International Journal of Industrial Engineering & Production Research

December 2014, Volume 25, Number 4
pp. 307-316

pISSN: 2008-4889

http://IJIEPR.iust.ac.ir/

Analyzing the Effect of Organizational Strategies on Organizational results using system dynamics based upon EFQM model

Mohammad Dehghani Saryazdi, Yahia Zare Mehrjerdi*

Mohammad Dehghani Saryazdi, *Department of Industrial Engineering, Yazd University, Yazd, Iran*
Yahia Zare Mehrjerdi, *Department of Industrial Engineering, Yazd University, Yazd, Iran*

KEYWORDS

Organizational Strategies, Organizational results, Business Excellence Model, EFQM, System Dynamics

ABSTRACT

In today's competitive environment, organizations need to identify their position in the market. Self-assessment is a tool which could be used to measure the competitiveness of organizations on the basis that they may find in their own ways for improvement. Excellence models, including the model developed by European Foundation for Quality Management (EFQM) provide a framework for self-assessment. To evaluate relationship between Organizational Strategies and Organizational results, a comprehensive model is required, which should be able to capture all aspects of business excellence. The EFQM model consists of two main domains: Enablers and Results. The first domain which includes processes and systems in general, "enable" the organization to have higher performance or "results". On the other hand, the feedback from the results makes the organization to correct the system. Hence, a dynamic model could be appropriate for analyzing the interrelated behavior of the two main domains as well as those within the criteria and sub-criteria. This research is an effort to find the relationship between Strategies and results through system dynamics tool based upon the EFQM model. Although, there are plenty of papers and case studies on the application and improvement of EFQM model in organizations, very few cases were found regarding the dynamics of the systems. In this paper, a dynamic model is presented in which the EFQM model items are linked through the causal relationships. The advantage is that by changing one parameter in the model, one can find how it could affect other parts of the model including the key results. By this analysis, it could be expected that the efficiency of EFQM model would be improved.

1- Introduction

EFQM observation from systemic sight is according to primary assumptions of its development. Systemic approach suggests that all different aspects of an organization relate to each other and one cannot recover an area or a total without affecting on other relative areas. On the other hand, among several observable variables and their relations, special cause

Corresponding author: *Yahia Zare Mehrjerdi*
Email: *yazm2000@yahoo.com*
Paper first received Nov. 07, 2011, and in accepted form July, 06, 2013.

and effect loops are only prevailing in determining general behavior of system. Reviews of various articles on EFQM models in organizations show that they could be divided into two general groups. First group includes articles that only implemented EFQM model and consequently resulted in guidance to and movement in the excellence path (V. Anderson et al [1], Flego [2], Wu and Wang [3], Radim [4], Leticia Santos-Vijande and I. Alvarez-Gonzalez [5], Michalska [6], Shafaei and Dabiri [7], Bou-Llusar [8], Stok et al [9], Nazemi [10], Nikolaidis and Terpos [11]). The second group is comprised of those articles try to improve the effectiveness of EFQM model by combining it with other models and tools such as DEA[2](Shahroudi [12]), Intellectual Capital Management (Kim et al [13]), and DEMATEL[3] technique (Sadeh and Arumugam [14]).

So far, several papers have been compiled about dynamic application of systems in different subjects such as healthcare (Zare Mehrjerdi [15]), New Product Development Process (Zare Mehrjerdi et al [16]) and Supply Chain (Mahmodi et al [17]). Also there are numerous case studies about the utilization of system dynamics for increasing the performance of models such as BSC[4] which each of them have used from dynamic capability of systems for compensating systemic weaknesses of BSC (Yim et al [18], Todd [19], Sterman [20], Sterman [21], Akkermans and von Oorschot [22], Rydzak et al [23], Bianchi and Ontemaggiore [24]). There are few articles about system dynamics in EFQM. Toloie Eshlaghy et al [25] investigate the Impact of Leaders' Responsibilities in Reaching Organizational Excellence in the EFQM using Systems Dynamics Approach. But In this article they investigated only the effect of leadership criterion on EFQM model. Dehghani Saryazdi et al [26] implement dynamics modeling for EFQM in regional electricity company in Iran. But, in that article they investigated only the effects of criteria without giving any details about EFQM model.

Since there are poor investigations about using dynamic systems for recovering the EFQM excellence model in literature we have taken this initiative to analyze the EFQM model comprehensively in this paper using system dynamics approach To obtain a dynamic structure for the EFQM model it is necessary to identify all key elements of the model i.e. problem variables. Then, the cause and effect diagram should be developed and later it become necessary to extract the dynamic of the EFQM by explaining the relations between variables.

2. Theoretical Bases

2-1. The EFQM Excellence Model

The EFQM Excellence Model was created in 1991 by the European Foundation for Quality Management (EFQM) as a framework against which applicants for the European Quality Award are judged, and to recognize organizational excellence in European companies. Nowadays, EFQM brings together more than 700 members located in many countries across the world. The EFQM Excellence Model is made up of nine elements grouped under five enabler criteria (leadership, policy and strategy, people, partnerships and resources and processes) and four result criteria (people results, customer results, society results and key performance results) [27].

2-2. System Dynamics

System Dynamics is a methodology aimed at studying the structures of social or organizational systems by representing the causal relationships among their elements and the evolution of a system over time. Its objective is to elucidate the general behavior of a given system, based on behavior patterns among its parts and on the structures determining those patterns[28].

The basic idea in system dynamics is that a system's dynamic behavior obeys a principle called the accumulation principle. This principle states that a system's dynamic response derives from the transition of the resources accumulated in stocks and that those transitions are controlled by entry and exit flows of resources in and out of the stocks. This principle leads to a specific causal representation known as stock-and-flow diagrams [28].

3. Benefits of Analyzing EFQM Model using Dynamic Systems

There are three significant disadvantages of EFQM model without using and developing system dynamics:

3-1. Unidirectional Causality too Simplistic

In using FEQM model, most organizations consider unidirectional causal relations .the use of causal-loops alone is seen as problematic and is in contrast to the reality and facts. Instead of causal relationship it is believed that the relationship is more of interdependence or is of bi-directional causality. This is because in actual world causal relationships is seldom unidirectional. However, in providing a dynamic model in this paper the effect of the criteria of the enabler domain on results criteria is considered. These effects act as bi-directional so it improves of Performance Indicators and Perception Indicators effects on enablers, separately[29].

3-2. Does Not Separate Cause and Effect in Time

The problem arises from the facts is that the time dimension is not part of the assessment because in some cause and effect relationships a time lag exists

[2] Data Envelopment Analysis

[3] Decision Making Trial and Evaluation Laboratory

[4] Balance Score Card

between the cause-and-effect. This is not shown by the BSC since it measures cause and effect at the same time. Simply looking at different measures simultaneously is not usually enough. The linkages between them must also be understood. In provided dynamic model in this paper according to what happens in reality, a time lag exists between the enabler criteria and the result criteria[29].

3.3. No mechanisms for validation

The analysis of EFQM excellence model using system dynamics provides a mechanism for maintaining the relevance of defined measures. The problem for managers is usually not identifying what could be measured, but reducing the list of possible measures to a manageable (and relevant) set. Thus, the advantage of checking just a few numbers may become a disadvantage when not the right numbers are selected for the EFQM[29].

The analysis of company's strategy based upon the EFQM model approach considers the causal relationships between performance variables only in qualitative terms. This implies that managers should rely on mental simulations and heuristics in order to quantify the results of their strategy and, hence, evaluate its efficiency and effectiveness. This task is even tougher when the company system is characterized by a high degree of complexity, non-linear relationships among variables, and delays between causes and effects.The validity of EFQM's assumptions about causal relationships between the criteria has been also questioned by the system dynamics. In particular, it has been demonstrated that the hypothesized links between quality and financial indicators may be not confirmed in reality. For instance, it has been remarked that the commonly assumed causal relationship according to which a higher customer satisfaction leads to higher financial results may not have any empirical evidence. On the contrary, it may happen that the costs of policies aimed to increase customer satisfaction are higher than the related benefits, both in the short and long term. For such reason, the lack of rigorous validation of the EFQM's assumptions may lead the management to the selection of performance indicators, which imply desirable perception indicators.

4. Modeling process

The purpose of Dynamic System modeling is establishing the relation between the various variables which make-up the system and are used to analyze decision-making policies in the realm under study. The Dynamic System modeling is an essential tool which helps modeling the real world problem in the form of feedback links.

4.1. Modeling and Model structure

Once the key variables of the model are recognized a simplified version of the model can be developed in the form of stock and flow diagram as shown in the following diagram. In this diagram, four interconnected elements are shown that together determine the dynamic behavior of the model. These elements make one overall feedback loop. This feedback loop is "reinforcing" or positive feedback loop.

.

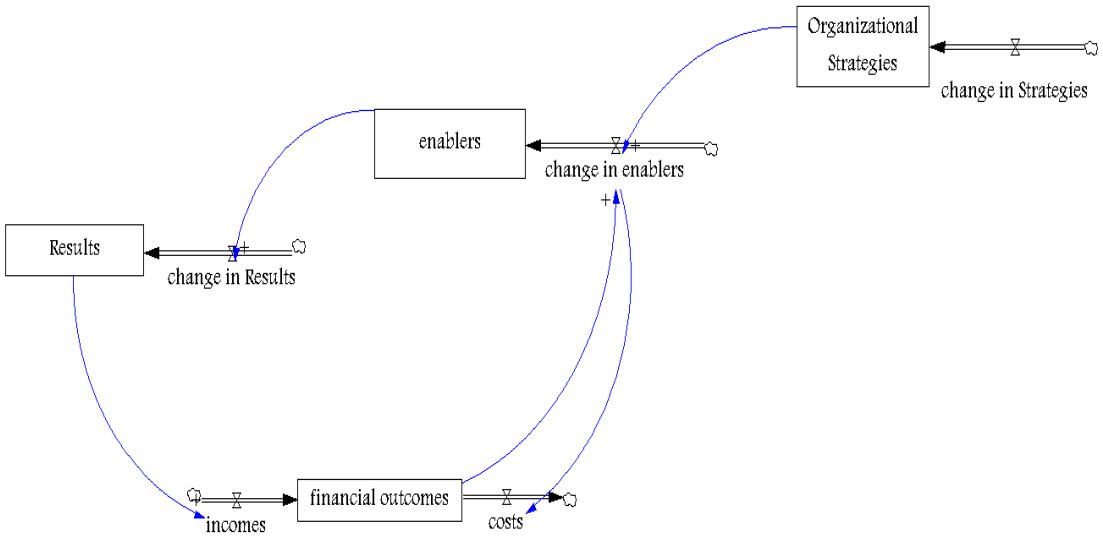

Diagram 1- overall image of model structure

Diagram 1 shows the relation between the Strategies and Financial outcomes. The key effectiveness variables in this relation are Strategies, Enablers, Results and Financial Outcomes. Expanded relations between the Strategies and Financial outcomes can be described as follows:

- The relationship between Strategies and Enablers.
- The relationship between Enablers and results.
- The relationship between results and financial outcomes.
- The relationship between financial outcomes and Strategies.

Due to the expanded relations defined above, in this article the relationships between the model's variables are used in the drawing the model. This is described as follows: it is believed in enterprises where reaching better results for customers' satisfaction, people satisfaction and society satisfaction is highly related to the enablers growth it begins by putting together the changes in organizational strategies. Therefore, strategies changes are effective on all model variables. An organization can attain better financial outcomes only when it reaches suitable results in the field of improvement customers, peoples and society satisfaction. By achieving better enablers then better financial outcomes would result. Therefore, interaction between these factors would improve organizational excellence.

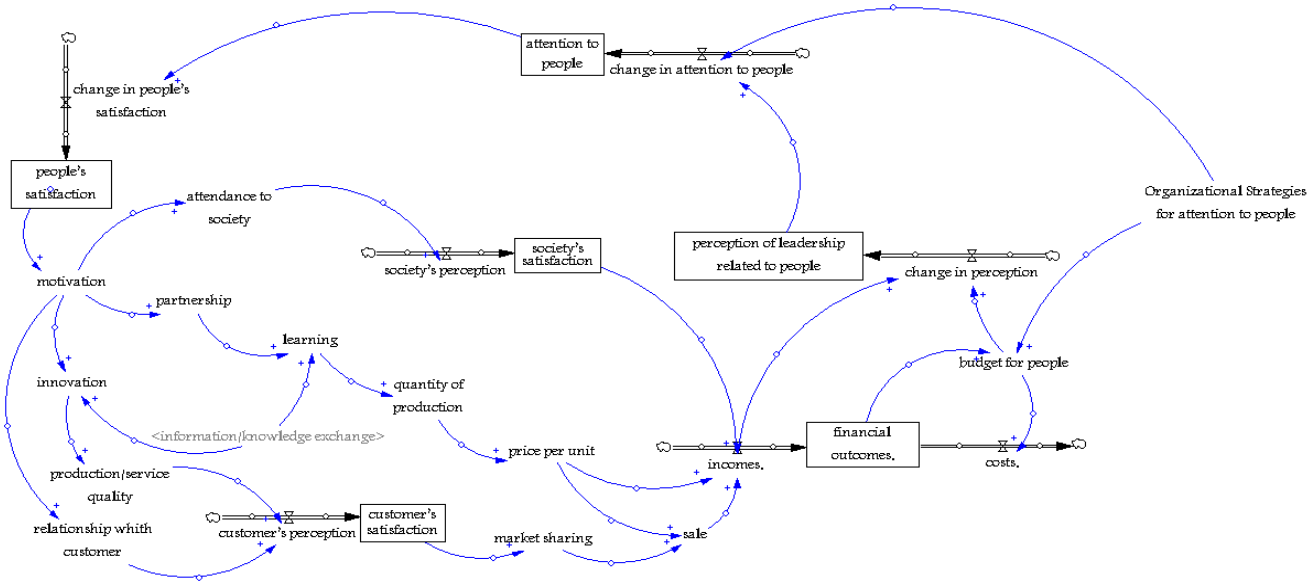

Diagram 2- attention to people

Diagram 2 shows the relation between the people strategies and financial outcomes. The key effectiveness variables in these feedback loops are attention to people, people's satisfaction, customer's satisfaction, society's satisfaction, financial outcomes and perception of leadership related to people.

Due to the expanded relations defined above, in this article the relationships between model's variables are used in drawing the Diagram.

This is described as follows:

It is believed that in the enterprises reaching the better results regarding people satisfaction is in need of higher attentions to people it itself begins by making changes in the people's Strategies.

Therefore, the people strategies changes are effective on all this diagram variables. When an organization obtains suitable results

With regard to people satisfaction it might be able to provide better customer's satisfaction as well. Also, an organization can attain better financial outcomes when it reaches suitable results in the field of customer's satisfaction. By achieving better financial outcomes better perception of leadership related to people can be acquired.

For completion of this feedback loop, the improvement in the leadership perception raises people strategies.

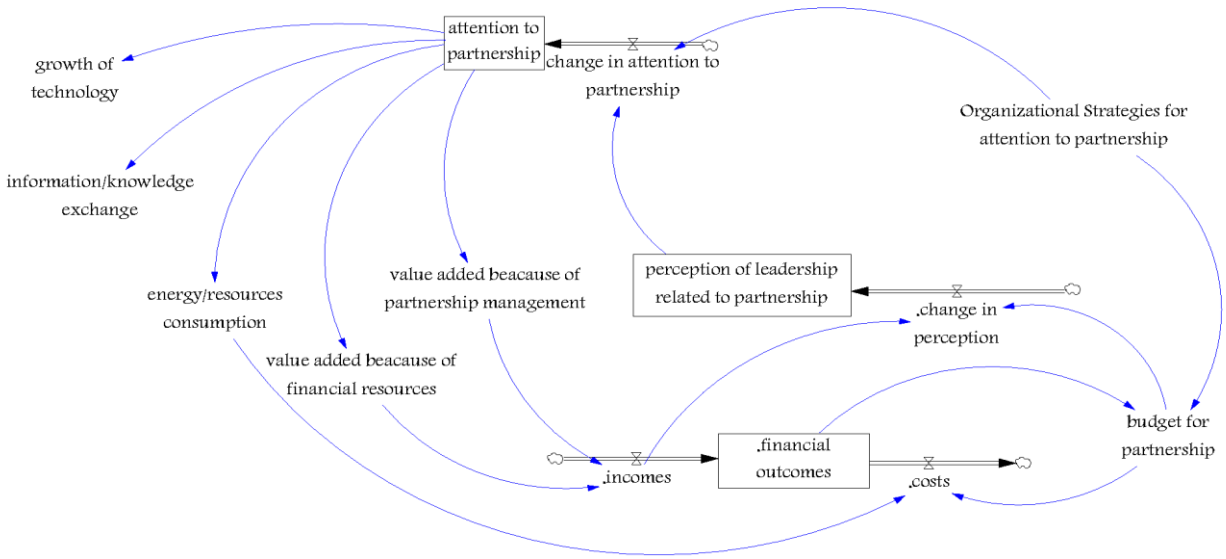

Diagram 3- attention to partnerships

Diagram 3 shows relation between the partnership strategies and financial outcomes. The key effectiveness variables in these feedback loops are attention to partnerships, financial outcomes and perception of leadership related to partnerships. Due to the expanded relations defined above, in this article the relationships between the model's variables are used for diagram drawing. This is described as follows: it is believed that an organization can attain better financial outcomes when it reaches suitable results in regard to better attention to the partnerships. By achieving more financial outcomes better perception of leadership related to partnerships can be obtained. For completion of this feedback loop, the improvement in the leadership perception raises partnership strategies.

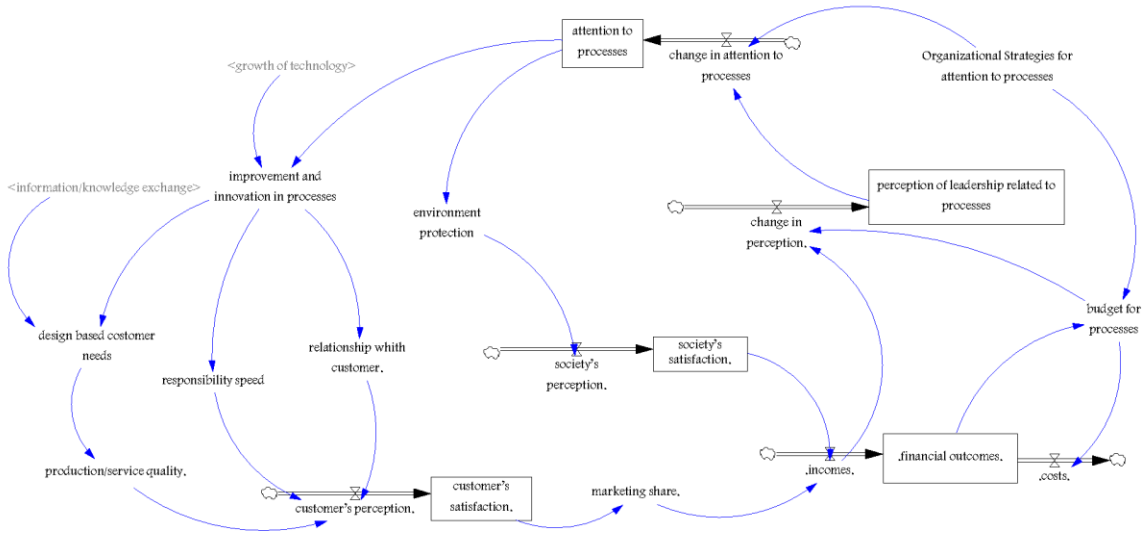

Diagram 4- attention to processes

Diagram 4 shows the relation between the processes strategies and financial outcomes. The key effectiveness variables in these feedback loops are attention to processes, customer's satisfaction, society's satisfaction, financial outcomes, and perception of leadership related to processes. Due to the expanded relations defined above, in this article the relationships between model's variables are used in diagram drawing. This is described as follows: it is believed that in enterprises for reaching better results regarding customer's satisfaction and society's satisfaction is in need of paying better attention to the processes, which itself begins with putting together the changes in processes strategies. Therefore, the processes strategies changes are effective on all this diagram variables. An organization can attain better financial outcomes when it reaches suitable results in the field of improvement customer's satisfaction and society satisfaction. By obtaining better financial outcomes better perceptions of leadership related to processes are obtained. For completion of this feedback loop the improvement in the leadership perception raises processes strategies.

4-2. Formulating the Model structure

Now according to the above structures, the stock and flow diagram of the EFQM model is performed using Vensim-PLE Software. The time unit is considered to be one year and the model is run for a planning horizon of 10 years period beginning from the year 2011. For studying the trend of organization development, customers' satisfaction, people satisfaction, society satisfaction, and financial outcomes are defined. These levels indicate the effects of policies, processes and organization activities during time.

In VENSIM PLE Software linking between model variables is done by the Lookup. It is used for showing the relationship between the performance indicators and perception indicators of the results' domain. For example, to link "learning" variable and "cumulative production" variable, a lookup function is defined which shows the relationship between cause and effect, where it is expressed as a diagram here. In this diagram, "learning" placed on the x-axis and "cumulative production" placed on the y-axis.

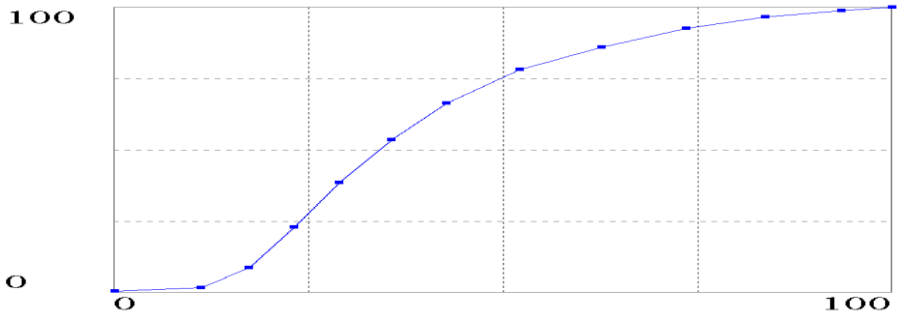

Fig .1: Relationship between "learning" variable and "cumulative production" variable

5. Performance Test of Dynamic Model

To validate the EFQM model, some well known conventional tests such as boundary efficiency test, unit consistency test, parameter evaluation test, cumulative error test, and extreme value test are performed. Each of these tests are described briefly in the sections that follow:

Unit consistency test: Our model passed this test while all of its units were approved by Vensim software when the Unit Check option was active.

Collaborative error test: the proposed model is independent of the time unit used in the modeling of the problem. For example, if the time unit is assumed to be "one year or 12 months" initially then when it is changed to "4 months or quarter" of that the model should generate quite similar results. Our results indicated no changes in the behavior of the mentioned variable in different time units as illustrated in figure 2.

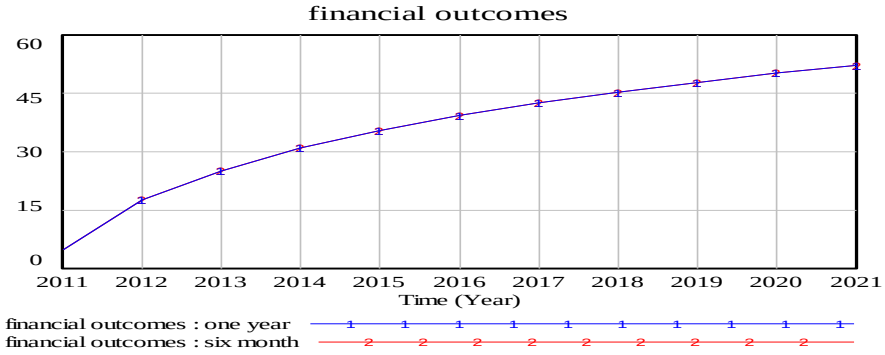

Fig.2: Behavior of financial outcomes in different time units

- **Scope sufficiency test:** This test was passed through further surveying the EFQM model, which involved defined criteria, sub-criteria, and indexes.
- **Parameter evaluation test:** expert opinions were used about all the variables of the model as an estimation of all parameters.

Structure evaluation test: This test was passed by the consistency of models behavior with its structure. Because the variables of the model create negative feedback loops, they should be goal-seeking. For example, the goal-seeking behavior of the variable financial outcomes is illustrated in figure 3.

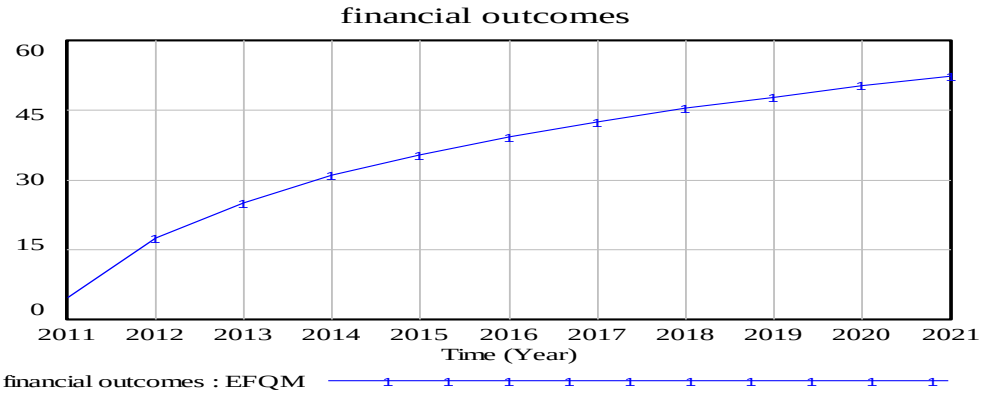

Fig.3: Goal-seeking behavior of variable financial outcomes

Boundary conditions test: This test was conducted for the model where its performance was approved for the boundary conditions. For example, the amounts of policy, strategy, and leadership variables tested on the boundary of 0 and 100 with their effects on customer results were captured. These results indicated no changes in the mentioned variable in the boundary conditions as illustrated by figure 4.

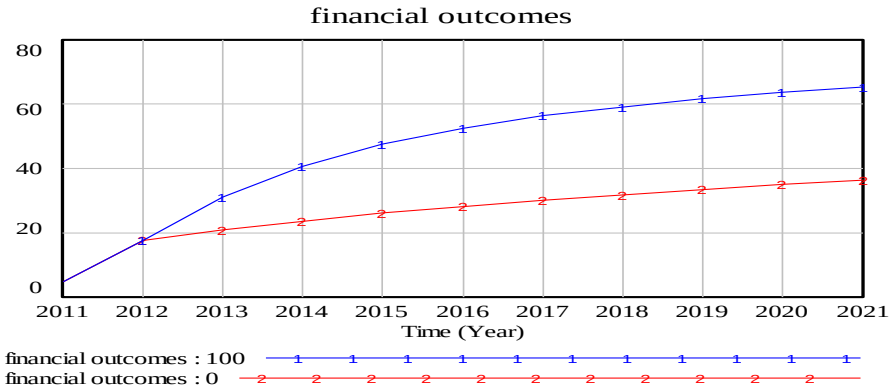

Figure 4: Behavior of Customer Results in boundary conditions

6. Policy Making

For this dynamic model the variables of "organizational strategies" are defined for people, customers and society Enablers in order to evaluate different policies which are based upon these criteria improvement (the exogenous variables are determined based upon the future goals and policies of the organization). Now, we discuss and compare three different policies and scenarios to find actions by which the firm can achieve its objectives. "Financial outcomes" variable is the main variable to which special attention must be paid. We consider following four scenarios here:

- **Policy 1:** We name the first scenario "people strategy based approach" with concentrating efforts to improve attention on people. It causes people's satisfaction to increase. As a result of that customer's
- satisfaction and society's satisfaction grows more. In conclusion, financial outcomes increase. Therefore, we assume the desired value of "people strategy" variable improvement is in their ideal values i.e. 50%.
- **Policy 2:** the second policy is named "partnerships strategy based approach" with

concentrating efforts to improve attention on partnerships. It causes value-added increment and costs decrement. In conclusion, financial outcomes grow. Therefore, we assume the desired value of "partnerships strategy" variable improvement is in their ideal values i.e. 50%.

- **Policy 3:** We name the third scenario "processes strategy based approach" with concentrating efforts to improve attention on processes. It causes customers' satisfaction and society's satisfaction to grow. In conclusion, financial outcomes grow. Therefore, we assume the desired value of "processes strategy" variable improvement is in their ideal values i.e. 50%.
- **Policy 4:** the fourth policy is called "total based approach" with the emphasis on people, partnerships and processes criteria. In this state, organization must strike a balance between these three above criteria and improve all of these variables but improvement is less than previous policies because resources are limited. Therefore, the desired values of these variables are taken at 20% level.

The results of applying each of these policies for "financial outcomes" are shown in figure 5.

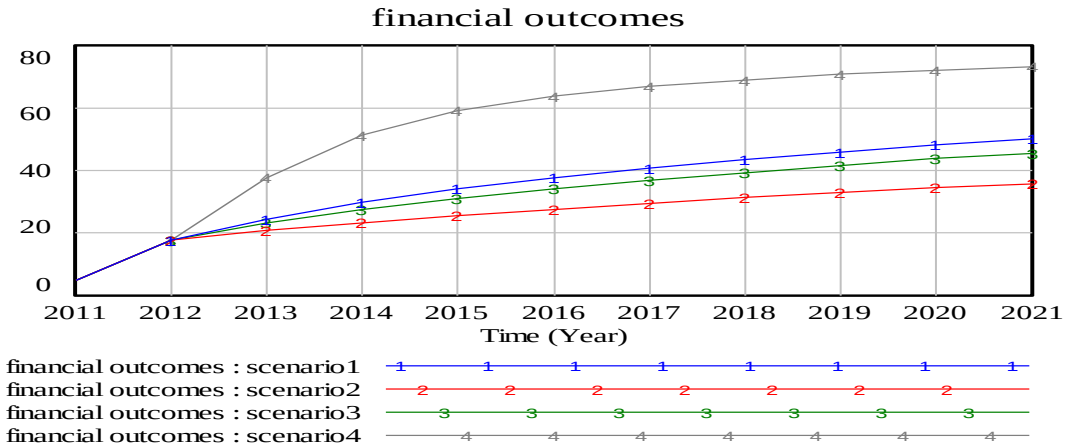

Fig.5: The results of applying four policies for the "financial outcomes" variable

As figure 5 demonstrates the "financial outcomes" has an exponential growth for the fourth scenario. The results of first simulation year increases faster than other years, then it grows less in the next years and this behavior continues forever.

Our comparison of these four scenarios indicates that fourth scenario follows a better trend than other scenarios. The better performance of the fourth scenario reveals this reality that the one criterion alone cannot have significant impact on the organization excellence. Activities, processes, and systems in general, enable the organization to have higher performance or results. Therefore, all the criteria of the Enabler domain have more significant impact on the organization excellence. As a result we can conclude that it is better for the firms that strike a balanced focus on all the criteria. Even if it's necessary to take smaller improves.

7. Concluding Remarks

In this paper, a new integrated dynamic approach investigating actual performance of EFQM in enterprises is presented. It gives rise to a comprehensive and holistic viewpoint. Since this approach fills existing gap among previous incomplete models the proposed model specially is appropriate for analysis, description and comparison of various types of enterprises. The proposed model is able to measure and monitor the effects of strategies on the results through system dynamics based upon the EFQM model as well. Hence, scenarios extracted from this model can steer enterprise toward improving decision making in strategic level.

In the proposed model, we indicated the effects of powerful factors on organizational results using system dynamics' model. We obtained and analyzed the trend of changes in terms of different values utilizing software. Analysis of technology effectiveness on lean manufacturing considering the dynamic behavior of the system provides a group of advantages which the most important one of them are as follows:

- Simulating the effect of strategies on enterprise results.
- Performing the "what's if" type analysis for learning the future potential threats and prospects.
- Visual representation capabilities for the relations exist among the values of the model.
- Reducing the risk of performing plans using simulation and studying the results and conclusions of different policies.

Following fields can rise for the next researches:

- More complete performance tests of the proposed model.
- Sensitivity analysis is one of the possible developments of this work. With doing sensitivity analysis we can increase the possibility of having precise scrutiny on different scenarios and policies.
- Doing more simulations on different policies with different analysis of their results may lead to better conclusion.

Inviting manufacturing systems experts and system dynamics experts as a focus group for better model development to improve the relationships and equations used in the model for its better use in the organizations.

References

[1] Henrik, V. A.,Gavin, L.,Michale,S., "*The Balanced Scorecard vs. the EFQM Business Excellence Model-Which is the better strategic management*".9th Turkish Quality Congress, Istanbul, November 2000.

[2] Flego, A., "*Methadone and Treatment Quality, "The EFQM Excellence Model*". Heroin Add &RelClinProbl, vol.8, no. 3, 13-36, 2006.

[3] Wu,C., Wang, S., "*Using the EFQM Model to share the Experience of TQM and develop Improvement Strategies for SMEs*", 12th International Conference on ISO 9000 & TQM, Taiwan,April 2007.

[4] Farana, R.,"*Application of EFQM Excellence Model at the Faculty*", Seminar ASR '2007 "Instruments and Control", Farana, Smutný, Kočí&Babiuch (Eds), 2007.

[5] Santos-Vijande, M., Alvarez-Gonzalez,L., "*TQM and firms performance: An EFQM excellence model research based survey*". Internat.J.Business Science and Applied Management, vol.2, no. 2, 2007.

[6] Michalska, J., "*Using the EFQM excellence model to the process assessment*", Journal of Achievements in Materials and Manufacturing Engineering, vol.27, no. 2, 2008.

[7] Shafaei, R., Dabiri,N., "*An EFQM Based Model to Assess an Enterprise Readiness for ERP Implementation*", J. Industrial and Systems Engineering, vol.2, no. 1, pp. 51-74,2008.

[8] Bou-Llusar, J., Escrig-Tena, A.B.,Roca-Puig, V.,Beltrán-Martín, I.,"*An empirical assessment of the EFQM Excellence Model: Evaluation as a TQM framework relative to the MBNQA Model"*,J.Oper. Manag , 27, pp. 1–22, 2009.

[9] Stok, Z.M.,Mesko,M.,Markic,M., "*The advantage of the EFQM excellence model in business management and leadership* ",Internet J. Entrepreneurship and Small Business, vol.8,no. 3, pp. 399 – 410, 2009.

[10] Nazemi, J., "*a process model for improvement through EFQM*", World applied science. J, vol.8 no. 3, pp. 279-287, 2010.

[11] Nikolaidis, Y., Terpos, C.,"*The evolution of quality management in DOKPY, Magnesia – Greece: from basic quality initiatives to EFQM*", Internet J. Productivity and Quality Management, vol.5, no. 4, 2010.

[12] Shahroudi, K.,"*The Application of Data Envelopment Analysis Methodology to Improve the Benchmarking Process in the EFQM Business Model",* IJO, vol.1 ,no. 3, 2009.

[13] Dong-young,K., Kumar, V.,Kumar, U.,Hwang, Y.,"*A linkage model for the integrated application of intellectual capital management and the EFQM business excellence model: the case of an ISO 9001 certified public R&D organization*", Internat.J.Learning and Intellectual Capital, vol.6, no. 4, 2009.

[14] Sadeh, E., Arumugam, V.C., "*Interrelationships among EFQM Excellence Criteria in Iranian Industrial SMEs*",Eur.J.Economics, Finance and Administrative Sciences,19 1,450-2887, 2010.

[15] ZareMehrjerdi,Y., "*A System Dynamics Approach to Healthcare Cost Control*", International Journal of Industrial Engineering & Production Research, Volume 23, Number 3 pp. 175-185, 2012.

[16] ZareMehrjerdi, Y., Dehghanbaghi, M., "*A Dynamic Risk Analysis on New Product Development Process*", International Journal of Industrial Engineering & Production Research, Volume 24, Number 1, pp. 17-35, 2013.

[17] Mahmodi, J., Minaee, M.H., "*Using System Dynamics to Model Rod Bar Supply Chain in Iranian Market*", International Journal of Industrial Engineering & Production Research, Volume 21, Number 3, pp. 129-135, 2010.

[18] Yim, N.H., Kim, S.H., Kim, H.W., Kwahk, K.Y, "*Knowledge based decision making on higher level strategic concerns: system dynamics approach*", Expert Systems with Applications, 27, pp. 143–158, 2000.

[19] Paul, D., "*A 'Dynamic' Balanced Scorecard, the Design and Implementation of a Performance Measurement System in Local Government*". A thesis submitted in partial fulfillment of the requirements for the degree of Master of Commerce in Management Science and Information Systems. University of Auckland, 2000.

[20] Sterman, J.D., "*Business Dynamics: Systems Thinking and Modeling for a Complex World"*, Irwin McGraw Hill. 2000.

[21] Sterman, J. D., "*All Models Are Wrong: Reflections on Becoming a Systems Scientist*", System Dynamics Review, vol.18, no. 4, pp. 501-531, 2002.

[22] Akkermans, H., von Oorschot, K., "*Developing a Balanced Scorecard with System Dynamics*", J. Oper.Res. Soc, 2002.

[23] Rydzak, F., Magnuszewski, P., Pietruszewski, P., Sendzimir, J., Chlebus, E., "*Teaching the Dynamic Balanced Scorecard*".Proceedings 22nd Internat'lConf, System Dynamics Society, 2004.

[24] Bianchi, C., ontemaggiore, G.B.,"*Building dynamic balanced scorecards to enhance strategy design and planning in public utilities: key-findings from a project in a city water company* ", Revista de Dinámica de Sistemas, vol. 2, no. 2, pp. 3-35, 2006.

[25] ToloieEshlaghy, A., AfsharKazemi, M.A., khlilou, A., "*Investigating the Impact of Leaders' Responsibilities in Reaching Organizational Excellence in the EFQM through the Systems Dynamics Approach*". International Journal of Business and Management, Vol 4, No 6 (2009).

[26] DehghaniSaryazdi, M., Noghondarian, K., Owlia, M.S., HosseiniAzabadi, J., "*System dynamics modeling for EFQM excellence model: Case study of a regional electricity company in Iran*". IEEM, 2011 2011, International Microwave Workshop Series on Innovative Wireless Power Transmission: Technologies, Systems, and Applications (December 2011), pg. 1330-1334.

[27] Bou-Llusar, J.C., Escrig-Tena, A.B., Roca-Puig, V., Beltra´ n-Martı´n, I., "*An empirical assessment of the EFQM Excellence Model: Evaluation as a TQM framework relative to the MBNQA Model* ", Journal of Operations Management 27 (2009) 1–22.

[28] Crescitelli, E., Figueiredo, J.B., "*Brand Equity Evolution: a System Dynamics Model*", BAR, Curitiba, v. 6, no. 2, art. 2, p. 101-117, Apr./June 2009.

[29] Akkermans, H., Von Oorschot, K., "*Developing a Balanced Scorecard with System Dynamics*", Journal of the Operational Research Society, 2002.