*J. Basic. Appl. Sci. Res.*, 3(2)587-595, 2013
© 2013, TextRoad Publication
ISSN 2090-4304
**Journal of Basic and Applied Scientific Research**
*www.textroad.com*

# Presentation of the Influence of Quality on Industrial Organizations' Agility; an Interpretive – Structural Approach Modeling

**Hessam Zandhessami[1], Akbar Alam Tabriz[2], Somaye Hasanlo[3], Keyvan Poloie[4]**

[1] Assistant Professor, Department of Industrial Management, Qazvin Islamic Azad University (QIAU), Qazvin, Iran
[2] Associate Professor, Department of Industrial Management, SHAHID BEHESHTI UNIVERSITY
[3] Department of Industrial Management, Kar Higher Education Institute, Qazvin, Iran
[4] Department of Industrial Management, Imam Khomeini International University (IKIU), Qazvin, Iran

## ABSTRACT

**Aim:** in a changing and unpredictable environment, survival in a competitive situation is one of the most important factors for organizations. To encounter continues changing, organizations must think beyond the quality of being compatible with the environment. One of the paradigms is agility which lots of organizations seek for it and try to reinforce their qualities through this. Quality has become an essential part of customers' demands and basic elements for competitions among organizations. Those organizations that ignore the quality, and stress on the betterment of agility may confront failure. Therefore in this research we seek for a frame work for organizations in order to determine the important dimensions of quality and main capabilities of agility and also discover the relations among the dimensions and capabilities to achieve agility.

**Methodology:** This research is descriptive – analytical and functional if we consider its aim. Data collection was done by reviewing existed literature, interviews with experts and scholars and questionnaires. Then data were analyzed through interpretive – structural modeling technique and finally the relation and sequence of dimensions and criteria were obtained.

**Findings and conclusions:** After surveying the resources of the study, two dimensions "quality" and "capability" were identified in organizations. To investigating the dimensions of quality, according to experts opinions, we chose Garvin's model with 8 dimensions as the main model, and for qualities of agility four key and main criteria were identified, they are "response", "competence", "flexibility" and "speed". Results show that dimensions "duality", "reliability" and "serviceability" are the bases of the model.

**KEY WORDS:** Agility, Quality, Interpretive – Structural modeling.

## 1 INTRODUCTION

Organizations are dealing with changing situations which lead them to have adaptive strategies. In fact finding the ways for organizations to be successful in unpredictable situations has become a problematic issue in the new business world. Although different solutions such as on time production, reengineering, virtual organizations and networking have been introduced, agility is the most favorite. In such a situation agility has become an important quality which has enormous effects on organizations' functions[24].According to customers' demands agile production can be defined as an ability of responsiveness in an environment that changing and unreliableness are the distinguished characteristic of it. In an unreliable and variable environment agility is one of the important factors for progress and survival[28].

Dictionaries define agile as a fast and active move, and agility as the ability to move quickly and easily [9] And the ability of thinking at once with a smart approach[15]. According to Sharifi and Zhang (1999) agility is the ability of each organization to predict and find the changes in a business environment[27]. Such an organization must identify the changes of the environment and look at them as developmental factors. According to Yusuf agility is the successful adaptation based on competitiveness considering criteria like "speed", "flexibility", "innovation" and "quality" which are achieved by resources integration and existence of appropriate factors in a changing atmosphere. It tries to provide goods according to customers' demands[32]. Despite some differences, all the conventional definition of agility stress on "speed" and "flexibility" as the most essential features that an organization must have[11, 27, 32].

According to the "The Sand Cone Model" which is the expanded model of Ferdows and De Meyer Quality is considered as an important and effective factor in organizations' success and a prerequisite for improvement and development of other aspects of competitiveness [8, 17]. We need to think of improvement and development of agility's quality and capability before achieving to an acceptable level of agility. In other words efforts for betterment the agility must be made towards improvement of quality and capability, and the organizations that concentrate on agility's advancement regardless to quality may encounter failure. Therefore achieving agility in the context of "quality" looks favorable.

***Corresponding Author:** Somaye Hasanlo, Department of Industrial Management, Kar Higher Education Institute, Qazvin, Iran. E-mail: somayehasanlo62@yahoo.com , Tel: +98-912-4721813

According to all said above, and the difference between importance coefficient of agility's functionality and quality, this study tries to evaluate the quality and functionality of agility and estimate the effectiveness of these factors on agility in industrial organizations.

In the second part of this study we reviewed literature and discuss the theoretical basics of agility. The third part is allocated to methodology of the research which explains the type of the research, data gathering and the stages of interpretive-structural modeling approach. And finally findings achieved by ISM approach are presented in the fourth part.

## 2 THEORIES AND REVIEW OF LITERATURE

### 2.1 Organizational agility

From late of 1980's to the mid of 1990's, there have been efforts to recognize the effective factors on global business because of the widespread political and economical changes. The United Sates was the first country for taking action when felt a significant decline in the business world (since it confronted Asia and Europe as new competitors). In 1991 a group of industrial experts observed that the increasing rate of changes is beyond the conventional organization's adaptation ability to changes.

These organizations were unable to benefit from opportunities presented to them and this disability could result in bankruptcy and failure in a long term period of time [5, 14]. Therefore a new paradigm was introduced and published in a report under the title of "strategy for producing organizations in the 21st century; industrial expert' point of views" by Iacocca Institute [19]. Soon after the term "agile manufacturing" was used by public[12].

Experts such as Dove, Gunasekaran, Yusuf, …. believe that the best choice to produce and supply the various products according to changing demands of the customers is agile production[16]. In fact agility is related to organization's ability to remain in a competitive environment with unpredictable changes [4].

Accordingly, in order to have agility we must pay attention to agile qualities. Any organization that wants to be agile must have these qualities. Agile qualities are elements and infrastructures which enable an organization to response to the changes in a competitive environment[2]. Agile capabilities include four keys that are the basics of maintaining agility:

1. **Response:** the ability to recognize the changes, benefit from them and to have a quick reaction towards them.
2. **Competency:** a broad set of abilities which adjust the efficient activities with organizations' aims and targets.
3. **Flexibility:** the ability to have various functions with the use of equal facilities and services.
4. **Speed:** the ability to complete an activity as fast as possible [27, 29].

Therefore if an organization seeks to have agility must regard these qualities and reinforce them.

### 2.2 Quality

In recent years because of the development if industries, variety of customer's demands and growing public knowledge about goods' qualitative utility, "Quality" has been considered as an essential an important issue[13]. If organizations want to remain in the market, they need to provide products with higher quality and lower price. In a situation with the existence of global market and WTO, having higher quality production is the first condition of victory in markets. Quality of something is like a part of its identity. The term "quality" comes from the Latin word "Quails" which means "of what kind". Betterment of quality is the most important issue for an organization to achieve to its goals [18]. There have been different definitions for quality, but we indicate some of the important ones here.

The international standard organization defines Quality as "a set of factors and indices of a product which is related to the ability of providing the demands and needs of that product" [3]. Taguchi introduces quality as "avoidance of loss" [25]. Harington believes that quality is "providing costumers' needs or surpass the needs with equal price to the value" [13]. Feigenbaum defines quality in the book "Total Quality Control" as the combination of marketing, engineering, production and services which determines the level of customers' providing expectations when they use the products[7]. Crosby describes quality as "the accordance with standards, specifications and requirements" [31]. Ishikawa says: "the definition of quality is producing or providing services which is completely economical and usable or can brings about the customers' satisfaction whether in the present or in the future [13].Simply quality is demands, knowledge and expectations of customers and clients [21]or customers' ignorance which must be omitted by productions or service providers.

### 2.3 Dimensions of quality

In 1981 a research was conducted and showed that 68% of American managers think they had improvement in their key products' quality in the recent five years while 25% of their customers didn't agree and thought one of the important reason of this discrepancy is because of the different definitions of quality that customers and producers have. In other words anyone perceives quality from his/her point of view[13]. Maxwell، Evans & Lindsay، David Garvin and Parasuraman define quality from different perspective:

Maxwell described six dimensions of quality - accessibility, equity, appropriateness, effectiveness, efficiency, and social acceptability [19]. Evans & Lindsay (2005) described eight dimensions of quality - time, timeliness, completeness, courtesy, consistency, accessibility and convenience, accuracy, and responsiveness [6].Garvin (1991) identified eight dimensions of quality -Performance, Features, Reliability, Durability, Serviceability, Conformance, Perceived quality and Aesthetics[10]. Parasuraman identified eight dimensions of quality: Tangibles, Reliability, Responsiveness, Assurance and Empathy [22, 26, 30]. Organizations don't need to be best in all the dimensions, any organization should try to have better condition in quality according to the circumstances in which it is. Manufacturers of food products, such as Noram Foods, might focus heavily on conformance, reliability, and aesthetics. In contrast, a diesel engine manufacturer, such as LongXi Machinery Works, could emphasize performance (i.e., power) and features relative.

## 3 RESEARCH METHODOLOGY

This is a descriptive- analytical research and applicable if we consider its targets. We used Persian and Latin resources such as theses and different books to identify dimensions of quality and abilities of agility. Also to determine the relation among the aspects and indices and to present an agile model of industrial organization we used interpretive-structural modeling approach. To achieve the most complete and appropriate model for quality's dimension we wanted 10 managers of industrial organizations, experts and scholars familiar with concept of agility to fill out questionnaires. This research is question oriented and with the use of decision making techniques seeks to answer the research questions. The research questions are:

***Main question***

1. How are the relations between quality's dimensions and agility's capabilities?

***Sub-questions***

1. Which dimension and capabilities have the most and the least effect on industrial organizations agility model?
2. Which dimensions and capabilities have the most and the least driving power in industrial organizations agility model?
3. Which dimensions and capabilities have the least and the most dependency in industrial organizations agility model?
4. By answering these questions and determining the key agility's capabilities and quality's dimensions we can show managers the factors that they have to reinforce and help them to achieve agility.

### 3.1 Descriptive-industrial modeling approach

The descriptive-industrial modeling (ISM) is used by Warfield(1967, 1974) to determine the levels, priorities and identification the relations among the elements of a system. To apply this approach we must pass the stages below[1, 23]:

***First Stage- determination of variables***

***Second stage- obtaining the variables' structural internal relation matrix (SSIM):*** after variables' determination, the mutual relation between variables is determined and showed by symbols as explained below. The obtained matrix is called structural internal relation matrix (SSIM). This is a matrix with dimensions equal with variables which are entered in its row and column accordingly.

- V: variable i will help to achieve variable j;
- A: variable j will help to achieve variable i;
- X: is used to show mutual effect of i and j
- O: variables j and i are unrelated.

***Third stage – obtaining Reachability matrix:*** with the SSIM matrix symbols transformation to zero and one, we can obtain Reachability matrix.

- If the place (j,i) in SSIM matrix is the symbol "V", it will be 1 in access matrix and be zero in its symmetric place (i,j).
- If the place (j,i) in SSIM matrix is the symbol "A", it will be zero in access matrix and be 1 in its symmetric place (i,j).
- If the place (j,i) in SSIM matrix is the symbol "X", it will be 1 in access matrix and be 1 in its symmetric place (i,j).
- If the place (j,i) in SSIM matrix is the symbol "O", it will be zero in access matrix and be zero in its symmetric place (i,j).

***Fourth stage- matrix compatibility (final Reachability matrix)***: after obtaining initial Reachability matrix, their internal consistency should be established. For example if variable A results in variable B, and variable B results in variable C, then variable A must result in variable C, and if this relation isn't applied in the access matrix, the matrix should be modified and the missed relations must be reconsidered. There are several approaches to make a matrix compatible, they are:

***First approach:***if the matrix is not compatible, then experts' opinions should be recollected over and over again to achieve compatibility;

***Second approach:*** in this approach we use mathematical rules to have compatibility by multiplying it by (K + 1) and k≥1.

In this study we use second approach to have matrix compatibility(final Reachability matrix).

***Fifth stage– determining level and priority of variables:*** to determine level and priority of variables, Reachability set and Antecedent set are established. Reachability set of each variable includes variables that can be achieved by that variable, and Antecedent set includes variables that variable in Reachability set can be obtained by. This can be done by Reachability matrix. After determining Reachability and Antecedent set for each variable, the common elements in Reachability and Antecedent set are identified for each variable. Then after determining Antecedent set, Reachability and common elements, we find out the variables' level (factors). The highest leveled variable is the one with equal Reachability set and common elements.

***Sixth stage-drawing the model:*** after determining relations and variables' level we can draw determinations through a model. Therefore, variables are ordered respectively, and then according to the table of values (Reachability and Antecedent set) we identify relations among variables.

***Seven stage- criteria classification according to driving Power and dependence power:*** in this part variables are subcategorized into 4 divisions. First division includes Autonomous Variable which has low driving power and dependency. These variables are not usually connected to the system and have weak relation to it. Second division is dedicated to dependent variables that have weak driving power but strong dependence power. Third division contains Linkage Variable with high driving power and strong dependence power. Fourth division includes independent variables with strong driving power and weak dependence power. They operate as foundation stones and must be emphasized before all to start working on the system.

## 4 FINDINGS

### 4.1 Determining the used variables in the model

According to investigation of research resources, two variables of agile capabilities and dimensions were identified for achieving agility in industrial organizations. As stated by experts and scholars to investigate the dimensions, among different models we chose Garvin's model with 8 dimensions, and for agility's capabilities the recognized dimensions in resources we determined 4 main and key criteria "response", "competency", "flexibility" and "speed" which are presented in the table below[10]:

**Table 1: Effective quality dimensions on agility of industrial organizations**

| Dimension | Definition |
|---|---|
| **Performance** | Deals with the primary purpose of the product or service or how well theproduct or service is achieving its objective. |
| **Features** | Deals with added touches, bells, and whistles or secondary characteristics that the product or service possesses or extra features present in the product or service. |
| **Reliability** | Measures the consistency of performance of the product or service over time |
| **Durability** | Measures the useful life of the product or service. |
| **Serviceability** | Deals with the ease of servicing the product when necessary or resolving conflicts and complaints from customers. Many of the issues here deal with service after sales. |
| **Conformance** | Deals how the product or service satisfies customers' expectations. |
| **Perceived quality** | Is often referred to as reputation since it is the perceived reputation of the product or service based on past performance and other intangibles that may influence its perceived quality. |
| **Aesthetics** | Deals with sensory characteristics and outward appearance of the product or service. Characteristics such as feel, looks, and sounds are important. |

**Table 2: Effective capabilities on agility of industrial organizations**

| Capabilities | Definition |
|---|---|
| **Responsiveness** | The ability to recognize the change in the environment and benefit from it and to react fast |
| **Competency** | An expanded set of abilities which adjust the efficient activities with organizations' aims and targets. |
| **Flexibility** | The ability to have various functions with the use of equal facilities and services. |
| **Speed** | The ability to complete an activity as fast as possible. |

### 4.2 Determination of levels and priority of criteria

The identified dimensions and capabilities are stated in the columns and rows of the table below which handed down to respondents in questionnaires to determine the mutual relation between each two according to the symbols explained in the methodology. The questionnaires were given to 11 experts familiar with concept of agility and 10 of them were completed.

**Table3: The structural matrix of internal relation of variables**

| | Factors | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | Performance | V | A | A | V | A | X | A | A | A | A | A | A | - |
| **2** | Features | V | V | V | V | V | V | A | A | A | X | A | - | - |
| **3** | Reliability | V | V | V | V | V | V | V | O | X | V | - | - | - |
| **4** | Conformance | V | V | V | V | V | V | A | A | A | - | - | - | - |
| **5** | Durability | V | V | V | V | V | V | V | O | - | - | - | - | - |
| **6** | Serviceability | V | V | V | V | V | V | V | - | - | - | - | - | - |
| **7** | Aesthetics | V | V | V | V | V | V | - | - | - | - | - | - | - |
| **8** | Perceived quality | V | A | A | V | A | - | - | - | - | - | - | - | - |
| **9** | Response | V | V | X | V | - | - | - | - | - | - | - | - | - |
| **10** | Competency | V | A | A | - | - | - | - | - | - | - | - | - | - |
| **11** | Flexibility | V | V | - | - | - | - | - | - | - | - | - | - | - |
| **12** | Speed | V | - | - | - | - | - | - | - | - | - | - | - | - |
| **13** | Agility | - | - | - | - | - | - | - | - | - | - | - | - | - |

With transforming the relation symbols of Matrix SSIM to zero and one and based on defined relations the reachability matrix is achieved in the third stage of ISM approach.

**Table 4: Initial reachabity matrix**

| | Factors | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Performance | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2 | Features | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| 3 | Reliability | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 4 | Conformance | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| 5 | Durability | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 6 | Serviceability | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 |
| 7 | Aesthetics | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 8 | Perceived quality | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 9 | Competence | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 10 | Response | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | Flexibility | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 12 | Speed | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 13 | Agility | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

In this study we used mathematical approach to make initial matrix compatible. The result can be seen in table 5. In this table those numbers with sign *, show that they were zero in reachability matrix and they became one after compatibility.

**Table5: The compatible matrix (the final reachablity matrix)**

| | Factors | 13 | 12 | 11 | 10 | 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Performance | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 2 | Features | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| 3 | Reliability | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 4 | Conformance | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| 5 | Durability | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 |
| 6 | Serviceability | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 |
| 7 | Aesthetics | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 |
| 8 | Perceived quality | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 9 | Competence | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 10 | Response | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | Flexibility | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 12 | Speed | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 13 | Agility | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Finally, according to the explanation in previous stage, through 8 tables, we obtained the eight levels of criteria which are presented in table 6. As you can notice “durability”, “reliability” and serviceability” criteria are shown in the lowest level (first level) which play the important rule among thirteen criteria. The criterion “agility” is in the highest level (thirteenth level).

**Table 3: Determination of level and priorities of variables**

| | Factors | Reachability set | Antecedent set | Common set | level |
|---|---|---|---|---|---|
| 1 | Performance | 1,8,10,13 | 1,2,3,4,5,6,7,8,9,11,12 | 1,8 | 3 |
| 2 | Features | 1,2,4,8,9,10,11,12,13 | 2,3,4,5,6,7 | 2,4 | 6 |
| 3 | Reliability | 1,2,3,4,5,6,7,8,9,10,11,12,13 | 3,5 | 3,5 | 8 |
| 4 | Conformance | 1,2,4,8,9,10,11,12,13 | 2,3,4,5,6,7 | 2,4 | 6 |
| 5 | Durability | 1,2,3,4,5,6,7,8,9,10,11,12,13 | 3,5 | 3,5 | 8 |
| 6 | Serviceability | 1,2,4,6,7,8,9,10,11,12,13 | 6 | 6 | 8 |
| 7 | Aesthetics | 1,2,4,7,8,9,10,11,12,13 | 3,5,6,7 | 7 | 7 |
| 8 | Perceived quality | 1,8,10,13 | 1,2,3,4,5,6,7,8,9,11,12 | 1,8 | 3 |
| 9 | Competence | 1,8,9,10,11,12,13 | 2,3,4,5,6,7,9,11 | 9,11 | 5 |
| 10 | Response | 10,13 | 1,2,3,4,5,6,7,8,9,10,11,12 | 10 | 2 |
| 11 | Flexibility | 1,8,9,10,11,12,13 | 2,3,4,5,6,7,9,11 | 9,11 | 5 |
| 12 | Speed | 1,8,10,12,13 | 2,3,4,5,6,7,9,11,12 | 12 | 12 |
| 13 | Agility | 13 | 1,2,3,4,5,6,7,8,9,10,11,12,13 | 13 | 1 |

After determination the relation and level of variables, the model can be drawn. To do so we first regulated the variables according to their levels, and then based on the specified numbers in table of determination level (reachability set and antecedent set) we determine the relations between variables.

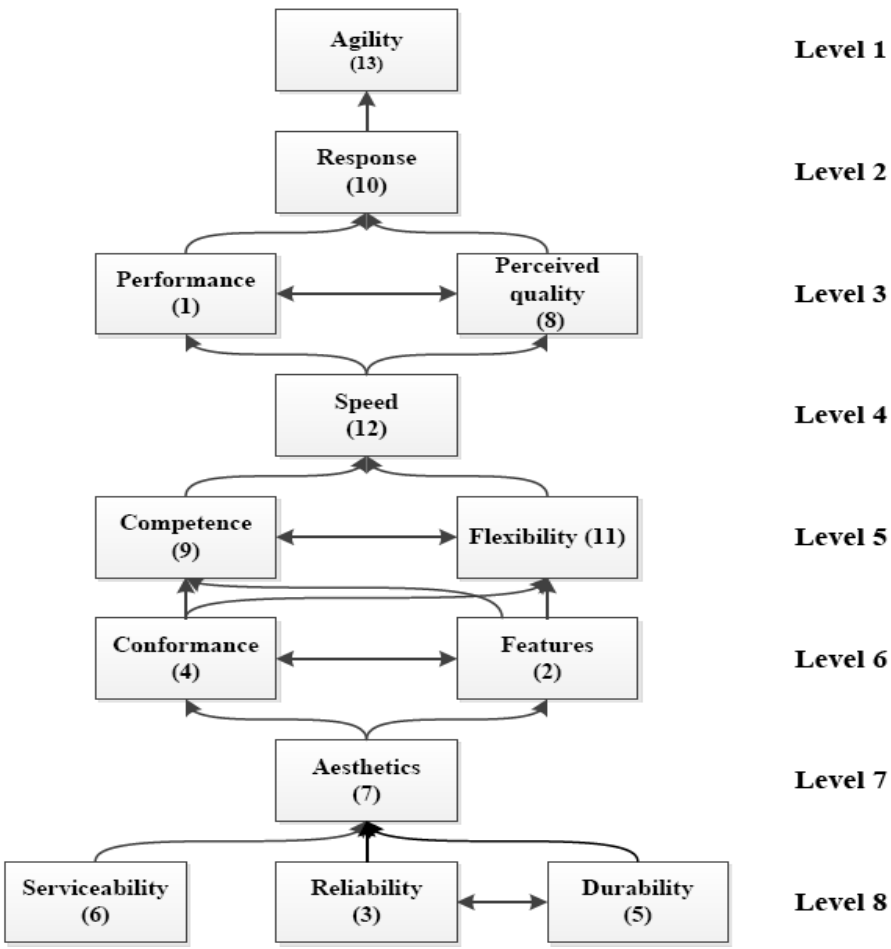


**Figure 1: Relation among quality's dimensions and agility's capabilities**

In figure 1, the relations among quality's dimensions and agility's capabilities are presented. This figure is the result of information of table 6. This model provides us with a better understanding of the table above. The perceived information of figure 1 consists of sequence and priority of criteria, their level and the relations among them and their influence on each other.

### 4.3 Classification of criteria according to driving power and dependence power

According to table 7, criteria can be shown in four areas based on driving power and dependence power. None of the criteria are in first group (independence variables) which means none of the variables are independent and all of them are related to each other.

**Table 4: The degree of driving power and dependence power of variables**

| variables | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Driving power | 4 | 9 | 12 | 9 | 12 | 11 | 10 | 4 | 7 | 2 | 7 | 5 | 1 |
| Dependence power | 11 | 6 | 2 | 6 | 2 | 1 | 4 | 10 | 8 | 12 | 8 | 9 | 13 |

"Performance" (1), "perceived quality" (8), "speed" (12), "response" (10) and "agility" (13) are in the second group (dependent variables). These variables have high dependent and low driving power that means they are influenced more. As you can see in the figure, these variables are in the highest level. The variables "competence" (9) and "flexibility" (11) are in the third group (connected variables). These variables are the most affected variables by other and have the most effect on other as well. As you can notice they are in the middle part of the figure. The fourth group of variables is stimulus variables "reliability" (3), "duality"(5), "serviceability" (6), "aesthetics" (7), "features" (2) and ""conformance". These variables influence other variables.

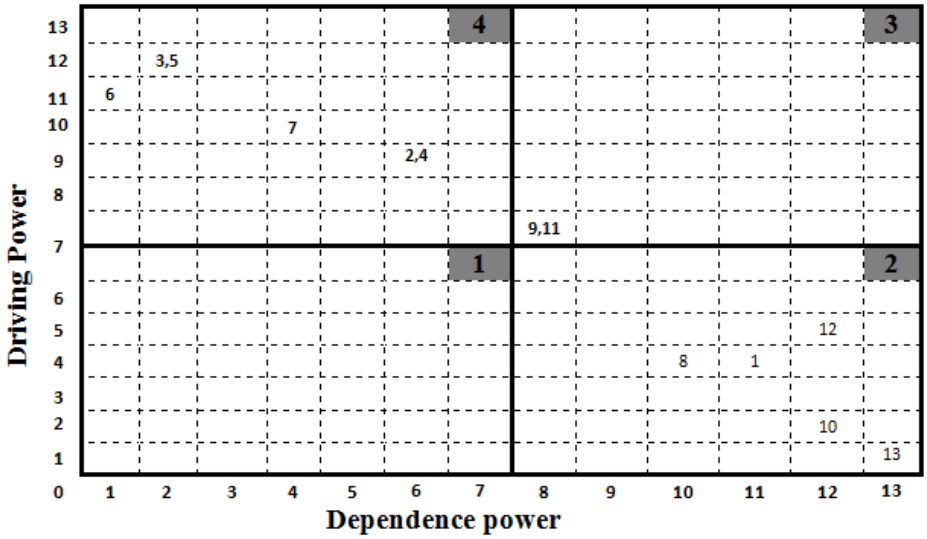


**Figure 2: The model for driving power and dependence power**

## 5 CONCLUSION AND DISCUSSION

Agility has been considered as a dominant paradigm for business in the third millennium. Lots of organizations regard agility as the only way for survival. As a result lots of efforts have been made to achieve agility in a proper and desired level. However some efforts lead organizations to confront failure because of the ignorance of the production's quality. On the other hand paying attention to agility's capabilities is so important in order to obtain agility. Any organization that wants to be agile and have a stable situation must attain agility in a proper level. Therefore organizations and industries that ignore "Quality" and "Capability" of agility may accost malfunction.

To acquire agility we must have the specific capability of it. One of the best ways to reinforce the capability is moving in the context of quality, as a result this research was conducted with the aim of finding how each main dimension of quality is related to main capability of it in industrial organizations. This study seeks to find out the most and least effective dimensions and capabilities in the agile model of industrial organizations, and to attain the dimensions and capabilities with highest and lowest driving and dependence power.

According to previous studies in the area of quality's dimensions and experts' opinions we chose Garvin's model among other which includes 8 criteria such as "performance" (1), "features" (2), "reliability"(3), "conformance"(4),"duality"(5), "serviceability" (6), "aesthetics" (7), "perceived quality" (8), and 4 criteria for agility's capabilities as "response" (1), "competence" (2), "flexibility" (3) and "speed" (4). Organizations must regard these 8 dimensions of quality and 4 capabilities of agility and move towards their reinforcement.

This framework helps managers to have proper reactions against unpredicted changes and benefit from them. They must identify the factors that help them to response to sudden changes. Therefore ISM technique was used to obtain the relation and sequence of the dimensions and capabilities to achieve agility. The results show that among the dimensions of quality, three criteria "reliability"(3), "duality"(5), "serviceability"(6) and among the capabilities of agility "competence" (9) and "flexibility" (11) are the bases of agility's achievement. This means that organizations should concentrate on these dimensions and capabilities first which will result in gaining agility in higher levels.

As it was said before the criteria “reliability” (3), “duality” (5) and “serviceability” are the most important criteria for achieving agility. These criteria are in the lowest level and affect the criterion “aesthetics” (7). The other two criteria in this level “reliability” (2) and “duality” (4) have mutual effects, they also influence on the sixth level criteria “features” (2) and “conformance” (4). These two last criteria have mutual effects as well and influence the fifth level criteria “competence” (9) and “flexibility” (11) which has mutual effects too. The criteria of fifth level have influence on criterion in fourth level “speed” (12). This criterion affects the criteria in the third level “perceived quality” (10) and “performance” (1) which have mutual effects as well. The third level criteria effect the second level criterion “response” (10). Finally all the criteria influence agility in the first level.

According to reachability and antecedent sets that were determined for each variable we can conclude that in classification of criteria based on driving and dependence power, variables can be sub categorized into four groups. In this study none of the criteria are in the group of independent variables. The second group is specified to dependent variables which have low driving power but strong dependence power. The criteria “performance” (1), “perceived quality” (8), “speed” (12), “response” (10) and “agility” (13) are in this group. The criteria “competence” (9) and “flexibility” (11) are in the third group named as connected variables. This group’s criteria have strong driving and dependence power. The fourth group’s criteria which are the bases of the model are “reliability”(3), “duality”(5), “serviceability” (5), “aesthetics” (7), “features”(2) and “conformance” (4).

In the diagram of driving and dependence powers none of the variables were in the first group which means all the variables are dependent and effective on agility. The variables “features” (2), “conformance” (4), “aesthetics” (7), “duality” (5), “reliability” (3) and “serviceability” (6) are in the fourth groups which are the stimulus variables of this research. These variables are known as the most important factors in obtaining agility. In other words to achieve agility we must reinforce these variables first. Among the variables “duality” (5), “reliability” (3) and “serviceability” (6) have the most stimulus power. The variables “performance” (1), “perceived quality” (8), “response” (10), “speed” (12) and “agility” (13) are in the second group and known as connected variables. Among variables agility has been introduced as the aim of the model which all the other variables end with it. And finally criteria “competence” (9) and “conformance” (11) are known as the variables of third group which are the connector between stimulus and connected variables.

The results of this research can be used by managers who work in a dynamic and changing environment and seek to make their organizations agile. In this research we must consider several issues:

According to organization and environment, the first issue that must be regarded is paying attention to the selected factors. In different environments and circumstances, the importance of factors is different too. Therefore a manager must notice the specific circumstances which exist in the working environment of him/hers.

The second issue is related to factors’ levels. The obtained levels by ISM technique represent the sequence of factors considering their performance. The result show that to have agility we must first stress on criteria “duality”, “reliability” and “serviceability” among dimensions of quality and “flexibility” and “competence” among capabilities of agility.

The third point considers the relations among criteria. As you witnessed none of the factors are extra, they all influence each other, and therefore any ignorance of any criterion may lead us to a false conclusion.

In this research we reviewed literature to identify the factors while factor analysis could be used too. This research can be used for different industries with the expansion of research population. Also the obtained model can be tested with path analysis to evaluate the creditability of the model.

**Acknowledgements:**

The authors would like to thank the Qazvin Islamic Azad University (QIAU) and Kar Higher Education Institute for financial supports.

## REFERENCES

1. Azar A., Tizroo A., Moghbel Baarz A., Anvary Rostamy A.; (2011), Modeling the agility of supply chain using interpretive structural modeling approach; Quarterly journal modares human sciences management research in Iran, vol. 14, No. 4, 1-26.
2. Bottani, E. (2009). A Fazzy QFD Approach To Achieve Agility. International journal of Production Economics.119(2), 380-391
3. David Hoyle,(2009),"ISO 9000 Quality Systems Handbook",completely revised in response to ISO 9000:2000.
4. Dove, R. (2001) Response Ability: the Language, Structure, and Culture of the Agile Enterprise. Wiley. New York.
5. Dove, R. (1994), the meaning of life andthe meaning of agile. Prod Mag., 106(11), pp. 14– 5.
6. Evans, J. R. & Lindsay, W. M (2005), The Management and Control of Quality, 6th edn, Cincinnati, South-Western Ohio.

7. Feigenbaum, A.V.,(1986) “Total quality control”, 3nd ed, Singapore: MC Graw-hill, pp.7,22-23, 59-61, 11-114.
8. Ferdows, K; De Meyer, A (1991): Lasting improvements in manufacturing performance: in search of a new theory, Journal of Operations Management, Vol. 9 No. 2, pp. 168-186.
9. Ganguly A. Nilchiani R. , Farr J. (2009)- Evaluating agility in corporateenterprises-Int. J. Production Economics 118 (2009) 410–423
10. Garvin, D. (1991), Competing on the eight dimensions of quality, Unconditional Quality,Harvard Business Review, Cambridge,MA.
11. Gunasekaran. A., (1999)“ ,Agile manufacturing: a framework for research anddevelopment ,”International Journal of Production Economics ,62pp. 87–.105
12. Gunasekaran A., Mcgaughey R.E.; (2001), TQM is supply chain management; The TQM magazine, Vol.15, No.6, pp.: 523-533.
13. Hasanlo .S., (2012), A framework for measuring agility in supply chain in Iranian mass construction industry, The thesis presented of the degree of Master of Science in management (production). Kar higher education institute.
14. Hormozi, A.M (2001): Agile manufacturing: the next logical step, Benchmarking an international journal, 8(2), 2001, 132- 143.
15. Hornby A.S.(2000): Oxford Advanced Learner’s Dictionary of Current English, Sixth edition, Oxford University Press.
16. Jafarnejad A., Shahaie B. (2008). Evaluating and improving organizational Agility: definition, critique and new conceptual framework, accepted paper for presentation in international conference on management of transformation, Delhi, India.
17. Jafarnejad A., Shahaie B. (2007). Providing An integrated model for agility evaluation, implementation and enhancement in modern organization, Annual conference of international academy of business and economics, Nevada, Lasvegas, America.
18. Kossmann, Mario,(2006), "Delivering excellent service quality inaviation", Published by Ashgate Publishing Limited.
19. Maxwell, R J 1992, ‘Dimensions of quality revisited: from thought to action’, Quality in Health Care, vol.1, no.3, pp. 171–177.
20. Nagel, R. Dove, R. (1991). 21 st Century Manufacturing Strategy: An industry- Led view, Coolingdale, Pa: Dlane Publishing Company.
21. Nephawe, Rendani,(2008), "The importance of employeeinvolvement in Total Quality Management in South Africancompanies, "University of Johannesburg.
22. Parasuraman A., Zeithaml V. A, Berry L. L. (1993), “research note: more on improving servicequality management”, Journal of Retailing, Vol.69 No.1.
23. Poloie K., Fazli S., Alvandi M., Hasanlo S. (2012). A framework for measuring the supply chain's agility of mass construction industry in Iran, Management Science Letters 2 , pp 2317–2334
24. Ravichandran T. (June 15, 2007) -IT Competencies, Innovation Capacityand Organizational Agility: Performance Impact and the Moderating Effectsof Environmental Characteristics- Lally School of Management &Technology Rensselaer Polytechnic Institute-Submitted to CIST, INFORMS
25. Reeves, C.A., AND Bednar, D.A.(1994),”Defining quality: Alternatives and Implications” Academy of management Review, vo1.19,NO,3 PP.410-445.
26. Shahin, A. (2006), "SERVQUAL and model of service quality gaps: A framework for determining and prioritizing critical factors in delivering quality services", In Partha Sarathy, V. (ed), Service quality – An introduction, Andhra Pradesh: ICFAI University Press, pp. 117-131.
27. Sharifi. H; Zhang, Z (1999): A methodology for achieving agility inmanufacturing organizations: an introduction. International Journal ofProduction Economics. 62 (1999), 7-22.
28. Sterling J. (2008)- Organizational Agility-The Association for Laboratory Automationdoi: 10.1016/j.jala.2008.09.002
29. Trong Lin, C., Chiu H., Tseng, Y. H (2005): Agility evaluation using fuzzy logic, International Journal of productionEconomics, pp. 1-16.
30. Van Iwaarden, J., van der Wiele, T., Ball, L., and Millen, R. (2003), "Applying SERVQUAL to websites: An exploratory study", International Journal of Quality & Reliability Management , Vol.20, No.8, pp. 919-935.
31. Wilkinson Adrian & tom Redman & ed snape and mickmarchington,(1998),"managing with total quality management",macmillan business.
32. Yussuf,.Y; Sarhadi, M; Gunasekaran, A (1999): Agile manufacturing: Thedrivers, concepts and attributes. International Journal of ProductionEconomics, 62, 33–43