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Nejatian, M., Zarei, M. H., Nejati, M. & Zanjirchi, S. M.

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A Hybrid Approach to Achieve Organizational Agility: An Empirical Study of A Food Company

Majid Nejatian
PhD candidate, Faculty of Management and Economics, Tarbiat Modares University (TMU), Tehran, Iran
majid.nejatian@modares.ac.ir

Mohammad Hossein Zarei [a & b *]
(Corresponding author)*
Double-PhD candidate
a) Department of Management, Economics and Industrial Engineering, Politecnico di Milano, Via Raffaele Lambruschini, 4/B, 20156 Milan, Italy
b) Department of Organization Engineering, Business Administration and Statistics, Escuela Técnica Superior de Ingenieros Industriales, Universidad Politécnica de Madrid, C/Jose´ Gutie´rrez Abascal, 2, 28006 Madrid, Spain
mohammadhossein.zarei@polimi.it
mh.zarei@upm.es

Mehran Nejati
Senior Lecturer
School of Business and Law, Edith Cowan University, Joondalup, Australia
m.nejati@ecu.edu.au

Seyed Mahmood Zanjirchi
Associate Professor, Department of Economics, Management and Accounting, Yazd University, Yazd, Iran
zanjirchi@yazd.ac.ir

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A Hybrid Approach to Achieve Organizational Agility: An Empirical Study of A Food Company

Structured Abstract:

Purpose: *In today's intense global competition, agility is advocated as the fundamental characteristic for business survival and competitiveness. This research proposes a practical methodology to achieve and enhance organizational agility based on strategic objectives.*

Design/methodology/approach: *In the first step, a set of key performance indicators (KPIs) of the organization were recognized and classified under the perspectives of balanced scorecard (BSC). Critical success factors (CSFs) were then identified by ranking the KPIs according to their importance in achieving organizational strategic objectives using the technique for order of preference by similarity to ideal solution (TOPSIS). In the second step, three houses of quality (HOQs) were constructed sequentially to identify and rank the main agile attributes, agile enablers, and improvement paths. In addition, in order to translate linguistics judgments of practitioners into numerical values in building HOQs, fuzzy logic was employed.*

Findings: *The capability of the proposed methodology was demonstrated by conducting a case study in a multi-national food company in Iran. Through the application, the company could find the most suitable improvement paths to improve its organizational agility.*

Research limitations/implications: *A limited number of KPIs were chosen due to computational and visual constraints related to HOQs. Another limitation, similar to other agility studies which facilitate decision making among agility metrics, was that the metrics were more industry-specific and less inclusive.*

Practical implications: *A strong practical advantage for the application of the methodology over directly choosing agility metrics without linking them is that through the methodology the right metrics that match organization's core values and marketing objectives were selected. While metrics may ostensibly seem unrelated or inappropriate, they actually contributed to the right areas which there were gaps between the current* *and desired level of agility. It would otherwise be impossible to choose the right metrics without a structured methodology.*

Originality/value: *This paper proposes a novel methodology for achieving organizational agility. By utilizing and linking several tools such as BSC, fuzzy TOPSIS, and quality function deployment (QFD), the proposed approach of the current study enables organizations to identify the most appropriate agile attributes, agile enablers, and subsequently agile improvement paths.*

Keywords: *Organizational Agility; Enterprise Agility; Agile Organization; Balanced Scorecard; Quality Function Deployment; House of Quality; Multiple Criteria Decision Making; Fuzzy Logic; TOPSIS.*

1. Introduction

Uncertainty and change has always been a significant issue in the rapidly changing business environment (Zhang & Sharifi, 2000). The beginning of the twenty first century was coincided with increasing customers' dynamic demands and deterioration of economic circumstance in many countries which has changed the marketplace into "battlefield" (Yusuf, Sarhadi, & Gunasekaran, 1999). Since then, the terms "business turbulence" and "change" have been considered as the main causes of failure in many industries (Small & Downey, 1996), even among the giants. This fact acutely forced enterprises to efficiently respond to the market changes in a quicker and more flexible way.

In the beginning of the 1990s, a new solution for managing dynamic and constantly changing environments emerged by the experts of Iacocca Institute of Lehigh University (USA), called agility (Sherehiy, Karwowski, & Layer, 2007). Ever since its inception, agility has become a prevailing topic and received increasing attention from both industry and academia. Various definitions of agility have been presented by different scholars; all of which share the same trait: "the ability of an enterprise to survive and prosper in a competitive and unpredictable environment by responding quickly and effectively to any kind of change - anticipated or unpredicted - in proper ways and due time (Gunasekaran, 1999; Brown & Bessant, 2003; Sharifi & Zhang, Agile manufacturing in practice: application of a methodology, 2001). It aims at satisfying customers' various demands in terms of price, quality, quantity, specification, and delivery (Prince & Kay, 2003). Although in the beginning it solely referred to the manufacturing context, today the paradigm is expanded to different types of organizations in various industries (Christopher, 2000). Different terms are used in the literature to refer to agility at organizational level: enterprise agility (Yang & Liu, 2012), business agility (Morgan, 2004), and organizational agility (Nejatian & Zarei, 2013). Despite some minor differences, they can be interchangeably used. In this paper, the term "organizational agility" is used throughout the paper.

Previous literature has shown that organizational agility is tightly linked with the success of organizations. It empowers organizations with producing and delivering innovative products and services in a cost-efficient way (Swafford, Ghosh, & Murthy, 2006), increased customer satisfaction, increased competitiveness, eliminating non-value added activities, and decreasing manufacturing costs (Lin, Chiu, & Chu, 2006), enhancing organizational excellence (Nafei, 2016 b), and organizational performance (Kuleelung & Ussahawanitchakit, 2015; Nafei, 2016 a).

However, agility is not a solid goal to be gained and then forgotten; rather, it is the means to maintain competitiveness in unpredictable, dynamic, and constantly changing markets (Jackson & Johansson, 2003) and deliver the right products at the right time to the customers (Agarwal, Shankar, & Tiwari, 2006; Lin, Chiu, & Chu, 2006; Yusuf, Sarhadi, & Gunasekaran, 1999). Hence, there is need for methodologies that continuously measure the gap between current and desired level of organizational agility along with the changes in the organizational environment. However, the literature of agility scants such studies. This paper tries to fill the void by proposing a methodology and its application for improving organizational agility. The methodology considers organization's strategy and core competencies and highlights the specific areas of focus that results in higher organizational agility. As such, the main objective of this study is to propose a structured methodology that improves organizational agility. The methodology is aimed to select the agility metrics (i.e. KPIs, agile attributes, agile enablers, and improvement paths) that are in line with organizational strategic goals and lead to increased market competitiveness. Moreover, since previous methodological studies in the area of organizational agility scant practical applications, another objective of this research is to show a full empirical implementation of the proposed methodology in a competitive market.

The remainder of the paper is organized as the following. In section 2, a review of the prior studies on agility is provided, with a specific concentration on agile attributes, agile enablers, and methodologies to achieve agility. Section 3 explains the proposed methodology of the current study. Next, an empirical investigation is conducted to demonstrate the application of the proposed methodology and the findings in section 4. Discussions of the findings, the limitations of the study, and some future research directions are provided in section 5. Finally, section 6 rounds up and concludes the paper.

2. Literature review

This section reviews the literature of organizational agility with the focus on methodological studies. Since most of these studies, as well as our paper, use specific agility metrics such as agile attributes and agile enablers, we first elucidate these metrics and briefly review the literature around them. Then, we review and compare the main methodological papers about organizational agility.

2.1 Agile attributes

Agile organizations are characterized by "agile attributes", also known as "agility capabilities", which provide enterprises the potency to promptly respond to the market changes (Ren, Yusuf, & Burns, 2003; Bottani, 2010; Tallon & Pinsonneault, 2011). Agile attributes are essential capabilities that a company has to develop within its structure in order to effectively cope with the changes or pressures from the business environment that lead companies to embrace the agile paradigm (called agility drivers) (Sharifi & Zhang, 2001).

During the past years, researchers have found that the core concept of agile attributes, which had been solely referred to manufacturing, has to be extended to the entire supply chain as it is impossible to achieve agile manufacturing while the rest of the supply chain operate on a normal speed (Christopher, 2000; Van Hoek, Harrison, & Christopher, 2001; Ren, Yusuf, & Burns, 2001; Sherehiy, Karwowski, & Layer, 2007; Nejatian & Zarei, 2013). This calls for engaging all the organizations within the supply chain, either manufacturing or not, to move towards organizational agility. Various agile attributes have been presented in the literature. Kidd (1994) suggested that agility can be achieved through the following capabilities: “integration of organization, highly skilled and knowledgeable people, and advanced technologies”. In a similar view, Goldman et al. (1995) and Gunasekaran (1998) have introduced four main dimensions of agility as “enriching the customer, co-operation, organizing to master change and uncertainty, and leveraging the impact of people and information”. Ren et al. (2001) and Christopher and Towill (2001) expressed that agile attributes encompass the integration of information systems or technologies, people, business processes, and facilities. Dove (1996) and Swafford et al. (2006) proposed the term “flexibility” as one of the main foundations of agility. Yusuf et al. (1999) stated that the development of a strategic architecture which presents a corporate wide map of core skills enables organization to make rapid changes and afford reconfiguration of the business when an opportunity emerges. Mohanty and Deshmukh (2001) proposed various attributes of agility ranging from rapid response to enquiry and customer service to image and quality. Yusuf et al. (1999) proposed a comprehensive taxonomy of agile attributes based on their review of literature comprising 32 attributes characterizing an agile enterprise, stretching from “concurrent execution of activities”, up to “employees’ satisfaction” all of which classified under 10 decision domains. We have used their taxonomy in our methodology due to its completeness and inclusion of decision domains. The taxonomy is shown in Table 1.

Table 1: List of agile attributes and in decision domains (Yusuf, Sarhadi, & Gunasekaran, 1999)

Decision Domain	**Related Agile Attributes**
Integration	1. Concurrent execution of activities 2. Enterprise integration 3. Information accessible to employees
Competence	4. Multi-venturing capabilities 5. Developed business practice difficult to copy
Team building	6. Empowered individuals working in teams 7. Cross functional teams 8. Teams across company borders 9. Decentralized decision making
Technology	10. Technology awareness 11. Leadership in the use of current technology 12. Skill and knowledge enhancing technologies 13. Flexible production technology

Quality	14. Quality over product life 15. Products with substantial value-addition 16. First-time right design 17. Short development cycle times
Change	18. Continuous improvement 19. Culture of change
Partnership	20. Rapid partnership formation 21. Strategic relationship with customers 22. Close relationship with suppliers 23. Trust-based relationship with customers/suppliers
Market	24. New product introduction 25. Customer-driven innovations 26. Customer satisfaction 27. Response to changing market requirements
Education	28. Learning organization 29. Multi-skilled and flexible people 30. Workforce skill upgrade 31. Continuous training and development
Welfare	32. Employees' satisfaction

It has been suggested by Ren et al. (2003) that different agile attributes would steer to different levels of competitive bases, also referred to as competitive or competing priorities. According to Yusuf et al. (1999) competitive bases which companies typically compete along include responsiveness, new product introduction, delivery, flexibility, quality, concern for the environment, and international competitiveness. The relative importance of each competitive base in achieving competitive advantage depends on the specific market field (Bottani, 2009a). Moreover, due to trade-offs between competitive bases, it has been ascertained that companies cannot excel in all of them simultaneously (Burgess, Gules, Gupla, & Tekin, 1998). Therefore, agile attributes may alter depending on the competitive bases the enterprises are aspiring to surpass in (Ren, Yusuf, & Burns, 2003).

2.2 Agile enablers

In order to best achieve agile attributes, companies should utilize appropriate leverages, referred to as "agile enablers" (Lin, Chiu, & Chu, 2006; Bottani, 2009a; Bottani, 2010). Gehani (1995) identified six key actions necessary to implement an agile strategy viz. "cross-functional team sharing, empowerment for front-line decision making, modular integration of available technologies, delayed design specification, product succession planning, and enterprise-wide integration of learning". The adoption of cross-functional teams and concurrent engineering practices as the substantial means for achieving time compression was also supported by Kumar and Motwani (1995).

Later, seminal studies of Gunasekaran (1998; 1999) comprehensively defined and identified main agile enablers in the agile manufacturing context viz. "virtual enterprise formation tools/metrics, physically distributed teams and manufacturing, rapid partnership formation tools/metrics, concurrent engineering, integrated product/production/business information system, rapid prototyping tools, and electronic Commerce". The taxonomy was extracted from the work of earlier researchers [e.g., (Cho, Jung, & Kim, 1996), (Gehani, 1995), (Burgess, 1994)]. It is still being used as the basis for many current agility studies due to its comprehensiveness and validity.

2.3 Agility methodologies

One of the first integrated proposed frameworks to achieve agility has been offered by Gunasekaran, (1998) which illustrates how the main capabilities of agile manufacturing such as "co-operation", "value-based pricing strategies", "investments in people and information", and "organizational changes" should be supported and integrated with appropriate agile enablers to develop an adaptable organization. Gunasekaran's study (1998) illustrates the impact of agile enablers on agile attributes and how it can help to become more agile. Yet, the model was mainly conceptual and could not fully provide a practical basis for companies to achieve agility. Later, two other seminal studies of Zhang and Sharifi, (2000), and Sharifi et al., (2001) contributed to the evolution of agility literature. They developed a three-step approach to implement agility in manufacturing organizations which links "agility drivers" to four overriding agile capabilities (also known as agile attributes). In the final step, a set of viable tools, labeled as "agile providers", are described which guarantees the achievement of capabilities.

Some methodological studies in the context of agility investigate the impact of agility on organizational performance. Jackson and Johansson (2003) proposed a three-step model for analyzing the agility of production systems. It started by assessing the degree of market turbulence to determine the relevance of agility in a specific context. Then, by concentrating on the potentials to enhance flexibility and change, the strategic view of the company was examined in order to achieve competitive advantage. Finally, agile attributes required for future were identified. The aim of their model was to evaluate organizational performance against four main agile attributes: “product-related change capabilities”, “change competency”, “co-operation”, and “people” to identify the required improvements. The studies of Dowlatshahi and Cao (2005; 2006) explored the impact of alignment between two agile enablers, namely virtual enterprise and information technology (IT) on the business performance of agile manufacturing in different industries. In the same vein, Vàsquez-Bustelo et al., (2007) provided empirical support for the linkage between agility and business performance and showed that agility can become a critical success factor (CSF) in different industrial fields in Spain. Another stream of methodological studies proposes agility measurement models and then tests it through in-field applications or case studies (e.g. (Lin, Chiu, & Chu, 2006; Ren, Yusuf, & Burns, 2009; Bottani, 2009a)).

Another stream of agility literature is devoted to deductive approaches and methodologies based on empirics. Zhang and Sharifi (2007) provided a taxonomy of agility strategies based on an empirical study in the UK. They categorized the companies into three clusters, namely quick, responsive, and proactive players, and investigated the main characteristics of each cluster based on the typical agility drivers and attributes. Another in-field analysis of agility was performed by Bottani (2009b) which studied two case studies related to agile manufacturing and assessed the current agility level of the studied companies. Later, she conducted another empirical study (Bottani, 2010) to investigate the profile of agile companies and the enablers practically adopted by them for achieving agility. The findings offered a detailed description of the agile paradigm and suggested new taxonomies for agile attributes and enablers. More recently, a stream of literature has expanded agility to supply chain field [e.g. (Gligor, Esmark, & Holcomb, 2015) (Fayezi, Zutshi, & O'Loughlin, 2015) (Kisperska-Moron & Swierczek, 2009)]. For example, in a relevant study to ours, Kisperska-Moron and Swierczek (2009) explored the main agile attributes of supply chain in Polish companies. Table 2 summarizes main agility methodologies and conceptual studies in the pertinent literature.

Table 2: Main conceptual and methodological studies in the agility literature

	Objective	Applicability of the Methodology	Methods and Techniques	Main Identified Agility Metrics	Findings from the Application (if any)
Gunasekaran, (1998)	Proposing a conceptual framework for agile manufacturing and defining key agile enablers	Manufacturing	Business process redesign, legal issues, concurrent engineering, computer integrated manufacturing, cost management, total quality management, and information technology	Key agile enablers namely virtual enterprise, formation tools/metrics, physically distributed manufacturing architecture and teams, rapid partnership formation tools/metrics, concurrent engineering, integrated product/production/business information system, rapid prototyping tools, and electronic commerce.	Conceptual paper – no application
Zhang and Sharifi, (2000)	Proposing a methodology for enhancing agility based on a conceptual agility model	Manufacturing	Data-driven	A set of agility capabilities categorized under responsiveness, competency, flexibility, and speed as well as agility providers and agility drivers	Validation of the proposed methodology by industrial questionnaire surveys and case studies
Lin et al., (2006)	Proposing an agility model for measuring and enhancing supply chain agility	Supply chain	Fuzzy logic and MCDM	Supply chain agility attributes categorized under collaborative relationships, process integration, information integration, and customer/marketing sensitivity	Validation of the proposed model, providing a holistic picture of supply chain agility, identifying supply

					chain weaknesses, facilitating quality improvement in the supply chain
Sherehiy et al., (2007)	Conceptual review of agile manufacturing and agile workforce to extend to organizational agility	Organizational level at all domains	Extensive literature review	Key organizational agile attributes namely flexibility, responsiveness, speed, culture of change, integration and low complexity, high quality and customized products, and mobilization of core competencies	Conceptual review – no application
Bottani (2009a)	Proposing a practical integrated methodology for enhancing agility which links competitive bases, agile attributes, and agile enablers	Organizational level at all domains	QFD, HOQ, and fuzzy logic	Competitive bases, agile attributes, and agile enablers	No real application is provided. An illustrative example using the data from the literature is given to show the applicability of the methodology.
Current Paper	Proposing and applying a practical integrated methodology for enhancing agility which links competitive bases, agile attributes, agile enablers, and improvement paths	Organizational level at all domains	QFD, HOQ, fuzzy logic, TOPSIS, and BSC	Competitive bases, agile attributes, agile enablers, and improvement paths	Full application of the proposed methodology to a multi-national company in a competitive food market

One of the recent seminal agility methodologies has been proposed by Bottani (2009a). According to the review of literature by that study, most of the previous methodological studies about agility share a general structure:

1) Recognizing competitive bases by which organizations can develop competitive advantage considering the specifications of the market place
2) Identifying agile attributes boosting the recognized competitive bases
3) Applying agile enablers to achieve the essential agile attributes

Her study developed an integrated methodology for implementing agility. The procedure was grounded in linking competitive bases, agile attributes, and agile enablers to identify, depending on the competitive priorities of market field, appropriate agile enablers each company should exploit to achieve the required agile attributes. To this end, the author applied house of quality (HOQ) which is the main component of quality function deployment (QFD) methodology. The approach could be easily adopted by companies that are willing to implement agile strategies.

The current study attempts to develop Bottani's (2009a) methodology and shows its applications by addressing its shortcomings and following the future research directions introduced in that paper. Hence, this paper makes several contributions to the work of Bottani (2009a) in specific and to the literature of agility in general. First, the study of Bottani (2009a) leaves a void regarding the application of the methodology. Bottani's methodology consisted of two consecutive HOQs which ends up with providing agile enablers resulting from the second HOQ. Identifying agile enablers leaves the practitioners with the question of "how these agile enablers can practically lead to enhancing agility?". Our methodology answers this concern by adding a third HOQ which identifies a set of pivotal "improvement paths" that satisfy the identified agile enablers. Second, in the study of Bottani (2009a) there was no systematic procedure to recognize and categorize Critical Success Factors (CSFs) of the organization. To tackle this shortcoming, we have used a balanced scorecard (BSC) to clearly classify KPIs under financial and non-financial organizational measures and prioritize them accordingly in order to diagnose which are the most important ones for organization's success.

Third, by a successful application of the methodology in the competitive food industry, this research transforms the methodology from purely theoretical to an empirically-tested one, as suggested in the future research directions of Bottani (2009a). Generally, the field of organizational agility suffers from scarcity of empirical studies (Sherehiy, Karwowski, & Layer, 2007). Our empirical work contributes to the body of literature in the field of agility by showing the applicability of the methodology in a highly competitive market. Fourth, our implementation reveals the correlations between agile attributes, as well as agile enablers, and improvement paths calculated in the roof of the HOQs. The literature scants research that investigates the interrelation between agility metrics in a practical domain (Bottani, 2009a). Our empirical results indicate that the correlations among agile attributes, enablers, and improvement paths have significant impacts on the final scores of the HOQs. This finding provides valuable insights for further analysis.

3. The proposed approach

The proposed approach in this study is grounded on the earlier study by Bottani (2009a). The general procedure of the proposed methodology is described in the following. The stages of the methodology and the methods used at each step are presented in Figure 1. The methodology starts with defining the appropriate indicators for evaluating the organizational performance. These indicators will be selected by means of comparing and analyzing information obtained from: a) MVV[1], strategies and overall objectives of the company, and, b) pool of indicators, which is extracted from the existing literature on organizational performance assessment. The company's MVV, strategies and overall objectives provide the criteria for short listing and selecting the key performance indicators (KPIs) under four major perspectives inspired by BSC; financial, customer, internal processes, and learning and growth. Then, the importance of each KPI and the performance gap between the existing performance level and the desired one will be measured based on the opinions of the experts in the company by means of questionnaire within a two-stage process. Criteria are prioritized not only based on the gap analysis, but also their importance in order to ensure that both KPI's performance gap and importance are taken into account. To this end, we have deployed Fuzzy TOPSIS technique, which is a method under multiple-criteria decision making domain (MCDM), to rank all the

[1] Mission, Vision, and Values

indicators based on the "importance of the indicator" and "level of performance gap". The upper quartile (the highest 25% of KPIs) is chosen as the CSFs of the company for achieving its strategic objectives, since they all have high importance and yet large gaps in between their current and desired performance levels. Nonetheless, the percentage of CSFs to be chosen out of KPIs is relative to several issues such as top managers' decision, the availability of budget, resources, and time.

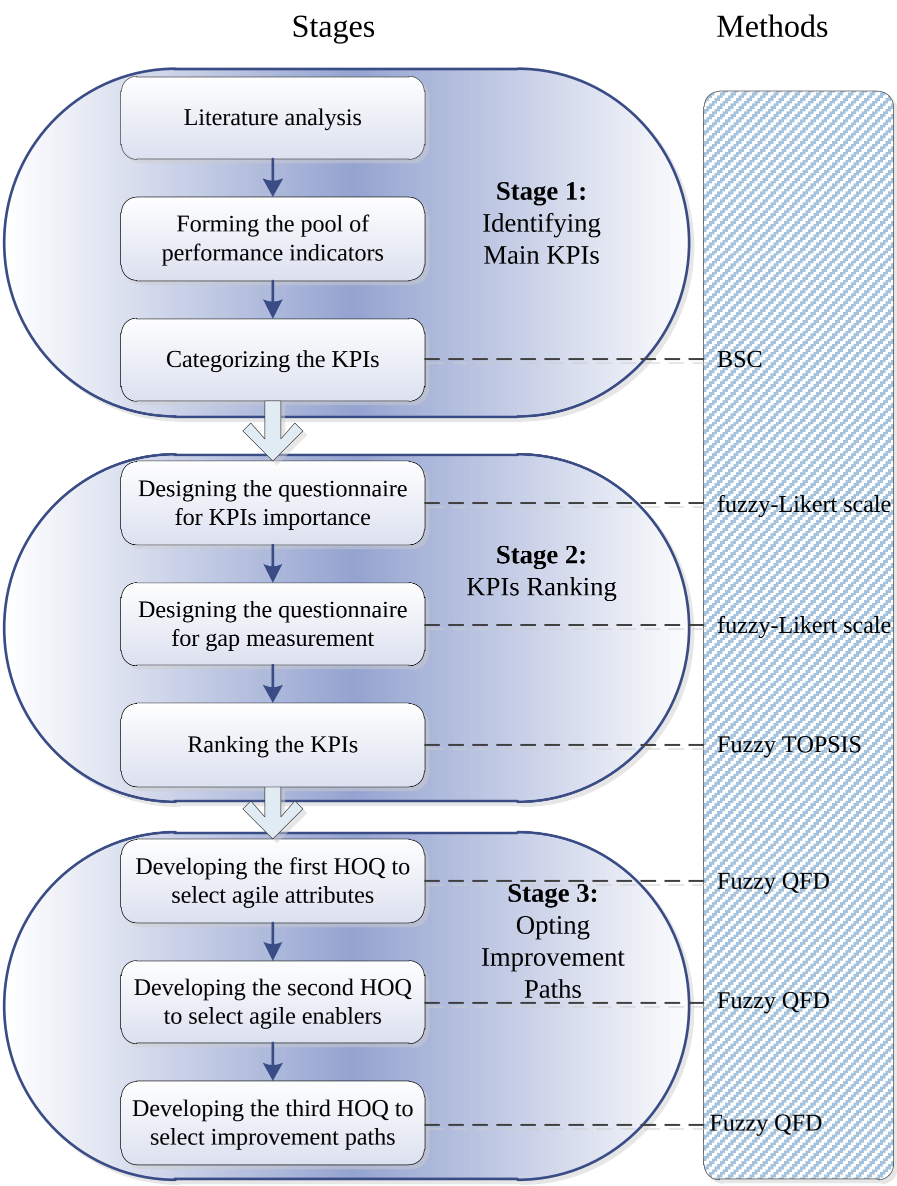

Figure 1: The Structure for the Proposed Approach

Our methodology uses a sequence of HOQs, the main component of QFD. QFD has shown to be a useful tool to facilitate strategic decision making especially when combined with fuzzy logic to address uncertain, vague, or volatile environments. Fuzzy QFD has been used for different purposes such new product planning and design (Chena & Ko, 2009; Liu, 2009), supplier selection (Lima-Junior & Carpinetti, 2016; Dursun & Karsak, 2013; Bevilacqua, Ciarapica, & Giacchetta, 2006), and strategic logistics management (Bottani & Rizzi, 2006). Coming to the context of agility, it ensures that the right agility metrics in line with the marketing objectives are selected and hence mitigates the risk of misalignment between selected agility metrics and organization core values. It also fills the missing in the literature between the "What" are the appropriate organizational capabilities and "How" they can be used to increase competitiveness and efficiency (Koskinen, 2014). In our first HOQ, CSFs are satisfied using relevant agile attributes. In the second HOQ, the most important agile attributes resulted from the first HOQ are linked with agile enablers. Finally, in the third HOQ, agile enablers are achieved through a set of improvement paths (Figure 2). Since one of our contributions is adding a new HOQ to identify improvement paths, the processes of the third HOQ is explained in more detail. For an elaborate reading on the processes of the first two HOQs, readers are directed to Bottani (2009a).

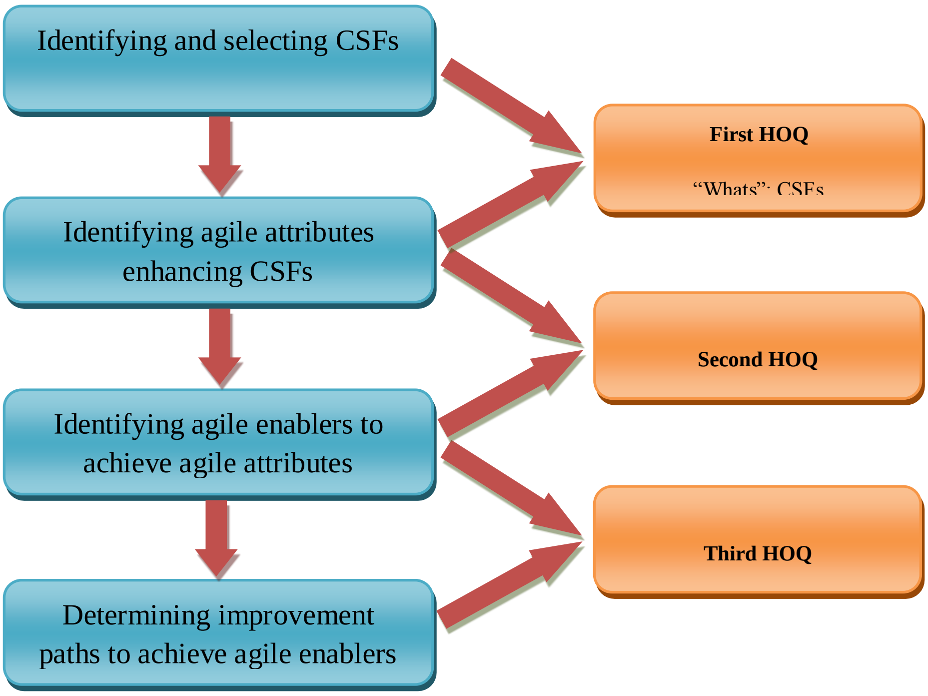

Figure 2: The 4-Step Methodological Approach for Achieving Agility

As shown in Figure 2, the proposed approach requires building three HOQs. The structure of these houses is shown in Figure 3.

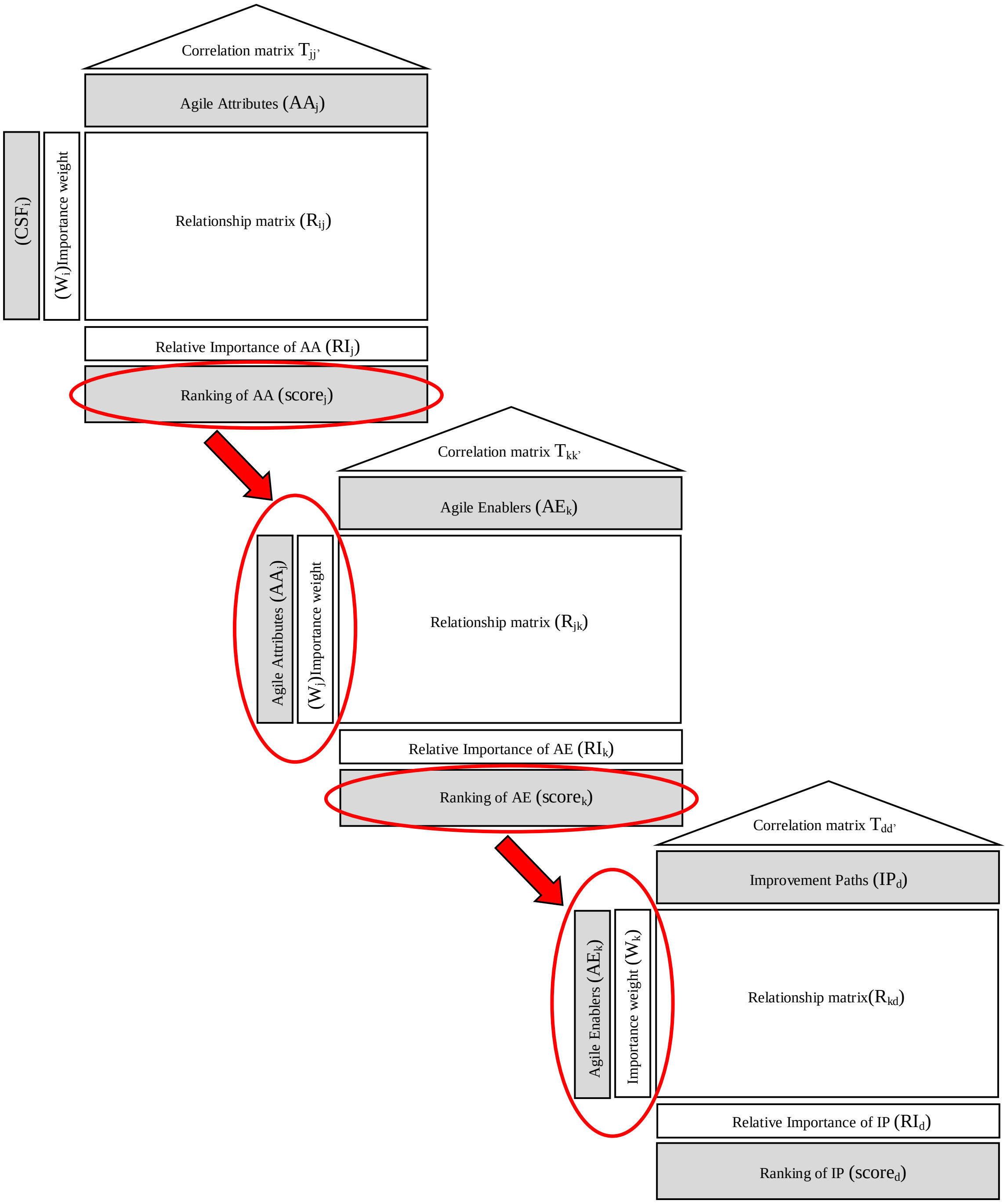

Figure 3: The Structure of HOQs

The third HOQ has a structure similar to the first two HOQs and aims to identify the most critical improvement paths to achieve agile enablers swiftly. Agile enablers will be placed in the "Whats" column (AE_k, k = 1,…, p), while improvement paths will be located in the "Hows" row (IP_d, d =1,..., g). Then, by considering the relationship between agile enablers and improvement paths (R_{kd})[1] as well as the correlation between improvement paths ($T_{dd'}$)[2],the relative importance (RI_d) and the final score of each improvement path ($score_d$) can be calculated according to the following equations:

$$RI_d = \sum_{k=1}^{p} W_k \times R_{kd} \qquad d = 1, \dots, g \tag{1}$$

$$score_d = RI_d + \sum_{d' \neq d} T_{dd'} \times RI_{d'} \qquad d = 1, \dots, g \tag{2}$$

Finally, using the following equation, the fuzzy scores of the improvement paths will be converted into non-fuzzy figures and used for prioritizing the paths.

$$crisp\ value = \frac{l + 2m + u}{4} \tag{3}$$

Therefore, the output of the current method is a collection of the most pivotal improvement paths, ranked based on their relative priority and importance in budget allocation and implementation. These paths are developed in line with the four perspectives of BSC to achieve CSFs. Using the current proposed methodology enhances the agility of an organization and enables it to identify, understand, and predict changes in the business and market environment and to react quickly to these changes. Such agile reactions to changes in business environment create a competitive advantage for the organization.

4. The empirical investigation

4.1 Description of the Case study

Food industry is selected as the case study due to its highly competitive environment, significant effect on GDP, and its major role on national employment level. Regarding

[1]Relationship between Agile Enablers (AE_k) and Improvement Paths (IP_d)
[2] Correlation between the d[th] and the d'[th] Improvement Path ($T_{dd'}$)

research methodology which is based on in-field analysis, the research society was the case study in a company called Nutricia-MMP, an affiliation of Group DANONE, which is a high-ranked leader in the food industry. The company’s mission is "to bring health through food to the largest number of people possible". The company is specialized in baby nutrition such as infant milk powders and its factory site is located in the city of Mashhad, Iran. The factory operates to the highest of quality standards and has recently been selected as a benchmark for the province of Khorasan Razavi by the Ministry of Health and the Institute of Standards.

4.2 Questionnaires’ contents and data collection process

The required data for this study were collected through two questionnaires: questionnaire (1) and (2). Both questionnaires were returned to the research team after being answered by the experts (100% response rate). No missing or incomplete data were observed and all the collected responses were used for the analysis. Moreover, in this study, we have considered two groups as “experts”: first, all top and middle managers of the subject companies; and second, academic researchers and university lecturers holding a PhD in management with relevant experience in organization agility.

The purpose of developing questionnaire (1) was to identify the major performance measurement indicators of the companies in order to access the strategic goals of organization. Therefore, based on the review of the relevant literature on performance measurement of food producing industries, a number of suitable indicators were extracted to form questionnaire (1). Then the questionnaire was given to the experts for validation. After making necessary amendments, the questionnaire was confirmed. The final performance measurement indicators used in questionnaire (1) are shown in figure 4.

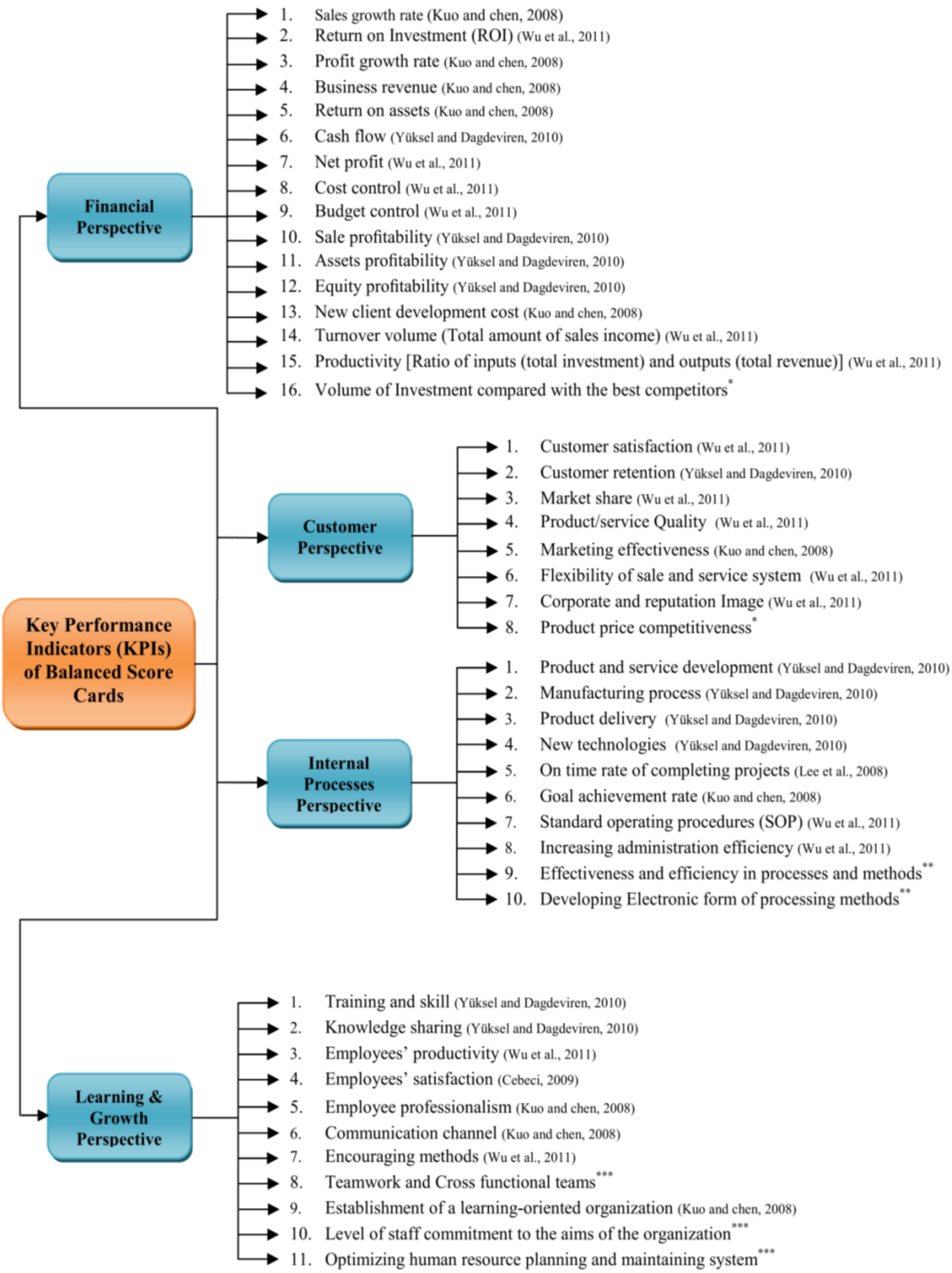

Figure 4: Performance measurement indicators applied in questionnaire (1)

In order to consider the importance of each indicator in questionnaire (1), a 5-point Likert scale was applied ranging from "the least important" to "very important". Totally, there were 45 questions divided into four sections. After collecting the responses from the experts in the company, all the questionnaires were sent to the CEO of the respective company to score the questionnaires (i.e. from 1 to 10) based on the managers' experience and expertise in the "CEO Score" section of the questionnaire. The CEO score in fact shows the importance of respondent's ideas. For instance, the CEO might be willing to outweigh the responses of a department manager over a supervisor. The questionnaires were then submitted to the research team and with the information collected from the questionnaire (1), questionnaire (2) was developed.

The ranges of responses for both questionnaires were designed based on the fuzzy numbers introduced by Cheng et al. (1999). The value of these fuzzy numbers and their linguistic expressions are presented in Table 3.

Table 3: The value of fuzzy numbers applied in the questionnaire

(Cheng, Yang, & Hwang, 1999)

Linguistic Expression	Fuzzy Number
Very Low(VL)	(0.25: 0: 0)
Low(L)	(0.5: 0.25: 0)
Medium(M)	(0.75 : 0.5:0.25)
High(H)	(1 : 0.75 : 0.5)
Very High(VH)	(1: 1 : 0.75)

To enhance the accuracy of this approach, at the end of each section in questionnaire (1) there was a section for the experts to list the missing indicators which they think as important for the success of their organization. As such, apart from the existing indicators in the questionnaire, some indicators were proposed by the experts. After eliminating rather-identical indicators, the final indicators were constructed. They are illustrated in figure 5.

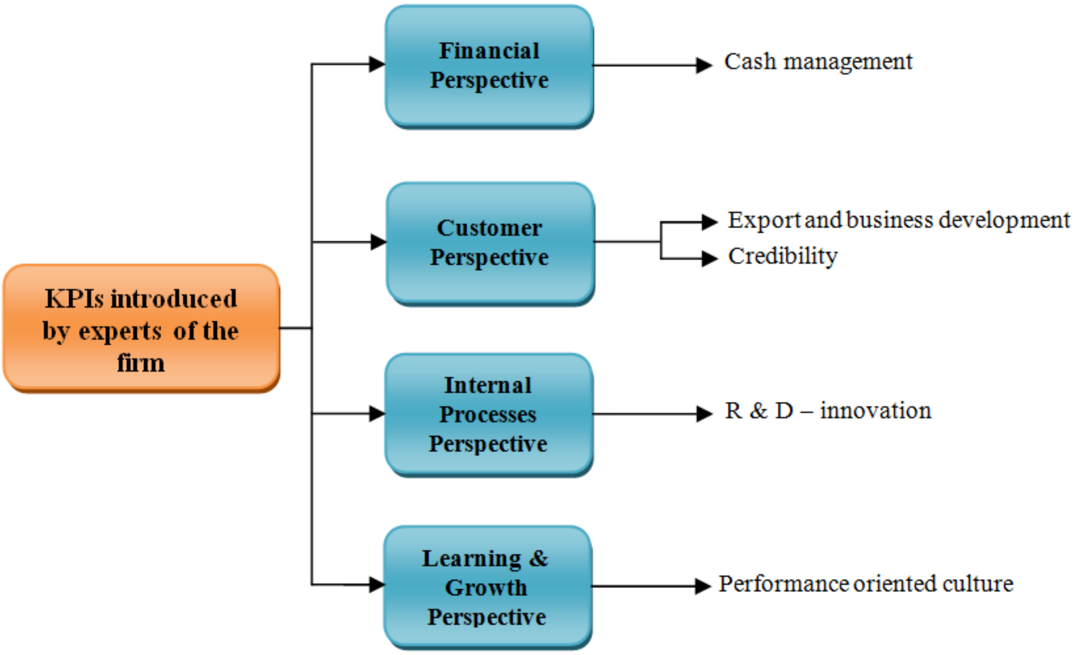

Figure 5: Performance measurement indicators proposed by the experts of the respective company

The new proposed indicators were included in questionnaire (2) to let the other experts not only rank the importance of the indicators but also identify the gap between the current situation and the optimal situation of the indicators. A 5-point Likert scale, similar to questionnaire (1), was applied to questionnaire (2) as depicted in Table 3. To identify the level of current performance and the level of optimal performance of each indicator, a range of [0, 4] was applied. To convert each number to its fuzzy equivalent, the range proposed by Cheng et al. (1999) was used which is shown in Table 4.

Table 4: Euclidean gap of each indicator and its fuzzy number

Euclidean Gap	Equivalent Fuzzy Number
0	(0.25: 0: 0)
1	(0.5: 0.25: 0)
2	(0.75 : 0.5:0.25)
3	(1 : 0.75 : 0.5)
4	(1: 1 : 0.75)

4.3 Examining the validity and reliability of questionnaires

Validity of the questionnaire determines to what extent the instrument can measure the specific concept (Rasouli & Zarei, 2015). In other words, whether an instrument measures the specific concept is determined by testing its validity. Since the previous studies in the literature were considered in developing the questionnaire, and also experts' opinions were taken into consideration to validate the questionnaire, the validity of the research instrument was confirmed by experts.

One of the established techniques to assess the reliability is Cronbach's alpha obtained from the following equation.

$$\alpha = \frac{n}{n-1}\left(1 - \frac{\sum S_i^2}{S_t^2}\right) \tag{4}$$

where S_t is the overall variance, *n* is the number of questions of the questionnaire, and S_i is the variance of the *i*th question. The value of α would range between -1 and 1. The closer the value to 1, the higher reliability the questionnaire has. After collecting the data, *SPSS* computer software was used to measure the Cronbach's alpha for each perspective separately. The results are presented in Table 5.

Table 5: Cronbach's alpha coefficient calculated for different perspectives of the questionnaire

Perspectives	Number of Items	Cronbach's Alpha Coefficient
Financial	16	0.899
Customer	8	0.780
Internal Processes	10	0.795
Learning and Growth	11	0.928

The integrated value of Cronbach's alpha for the questionnaire was equal to 0.951. Since the value of Cronbach's alpha coefficient exceeded the threshold of 0.7, the reliability of the questionnaire was confirmed.

4.4 Agile attributes and enablers used in the case study

In order to enhance the compatibility of the research with real life conditions and enhance the methodology efficiency, it is better to use more than one source for identifying the organizational agile attributes and enablers. In this research, the first source included past research studies in the field and the second source involved analyzing the existing organizational information, as well as the analysis of market and competitors.

Upon discussion with experts, the set of 32 agile attributes proposed by Yusuf et al. (1999) was determined to have comprehensiveness and decided to be used in the current study. To select agile enablers, six items from the set of enablers proposed by Gunasekaran (1998), and Gunasekaran and Yusuf (2002) were used, which comprise of supply chain management, project management, team building, knowledge management, simultaneous engineering, and information technology. Besides, in a research by Bottani (2010), 18 items were introduced as agile enablers in food industry, out of which 7 new enablers were selected for the current study based on the expert opinions. Figure 6 depicts the agile enablers used in the current study.

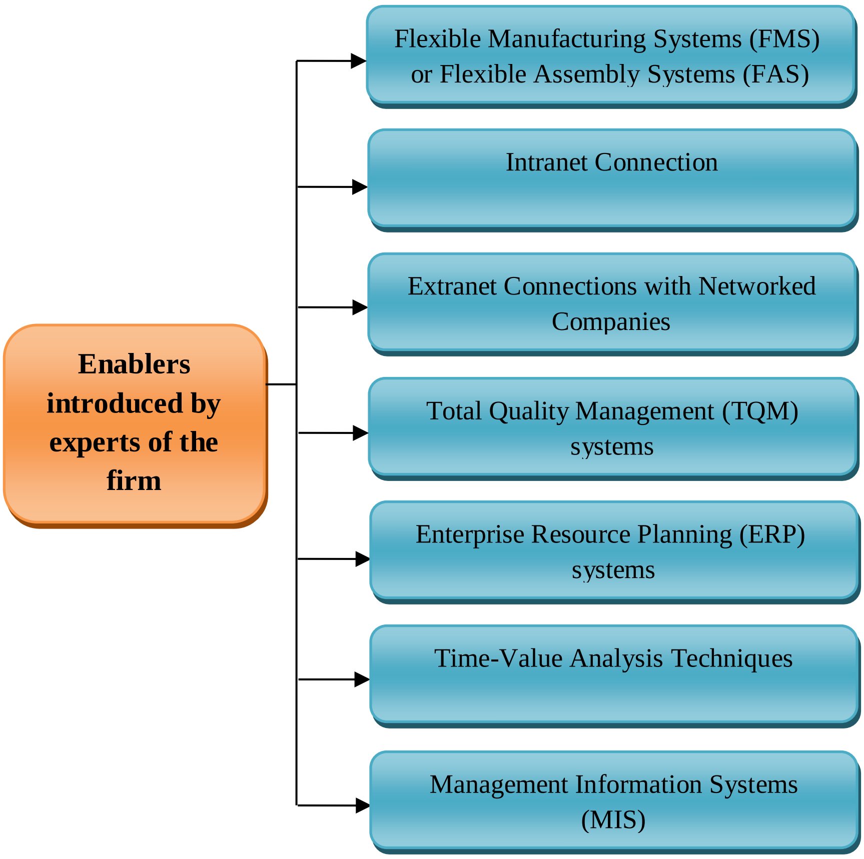

Figure 6: Proposed Agile Enablers

4.5 Findings

4.5.1 KPIs Ranking

Upon identifying the importance level of each indicator using questionnaire (1), and gap analysis of each indicator using questionnaire (2), all the indicators were ranked according to their importance as well as the result of gap analysis using Fuzzy TOPSIS. The hierarchical structure of the decision-making problem is depicted in Figure 7.

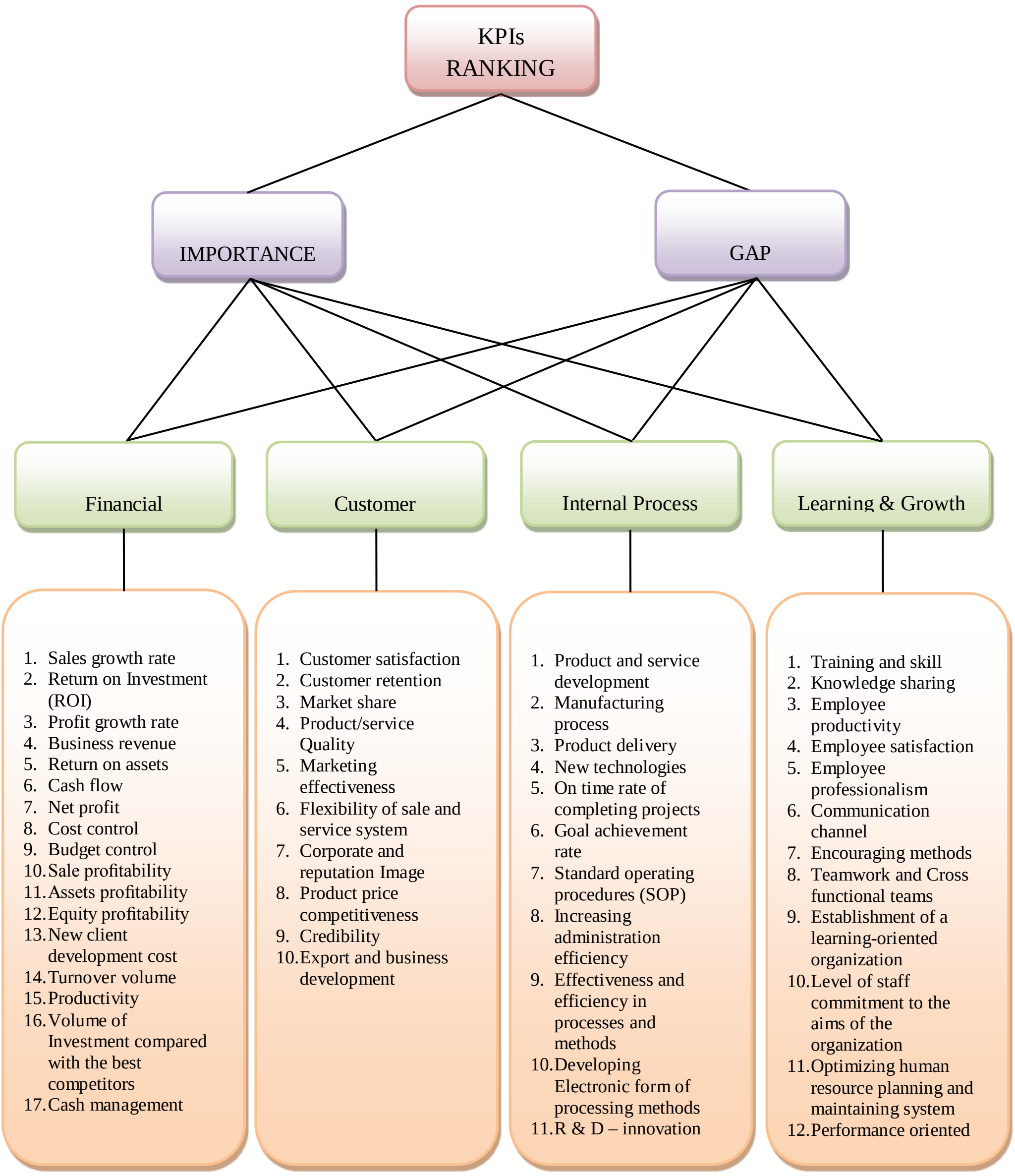

Figure 7: Hierarchical Structure of the Decision Making Problem Using Fuzzy TOPSIS

By applying TOPSIS, the final ranking of the performance indicators, shown in Table 6, was made based on the closeness coefficient to the ideal solution (*CC_i*).

Table 6: Final ranking of performance indicators

Rank	KPI	CC_i	Perspective	Rank	KPI	CC_i	Perspective
1	Net profit	0.712	Financial	26	Sales growth rate	0.576	Financial
2	Cash flow	0.708	Financial	27	Budget control	0.573	Financial
3	Market share	0.660	Customer	28	Customer retention	0.571	Customer
4	Profit growth rate	0.657	Financial	29	Return on Investment (ROI)	0.562	Financial
5	Employee productivity	0.649	Learning & Growth	30	Goal achievement rate	0.559	Internal Process
6	Communication channel	0.634	Learning & Growth	31	Optimizing human resource planning and maintaining system	0.553	Learning & Growth
7	Level of staff commitment to the aims of the organization	0.632	Learning & Growth	32	performance oriented culture	0.552	Learning & Growth
8	Knowledge sharing	0.628	Learning & Growth	33	Assets profitability	0.548	Financial
9	Training and skill	0.625	Learning & Growth	34	Marketing effectiveness	0.547	Customer
10	Cash management	0.624	Financial	35	Flexibility of sale and service system	0.544	Customer
11	Teamwork and Cross functional teams	0.622	Learning & Growth	36	Turnover volume	0.541	Financial
12	Customer satisfaction	0.605	Customer	37	Return on assets	0.540	Financial
13	Business revenue	0.605	Financial	38	Manufacturing process	0.540	Internal Process
14	Sale profitability	0.602	Financial	39	Product delivery	0.539	Internal Process
15	Credibility	0.600	Customer	40	Product and service development	0.532	Internal Process
16	Employee professionalism	0.597	Learning & Growth	41	Ontime rate of completing projects	0.527	Internal Process
17	Employee satisfaction	0.596	Learning & Growth	42	Equity profitability	0.520	Financial
18	Establishment of a learning-oriented organization	0.595	Learning & Growth	43	product price competitiveness	0.514	Customer
19	Encouraging methods	0.594	Learning & Growth	44	Standard operating procedures (SOP)	0.511	Internal Process
20	Cost control	0.588	Financial	45	Effectiveness and efficiency in processes and methods	0.506	Internal Process
21	Export & business development	0.588	Customer	46	Developing Electronic form of processing methods	0.495	Internal Process
22	R & D – innovation	0.586	Internal Process	47	Increasing administration efficiency	0.473	Internal Process
23	Productivity	0.584	Financial	48	Volume of Investment compared with the best competitors	0.468	Financial
24	Product/service Quality	0.579	Customer	49	New client development cost	0.456	Financial
25	Corporate and reputation Image	0.576	Customer	50	New technologies	0.441	Internal Process

This ranking revealed the CSFs for the studied organization. These factors were regarded as the initial input for the first HOQ which can be achieved through agile attributes. Capabilities with the highest crisp scores were the inputs for the second HOQ where they were empowered and achieved through agility enablers. In a similar vein, enablers with the highest crisp scores were moved to the third HOQ where they were gained through a series of improvement paths.

It is for sure favorable to remove the gap of all indicators; however, considering the time and amount of resources assigned for the improvement at the time the case study was being conducted, the first quartile of indicators was chosen as CSFs (Figure 8).

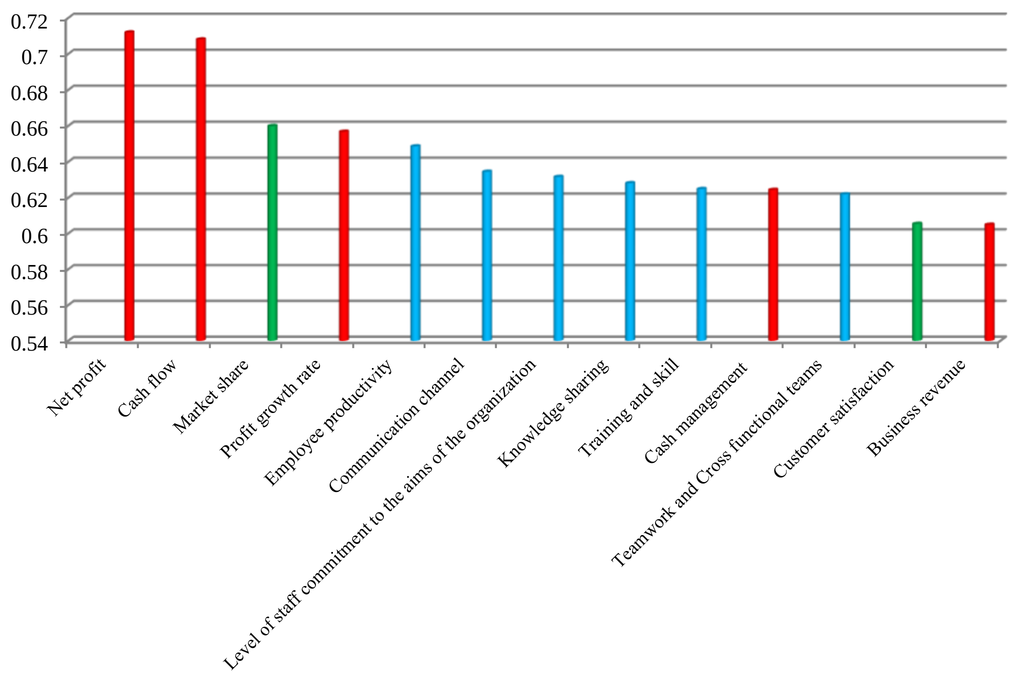

Figure 8: The Identified CFSs

4.5.2 The First HOQ

In order to calculate the fuzzy weight for each CSF, shown in Table 7, the importance level of W_i was multiplied by its pertaining gap. It should be noted that both figures are fuzzy and the result of multiplication is accordingly a fuzzy number.

Table 7: CSFs and their fuzzy weights

CSF_i	W_i		
Net profit	0.25	0.58	0.89
Cash flow	0.24	0.56	0.83
Market share	0.15	0.45	0.70
Profit growth rate	0.17	0.46	0.75
Employee productivity	0.17	0.45	0.75
Communication channel	0.12	0.40	0.67
Level of staff commitment to the aims of the organization	0.12	0.40	0.67
Knowledge sharing	0.14	0.40	0.71
Training and skill	0.15	0.39	0.69
Cash management	0.13	0.40	0.69
Teamwork and Cross functional teams	0.13	0.40	0.69
Customer satisfaction	0.07	0.33	0.59
Business revenue	0.11	0.35	0.64

The evaluation of the impacts of agile attributes on CSFs in the relationship matrix of the first HOQ required experts' opinions from academia and industry. The opinions were narratively obtained through phone interviews and then were converted into their fuzzy equivalents. In order to enhance the accuracy of HOQs, the opinions were gathered from three key groups, comprising of (1) managers and experts at the case organization, (2) university professors with prominent experience on organizational agility, and (3) active researchers in the field.

Since the set of agile attributes in this study includes 32 components, evaluating their correlations was complicated as it required 496 paired comparisons. In order to tackle the complexity, this step was simplified by categorizing and ranking the agile enablers according to the findings of Yusuf et al. (1999) advocated by Bottani (2009a). In that classification, the studies that indicate correlations between different decision domains were found according to the survey of literature. These studies are shown in Table 8.

Table 8: Correlations between decision domains resulting from literature analysis

Source: (Bottani, 2009a)

	DD1	DD2	DD3	DD4	DD5	DD6	DD7	DD8	DD9	DD10
DD1		Prahalad and Hamel, 1990	Goldman et al., 1995	Goldman and Nagel, 1993	Yusuf et al., 1999; Youssef, 1992			Goldman and Nagel, 1993	Corbett and Rastrick, 2000	
DD2			Higgins and Maciariello, 2004		Yusuf et al., 1999; Kidd, 1994	Prahalad and Hamel, 1990	Jacob, 2006	Prahalad and Hamel, 1990	Kidd, 1994	
DD3					Kathuria and Davis, 1999			Lakemond and Berggren, 2006	Higgins and Maciariello, 2004	
DD4					Messer et al., 2006					
DD5						Jung and Wang, 2006		Corbett and Rastrick, 2000		
DD6								Earle et al., 2006		
DD7								Droge et al., 2004		
DD8										
DD9										Kidd, 1994
DD10										
DD1: integration; DD2: competence; DD3: team building; DD4: technology; DD5: quality; DD6: change; DD7: partnerships; DD8: market; DD9: education; DD10: welfare.										

Each of the studies shown in Table 8 indicates the correlations between two specific decision domains. They were used as the basis to derive the correlations required for the roof of our HOQs. The table was also used as a guide for the experts such that by presenting the highlights of studies indicated in Table 8, the nature of correlations between decision domains were clarified for the experts. Then, they were asked to express their own opinions about the strength of correlations between the agile attributes in the roof of the first HOQ. Thus, the roof in the first HOQ was completed as shown in Figure 9.

Next, using equations similar to equitation 1 and 2, the relative importance (RI_j, j = 1, 2, …, 32) and the score ($Score_j$) of each agile attributes were calculated. Results of these calculations are presented in the last row of Figure 9.

Figure 9: The First HOQ

(Please find the figure at the end of the manuscript.)

Several results can be deducted from Figure 9. Firstly, it shows that the agile enablers under competence (DD_2) achieved the highest crisp scores, followed by market (DD_8), education (DD_9), and integration (DD_1). These results were achieved due to the high correlations between the aforementioned DDs and other DDs. Specifically; there was a high correlation between competence (DD_2) and quick response to market (DD_8), and also the education of personnel (DD_9). Secondly, competence (DD_2) could be empowered and enhanced through integration (DD_1) and applying the culture of change (DD_6). Finally, team building for product development (DD3) and quality (DD5), which both are involved in developing and manufacturing products to meet customers' expectations, as well as software and hardware technology (DD4), and partnership with suppliers and customers (DD7) were also recognized as overriding attributes to enhance organizational competence. The ranking of agile attributes was estimated based on their crisp scores shown in Table 9.

Table 9: Ranking of the agile attributes according to crisp scores

Rank	Agile Attributes	Decision Domain	Crisp Score
1	Multi-venturing capabilities	Competence	29.34
2	Developed business practice difficult to copy	Competence	28.61
3	Response to changing market requirements	Market	27.64
4	Customer satisfaction	Market	27.26
5	Customer-driven innovations	Market	26.52
6	New product introduction	Market	25.16
7	Learning organization	Education	24.40
8	Continuous training and development	Education	24.30
9	Workforce skill upgrade	Education	23.63
10	Multi-skilled and flexible people	Education	23.60
11	Concurrent execution of activities	Integration	23.37
12	Enterprise Integration	Integration	22.96
13	Information accessible to employees	Integration	22.86
14	Continuous improvement	Change	19.86
15	Empowered individuals working in teams	Team building	19.37
16	Quality over product life	Quality	19.13
17	Culture of change	Change	19.13
18	Products with substantial value-addition	Quality	18.47
19	First-time right design	Quality	18.38
20	Teams across company borders	Team building	18.37
21	Cross functional teams	Team building	18.25
22	Decentralized decision making	Team building	18.15
23	Leadership in the use of current technology	Technology	17.64
24	Short development cycle times	Quality	17.35
25	Skill and knowledge enhancing technologies	Technology	17.29
26	Flexible production technology	Technology	17.05
27	Technology awareness	Technology	16.91
28	Trust-based relationship with customers/suppliers	Partnership	12.46
29	Close relationship with suppliers	Partnership	12.04
30	Strategic relationship with customers	Partnership	11.81
31	Rapid partnership formation	Partnership	11.21
32	Employees satisfaction	Welfare	4.33

4.5.3 The Second HOQ

In order to form the second HOQ, either all the agile attributes or the ones with the highest crisp scores can be moved from the first HOQ based on the time and resources that are assigned for the improvement. In this case study, all agile attributes presented in the first HOQ were listed under the "*whats*" column in the second HOQ to illustrate a comprehensive implementation of the methodology. For estimating the weight of agile attributes, the respective normalized scores in the row before the last of the first HOQ were used. Normalization was done by dividing the fuzzy score of each capability ($Score_j$) to the highest score (related to multi-venturing capabilities). Therefore, as shown in Figure 10 (the second HOQ), the agile attributes and their normalized weights are listed in the first and second columns of the second HOQ, respectively.

In order to measure the correlations among the agile enablers in the roof of the second HOQ, prior literature was consulted. Since the existing research in this area is limited, merely some of the correlations among the agile enablers were identified. The studies indicating correlations are shown in Table 10.

Table 10: Correlations among decision domains extracted from the literature

Source: Bottani (2009a)

	Supply chain management	Concurrent engineering	Project management	Information technology	Teambuilding	Knowledge management
Supply chain management		Van Hoek, (2000)		Vonderembse et al., (2006), Chung and Snyder, (2000)	Christopher, (2000), Gowen and Tallon, (2003)	Yusuf et al., (1999), Gowen and Tallon, (2003
Concurrent engineering			Ainscough et al., (2003		Van Hoek, (2000), Gunasekaran, (1999)	Jacob, 2006
Project management						
Information technology						Gunasekaran, (1999)
Teambuilding						
Knowledge management						

Based on the results of the relationship matrix in Figure 10 and experts' opinions, the roof of the second HOQ was formed. Numerical results extracted from Figure 10 shows that information technology (AE_6) had the highest crisp score due to frequent and high correlations with other agile enablers as well as strong relations with some agile attributes. Therefore, it had the priority for enhancing organizational agility, followed by management information systems (AE_{13}) and supply chain management (AE_1). The ranking of agile enablers based on their crisp scores is shown in Table 11.

Figure 10: The Second HOQ

(Please find the figure at the end of the manuscript.)

Table 11: Ranking of agile enablers according to their crisp scores

Rank	Agile Enablers	Crisp Score
1	Information Technology (IT)	735
2	Management Information Systems (MIS)	628
3	Supply Chain Management	592
4	Intranet Connection	530
5	Extranet Connections with Networked Companies	528
6	Enterprise Resource Planning(ERP)systems	518
7	Knowledge Management	484
8	Total Quality Management(TQM) systems	403
9	Time-Value Analysis Techniques	331
10	Project Management	297
11	Concurrent Engineering	265
12	Teambuilding	235
13	Flexible Manufacturing Systems (FMS) or Flexible Assembly Systems (FAS)	222

4.5.4 The Third HOQ

Similar to the procedure of previous HOQs, all agile enablers were moved from the second HOQ to the third HOQ and listed under the "*whats*" column to enhance the process accuracy. The estimation of the weights for agile enablers was similarly made using the normalized scores in the row before the last of the second HOQ. The normalized score was calculated by dividing the fuzzy score of each enabler ($Score_k$) to the highest score (related to information technology). Therefore, as shown in Figure 11(the third HOQ), the agile enablers and their normalized weights are listed in the first and second columns of the third HOQ, respectively.

In order to identify the most crucial improvement path for achieving agile enablers, opinions from university and industry experts in the fields of production and operation management, information technology, and knowledge management were obtained. Each of the improvement paths was then developed and proposed in accordance with the current organizational progress in the pertaining area.

The numerical results shown in Figure 11 indicate that ‘planning for obtaining international business excellence awards’ achieved the highest crisp score due to its frequent and high correlations with other improvement paths as well as its strong relations with some of the agile enablers. It is therefore the improvement path with the highest priority, followed by ‘development and integration of functional applications in main areas of organization’ and ‘provision of ERP infrastructure’. The ranking of improvement paths based on their crisp scores of the implementation infrastructures is shown in Table 12. This table shows the suggestions by the academic lecturers for improving the organization performance.

Figure 11: The Third HOQ

(Please find the figure at the end of the manuscript.)

Table 12: Ranking of improvement paths according to their crisp scores

Rank	**Improvement Projects**	**Crisp Score**
1	Planning for obtain International Business Excellence Awards	21554
2	Development & integration of Functional Applications in main areas of organization	20618
3	Provision of ERP infrastructure	17638
4	Designing and implementing Decision Support Systems (DSS)	16890
5	Preparation of corporate knowledge strategy in knowledge management district	16535
6	Use of EDI in B2B interactions	16242
7	Planning for long-term interactions with suppliers	15673
8	Development of web-based activities as portal configuration	14149
9	Strategic Planning	11180
10	Training needs assessment and long-term educational planning with multi-skilled employees approach	10062
11	6 sigma implementation	9640
12	Forming and developing Quality Circles	9053
13	Technology Management	5963
14	product development unit start up	5452

5. Discussion and Limitations

This section discusses the findings from the application of our proposed methodology. Then, we move to the limitations of our work and suggesting the future research directions. We start with elucidating the main findings of our study: Looking at CSFs (figure 8), out of 13 CSFs, 6 of them were related to "Learning and Growth" perspective, 5 of them to "Financial" perspective, and 2 of them are related to "Customer" perspective. High number of CSFs related to "Learning and Growth" perspective states that human resource management should become the foci of the company. Bringing issues such as employees' training, knowledge and skills, motivation, and productivity to the center of attention propels the company towards achieving its strategic goals and benefitting from a higher level of agility. On the other hand, none of the identified CSFs belong to "Internal Processes". Also, the first 3 indicators of "Internal Processes" among the 50 KPIs are in ranked 22, 30, and 38, considerably far from the CSFs (top 25% of KPIs). This implies that the organization is performing well with respect to its internal processes. The main internal processes of the organization concern production of milk nutrition products as mentioned earlier. Given the high expertise and high level of technology used for the production, scoring high for internal processes was not far from expectations.

The ranking of agile enablers (Table 9) reveals that the first top two enablers viz. "Multi-venturing capabilities" and "Developed business practice difficult to copy" belong to the decision domain of "Competence". The next four agile enablers pertain to "Market" domain viz. "Response to changing market requirements", "Customer satisfaction", "Customer-driven innovations", and "New product introduction". Prioritizing "Competence" and "Market" over all the other decision domains by the experts indicates that the food market in Iran is highly competitive and requires high levels of innovation and responsiveness. Basically, the main mechanism for survival in such markets is building unique competencies which are unique, innovative, and difficult to imitate by rivals. This is coherent with the resource based view (RBV) theory stating that firms need to build and rely on resources which are inimitable, rare, valuable, and non-substitutable in order to achieve a sustained competitive advantage in competitive markets (Barney, 1991). All the top 6 agile enablers follow the same characteristic as the ones pointed out by the RBV theory.

A practical implication of work comes from comparing the identified KPIs under different perspectives of BSC. It can be observed that "Customer" perspective has the least number of KPIs identified by the experts (figure 7). Also, few "Customer"-related KPIs are present in the first quartile of ranking, known as CSFs (figure 8). While the ultimate goal of organizational agility is to retain customers and responding to their changing needs, it is interesting that less attention is given to "Customer" perspective. We infer that the reason for this is twofold. First, the case study was conducted in a developing country where attention to customer as a driver of organizational success is weaker compared to developed countries. It is in line with the findings of previous studies in developing countries. Upadhaya et al. (2014) used BSC to assess organizational effectiveness and its association with performance measurement systems in Nepal. They concluded that customer performance measures in BSC are considered less significant compared to other measures such as financial. The study of Khan et al. (2011) on 60 cross section Bangladeshi companies also confirmed that use of financial measures on BSC overweighs non-financial ones such as customer measures. Interestingly, they found out that food industry had the lowest use of non-financial measures among other sectors (only 42%). Second, we argue that it is not only the "Customer" perspective in BSC that can lead to being agile in fulfilling customers' demands. Organizational agility as a multifaceted concept is influenced, even though implicitly, by the other three aspects of BSC as well. For example, improving the CSF "Communication Channel" belonging to the "Learning and Growth" perspective, will undoubtedly contribute to the betterment of customer experience.

Moreover, we discuss the relatability of CSFs, agile attributes, agile enablers, and improvement paths. As an example, we scrutinize the metrics related to the "Customer" perspective. The first CSF belonging to this perspective is "market share". Four agile attributes are identified for market share viz. "New Product Introduction", "Customer-driven Innovations", "Customer Satisfaction", and "Response to Changing Market Requirements" fall under the decision domain "Market" (see Table 1). These are the agile attribute that can eventually result in the increase of market share. Here, one might question that some of the pertaining agile enablers resulting from these agile attributes might seem irrelevant e.g. Flexible Manufacturing System (FMS) and Flexible Assembly Systems (FASS). It can be argued that these enablers can increase the customer-driven innovations, satisfy their needs, increase their loyalty, and consequently increase and develop the market share (see Figure 10). Therefore, these factors impact the market share of the company. In fact, one of the strengths of the proposed methodology that through three consecutive and intertwined HOQs identifies fundamental mechanisms that, even ostensibly unrelated, lead to the enhancement of organizational agility. It would otherwise be impossible to find such mechanisms by conventional straightforward methodologies.

We also posit that the use of ranking in our methodology should not cause negligence to lower ranked metrics. For example, the fact that “New Technologies” obtained the last place among the 50 performance measurement indicators (see Table 6) and is the least important indicator shows that the organization is currently using the latest up to date technologies in its production system. However, maintaining high level of technology is crucial for the company to survive in the highly competitive food market. This can also be understood from the concerning agile attributes such as “Technology Awareness” which pinpoints the importance of commitment to up to date technologies. Therefore, existence of no or little gap to fill does not imply that the company should stop its current efforts to stay tuned with new technologies.

Our findings also have some implications regarding the use of internet and information systems. Analysis of Table 11 (ranking of agile enablers) shows that Information Technology (IT), Management Information System (MIS), Intranet, Extranet, and Enterprise Resource Planning (ERP), and Knowledge Management have been respectively ranked as number 1 to 7 of most important agile enablers in the organizations. Since all of these factors are categorized under the virtual enterprise tools, the organization needs to be more virtually empowered to become more agile. It is essential to equip the organization with better internet and intranet infrastructure, management information software, and data banks. Besides, harmonizing the employees and operational processes with the new improved virtual environment is crucial for organizations. Our findings are coherent with previous studies which showed the use of virtual enterprise systems enhances organizational agility in developed countries (e.g. New Zealand (Mathrani, 2014), but at odds with the domestic studies of organizational agility in Iran where IT has not shown to have any direct relationship, but it even showed a negative relationship with organizational agility. This can be explained due to the fact that Iran as a developing country suffers from unstable or slow internet connection and restricted access to some internet content. Therefore, the studied companies in literature which were equipped with IT systems failed to benefit from their IT advantage for improving their agility. In addition, local Iranian companies studied in the literature were collaborating with partners (e.g. suppliers) that were not IT-equipped. Such isolated organizations have major difficulties in building IT-based communications with their partners and moving towards the notion of virtual enterprise.

Building upon the empirical observations about the category to which top ranked KPIs belong to, few number of customer-related KPIs, and internet and information systems findings, we put forward some implications for any organization using the methodology. Basically, it is possible for a company to choose a set of agility metrics that are deemed to make the organization more agile based on the idea of managers or experts. However, these metrics, although believed to be appropriate by the decision maker, might not be fully in line with organizations' core values and marketing objective or they might address areas in which there is little gap between the current and desired level of agility. It is because agility metrics, as shown by quantitative calculations in HOQs, are highly interrelated and intertwined. One cannot directly choose the right metrics based on his insight or experience without the risk of wrong or inconsistent judgments. It has been shown that when making multiple-criteria decisions, the level of inconsistency in human's judgments exponentially increases as the number of criteria and their interdependence increases (Saaty & Shang, 2014). The correlations calculated in each HOQ are beyond the capability of human mind to be considered simultaneously. This is a strong advantage of using a systematic and structured methodology that facilitates the decision making process by considering various aspects and correlations.

A major concern when deriving agile attributes and agile enablers from the literature is that they are industry specific. They are especially tailored for the mechanical manufacturing context which leaves other industries little or no relevant metrics. This is advocated by the study of Bottani (2009b) where she states that literature driven metrics used for the food industry result in very low or low results while the company is in fact sufficiently agile. We have tried to tackle this shortcoming by using multiple sources to identify our metrics besides the literature. These sources included experts' ideas both from academia and the industry and also using the studied organization information for defining pertinent metrics. However, defining agility metrics such as KPIs, attributes, enablers, and improvement paths remains to be the limitation to any methodological agility study including ours. Hence, more industry specific research is needed to explore different companies in similar market segment and finding mutual agility metrics to be used for that segment. Case studies can contribute to generate valuable knowledge in this area. Also, future literature reviews in the agility arena can compile the previously identified metrics from the literature.

Another limitation concerning our application is that we have confined our analysis to the first quartile of performance measurement indicators with higher priority. The reason was that choosing a higher number of indicators increases the amount of calculations significantly and makes the HOQs unusually large. A suggestion to address this limitation is developing QFD computer software to enable them for handling larger HOQs. Moreover, the process accuracy of HOQs can be enhanced through using an innovative method such as analytic hierarchy process (AHP) which measures the consistency of responses for each respondent at the time of building the relationship and correlation matrix. This has not been implemented in the QFD domain so far and would be an innovation to be addressed by future researchers.

Finally, this study does not explicitly measure the initial need for agility due to the nature of our case study. The Nutricia MMP Company in collaboration with DANONE Group is the second largest producer of powdered milk in the world and has a close competition with its rival brand, Nestle. Once a company like our studied case could strive to achieve the highest market share in a competitive industry, it can be surmised that it achieved the highest level of agility, regardless of how much its initial need of agility was. However, for future studies, especially when the company is not a market pioneer or the market seems less competitive, it is recommended that first the need for agility of the organization is measured so that it can be used as a basis for determining the improvement paths. Various methods have been proposed for measuring the agility need level. Amongst all, we recommend the method proposed by Zhang and Sharifi (2000) as it has shown high comprehensiveness and accuracy.

6. Conclusions

This study aims at improving organizational agility by integrating some operations management techniques from the domains of decision making, quality engineering, and organizational performance assessment. It proposes a new approach at strategic management level for achieving macro organizational goals in competitive industries. To this end, upon evaluating organizational performance using BSC technique, the importance level and existing gap in each of the performance indicators, extracted from macro and strategic long term goals of the organization, were identified. Then, using Fuzzy TOPSIS from MCDM domain, all indicators were ranked to identify the indicators with highest priorities, called as the organizational CSFs. Later, using QFD technique in fuzzy environments, the following three objectives were simultaneously pursued:

1) Reducing/removing the existing gap among CSFs using improvement paths obtained from HOQs
2) Propelling to the organization in achieving its strategic goals
3) Enhancing organizational agility and increasing the capability to feel, perceive, and predict changes in the business environment and market as well as propelling the organization to show a timely reaction to volatility and improving its competitive advantage

The application of our methodology in the highly competitive food industry revealed that it is capable of achieving the aforementioned objectives. The proposed methodology can be used for future agility studies. We recommend recollecting the metrics i.e. CSFs, agile attributes, agile enablers, and improvement paths to fit the needs of the case and its market and also to develop and expand our knowledge beyond the currently existing metrics. Moreover, the proposed model can be adopted in other environments with high levels of volatility and agility need such as humanitarian context. Humanitarian operations need to be agile not only in the provision of aid, but also in adjusting the intra-organizational pace with the environmental changes (e.g. responding to a disaster). However, humanitarian literature has been more focused on operational agility and organizational agility is rarely addressed (L'Hermitte, 2016). Application of the proposed model can be an interesting future research avenue that fills the void of organizational agility in humanitarian organizations.

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