Impacts of Knowledge Management on Customers loyalty: System Dynamics Approach

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Abstract

In today's competitive business environment, those organizations are approaching excellence when they achieve acceptable results besides providing appropriate infrastructures and following right processes. The one of these results is customers' loyalty. One of organization infrastructures is KM[1], which is gaining increasing attentions nowadays regarding the soaring significance of knowledge resources. Because Knowledge Management affects on customers' loyalty; in this article, we review the effect of KM on customers' loyalty. In order to review this relation, a comprehensive model is required, which should be able to capture all aspects of KM. One of such models is KMAT[2]. Also, a comprehensive model is required to capture all aspects customers' loyalty. The such models are Excellence models. Excellence models, such as EFQM[3], try to establish a tradeoff between enablers and perceptions in evaluating organizational performance. This research is an effort to find the relationship between

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[1] Knowledge Management

[2] knowledge Management Assessment Tool

[3] European Foundation for Quality Management

knowledge management and customers' loyalty through system dynamics tool. In other words, this research exploits system dynamics in order to measure the effects of KM on customers' loyalty using mentioned tool based upon a combination of KMAT and EFQM.

Keywords: Knowledge Management; Knowledge Management Assessment Tool; Business Excellence Model; European Foundation of Quality Management; customer loyalty; System Dynamics

1. Introduction

In a world of dynamic and discontinuous change, organizations are constantly seeking ways to adapt themselves to new conditions so that they are prepared to survive and flourish in a competitive marketplace (Albert, 1997). The proliferation of the knowledge economy (Castells, 1996), emphasizing the value of information as an enabler of competitive advantage, is naturally driving many companies to re-examine the ways they have treated their knowledge assets in the past and to identify ways in which they can exploit them more effectively in the future. (Drucker, 1993) has described knowledge, rather than capital or labor as the only meaningful economic resource in the knowledge society, and (Senge, 1990) has warned that many organizations are unable to function as knowledge based organizations, because they suffer from learning disabilities those organizations that will succeed in the global information society are those which can identify, value, create and evolve their knowledge assets (Rowley,1999; Lai, 2007).In such a landscape, it is not surprising that knowledge and information management has emerged as one of the most popular strategic change management approaches in the dawn of the twenty-first century (Davenport and Prusak, 1997). Its supporters argue that organizations may achieve significant competitive advantages by analyzing the data and information that often remain unexploited in organizational systems and by transforming them into useful and actionable knowledge (Giaglis, 2002). In other hand, In today's competitive environment, Customer loyalty is an important construct for all marketers and defines a means to develop relationship with customers and hence increased business and customer retention. So, It's essential that organizations pay attention to simultaneous investigation of customer loyalty and KM for finding the effects of KM on customer loyalty. Based upon a review on the related literature, the conducted studies in the field could be divided into three chief categories:

1- Studies exploiting system dynamics in knowledge management, such as: Eklöf et al.(2004), the main goal of which is to survey the knowledge management in an Law Firm with focus on the supportive role of information technology. For this aim, system dynamics simulation tool is applied to present diagrams of cause and effect loops, stock and flows, in order to describe different variables and their effects on each other. These diagrams indicate variables influencing the general level of organization's knowledge and the need to knowledge management. Through the higher levels of investment on information technology,

which supports knowledge management, these diagrams approve Gottschalk's (2002 and 2004) growth theory of the KMT stage model. Generally, this paper states that if the knowledge management is upheld by information technology, it will improve organizational performance through enhancing efficiency. The remarkable point is that, regardless of the stage of progress in which the organization is, when the level of organizational knowledge increases due to entrance of new lawyers and creation of working knowledge and experience via socialization, Externalization, combination, and Internalization processes, the management of this knowledge is supported by information technology, even for higher levels of knowledge creation. Drew&Smith (1996) in which, with regard to the importance of knowledge resources (as a competitive advantage) in increasing the market share of a business, it is stated that the nature of these intellectual capitals and the interactions of their system dynamics are recognized weakly yet. This results in inappropriate evaluation of competitive value, and even worse, anti-competitive management of capitals. So, in this paper, based on a field study and ideas of area experts, a system dynamic model is provided, which reveals and simulates the relations between the technical and human aspects of knowledge management and customer satisfaction and market penetration. This simulation helps the organization manager find a practical view to significant strategic and operational issues, such as whether the organization is increasing its intellectual capital in order to make a long-life relationship with customers or not. The article concludes that organizational performance is highly influenced by organizational learning and knowledge management and that the financial managers are being replaced with intellectual capital managers. Accordingly, system dynamics can act as an applicative tool helping managers understand fundamental processes and develop knowledge extraction strategies.

2- Studies utilizing system dynamics for customer, such as: King & Geursen (2001), which aims at providing a system which reveals the relationships between the structures and other intermediate variables such as market share and distribution of monetary flow resulted from operations. For this goal, the research has exploited causal loop diagramming in order to develop a model relating customer satisfaction to profitability. The generated model includes disconfirmation, the effects of values on customer satisfaction, and the dependence of customer retention rate on the number of customers. The customer retention rate, on its own right, depends on factors such as geographical location and switching costs. After that, three scenarios were simulated. First, the scenario of the relationship between customer satisfaction, customer retention, and revenue were surveyed and the simulation results were in accordance with the results of simple mathematical model created by Kind and Rickard (1994) regarding the relationship between customer retention and firm profitability, which stated that 5% increase in retention rate causes the revenue to grow 23 to 50 per cents after 5 years. In the simulation, also, the revenue soared exponentially to reach the value of $4000 per year. Second, the scenario of the effects of high primary

expectations on customer satisfaction and revenue was investigated and results indicated that initially the expectations was higher than the perceived quality by the customer and the satisfaction decreased because of unmet expectations. This caused reduced retention while the revenue raised to $3000 per year with an exponential rate. Finally, the third scenario analyzed relationship between customer satisfaction, customer retention, and revenue when the number of new customers depends on customer retention and values. In this scenario the expectations was consistence with the perceived quality and since disconfirmation is zero the customer satisfaction remains constraint. Then the firm increases the price of its products assuming that the customers will endure it because of the high quality of products. But, this increment influences the customer value and retention rate and this slump in retention rate slows the flow of new customers which, consequently, sharply deteriorates the revenue. This is while the firm could not predict this, because it thought that the customer satisfaction is under control. Caramia et al. (2003), which is conducted in one the most classic service centers, Telephone Center. The study aims at proving that an efficient customer churn management and the quality of products delivered to customers will affect appropriate leveraging of system resources positively. This could be understood from simulation very easier than queuing theory or operations research. Results showed that system dynamics method is remarkably useful in analysis and evaluation of a system's resources and does not possesses the constraint we face with in queuing theory. Furthermore, this method improves our perceptions of system behavior and the influence of quality service on service level, average response time, and resource management. Generally, investigations indicate that the resource level could be decreased further and although the customer is usually assumed an entity outside of the system, it has a significant economic and operational role in performance of the system. Kang (2006) which, first, the effects of the rate of receiving customer complaints and the ability to interact with these complaints on customer satisfaction, repeated purchases, and customer loyalty is studied. Then the amount of change on customer resulted from these effects is studied and based on the system's operational mechanism a model is generated using system dynamics. Then, utilizing Vensim software application, the trend of customer flow is simulated using the data of mobile service customers and the key factors of the system is extracted based on the results of the simulation. Finally, the model was investigated in a particular company in order to make better decisions and factor adjustment regarding experimental data. Yeon et al. (2006), which mentions that, sometimes suppliers might hoard their products for a higher benefit in a shorter time while this might has bad effects on their relationships with customers in long time. This research tries to answer the general question that, how do suppliers draw appropriate and on-time decisions about diffusing novel technologies among their users. For this aim, first whole the technology adoption and diffusion process is studied, then an integrated model is established by appending three prominent technology innovation management models

(i.e. diffusion, adoption, and customer satisfaction models) and its underlying dynamic mechanisms are investigated using system dynamics. This research has resulted into five general outcomes: 1) The technology diffusion system is dynamic, complex, and interdependent and decision maker should be aware of all internal and external relationships. 2) Customer's satisfaction and expectations should be measured to have a growing business. 3) Various behaviors of diffusion process are the results of complex feedback structure and the best approach is being balanced. That is, long time and short time ideas and proceedings should be considered simultaneously. 4) There are different kinds of diffusion behaviors in reality, because The behavior of customers varies depending on which effect is dominated between the expectation and the word-of mouth effects. Generic S-shape appears when the Word-of-mouth effect dominates; while goal-seeking behavior does in case that the effect of expectation dominates the system. 5) Extension speed is influenced by the combinatorial customer expectations and satisfaction effects. More expectations results in faster growth and more satisfaction yields more adopters, and adopters' behavior will be disturbed by high expectations caused by hoarding. Li et al. (2007), which is an endeavor to provide a new method for identifying customer satisfaction mechanism. For this goal, firstly, customer satisfaction model was constructed based on TAM[4] and ACSI[5]. Then models significant correlation coefficients were calculated through SEM[6] and chief performances of system dynamics model were constructed using them. Indeed, based upon correlation coefficients, the dynamic system created by customer feelings (e.g. customer satisfaction) and organization performance factors was simulated. Then, the system evolution was simulated using Vensim software application based on the value of external variable. Finally, the model was analyzed in a case study involving 65 students of Beijing University of Post and Communication all using the same operator. The results indicated that there are a contradiction between customer satisfaction, image of the company and income level, so that the best opportunity for the company regarding image and income exists in the lower or average competitive levels, while the customer satisfaction is not maximum at these levels. In other words, improving customer satisfaction would not definitely result in the main goals of company, which are better income and image levels. Yang et al. (2009), which, different from traditional viewpoints considering expectation operation and expectation perception management, tries to identify the interactive effects of service provider and customer on each other, the way system affects customer expectation, and generally, how the service environment is established, using system dynamics method. In the first phase the Critical Incidence Technique (CIT) was used to gather, categorize and analyze data where the categorization was based on

[4] Technology Acceptance Model

[5] American Customer Satisfaction Index

[6] Structural Equation Modeling

dramaturgical theory. Then the casual diagram of customer queuing willingness was constructed through systemic thinking and based on the results of classification step. Regarding the generated system dynamics model, the research provides several suggestions in the areas of "Setting", "Actors", and "Performance". In the "Setting" area, it suggests providing hardware and software facilities that create more convenience for customer in the queue. In the "Actors" field, improvement of their perceptions of work, teaching social abilities to employees providing services, enhancement of their values and job opportunities, development of their commitment to the customers, and being active is suggested. Finally, about the "Performance", the paper addresses being customer demand-oriented, design system process, and optimize service workflow to provide every customer the immediate service. Moreover, ensure the quality of tangible products and fair queuing in system workflow design. García and Caro (2009) which aims at providing a model to understand the complex managerial issue of customer loyalty in governmental sport section. For this aim customer loyalty was surveyed by system dynamics methodology such that the proposed model includes the dynamic, non-linear, asymmetric, and mutual relationships between elements and makes system evolution analysis under hypothetical conditions and regeneration of previous data of customer churn and customers' Attitude Toward Service (ATS) possible. Simulations exhibits how entrance of new rivals in the future could be a threat to general service section and that customers' attitude toward service is not a good predictor for customers' behavior.

3- Studies considering both customer and knowledge management, such as: Akhavan and Heidari(2008), which, with focus on how could knowledge management concepts be exploited in managing customer knowledge, provides an understanding of customer knowledge management as an integrated management approach and finally concludes that the outcome of customer knowledge management process is fruitful both for the customer and the firm, because the firm would recognize real requirements and expectations of customers well through customer knowledge management. Listening carefully to customers not only reveals their implicit knowledge, but also would help organization in identifying customer trends and purchase patterns. Indeed, by finding a better understanding about the customer needs and expectations, the organization would be able to enhance customer services and reach higher rates of customer retention and satisfaction. Better relationships with customers would result in improved sales and would attract new customers. Successful adoption of customer relationship management that is empowered by knowledge management redefines the traditional models of relationships between organization and customers. In fact, customer relationship management is a competitive advantage for organizations, because it enables organizations to extract customers' knowledge and utilize it for creating long time relationships with them. This research indicates that, through better management of customer knowledge, organizations would most probably be able to recognize emerging market opportunities and make economic value to

business, their stakeholders, and their customers faster. Customer knowledge management is a strategic process through which up to date organizations turn their customers from passive state of a receiver of products and services into knowledge patterns.

As discussed above, there is no study on the related literature about KM and customer loyalty. There for, this research aims at developing a dynamic model for measuring the effectiveness of Knowledge Management processes on customer loyalty in organizations. This analysis would be conducted through simulation and by using the mentioned dynamic model. For relating the KM and the customers' loyalty, it is required to understand and establish the "cause and effect" relationships between the KMAT dimensions and customer's loyalty indicators in EFQM model. Systematic approach shed light on the cause and effect relationships. Furthermore, it states that all diverse aspects and sections of an organization are related to each other and nobody could improve on section or whole of an organization without enhancing others. On the other hand, amongst the numerous variables and their relations, only some especial cause and effect loops dominate and are significant to overall behavior of the system. In this paper, after defining the relationships between variables and formulating a combinational dynamic model for measuring the effectiveness of KM, different Policies are designed for developing KM plans and their results are evaluated. Amongst the various methods for modeling system dynamics, a simple one consisting of problem definition, cause-and-effect diagram modeling, Stock and Flow Map Modeling, Performance Tests of the Developed Model and Policy Making is utilized.

2. Theoretical Bases

2.1. Customer loyalty

Customer loyalty, a major theme in marketing research, has become an essential concern for managers, and a strategic obsession for many. This increasing concern has mainly been due to intense competition, and the current focus on the relationship between consumers and organizations, which is the core of the relational marketing approach. Basically, marketing research now recognises that acquiring new customers costs more than retaining current ones (Reichheld, 1996). Customer loyalty can be a double edged sword. If mismanaged, it can seriously hurt the company's bottom-line. That is, profitability may be compromised for loyalty. But, if customer loyalty is managed prudently and in conjunction with profitability, it could be the most potent weapon against competition in the company's marketing arsenal. In the civilized world of 21st century, marketers striving to defend or capture market share with the help of a loyal customer base (Kumar,2004). Customer loyalty has been universally recognized as a valuable

asset in competitive markets (Srivastava, Shervani, & Fahey, 2000). Investments in loyalty management is especially important if consumers face low switching costs, because they are not locked in by a contract (Shapiro & Vivian, 2000).The concept of customer loyalty has pervaded several industries in the past decade (Lewis, 1997). Membership to customer loyalty initiatives provides members with rewards and additional value, making it popular among consumers (Liebermann, 1999).

Then, The important question is, what's the definition of 'loyalty'?. Loyalty has been defined as "a deeply held commitment to re buy or re patronize a preferred product/service consistently in the future" (Oliver, 1999, p. 34). Customer loyalty has two meanings: long-term and the short-term loyalty (Jones & Sasser, 1995). Cus- tomers with long-term loyalty do not easily switch to other service providers, while customers with short-term loyalty defect more easily when offered a perceived better alternative. Also, According to Shoemaker and Lewis (1999), loyal customers are customers "who feel so strongly that you (the company)can best meet his or her relevant needs that your (the company's) competition is virtually excluded from the consideration set; these customers buy almost exclusively from you (the company)". This observation by Shoemaker and Lewis implied that customer loyalty is difficult to build and sustain without including the underlying attitudinal aspects of the customer that drive customer behavior.
Reinartz andKumar found empirical evidence in support of Dowling and Uncles (1997) refuting the four commonly believed benefits of customer loyalty (Reichheld, 1996):

- The costs of serving loyal customers are less;
- Loyal customers are less price sensitive;
- Loyal customers spend more time with the company;
- Loyal customers pass on positive recommendations about their favorite brands or suppliers.

Therefore, it was clear that:

- Behavioral loyalty by itself cannot be a measure of 'true'customer loyalty.
- Behavioral loyalty can be an unreliable predictor of customer profitability (Kumar, 2004).

A literature search found three main streams of research of loyalty: behavioral loyalty (e.g., Tellis, 1988; Tucker, 1964), attitudinal loyalty (e.g., Bennett and Rundle-Thiele, 2002) and composite loyalty (e.g., Day, 1969; Jacoby, 1971; Jacoby and Kyner, 1973; Chaudhuri and Holbrook, 2001). In an early school of thought, Tucker (1964) argues that behavior (past purchases of the brand/product) completely accounts for loyalty. Jacoby and Chestnut (1978) observe that behavioral loyalty studies have focused on interpreting patterns of repeat purchasing in primarily panel data as a manifestation of loyalty. Consistent with this viewpoint, Uncles and Laurent (1997) suggest that such behavioral loyalty is stochastic. In terms of attitudinal loyalty, various authors identify attitudinal concepts as providing positive word of mouth

(e.g., Zeithaml et al., 1996; Andreassen and Lindestad, 1998), recommending the service to others (Zeithaml et al., 1996), and encouraging others to use the service (Bettencourt and Brown, 1997).

The loyalty literature (e.g., Dick and Basu, 1994; Jacoby, 1971; Jacoby and Kyner, 1973; Jacoby and Chestnut, 1978) supports the utilization of a composite measure of loyalty having behavioral and attitudinal aspects. Day (1969) proposes a reconciliation of both behavioral and attitudinal components of loyalty and cautions that viewing loyalty solely in terms of purchase decisions may not distinguish between loyalty and spurious loyalty and indicates a need to extend typical definitions and measurement approaches of loyalty (Baldinger and Rubinson, 1996). Jacoby and Chestnut (1978), and Uncles and Laurent (1997) suggest that researchers should study the attitudinal components of loyalty for an additional understanding of the stochastic representation of behavioral loyalty. Following these suggestions, a composite approach to loyalty provides both behavioral aspects and attitudinal loyalty in order to fully explain the concept of customer loyalty. Many researchers (e.g., Bloemer and Kasper, 1995; Pritchard and Howard, 1997; Baldinger and Rubinson, 1996; Knox and Denison, 2000) follow Day's (1969) view point with attempts to explain loyalty. Basing their approach on the theory of composite loyalty, these authors explain the disadvantage of solely focusing on behavioral loyalty is that it will be difficult to tell which customers are loyal and to identify different degrees of customer loyalty by using only behavioral measures Rauyruen (2007).

2.3. Knowledge management

Knowledge is a powerful tool that can make changes to the world. It is now considered as the main intangible ingredient in the melting pot that makes innovation possible. Knowledge and knowledge management (KM) are rapidly evolving as the starting point for action in all businesses, and over the past ten years, this understanding has surfaced as a major focus for its role in the enterprise value process. Today, knowledge and the capability to create and utilize knowledge are considered to be the most important source of a firm’s competitive advantage (Hosseini Ezzabadi et al., 2012).

3. KMAT Model

The knowledge management assessment tool (KMAT) is designed to help organizations make an initial high-level assessment of how well they manage knowledge. Completing the KMAT can direct organizations toward areas that require more attention, as well as identify knowledge management practices in which they excel. The KMAT proposes ways that four enablers (leadership, culture, technology and measurement) can be used to foster the development of organizational knowledge through the knowledge management process. This process embraces the steps that the organization takes to

identify the information it needs and the manner in which it collects, adapts and transfers that information across the organization. The model places all the major knowledge management activities and enablers together in a dynamic system (Jager, 1999).

4. System Dynamics

System dynamics is an approach to understanding the behavior of complex systems over time. It deals with internal feedback loops and time delays that affect the behavior of the entire system. What makes using system dynamics different from other approaches to studying complex systems is the use of Cause and Effect Diagrams and stock and flow diagram. These elements help describe how even seemingly simple systems display baffling nonlinearity (Sterma, 2000).

5. Modeling Process

5.1. Cause-and-Effect Diagram Modeling

In the first phase, the cause-and-effect diagram of the combinational model of KMAT and EFQM is designed regarding the identified variables (see figure 1). It can be seen in this diagram that in the forward direction the business strategy and policy affects the KMAT dimensions and consequently KMAT dimensions influence the performance indicators of the results section of EFQM, which in its turn changes the outcome indexes of the results section. Furthermore, in the backward direction, the performance and outcome indexes influence KM separately and KM impacts the business strategy and policy. Thus, these forward and backward paths create some loops in the model. Naturally, if the business strategy and policy are improved, knowledge would be managed better and when the KM in enhanced, the performance indicators would be amended in the result section. Increasing the values of performance indicators, results in the raise of outcome indexes. On the other hand, the better the KM, the more appropriate the business strategies and policies, and superior results decrease the need to KM improvement. Accordingly, the focus should be on the processes for which the results (i.e. performance indicators and outcome indexes) are smaller. So, the loops of this diagram are negative (balancing) feedback loops which are illustrated by  . It is notable that changes occurred for KMAT dimensions impact the performance indicators after a delay, like what happens between performance indicators and outcome indexes in the results section of the EFQM model. Other relationships have specific delay times too. In the diagram these delays in relationships between two variables are shown by two parallel lines (||) on the corresponding arrows. Furthermore, in the designed model one extra variable namely, customer loyalty is included which will be elaborated in the next section. Regarding the relationships between variables the following points could be seen in figure 4:

- Because one of the dimensions of KMAT is measurement, so this variable is included in the performance and outcome indicators of EFQM model and there is no obligation for defining a new variable under the name of ‘measurement’.
- Regarding that the business strategy and policy affects the leadership dimension of KM, and because leadership, on its own turn, affects the dimensions of processes, technology, and organizational culture, their impacts are illustrated in the cause-and-effect diagram through the relationships between them. On the other hand processes, technology, and organizational culture influence the results indexes and increasing the amounts of result indexes decreases the required effort for KM.
- Performance indicators affect the outcome indexes. Also, Customer loyalty is influenced by outcome indexes of customer results.
- In the model, letter ‘a’ indicates the outcome indexes and letter ‘b’ addresses performance indicators.
- In the model, processes, leadership, culture, and technology variables are exhibited by signs I, II, III, and IV respectively.
- In the proposed model, the measurement variable includes all the indexes of customer in the EFQM results section.

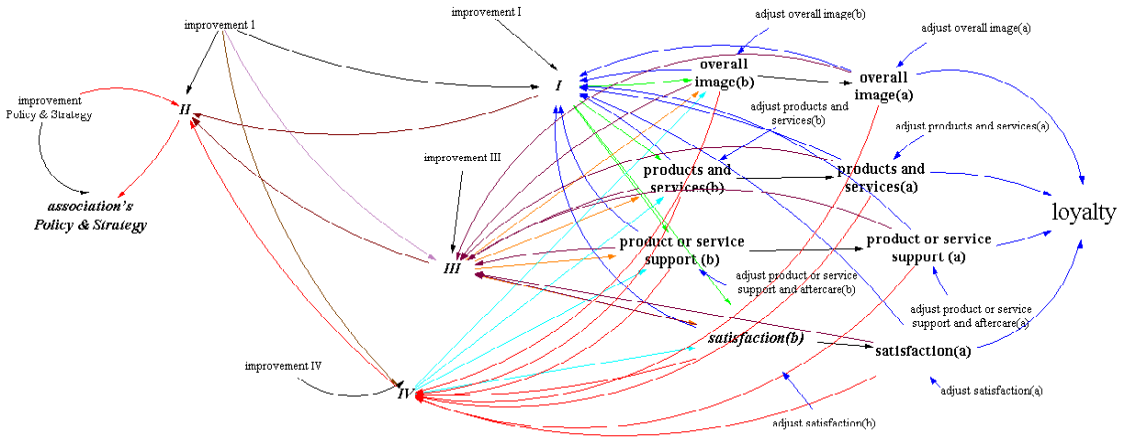

Figure 1. Cause-and-Effect Diagram

5.2. Stock and Flow Map Modeling

In this section the quantitative relationships between model variables are defined. Here, the time period is set to one year. The model is executed with Vensim PLE software application. The model is simulated for 12 years beginning from year 2008. Since KMAT and EFQM models evaluate the organization in a specific point of time, all the sub-criteria of the model are of auxiliary variable type.

For the cumulative trend of organizational progress to be evaluated, it is required to define levels in order to show the trend of organizational progress through the time. Based on this it is possible to define some levels regarding all the results indexes which show the progressive business trend during the time window. For increasing the model performance, in this paper level of customer satisfaction which is achievable from the resultant of model indexes, are defined. This level helps the organization significantly by showing the excellence path, because the make it possible to see the cumulated effects of organization's strategies, systems, and activities through the time, which illustrate the past and current organizational performance. In each time period the level of customer loyalty is the result of summing customer satisfaction rate which has outcome indexes of Customer Result (a) as its inputs.

In the suggested model, the variable 'adjust' is used in order to relate the performance indicators and outcome results. Regarding that there could not be a clear relationship determined between two concepts this variable is defined as a 'look up' variable in Vensim software application. Then, based upon some (x, y) tuples extracted from past information or expert opinions about the two variables (i.e. performance indicators and outcome results) the software fits a curve to their trend of changes. For example, for balancing the relationship between variable I and overall image (b) index, the 'adjust' auxiliary variable is utilized. Figure 2 depicts the curve produced by software based on past data. This figure illustrates the effect's changes according to cause's variations.

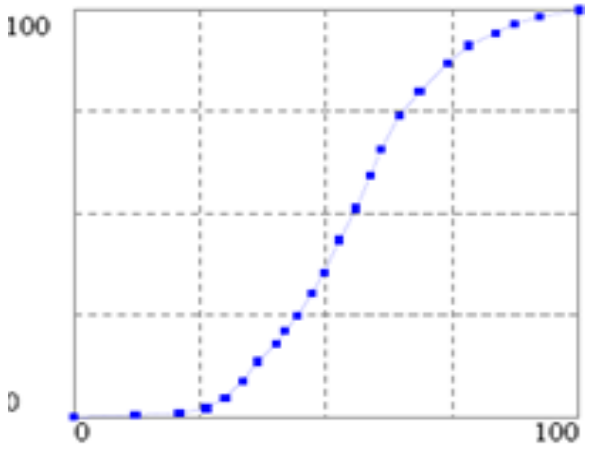

Figure 2: Curve of variable adjust overall image (b)

Based on the definitions of dynamical equations and relationships between variables, stock and flow map Of figure 3 emerged.

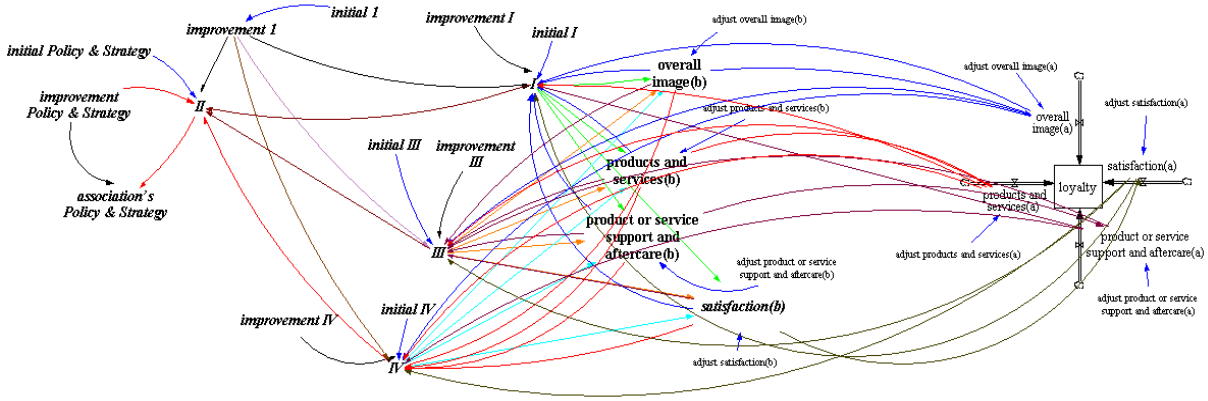

Figure 3: Stock and Flow map

6. Performance Tests of the Developed Model

In this research, diverse types of tests such as units consistency test, collaborative error test, scope sufficiency test, parameter evaluation test, structure evaluation test, and boundary conditions test are used in order to evaluate the model performance. These tests are described below:

- Unit consistency test: this test includes dimension analysis of the rate equations. Although this test is simple, most of the models fail it or only pass it based upon some parameters with weak or no meaning in the reality. Our model passed this test while all of its units were approved by Vensim software when the Unit Cheque option was active.
- Collaborative error test: emphasizes the models independency to time unit. That is, if the time unit is assumed “one year” initially, if it is changed to “six months” the model should generate quite similar results. This test was passed by the proposed model too.
- Scope sufficiency test: investigates the sufficiency of parameters and cause-and-effect loops in the model regarding the aim of modeling. This test was passed through further surveying the EFQM and KMAT models, which involve defined criteria, sub-criteria, and indexes.
- Parameter evaluation test: in this test the initial amounts of variables and parameters should be based upon the real or predicted data. Accordingly, the expert opinion is used in all the variables of the model as an estimation of all parameters.

- Structure evaluation test: tests the consistency of models behavior with its structure. In order for this consistency to apply, the positive and negative feedbacks should be respectively exponential and goal-seeking. Because the variables of the model create negative feedback loops, they should be goal-seeking. For example, the goal-seeking behavior of the variable Customer Result (b) is illustrated in figure 4.
- Boundary conditions test: emphasizes the stability of model in the boundary conditions. That is, under any circumstances, the model should perform an expected behavior when the value of inputs or the policy is changed. For instance, if the initial values of the KM variables are changed significantly, the value of other variables should change in their allowed ranges. This test was conducted for the model and its performance was approved in the boundary conditions. For example, the amounts of policy, strategy, and leadership variables was tested in the boundary values of 0 and 100 and their effects of overall image (b) variable was captured. The results indicated no changes in the behavior of the mentioned variable in the boundary conditions as illustrated in figure 5.

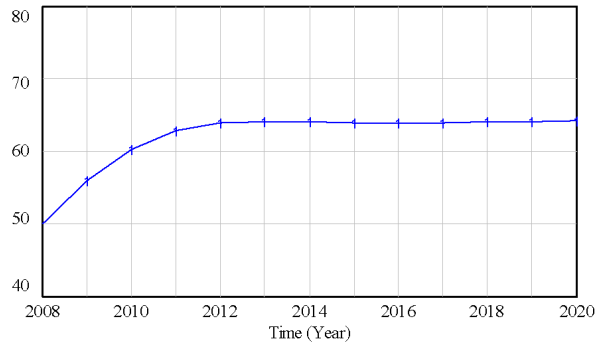

Figure 4. Goal-seeking behavior of variable overall image (b)

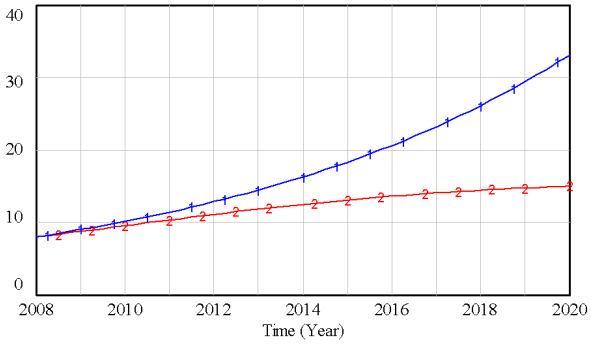

Figure 5. Behavior of variable overall image(b) in boundary conditions

7. Policy Making

For evaluating diverse policies by the generated dynamical model, an 'improvement' index is defined for variables I, II, III, IV, and Association's Strategy & Policy. The amount of improvement is measured for each policy regarding business goals and through the execution of the model for that policy. At the end the best policy is identified. Regarding the resource limitations and the variety of adaptable strategies in the organization, the resource should be distributed amongst all the five dimensions of KM (i.e. leadership, processes, technology, and organizational culture) in such a way that the maximum efficiency is achieved through out whole the model in order to have the best trends for customer loyalty level, employee loyalty level, and image. For simulating the model, first a number of chief variables should be identified, and then, based upon diverse Policies, they should be simulated and evaluated. The chief variables selected in this research were customer loyalty level, employee loyalty level, and image. Furthermore, three policies described below were simulated:

First Policy: This policy is called "Technology-based KM Approach" and highly attends to technologies required for KM. Technology plays important role in the advance of KM and its effect on result indexes yields in organizational excellence. In this policy the significant variable is variable IV, so the "Improvement IV" variable, indicating the amount of progress of variable IV, is increased 50%.

Second Policy: This policy takes the "Organizational Culture-based KM Approach" and attends to culture making and its penetration in the organization. Employees are the most valuable resources of an organization who should adapt the knowledge sharing culture. In this policy the significant variable is variable III, so the "Improvement III" variable, indicating the amount of progress of variable III, is increased 50%.

Third Policy: This policy is called "Overall KM Approach" and highly attends to all the two aspects of technology and culture simultaneously. Accordingly in this policy the significant variables are variables I, III, and IV. In this case regarding the limited resources and the need to hold a trade-off between all the three aspects, the organization should have a slower and equal progress in all of them. So, all the "Improvement" variables are increased 20%. The results of the above Policies are illustrated in figures 6 .

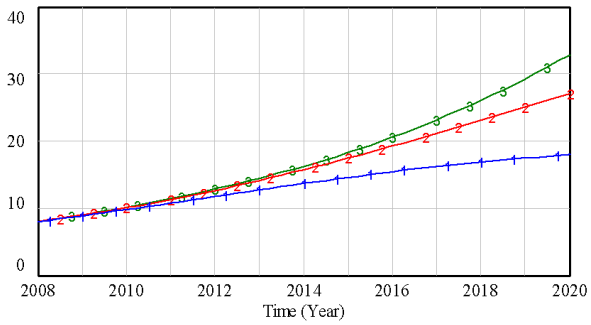

Figure 6. Trends of customer loyalty level for different policies

In figure 6, it could be seen that amongst the three above Policies, the third one, "Overall KM Approach", illustrates the best trend. Accordingly, it could be concluded that all-round development of knowledge management will result in better increasing of customer loyalty. After the third Policy, the second, and the first Policies exhibit the best trends respectively.

8. Conclusion

Organizations, regardless of activity type, size, structure or organizational maturity level, in order to make the customers loyal and get the success in achieving their strategic goals and objectives, and ultimately organizational excellence require proper management of organizational knowledge. In this regard, the current study presented a model based on a combination of Knowledge Management Assessment Tool (KMAT) model and Customer Results of the European Foundation for Quality Management (EFQM) model using system dynamics in order to analyze the impacts of knowledge management on customers' loyalty and select the best policies for customer loyalty among the applicable policies of knowledge management. The chief benefits of this model are:

- In the generated model the time distance between the effect of cause and appearance of its effects is mentioned by including delays.
- Applying the "What happens if". This action reduces the risk of program failures before implementing them. In the proposed model three Policies are designed and examined in order to find the best one.

Areas for further research could be:

- Regarding that in this research the knowledge management and customer loyalty are considered generally, in the future researches these concepts should be elaborated more in order to improve the relationships.

- Doing more comprehensive and accurate performance tests of the developed model.
- Building simulation of different policies and sensitivity analysis of the results in order to make more accurate conclusions about the policies.
- Modeling could not be of benefit for organizations solitarily, but it should be conducted along with execution and customization.

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