamics, deals with the effects of knowledge management on power quality and, then, "causal" and "the flow of research problem" diagrams will be provided. The proposed model specifies a framework to determine the effects of knowledge management on the quality of electrical energy, and provides the managers with an understandable and visual tool to understand this process better and make more effective decisions.

Key words: System dynamics; Knowledge management; Power quality; Strategy

1. Introduction

However, the introduction of knowledge as a critical factor in maintaining the competitive advantages of businesses is not a new subject. More than a century ago, Alfred Marshal in his book Principles of Microeconomic, argued that knowledge is the most powerful production engine (Marshal, 2007). Moreover, after the Second World War, several scholars have emphasized the importance of knowledge in economy. Davenport believes that knowledge management is the effort to discover hidden assets in one's mind and change it into the organization's assets, so that a large group of people, who are involved in the organization's decision makings, can have access to this asset and use it (Davenport, 2004). It can be said certainly that the relationship between knowledge management and employees' empowerment and its impact on improving power quality is important to the extent that the least neglect of the knowledge management may cause losses not only in electric power and its quality but also in other strategic industry. In this paper, using system dynamics, the causal effects of knowledge management on other variables will be evaluated.

Wilson (2008) provides useful descriptions on the relationship between information and knowledge with "processing hierarchy" that can be seen in the followings. He shows that by selecting one can produce information, by selecting and combining information, knowledge can be created and thereby one can decide and act.

Information is a concept and purpose but does not have meaning. When information s combined with testing contents, it will be changed into knowledge (Harris, 2002). The factors that have been proposed as success factors in knowledge management are classified into four groups: technology, processes, people, strategic commitment (Taomi, 2006). (Harinaran et al., 2007).

Different types of organizational knowledge resources include: organization's experts, end-user, management, external experts, literature (available documents), and electronic information (Cooke, 2007).

2. Knowledge management strategies

Knowledge management is a set of organizational arrays to achieve organizational goals. In 1999, Zack found out that in the conduct of knowledge management based on the strategic various missions; companies have adopted different administrative procedures. Findings show that knowledge management should be considered as a company's strategic tool. Although knowledge management strategy has not been yet classified by scientists, it should be deduced from the observation of its activities in the company's products (Shin and Chaing, 2009).

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Data → information → knowledge → decision making → act

Fig. 1: The hierarchy of data processing into information and knowledge in a hierarchy based on decision making and problem-solving

Among the studied literature, knowledge management strategy is often classified by the knowledge nature. This means that whether knowledge is implicit or explicit. Explicit knowledge refers to the information transferred by a systematic and standard approach. Thus, explicit knowledge management is called knowledge management encoding strategy. Companies that adopt such a strategy document a large-scale of useful information in database. The stored knowledge has become standardized and easily accessible and useful for the intended employees. The products and services of such companies tend to be standard and reusing of knowledge is emphasized in such companies. They will try to expand their standard operations for economies of scale, and to increase their market share, establish low success for their products (Shin and Chaing, 2009).

3. Knowledge creating organization

When knowledge is central to actualizing organization's strategic objectives, such an organization is called knowledge organization. In order for an organization to move from a knowledge-focused structure towards a knowledge-based structure, it should begin by identifying the organizational structures based on knowledge viewpoint. Knowledge level of an organization depends on some features including strategy, organizational structure, technology, performance measurement, human resource management, culture and the level of explicit knowledge (Lee and Choi, 2005).

David Parlbay and KPMG institute refer to a five-stage evolutionary path in knowledge management of an organization. KPMG shows exactly that only 10% of organizations have reached stage 4 or 5. The largest consulting organizations, those who identified knowledge in the investment of their markets, despite major investment in knowledge management systems are still involved with the cultural aspects of knowledge management (Lee and Choi, 2005). In order to reach the knowledge-orientation stage, adopting a balanced performance approach is required; a combination of mechanical knowledge management method with a strong emphasis on information technology solutions and organizational operations that are done from up to down. From a macro-perspective, organic knowledge management emphasizes on the structure and process with the most focus upon anthropogenic processes. Organic approach is considered to be a better method in developing the implicit knowledge (Evans, 2006).

4. Electrical energy and power quality

There are different definitions for the term power quality. In many cases, electrical companies use these terms for power non-outage and lack of power, or the users' inaccessibility to high-quality electrical energy. This is a major problem faced by the power industry that has negatively influenced the process of life and economic cycle. Power quality is used to describe changes in voltage, current and frequency in network. There is a direct relationship between the development of a society and the situation of electricity in that society. Therefore, low quality power or high extinction rate can cause many problems for companies and consumers. In today's competitive market that is characterized by uncertainty, those companies can compete that establish and distribute new knowledge in their organization and change it into goods and products. When an organization's knowledge resources are utilized, promotion will be observed in the organization and its dynamicity and business value will be enhanced (Tourban, 2008).

5. Research methodology

This is a descriptive analytic research by using dynamic of system. Dynamic of the system refers to a set of conceptual tools that enables us to understand the structure and dynamics of complex systems. Moreover, dynamic of the system is a sophisticated and elegant modeling approach that uses powerful systems to create computer simulations that in turn lead to the designing of effective organizations and policies (Sterman, 2008). Assuming that the system is going through its general and natural process, this method can be used to analyze system.

After drawing the causal loops, flow diagram is used so that the model can be analyzed better (Fig. 2).

In accumulation and flow diagrams the following main variables can be considered:

1. Level variable: refers to accumulations that determine the level of the system (are represented by rectangles)
2. Rate variable: that changes the input and output flow rates, which lead to changes in the system level (are shown by arrows).
3. Clouds: that, in fact represent the system border.

Causal loops diagram of the Fig. 2 are changed into accumulation and flow diagrams, so that they can be formulated and implemented by the computer. This diagram is shown in Fig. 3.

In the dynamics of the system based on the subjective models, the relationship between the components is determined. Then, using the least equations and mathematical assumptions, and changing the causal relationships into accumulation and flow diagrams. Finally, the model is simulated by

computer software (e.g. Vensim) and the real world is examined by a virtual model (Sterman, 2007).

Causal loop diagram of the problem: in modeling process, after determining the variables that affect the model in a diagram, not only the relationship between two or more variables, but also the direction of the variables' effect is specified. The result of this process is causal loop diagrams that examine knowledge management cycle of influence on power quality improvement from the viewpoint of etiology and its consequences. Using this tool, the causal relationship between the variables and causal loops has been simply shown in the strategy of power quality improvement. To solve the problem of this study, causal diagram is represented in figure 2. Several amplifier loops including, increasing loops of knowledge management, power quality and empowerment have been imported.

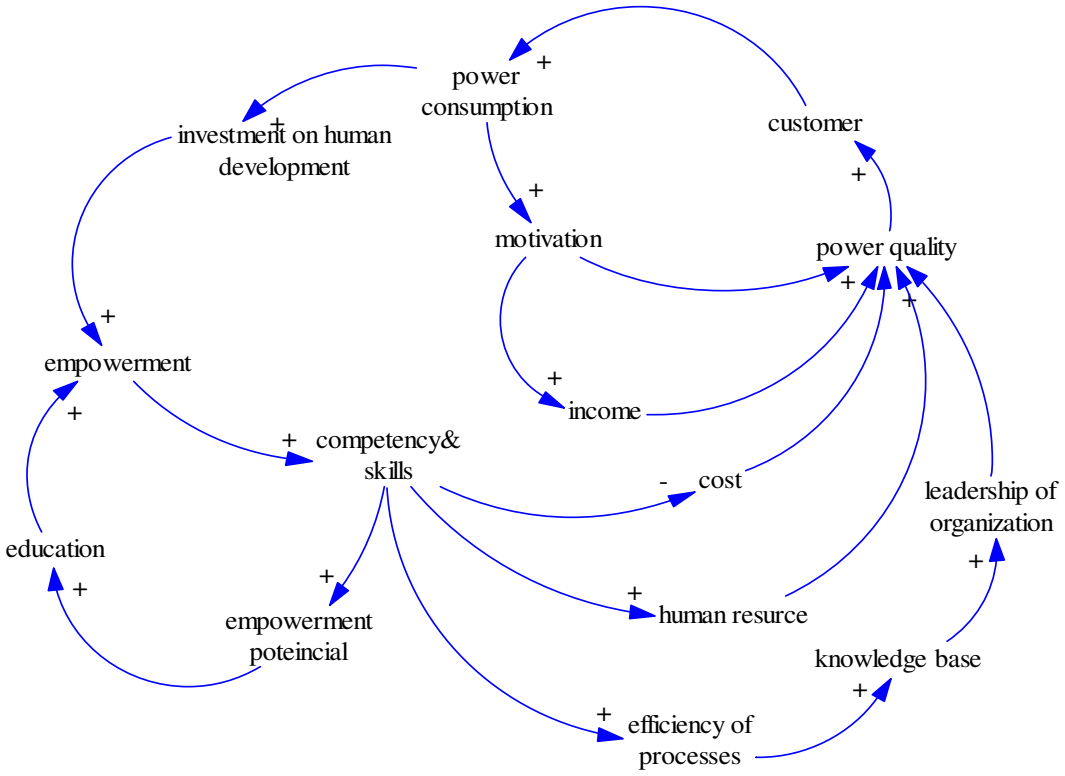

Fig. 2: Causal diagram

6. Flow diagram and defining the main variables of the model:

After drawing the causal loops, flow diagram is used so that the model can be analyzed better (Fig. 3). In fact, causal loop diagram emphasizes on the feedback structure of a system, but accumulation and flow diagrams emphasize on physical structures. These diagrams trace the accumulation of goods, money and information as they move along a system. Accumulations include production, transformation, loans and installments, investments, amortization, receptions and costs. Accumulations specify the level of a system and provide some information based on the basic decisions. Then, these decisions change the flow rate that in turn changes the accumulations and closes feedback loops in the system. Accumulation and flow diagrams are in fact the causal loops that can be formulated (Hamidi-zadeh, 2000).

7. Findings

This paper is an attempt to look at the topics of the discussion systematically, because through having a systematic view the components, relationships, and independencies of a large, complex and dynamic system can be understood. In this regard, the dynamic of the system that is closely related to systematic thinking can be helpful, and as said before, dynamic of the system is a skillful modeling approach that gives us special abilities through computer simulations. The performed modeling is related to the knowledge management strategy and power quality. This model has been an attempt to insert the most important factors into the model to prevent its excessive complexity.

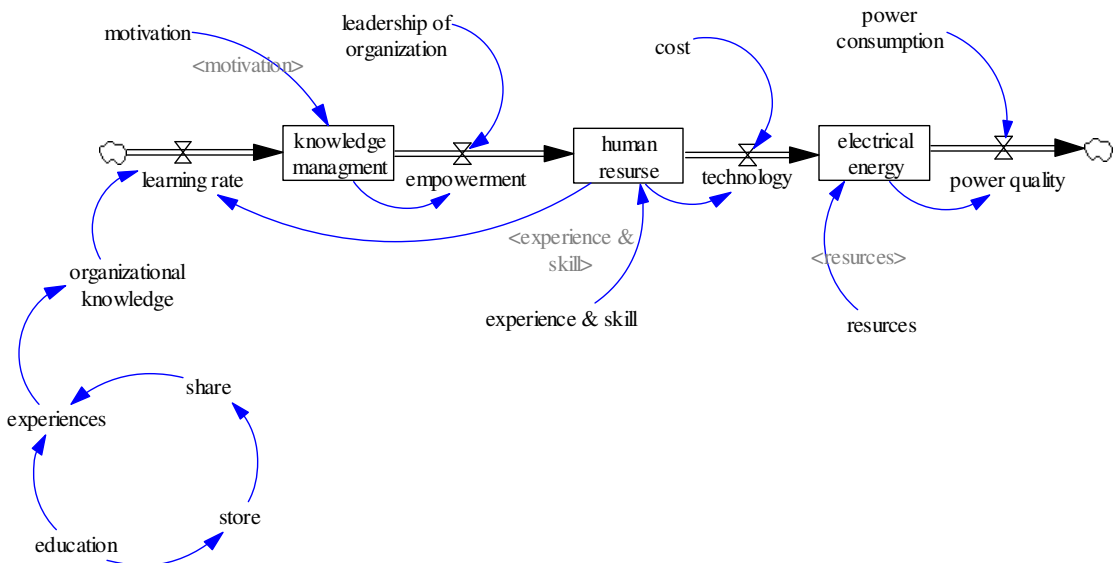

Fig. 3: Flow diagram for knowledge management influence on electrical energy

After collecting information from library resources and asking 25 experts opinions of Shahid Rajaei power plant in 20months period, using the formulas on the subject of the study, the relationship between the systems components were put into the model within 20 months period. It should be noted that obtaining more accurate numbers and figures requires years of time and more research. The variables whose behavior in the Vensim model has been strongly emphasized include: knowledge management, consumer power quality, empowerment, and human resources.

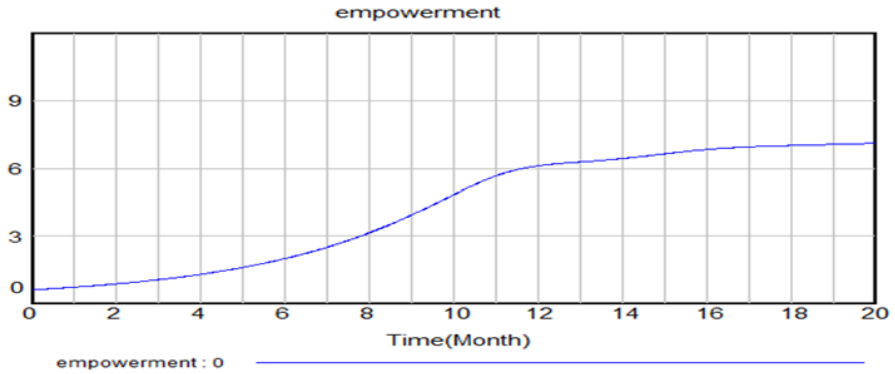

Fig. 4: Empowerment

Fig. 4 shows that more attention to knowledge management in organizations has a large impact upon employee empowerment and consequently will increase the employees' expertise.

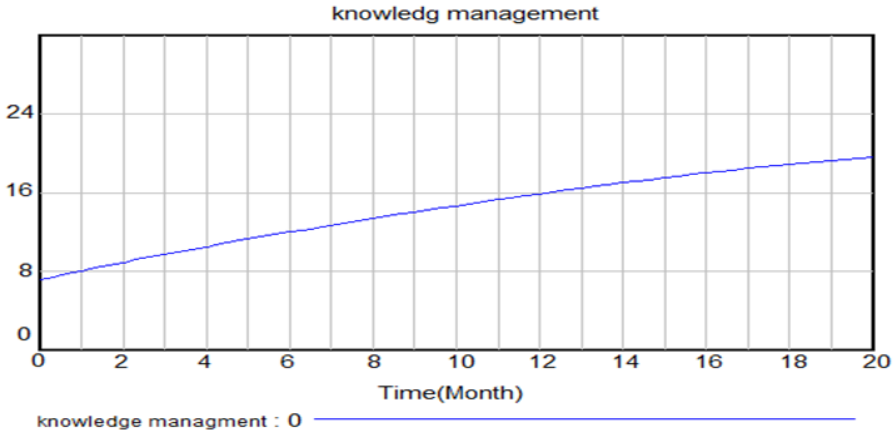

Fig. 5: knowledge management

Fig. 5 shows that through collecting employees' experiences and related knowledge and sharing them, organization's knowledge is managed and through increasing the commitment of organization management towards knowledge management, organizational knowledge accumulation will grow.

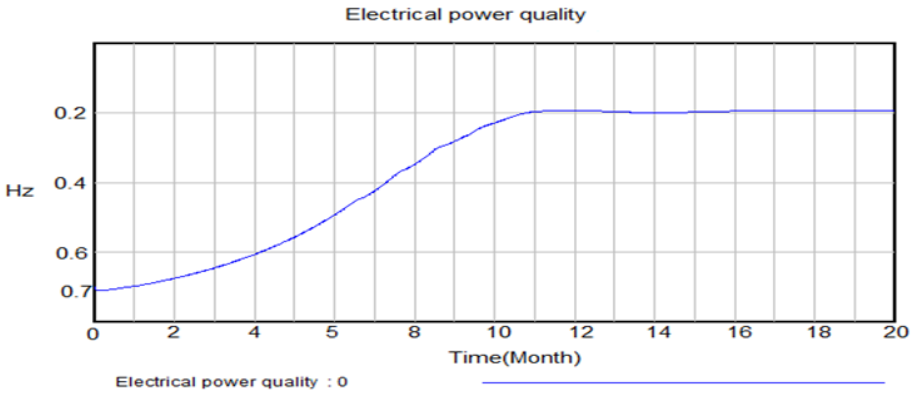

Fig. 6: Electrical power quality

In Fig. 6 it is indicated that by proper implementation of knowledge management and consequently by strengthening organizational knowledge, the effectiveness of processes will be increased and such costs as repair costs will be decreased.

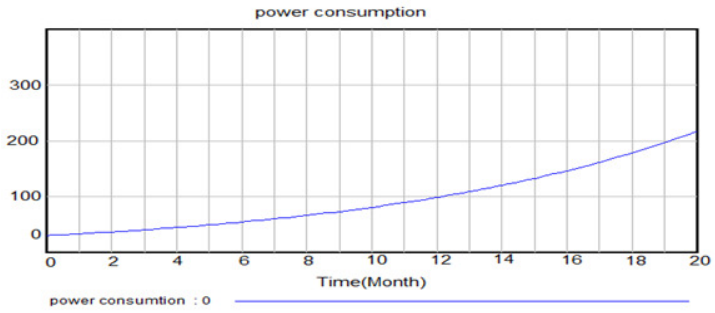

Fig. 7: Power consumption satisfaction

The improvement of power quality and reduction of energy costs will lead to the consumer's satisfaction. Increasing the power quality will decrease the amount of damage to the consumers' equipment and the consumers' stress that is due to the low-quality power that finally leads to their satisfaction and organization's charisma and reputation.

8. Discussion

The improvement of power quality and reduction of energy costs will lead to the consumer's satisfaction. With regard to the application of knowledge in organization, overhaul, repair time, periodic visits, and even the manner of doing repairs will have a significant impact on reducing the repair (maintenance) costs and increasing the efficiency of the systems that are involved in power production and distribution which in turn will lead to a decrease in power outage and an increase of power quality. Increasing the power quality will decrease the amount of damage to the consumers' equipment and the consumers' stress that is due to the low-quality power that finally leads to their satisfaction and organization's charisma and reputation. Producers and distributors of electrical energy and their subsidiary organizations are among the knowledge-based organizations. These organizations deal with an important business that is combined with a complex technology and knowledge where decisions should be very intelligent and based on sufficient information and knowledge. Otherwise, huge damages will be possible.

9. Conclusion

In this paper, the impact of knowledge management on power quality and their relationship was examined, and as mentioned, through having a systematic view, a system's components and connection can be understood, even if that system is a power production and knowledge management system. In this regard, using system dynamic that is a skillful modeling approach and based on subjective models, causal relationships between the components of knowledge management and power quality, that are two separate issues, were assessed. Using a dynamic model, the system boundary can be expanded; variables and new parameters can be

added into the model, and make the model closer to the realities.

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