DESIGNING A DYNAMIC MODEL OF WORLD-CLASS PRODUCTION WITH A NATIVE APPROACH

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Abstract

In view of the unavoidable process of globalization of production and industry,producers, in turn, have inevitably to reform their traditional, inefficient, and ineffective ways of past and adopt a new approach to production policies. Policies focusing on technology, customer orientation . In this study, using Delphi fuzzy technique, the factors affecting world class production were identifiedThis research is practical and based on data from the "Gorji" food company during 5 years since 2015 By 2019, we had developed formulas, according to which a mathematical model was obtained in Vansim software: the native model of "world-class production".In this study, 11 industry experts and 4 university professors have been used as experts A dynamic system approach was also developed to produce a world-class model with an indigenous approach using vensim software.

Keywords: world class, production model, world class manufacturing, Industry

1. Introduction

Global competition is a fundamental reason for changing the environment of manufacturing industry competition (De Felice, 2015).Today, with the globalization of the economy, the paradigms governing organizations have undergone many changes, which its natural result is the competition from national and international markets to international markets. (Alem Tabriz, 2014)

The world in which we live is unstable, mobile, and highly evolving. The changes are so lasting. It happens so fast that in many cases it is not only possible to surpass it, but even to imagine it. In such circumstances, global producers and organizations that promise high competitive performance in the field of global competition (Smith, 2011)

Production in the world class manufacturing is a level of organizational performance that can compete in the global arena and can provide an appropriate response to the today's need of business world (Farsijani, 2010).

World class manufacturing which means continuous improvement in the key resources of the organization caused a fundamental transformation in the arena of world business and manufacturing, with its two main axes is the global attitude toward the market and its relationship with customers and the development of goods and services globally. Hence, the conceptual design of contingency models with flexibility and environmental adaptation for organizations and companies has become an inevitable necessity for achieving excellence (Jafari Eskandari, 2015).

Entering world markets is also one of the important issues in iran country, which has attracted the attention of many industrial managers. With the advent of international organizations and regional memoranda, trade has extended in the global arena and commodities manufacturing countries have crossed the political and national borders and give to consumers that it may culturally and racially not have any competition with the producers of that commodity (Farsijani, 2017)

2.Theoretical foundations:

Production management has evolved over different periods and become world class manufacturing from manual and traditional production in the national dimension. Two important and influential revolutions took place on the evolution of production, at the beginning and end of the twentieth century. (Aghajani , 2013)

Dynamical system in mathematics and solving industrial-social and managerial issues is called to systems that their state is changed with time. (ford, 2009)

Table 1. Characteristics of World Class Manufacturers

Researcher	Characteristics
Wisner& Fawcett	Attention simultaneously to quality and productivity, having a systematic and integrated approach based on competition, emphasis on training and development of human resources, continuous improvement in product and process, simultaneous attention to all aspects of competition and long-term attitude (Farsijani, 2015).
Safaei Ghadikalaei	Strengthening the workforce, improving relationships with suppliers, compatible design of product with the process, simplifying work, improving quality, timely production controls, performance measurement, continuous modeling and improvement, proper utilization from capacity and emphasis on customer (Safaei Ghadikalaei, 2012).
Safaei Ghadikalaei and Dargahi	Inclusive quality management, Implementation of Employees' participation program, Timely production, Comprehensive productive maintenance, Continuous improvement, Choice of suppliers and appropriate technology (Safaei Ghadikalaei and Dargahi, 2012).
Farsijani	Electronic presence on the global arena, new social responsibility, dynamic integration of supply chain network, virtual organizational structure, modern technology, employee precedence, continuous improvement through continuous learning, team-based organizational structure, responsibility to environment and ecology, partnership with customers , a clear vision, a system for identifying positive outcomes and rewarding them, a culture of universal quality, and efficient processes (Farsijani, 2017).

Baroncell believes that the core components of world class competition mean that organizations in the global market are successful in any competition; that is, in terms of quality, waiting time, flexibility, cost and price, customer service and innovation to be better than any competitor or be equal to him (Baroncell, C. & Ballerio, N, 2016)

Andreas Gröbler in 2005 states the role of strategy and production capability as follows: In terms of production management, strategic capability has a major contribution in the success factors of companies in competition, i.e, the strength of a factory is the support of the strategy of the firm and help to improve and succeed in the market. Developing and transferring strategic capabilities is an important task of the production strategy. This task is often in conflict with solving everyday problems and strict activities of management of operations. One of the most prominent authors in this field has proposed four strategic capabilities in operations and production: Ability to produce 1: with less cost 2: with high quality 3: confident delivery 4: with flexiblity in combination and number of products (Bentes and 2011)

Safaei Ghadikalaei and Dargahi in 2012 by using FAHP and FSAW techniques and using a balanced scorecard following a comparison evaluation of strategies for achieving world class manufacturing in Tabarestan Steel Co. In order to achieve the research goal, after a comprehensive review of the subject literature, the views of 8 experts and the expert of the company have been used to prioritize the strategies for achieving world class manufacturing as follows: Accepting new technology to continuous improve and develop product quality, designing products based on customer needs, identifying new domestic and foreign markets, and ultimately improving after-sales services by expanding the service network (Safaei Ghadikalaei and Dargahi, 2012).

Safaei Ghadikalaei et al. (2012), with the aim of evaluating world class systems of Iran Khodro and three Indian automobile companies using the value performance analysis, concluded that Iran Khodro Co. could have better performance only in two programming and control factors and production control and flexibility versus Indian counterparts and have lower performance in factors of commitment excellent of management, customer satisfaction, and customer service, and the rest of the factors have a moderate performance. At the end, it was suggested that Iran Khodro, in order to achieve superiority over other manufacturers in the global arena, should pay more attention to all critical factors and pay particular attention to the supercritical factors of the commitment of excellent management and satisfaction and customer service (Safaei Ghadikalaei et al. , 2012).

Eid (2009) in an article entitled "Factors affecting the successful implementation of world class manufacturing in developing countries, a case study of Egypt" by stating that manufacturing factories need to understand what factors have a critical role in the application of WCM techniques, classified seven critical factors into two categories, that the first category is WCM strategic enablers, which include: management commitment, quality section, continuous improvement, and customer participation; The second category is the WCM tactical enablers that includes: supply chain management, management of technical capabilities, and management of manufacturing facilities. Experimentally, through a 96-sample selected from Egyptian manufacturing companies, it was concluded that WCM strategic factors and tactical success factors have a significant impact on the success of WCM, and also stated that some strategic enablers also affects tactical enablers (Chiarini, 2015).

Sangwan & Digalwar (2008), in a paper titled "Assessing world-class manufacturing systems, a case study of India's automotive industries", by reviewing the literature of the subject identified 172 variables of performance for the evaluation of WCM systems. Subsequently, 73 variables of performance were identified valid from a total of 172 variables that were classified using the nominal grouping technique in 12 critical factors categories and then, using the performance value analysis algorithm (PVA), the data obtained from three companies active in India's automotive industry which received the Malkolm Baldrig National Quality Award (MBNQA), Rajiv Gandhi National quality award (RGNQA) were compared in terms of success of world class manufacturing. Finally, the authors claim that the proposed model and algorithm have required validity and reliability using the case study, and it can be used to evaluate the automotive industry in the world (Sangwan &Digalwar, 2008).

Salahdin and Eid (2007), with the aim of implementing world class manufacturing techniques in Egyptian factories, as well as providing guidance for the successful implementation of world class manufacturing, concluded that reducing operating costs (marketing and manufacturing) and global issues (Environmental market) are important variables for the implementation of WCM. They also found that a poor program and lack of knowledge were among the most important barriers for implementing WCM in Egyptian factories. At the end, they suggested that the implementation of WCM requires knowledge growth and they stated that factories keen to implement WCM should understand this issue and insist in doing it until they get the expected profits (Borges, 2016).

Brown et al. (2007), in a paper titled "Cooperation and participation of production strategy and its relationship with world class manufacturing performance", explore the relationship between the process of developing strategy and the performance of operation of factories. Based on findings in the computer industry, this article suggests that high-performance factories should contribute both the content of strategic operations and strategic operations, together what the factories did not do with low performance. Therefore, it is suggested in this paper that the participation of operations and production managers in the strategic planning process helps to coordinate business and production strategy and this coordination is related with the high performance of production (Maurel, 2014).

In 2015, Vagnoni et al report that techniques such as Toyota's production system, timely production system, comprehensive quality control and lean manufacturing have been implemented by many people and have made numerous companies world-class. (Vagnoni, 2015)

In addition, removing trade barriers and intensifying internationalization today has put organizations at a competitive disadvantage in examining their traditional manufacturing practices and considering new emerging practices such as manufacturing at the World Cup and seeking to differentiate them. And competitive advantage (Haleem et al., 2012).

World-class manufacturing is introduced to achieve or maintain world-class competitiveness through superior products and best practices. The world-wide production mission will bring more production closer to the market by eliminating undervalued products. This mission has become a reality through the goals of cost reduction, quantity control, quality assurance and respect for humanity. Over the past 20 years, the concept of world-class production has evolved with the change of its original pillars. (DUDEK, 2014).

Various researches and models have been presented to study the different components according to the culture, technology level and the needs of the society. Regarding the production structure of our country, the role of technology, management and environmental factors has been examined more closely. from among the variables in the world-class production components, a model with the components and formula was designed according to the native requirements, considering the necessity of expanding exports and having a world-class product.

Decline in market share and customers due to some factors such as lower demand rates, increase in domestic competitors and in price and decrease in customer satisfaction, presence of new and more diversified competitors and new products has led to an upward trend in the number of competitors and supply. And because of that, the Iranian market has fallen. So, there is a need to simulate and design a mathematical model to improve the process mentioned. The need to use technology and research and development and to invest in it and its impact on the production process World-class and software development in the food industry and company that can be extended to other companies and industries. That's why we felt it and tried to think of a solution.

2.1 Production models in the world class

Farsijani (2014) suggests the following three phases in the organizational development model to facilitate the movement of Iranian organizations to become a world class manufacturer, and in each phase, a series of basic features of world class organizations is considered and try to create them in a traditional organization.

- First Phase: 1. Perspective; 2. Inclusive quality culture; 3. Efficient processes; and 4. Modern technology.
- Second Phase: 5-Dynamic integration of the supply chain network, 6-staff priority and comprehensive quality management, 7-continuous improvement through continuous learning, team-based organizational structure, 8- partnership with customers, 9. system of identifying positive results and 10. Rewarding them
- Third Phase: 11 - Electronic presence in the global arena, 12 - New social responsibility, 13 - Virtual organizational structure, 14 - Responsibility to the environment.

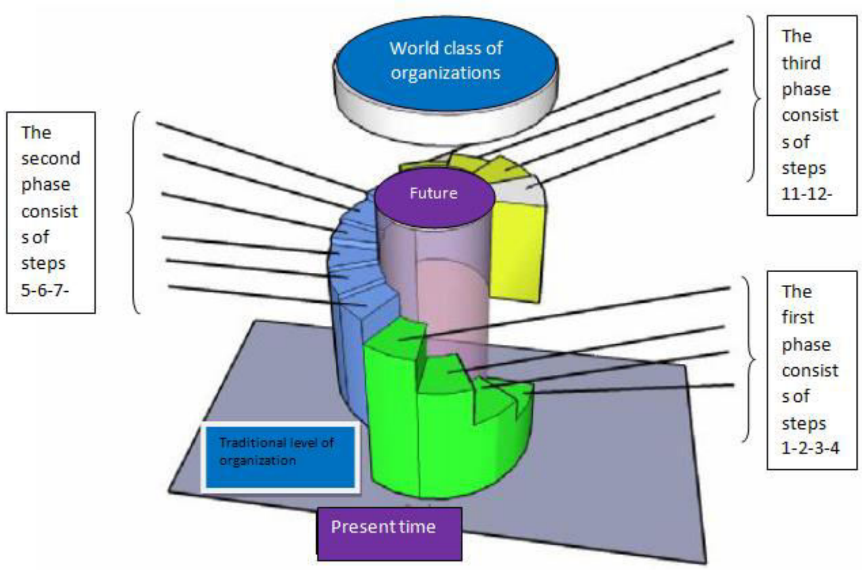

Figure1- World class manufacturing model,(Farsijani,2014)

Gajdzik (2013) states that, in practice, each company has to work its own way to reach the WCM level. However, many organizations have adopted the configuration of 10 main pillars that, after their implementation, should provide the reference position in its sector of activity, as shown in Figure 2 (Gajdzik, 2013).

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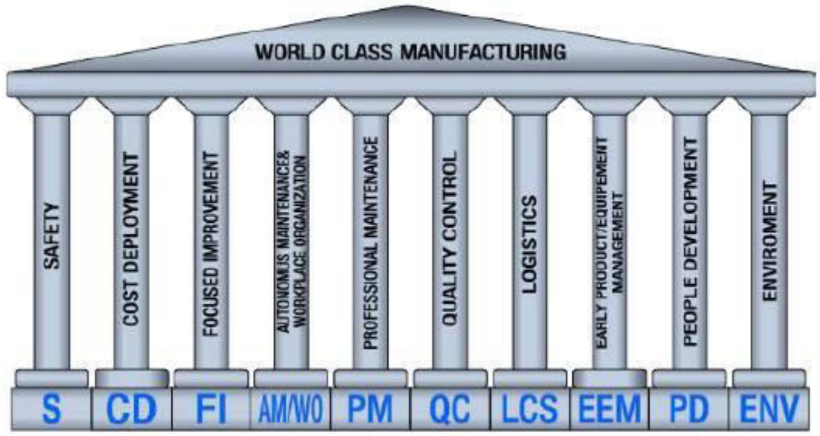

Figure 2. World Class Manufacturing pillars, Adapted from Gajdzik (2013).

3.Research methodology

In the first stage of the research, the questionnaire was used as a research tool. Questionnaires were administered to experts during two phases of fuzzy Delphi. It should be noted that in the process of doing the present research, first by studying the literature on each variable, and the world-class production literature, using a fuzzy Delphi method, a model for the research variables is chosen, since the model used in this system dynamics research is That is, after extracting the causal model that was reviewed by industry and university experts and approved after correction, the information needed was obtained from interviewing experts and from a library study of available statistics and documentation, and finally, soft outputs. The software was approved by experts.

3.1 Determining the factors affecting production in the world class

Since the compilation of factors contributing to world-class production is difficult, there is no significant experience in this regard either. Therefore, the nature of the problem and its solution in such a way that the achievement of objective achievements requires the cooperation and cooperation of experts. Therefore, in this paper, the Fuzzy Delphi method is used to determine the components affecting world class production. The primary core of the research The determination of the components affecting global production through the fuzzy Delphi method was established with library studies.

At this stage, the goal is to determine the number of factors affecting global production, in which many studies have been carried out. A study of published articles on global production identified 67 components, which were reduced to 37 with the help of consulting professors. With respect to these components, a questionnaire was developed to obtain expert opinions on the impact of these components on their impact or their impact, as well as on their impact on world-class production. However, due to the ambiguity in applied concepts, the questionnaire was designed based on fuzzy variables that are discussed below.

for identifying the variables and system parameters and the effective components in this model, experts and experts familiar with the subject of the initial consultation were consulted, and by summarizing their comments and based on the preliminary conclusion, the section Main models of the main model, were identified.

At this stage, as in the traditional Delphi method, the opinions of experts are collected. In this method, language variables are used to design the questionnaire and collect the opinions of experts. Based on the study of research literature and the opinion of professors and consultants, 37 components affecting production in the world class were proposed. According to the variables, a questionnaire was designed to be presented to experts. As can be seen, no new offers have been received in addition to the proposed options.

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Table 2. Results of counting the answers of the first stage of the survey

		The amount of agreement				
no	**Variable**	Very much	very	medium	little	Very low
1	production process	14	1			
2	Investment	14	1			
3	Production capacity	13	1	1		
4	Depreciation	12	2	1		
5	drop rates	14	1			
6	Standard Factors	15				
7	Production costs	13		2		
8	Resource costs	14		1		
9	Supply	13		1	1	
10	Tax rates	12	2	1		
11	Product costs	15				
12	Process Investment	15				
13	Virtual organizational structure	12	1	1	1	
14	production rates	13		1	1	
15	Surplus	13		1	1	
16	subsidies	13	1	1		
17	product variety	12	3			
18	domestic prices	12		3		
19	Domestic product prices compared to imported	12	3			
20	Visual Controls		5	1	4	5
21	decided to buy	12	3			
22	Market volume	3	12			
23	Technology Levels	14		1		
24	Learning Technology	14	1			
25	Research and Development	15				
26	loyal customers	15				
27	lost customers	15				
28	Potential customers	14			1	
29	Loss of Skills	13		1	1	
30	Human Resource Investment	12	1	2		
31	Training effect	13		2		
32	Use of sales condiments and special offers for customers	10	1	1	1	2
33	service capacity	14		1		
34	Demand	15				
35	Creativity and Innovation	15				
36	Commodity prices	12	2	1		
37	Basic Price	12	2		1	
New offer						
No offer was made						

3.2 Calculate the fuzzy value of each question

After collecting the opinions of experts at this stage, based on the collected data, we calculate the fuzzy value of each of the questions (indicators). To calculate the fuzzy value of each question, we do the following:

Assuming that the fuzzy value of each of the questions is displayed as (A_j)̃ = (L_j. M_j. U_j), so that L_j is the lower limit, M_j is the middle limit, and U_j is the upper limit of this fuzzy number:

$$L_j = \mathrm{Min}(x_{ij}) \qquad i = 1.2.\ldots.n \quad j = 1.2.\ldots.m$$

$$M_j = (\prod_{i=1}^{n.m} x_{ij})^{\frac{1}{n}} \qquad i = 1.2.\ldots.n \quad j = 1.2.\ldots.m$$

$$U_j = \mathrm{Max}(x_{ij}) \qquad i = 1.2.\ldots.n \quad j = 1.2.\ldots.m$$

The concept of each of the variables and parameters presented in the above relationships is as follows:

L_j: Low fuzzy value of the questionnaire or index j of the questionnaire, which is equal to the smallest amount that the experts have assigned to my question (index) j.

M_j: The mean of the fuzzy value of the question or index j of the questionnaire, which is equal to the geometric mean of all the opinions of the experts for the question (index) of j.

U_j: The upper limit of the fuzzy value of the question or index j of the questionnaire, which is equal to the largest value assigned to the question (index) j by experts.

x_ij: The value assigned by the expert i to the j index.

(A_j).: The fuzzy value of the triangular question or index j.

As can be seen, in the fuzzy method, all the opinions of the experts are involved in calculating the fuzzy value of each question.

3.3 Convert the fuzzy value obtained for each of the questions to the de-fuzzy value (S_j):

After calculating the fuzzy value of each research question, in order to be able to judge each of the questions, we must first dip the fuzzy value obtained for each of the questions to make it possible to compare and evaluate(Hsu, Lee, Kreng, 2010)

$$S_j = \frac{L_j + M_j + U_j}{3}$$

After calculating the de-fuzzy (definite) value of each question (indicators), it is necessary to evaluate their importance. There is no set rule for evaluating the importance of each question. But it is common to use a threshold limit (r) to assess the importance of each question. Therefore, two states are created based on the threshold value:

If S_j≥r, it means that the question (index) j is very important.

If S_j <r, it means that the question (index) j is of little importance. Due to the low importance of these questions, they can be removed.

Traditionally, the threshold limit is 3, and in the strict case, it can be considered as 4, which we took as 4 at the end.

Table 3. Fuzzy results in the first stage of questionnaire distribution

value threshold Estimated			**Di fuzzy threshold value**
0.72 703	0.96950	1	**0.91651**

The fuzzy value of each of the questions			Di fuzzy of amount each question	Status of question each	Percentage of consensus	Magnitude	Rating
L	M	U					
0.7	0.98605	1	0.9180250	Accepted	86.6667	0/02707	25
0.7	0.98605	1	0.9180250	Accepted	86.6667	0/02707	25
0.7	0.98605	1	0.9180250	Accepted	86.6667	0/02707	25
0.9	1	1	0.975	Accepted	100	0/02875	1
0.7	0.98605	1	0.9180250	Accepted	86.6667	0/02707	25
0.7	0.98605	1	0.9180250	Accepted	86.6667	0/02707	25
0.7	0.933	1	0.9215003	Accepted	93.3333	0/02717	16

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0.7	0.933	1	[redacted]	0.9215003	Accepted	93.3333	0/02717	16
0.7	0.98605	1	[redacted]	0.9180250	Accepted	86.6667	0/02707	25
0.7	0.98605	1	[redacted]	0.9180250	Accepted	86.6667	0/02707	25
0.9	1	1	[redacted]	0.975	Accepted	100	0/02875	1
0.9	1	1	[redacted]	0.975	Accepted	100	0/02875	1
0.1	0.98605	1	[redacted]	0.7695392	Unverified	53.3333	0/02004	35
0.9	1	1	[redacted]	0.975	Accepted	100	0/02875	1
0.7	0.98605	1	[redacted]	0.9180250	Accepted	86.6667	0/02707	25
0.9	1	1	[redacted]	0.975	Accepted	100	0/02875	1
0.7	0.98605	1	[redacted]	0.9180250	Accepted	86.6667	0/02707	25
0.9	1	1	[redacted]	0.975	Accepted	100	0/02875	1
0.9	1	1	[redacted]	0.975	Accepted	100	0/02875	1
0	0.71759	1	[redacted]	0.608795	Unverified	40	0/01795	36
0.7	0.933	1	[redacted]	0.9215003	Accepted	93.3333	0/02717	16
0.9	1	1	[redacted]	0.975	Accepted	100	0/02875	1
0.7	0.933	1	[redacted]	0.9215003	Accepted	93.3333	0/02717	16
0.7	0.98605	1	[redacted]	0.9180250	Accepted	86.6667	0/02707	25
0.7	0.933	1	[redacted]	0.9215003	Accepted	93.3333	0/02717	16
0.9	1	1	[redacted]	0.975	Accepted	100	0/02875	1
9/0	1	1	[redacted]	0.975	Accepted	100	0/02875	1
0.7	0.933	1	[redacted]	0.9215003	Accepted	93.3333	0/02717	16
0.9	1	1	[redacted]	0.975	Accepted	100	0/02875	1
0.7	0.933	1	[redacted]	0.9215003	Accepted	93.3333	0/02717	16
0.9	1	1	[redacted]	0.975	Accepted	100	0/02875	1
0	0.54721	1	[redacted]	0.52360	Unverified	40	0/01544	37
0.9	1	1	[redacted]	0.975	Accepted	100	0/02875	1
0.7	0.933	1	[redacted]	0.9215003	Accepted	93.3333	0/02717	16
0.9	1	1	[redacted]	0.975	Accepted	100	0/02875	1
0.7	0.933	1	[redacted]	0.9215003	Accepted	93.3333	0/02717	16
0.9	1	1	[redacted]	0.975	Accepted	100	0/02875	1

We considered the basis of the consensus of 80% of the experts and also the confirmation of the question in the formula. Therefore, questions 12, 20 and 32 are omitted in the second step.

In the second step, 34 variables were given to the experts in the 34-item Delphi Fuzzy questionnaire, which was approved for all 34 questions, and I did not bring the steps here to avoid wasting time.

3.4 Extracted variables

Investigating and applying the most important variables discussed in previous studies and using the fuzzy Delphi method has helped the researcher design a world-class conceptual model of production. The different dimensions used in this model are consistent with the literature of the subject and with the expert opinion. Due to the system dynamics model and because this model is a set of independent and dependent variables, the variables of this research were extracted from the study of research literature and expert opinion during the fuzzy Delphi process. World-class production variables and components include production process, investment, production capacity, depreciation, drop rate, standard factors, production costs, resource costs, supply, tax rate, product cost, process investment, rate Production, surplus, subsidy, product diversification, domestic price, domestic product price relative to imported, purchase decision, market volume, technology level, technology learning, R&D, loyal customer, lost customer, potential customer, lost Skills, Human Resources Investment, Training Effect, Service Capacity, Demand, Creativity and Vavry, commodity prices and the base price.

3.5 Dynamic model design

3.5.1 causal Diagram

causal Diagrams are one of the best ways to represent structures with cross-dynamic feedback that are very well understood and widely used in system dynamics simulations (Azar et al., 2010).

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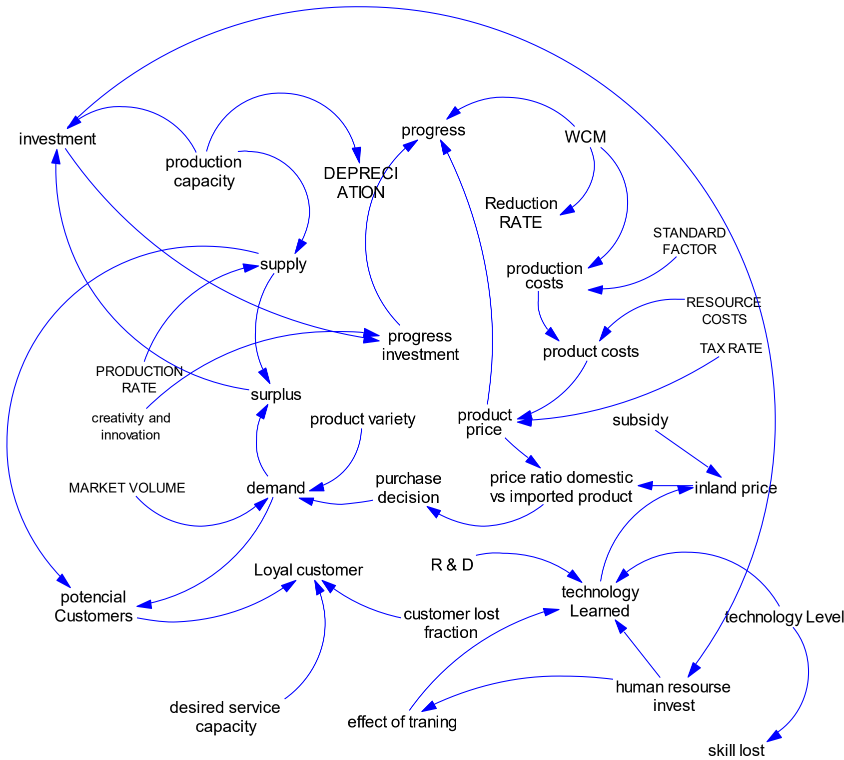

Figure 3. causal Diagram

3.5.2 Technology flowchart

Investing in HR and training centers has increased the level of skills and knowledge. The use of old and new employees has an impact on the level of personnel knowledge. Technology growth affects innovation and product, which increases the quality of processes; it also leads to increased product quality. Technology flowchart

creased product quality.

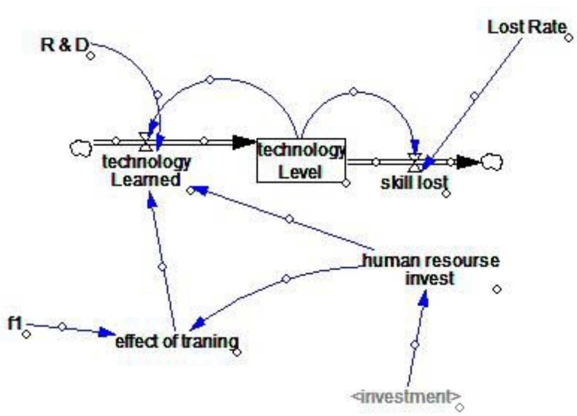

Figure 4. Technology flow diagram

3.5.3 Market and customer flow charts

This section shows the relationships of supply, demand and customer attractiveness

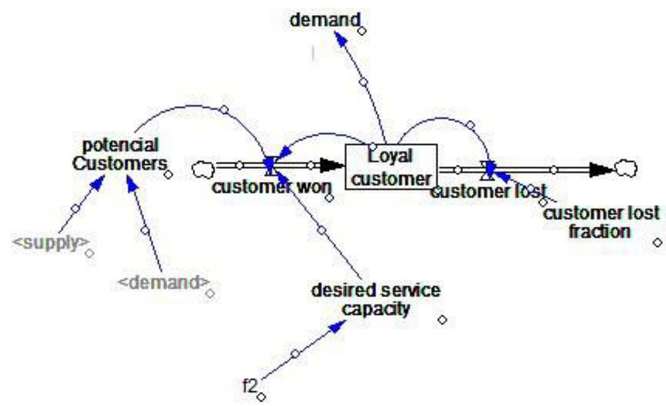

Figure 5. Diagram of flow chart of market and customer

3.5.4 Production and product process segment diagrams

Investment in manufacturing has increased process quality, but growth has been slow (slow). Slow growth of new lines has increased production capacity and production capacity, partly reducing production time as well as delivery times, as well as increasing the number of new products and the growth of new lines with modern technology, enhancing product quality, Sales (customers) and leads to revenue. Product quality is also an important factor that increases or decreases demand, sales and customer demand

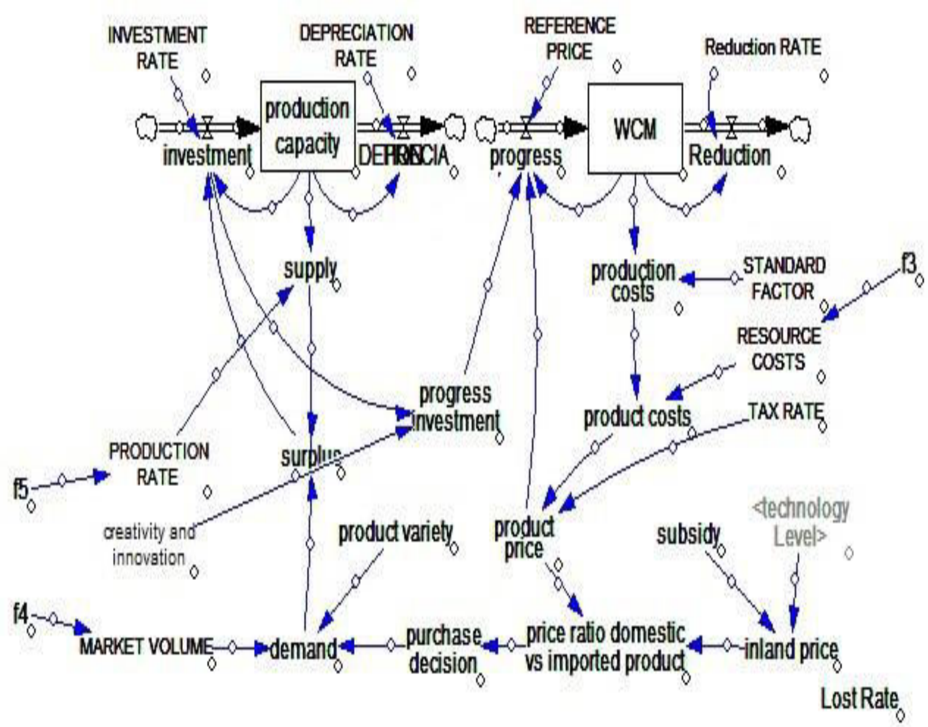

Figure 6. Diagram of the flow of production and product process

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3.5.5 Model flow chart

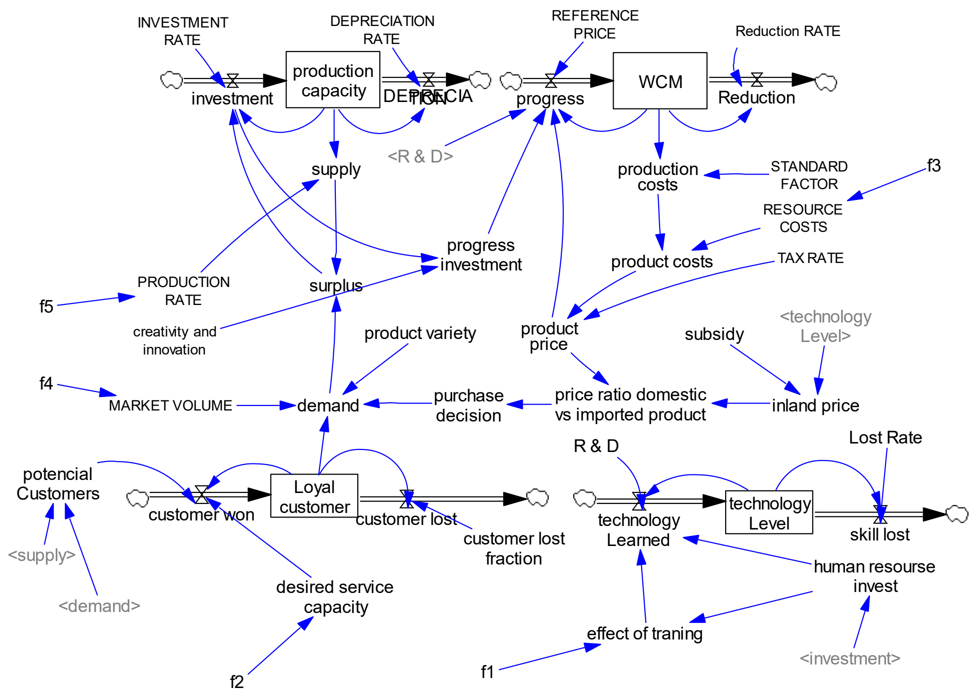

Figure 7. Model flow chart

4.The initial result of the simulation

This model has been implemented and solved in four different scenarios. The initial results of each of the scenarios obtained from simulation by vensim software are listed below.

The basic assumptions of each scenario are as follows:

Table 4. Initial assumptions of the scenarios considered

Variable Name	Scenario One	Scenaro Two	Scenario Three	Scenario Four	Scenario Initial
"R & D"	1	1	1	1.5	1
product variety	1	1.5	1	1.5	1
INVESTMENT RATE	0.1	0.1	0.2	0.1	0.1
creativity and innovation	1.5	1	1	1	1

4.1 sensitivity analysis

Sensitivity analysis is a mechanism for establishing certainty in model-based analyzes and proposed policies. Sensitivity analysis addresses the question of how sensitive the model is to changes in the values of parameters and minor changes in the structure of the model? When analyzing the behavior of a system, sensitivity analysis means calculating and estimating how sensitive the behavior we predict for the system (output of that system) is to the values of the independent variables (input of that system) (Teymouri and Partners, 2008)

For example, the rate of return on investment in model 0.1 is given, that is, the annual rate of increase in investment in the company is 0.1, which we reduce by 0.09 and also increase by 0.11 to result in output output in the class To see the world.

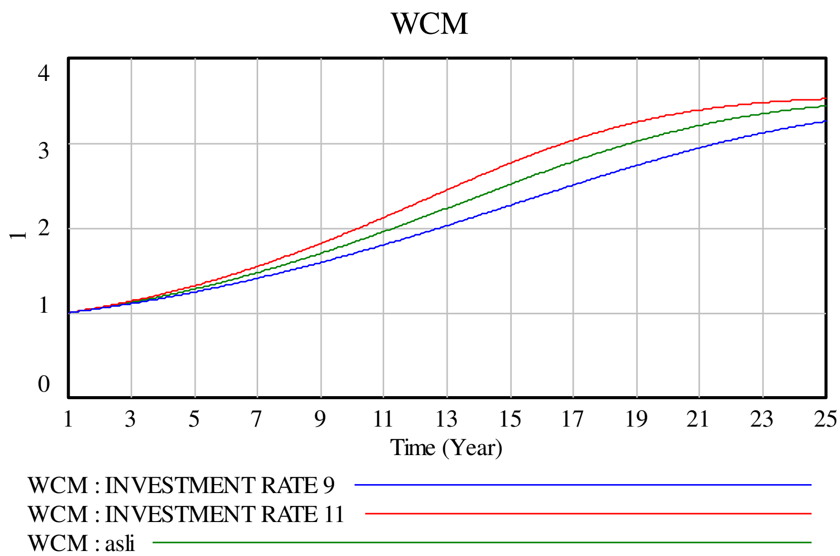

Figure 8. Variable sensitivity analysis of investment rates

4.2 Test of limit conditions

The boundary condition test emphasizes the robustness of the model to the boundary condition; that is, under any circumstances, the model must exhibit the expected behavior by changing policies or input values. For example, when we increase or decrease the initial values of the R&D variables, again, the values of all the variables change to their true range. After simulating and observing the behavior of all the components of the model over a period of time, the various variables of the model were modified and their impact on the main variable evaluated, which is the performance evaluation of the company concerned, was investigated and the model was studied. Approved in terms of limit conditions.

For example, when we increase or decrease the initial values of the R&D variable, again, the values of all the variables change in their true range.

That is, we set its value to the lowest or zero and to the highest or two, and it was observed that the behavior of this variable also changed the boundary conditions as shown in the following diagram:

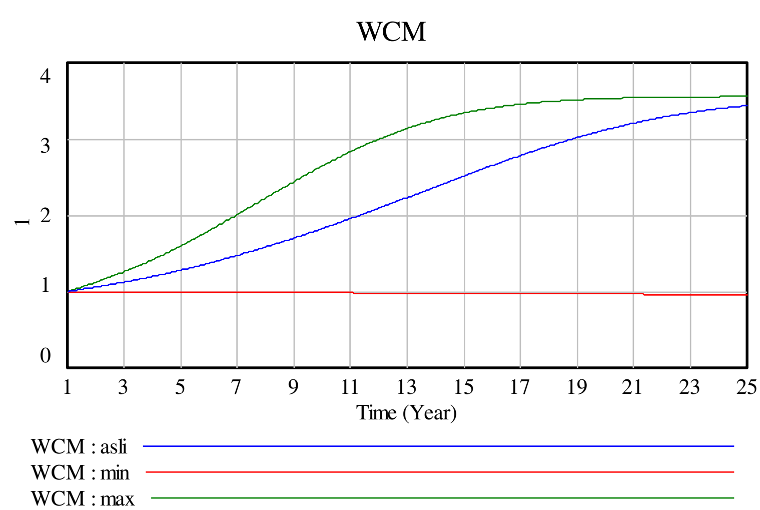

Figure 9.Analysis of R&D Test Variable

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4.3 Testing the adequacy of borders

The boundaries or bases of the research were identified by questionnaires made available to the experts using the fuzzy Delphi method and tested with the model boundary expert assessment approach.

4.4 How do world-class production variables change over time?

Considering the scenarios defined, we examine the effects of time variation on some important parameters and variables.

Changes the role of parameters and variables in the supply sector in time unit and in each scenario:

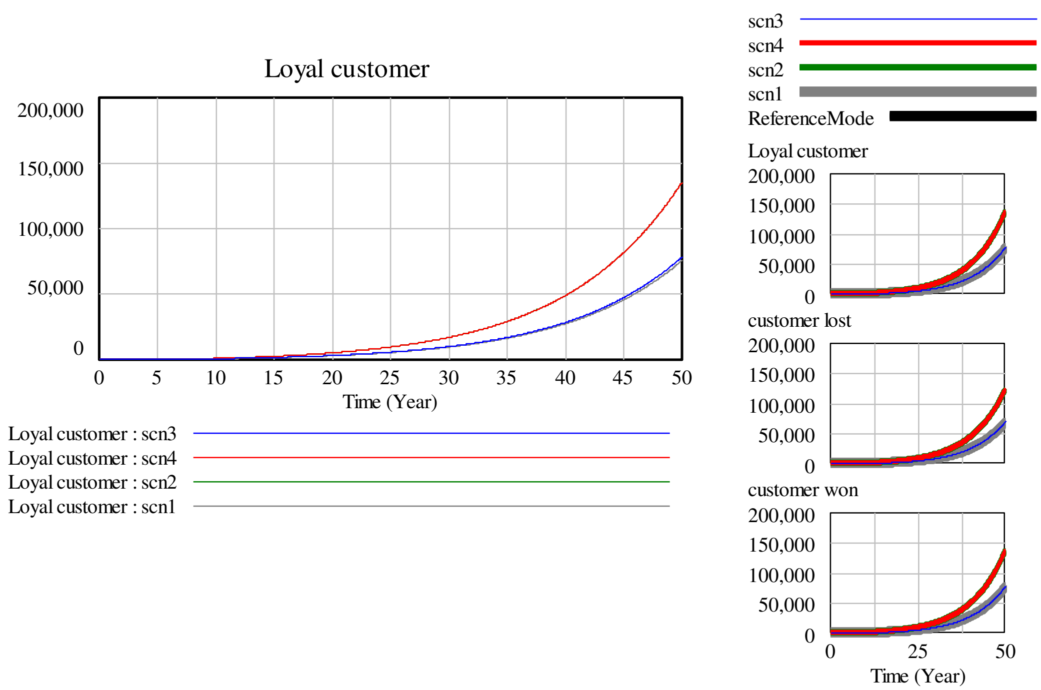

Figure 10. Changes in the role of parameters in each scenario

The graph above shows the impact of loyal customer-related components on world-class production, showing a gradual rise in all four scenarios.

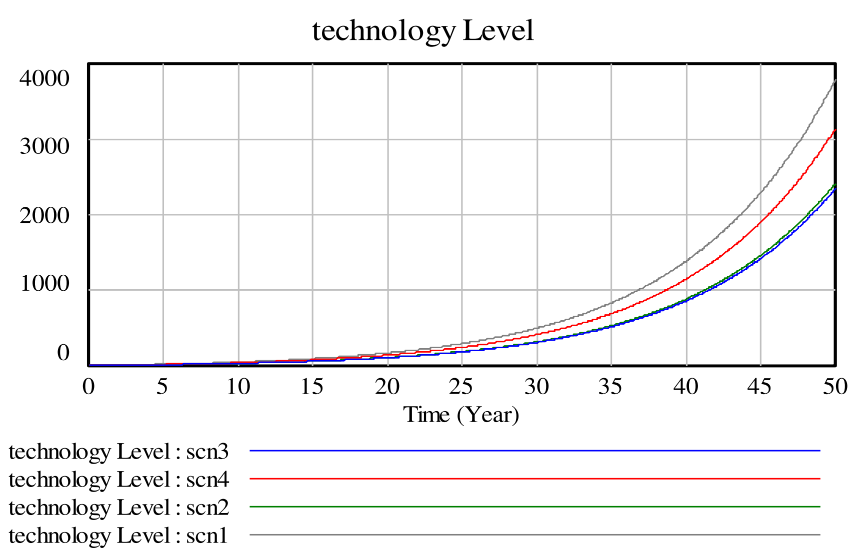

Figure 11. Changing role of parameters and variables in the technology

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The graph above shows the impact of technology-related components on world-class production, which shows a gradual rise in all four scenarios.

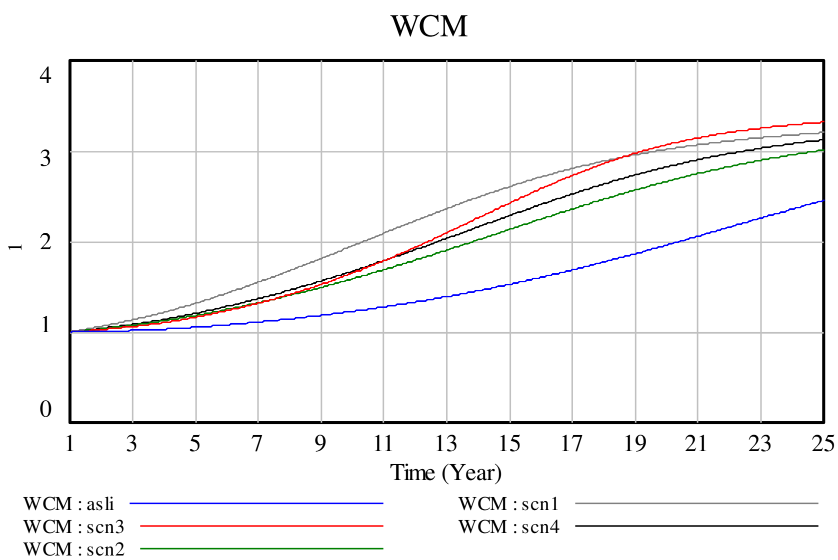

Figure 12. Components Impact on World Class Production

In all four scenarios, world-class production is showing progress, but the role of increasing realization and development in Scenarios 4 and 2 in the upward trend of world-class production is quite tangible.

Conclusion

It is crucial to achieve a dynamic model that can cover all aspects / factors, including internal and external, strategies, goals and policies. Therefore, identifying WCM factors can create a systematic movement that can determine the performance status of WCM, which results from the findings of Baroncel (2016), Nonaka (2014), Saloukdar (2012), Eid (2009) , Naqibi (2016), Nouri and Ali Askari (2003); Safa Qadika (2012) supports; and the background to implementing and institutionalizing a dynamic model is the design of a suitable mental model to incorporate key factors and effective causes. After analyzing these scenarios according to the current situation, R&D policy by providing support for technology upgrade over a long period of time plays an important role in improving system performance. In fact, world-class production is a situation that organizations are striving to achieve. Therefore, moving toward this situation presents the need for expertise and productive mentality and product innovation and diversity as the basis of the dynamic model, and this article discusses this issue.

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