

# DOCTORAL (PHD) DISSERTATION

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Debrecen

2020

**UNIVERSITY OF DEBRECEN**  
**FACULTY OF ECONOMICS AND BUSINESS**

**KÁROLY IHRIG DOCTORAL SCHOOL OF MANAGEMENT AND  
BUSINESS**

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**THE IMPACT OF FLEXIBILITY ON COMPANIES  
PERFORMANCE: EVIDENCE FROM SMALL AND  
MEDIUM PHARMACEUTICAL COMPANIES IN IRAN**

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**2020**

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SMALL AND MEDIUM PHARMACEUTICAL COMPANIES IN IRAN**

The aim of this dissertation is to obtain a doctoral (PhD) degree in the scientific field of  
“Management and Business”

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**Date of doctoral theses defence:** 202



## LIST OF ABBREVIATIONS

BP = British Pharmacopoeia  
CF = Coordination Flexibility  
CS = Customer Satisfaction  
DF = Delivery Flexibility  
DU = Demand Uncertainty  
FP = Financial Performance  
FS = Flowing Stream  
JCPOA = Joint Comprehensive Plan of Action  
LAP = learning-action performance  
MF = Mix Flexibility  
MOH = Ministry of Health  
NPF = New Product Flexibility  
OF = Operational Flexibility  
OP= Operational Performance  
PDF = Product Development Flexibility  
QF = Quality Flexibility  
RBV = Resource Based View  
RF = Resource Flexibility  
SU = Supply Uncertainty  
SF = Strategic Flexibility  
SAP = Situation-actor process  
UN = Uncertainty  
VF = Volume Flexibility

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## INTRODUCTION

Since 1896 performance and uncertainty have been strongly present in management and economics literature (Ross, 1896). DiFonzon and Bordia (2002) mentioned that uncertainty cannot be accurately understood because it is a result of unforeseen circumstances, but it is possible to reduce environmental uncertainty by using strategic actions that lead to higher levels of company performance. Here, we can refer to flexibility at the strategic level as one of those strategic actions. Moreover, environmental uncertainty as a result of a lack of familiarity with new markets is considered a serious threat to companies' survival because of their inability to predict or control environmental changes, which affect companies' ability to acquire the required resources for continued production (Bendickson et al, 2018). Thus companies should find a relevant way to deal with uncertainty in dynamic environments.

According to Newman et al (1993), uncertainty which emerges from external or internal sources has become a real concern for organizations, especially in a dynamic business environment, so successful companies should think about finding a technique to enhance their performance when confronted with new preferences of customers, and unpredictable and uncertain events, such as unstable supplies of raw materials or fluctuations in demand. As a solution to deal with uncertainty Swamidass (1988) suggested that manufacturing flexibility is the best technique to deal with uncertain situations, because of its importance to respond quickly to unexpected cases; in this regard, he defined flexibility as a "manufacturing system's ability to adjust effectively to the changes of the environmental conditions". Also, strategic flexibility has been suggested as a technic to cope with turbulence in business environments (Evans, 1991; Sanchez 1995, 1997).

Flexibility is considered an essential condition to enhance operational performance (Suarez et al, 1991; Pagell and Krause, 2003). In the same context, Silva and Ferreira (2017) found that uncertainty significantly affected the decision of the company to adopt flexibility because it affects operational performance as well; moreover, they suggested using flexibility as a moderating mechanism to reduce the effect of uncertainty on companies' performance. Also, Ketokivi (2006) reported that the kind and level of strategic flexibility which is used should be correlated with the degree of environmental uncertainty as presumed by managers. Sánchez and Pérez (2005); Merschamann and Thonemann (2011) mentioned that flexibility relates to the uncertainty of the situation; for example, in uncertain environments, increased flexibility

positively affects and improves company performance, whereas in more stable environments, a high level of flexibility leads to higher costs than lower financial performance. From Volberda's (1998) and Miller and Shamsie's (1996) perspectives, flexibility has a major effect on companies' performance in an unstable environment.

Much research related to flexibility and its relationship with performance has focused on financial performance (e.g. Nair, 2005; Sánchez et al, 2005; Arawati, 2011; Merschmann and Thonemann, 2011). However, other kinds of non-financial performance measurements should be considered, such as customer satisfaction (Vickery et al, 1999; Lummus et al, 2005) (Camisón and Villar Lopez, 2010). In the same context, Sáenz et al (2018) mentioned that manufacturing flexibility is an important mechanism, especially in dynamic environments, where the needs and preferences of customers are changing continuously. And as a competency, it helps companies to enhance their performance (Narasimhan et al, 2004). Moreover, Upton (1994) considered flexibility a critical capability that enables companies to achieve good performance by improving their ability to respond to changes quickly.

Many researchers have investigated the link between operational flexibility and companies' performance; for example, Sáenz et al (2018) highlighted the importance of flexibility in the context of contingency, and found that manufacturing flexibility strongly effects the performance of companies, especially in light of changes in customer preferences. Also, Grawe et al (2011), in the context of logistics, mentioned that operational flexibility enhances and increases the level of companies' performance. Moreover, many researchers have emphasized that operational flexibility is an essential mechanism which improves performance (Slack, 1983; Swamidass and Newell, 1987; Slack and Correa, 1992; Vokurka and O'Leary-Kelly, 2000; Yu et al, 2015; Chahal et al, 2018). However, Pagell and Krause (1999) and Fiegenbaum and Karnani (1991) could not find a significant relationship between flexibility and companies' performance. Furthermore, researchers such as Gupta and Somers (1996) and Jack and Raturi (2002) stated that flexibility is not necessary to drive performance positively and significantly. Business environments have become complicated because of the increasing level of uncertainty due to customer preferences changing, demand fluctuations, and misalignments between the capacity of production and demand realized. Moreover, small and medium-sized enterprises (SMEs) face a critical problem, which is the inability to offer products/services on time and in the optimal way to meet customers' needs (Peláez and Ruiz, 2001), and the inability to reduce the negative effect of demand fluctuations, and to improve and offer new products more quickly, all of which are considered important issues in the light of intense competition in the

market (Gaimon and Singhal, 1992). Such circumstances have been considered justifications for manufacturing flexibility.

According to Gerwin and Tarondeau (1982), Zang and Doll (2001), there are many reasons for environmental uncertainty, such as market fluctuations, technological turbulence, and intense competition. The contemporary literature of flexibility missed the impact of flexibility on customer satisfaction and focused on other measurements of performance (Pérez et al, 2016). This is an important issue since both customers and other stakeholders affect the financial performance of the company (Sáenz et al, 2018). So, we believe that flexibility should be investigated in terms of how it adds value for customers.

Managers need to be mindful of the causes of uncertainty to discover the optimal way to control the changes that occur because of uncertainty. In addition, market turmoil has demonstrated the changes in consumer expectations for products and services. Because of this, many new products have appeared due to changing demand. For this reason, companies try to adapt to changes by using both strategic and operational flexibility as techniques to deal with uncertainty and enhance performance.

Flexibility as a technique to deal with uncertainty enables companies to acquire flexible resources and then coordinate these resources in an optimal way to offer new products (new product flexibility), producing different amounts of products to meet demand variations (volume flexibility). Moreover, they can offer a wide range of products to fulfil customers' requirements (mix flexibility).

Based on what has been mentioned previously, this research tries to examine the effects of both strategic flexibility and operational flexibility on the performance of small and medium-sized pharmaceutical companies in Iran, and considers the moderating role of environmental uncertainty on this relationship. The research intends to enhance the competitiveness of these companies in the market by implementing strategic and operational flexibility which help them to improve their efficiency in tackling both supply uncertainty and demand uncertainty.

# **1. TOPICS AND OBJECTIVES**

## **1.1 Aims of the Research**

The thesis aims to highlight the interaction between strategic flexibility and operational flexibility and how they can affect companies' performance, and considers environmental uncertainty as a moderator in understanding the moderating effect of uncertainty on the relationship between flexibility and companies' performance.

The main focus starts from the importance of the synergistic relationship between strategic flexibility and operational flexibility as mechanisms to cope with unexpected circumstances, and how strategic flexibility can be viewed from an operational perspective. In other words, using strategic dimensions of flexibility which directly affect operations and the operational dimensions of flexibility at industrial companies, and using a moderator effect for a better explanation of how flexibility affects companies' performance.

## **1.2 The Objectives of The Research**

This research aims to achieve the following objectives:

1. The main objective of this research is to investigate the effect of flexibility on the performance of small and medium-sized pharmaceutical companies in Iran.
2. To identify the effect of strategic flexibility on companies' performance.
3. To identify the effect of operational flexibility on companies' performance.
4. To identify the moderating effect of uncertainty on the relationship between strategic flexibility and companies' performance.
5. To identify the moderating effect of uncertainty on the relationship between operational flexibility and companies' performance

## **1.3 Research Questions**

Based on the research objectives the following research questions were formed, and these questions will be the guide to achieve the results of the empirical study:

1. How flexibility affects companies' performance?
2. How strategic flexibility affects companies' performance?
3. How operational flexibility affects companies' performance?

4. How uncertainty could moderate the relationship between strategic flexibility and companies' performance?

5. How uncertainty could moderate the relationship between operational flexibility and companies' performance?

#### **1.4 Dissertation Structure**

The study is organized in 6 chapters, as follows:

**Chapter 1:** Defines the subject of the thesis, the objectives, research questions, and research hypotheses.

**Chapter 2:** Offers a review of the literature related to the topic of the thesis, and offers a theoretical background about the variables and how they connect with each other, in an attempt to provide a comprehensive theoretical understanding of the topic.

**Chapter 3:** Illustrates the methodology of the study, and the analysis methods used to meet the objectives of the research, the research variables, study population and sampling technique, data collection and questionnaire adaption, and data analysis techniques employed to obtain the results.

**Chapter 4:** Shows the results of the study and the evaluations of these results. It is an exhaustive analysis of the effect of the flexibility variables on the performance variables and how the moderator variable can affect this relationship.

**Chapter 5:** Provides the conclusions of the study. Depending on the conclusions of the study, recommendations will be made at the end, along with a discussion of the limitations of the research and the directions for future research.

**Chapter 6:** Shows the findings of the study and the conclusion of the thesis.

All the appendices, a list of figures, tables, publications, and references which are related to the study are available at the end of this thesis.

#### **1.5 Research Hypotheses**

Many studies have referred to the link between flexibility and company performance and how flexibility as a mechanism can enhance company performance in uncertain business environments.

1. In the framework of the relationship between SF and company performance, Aaker and Mascarenhas (1984) defined SF as an organizational capability to react in perfect time to serious environmental fluctuations which affect an organization's performance. For example, Daniels

et al (1996, 2004) found that effective allocation and utilization of RF helps companies to improve operational performance. But according to Oke (2005) the link between RF and customer satisfaction is still unclear. In this context, Chauhan and Singh (2014, p. 33) mentioned that RF can be used to offer a variety of products, including novel products, and to meet the demand of consumers more quickly.

Yuan et al (2010) mentioned that SF affects a company's performance, especially in a context of hyper-competition. But Pagell and Krause (2003) mentioned that companies that apply flexibility in a stable environment which does not have real changes will bear higher financial costs.

Miles et al (1978) also mentioned that SF enhances company performance by integrating with other managerial strategies such as good communications, and the synergy between production strategies and marketing plans. Moreover, Grewal and Tansuhaj (2001) clarified that the valuable benefits of SF can be noted after a crisis, especially in contexts of technological turbulences and demand fluctuations.

Moreover, from the customer satisfaction side, RF has an impact on customers through their willingness to pay for products or services, in other words, the expected benefits of the product versus its price (Chod and Rudi, 2005).

Based on what has been mentioned above, we can formulate the first main hypothesis and the related sub-hypotheses:

***H1: Strategic flexibility positively affects the performance of pharmaceutical SMEs in Iran.***

***H1a: Recourse flexibility positively affects the performance of pharmaceutical SMEs in Iran.***

***H1b: Coordination flexibility positively affects the performance of pharmaceutical SMEs in Iran.***

2. In the context of the relationship between operational flexibility and company performance, Scherrer-Rathje et al (2014) and Sáenz et al (2018), identified OF as one of the features of prosperous companies. It considered one of the most important types of organizational flexibility at the operational level, and it refers to companies' ability to reconfigure the available resources to offer a variety of products in order to adapt and react to uncertainty and market fluctuations, and as a result, achieve better performance in exceptional situations (Gerwin, 1993; Slack, 2005).

Moreover, Chod and Rudi (2005) mentioned that manufacturing flexibility implementation leads to reduced costs. Thus, OF may positively affect financial performance by enhancing profitability when costs are lower. In the framework of operation management, Newman et al (1993) defined manufacturing flexibility as a basic mechanism to cope with uncertainty and enhance company performance.

As a type of operational flexibility, VF is considered a mechanism to enhance performance and obtain a competitive advantage through customer satisfaction, and it is not a final goal but rather a method to achieve the final goal for the company (Oke, 2005). Also, many researchers have shown that VF impacts a company's performance positively (Kekre and Srinivasan, 1990; Suarez et al, 1996; Vickery et al, 1999). Moreover, it reduces demand uncertainty by controlling production size to meet demand fluctuations in urgent cases (Goyal and Netessine, 2011). It also directly affects customers' perceptions by meeting their needs at any time (Vickery et al, 1999), which will lead rationally to increased customer satisfaction.

Moreover, mix flexibility as a kind of affects the profitability and market share of a company positively (Kekre and Srinivasan, 1990; Suarez et al, 1996). In addition to this, Kekre and Srinivasan (1990) mentioned that there is a link between the success of the company as represented by obtaining more profits and a bigger market share, and the ability to offer a variety of products without high costs. Similarly, Suarez et al (1996) clearly noted that MF means a wide range of products at a particular moment. MF also helps companies to offer the required products which meet customers' needs and preferences (Zhang et al, 2003; Sáenz et al, 2018) consequently, this will lead to customer satisfaction.

In the context of PDF, Cottrell and Nault (2004) found that introducing new products positively affects company performance because of increasing product diversity, while Suarez et al (1996) mentioned that providing modern products has become essential for many industries, especially with rapid technological advances and changes in customers' preferences, and so. Therefore introducing new products can give company a significant competitive advantage.

Based on what has been discussed above, we can formulate the second main hypothesis and the related sub-hypotheses:

***H2: Operational flexibility positively affects the performance of pharmaceutical SMEs in Iran.***

***H21a: Mix flexibility positively affects the performance of pharmaceutical SMEs in Iran.***

***H2b: Volume flexibility positively affects the performance of pharmaceutical SMEs in Iran.***

***H2c: Product development flexibility positively affects the performance of pharmaceutical SMEs in Iran.***

3. Environmental uncertainty can be divided into three basic kinds, which are: supply uncertainty, demand uncertainty, and technological uncertainty (Davis, 1993).

In the current study, we try to investigate how environment uncertainty represented by demand uncertainty and supply uncertainty can moderate the link between flexibility and companies' performance.

DU indicates demand fluctuations. This means the changing amounts of products and the time of demand, whereas supply uncertainty relates to suppliers, it reflects supply fluctuations and the unpredictability of both the quantity and timing of supply (Fynes et al, 2004). Strategic flexibility is considered an essential mechanism for responding to environmental changes and a core factor that helps companies survive and succeed in markets that experience intense competition (Yuan et al, 2010). Due to the importance of flexibility as a mechanism to cope with uncertainty and respond to environmental changes (Gerwin, 1993; Sawhney, 2006; Chahal et al 2018) and its role in company performance, we will investigate the link between SF and company performance and test the moderating effect of uncertainty on this relationship.

Based on what has been mentioned above, we can form the third main hypothesis:

***H3: Uncertainty moderates the relationship between strategic flexibility and the performance of pharmaceutical SMEs in Iran.***

4. Flexibility can be seen from two basic sides, firstly as a capability in itself, and secondly as a powerful factor offering the manufacturing system the ability to react fast to market changes and acquire a competitive advantage (Hallgren and Olhager, 2009). In the case of environmental uncertainty, De Toni and Tonchia (1998) and Jack and Raturi (2002) considered flexibility an absorber for uncertainty. Also, it is a kind of reaction to uncertain situations (Swamidass and Newell, 1987).

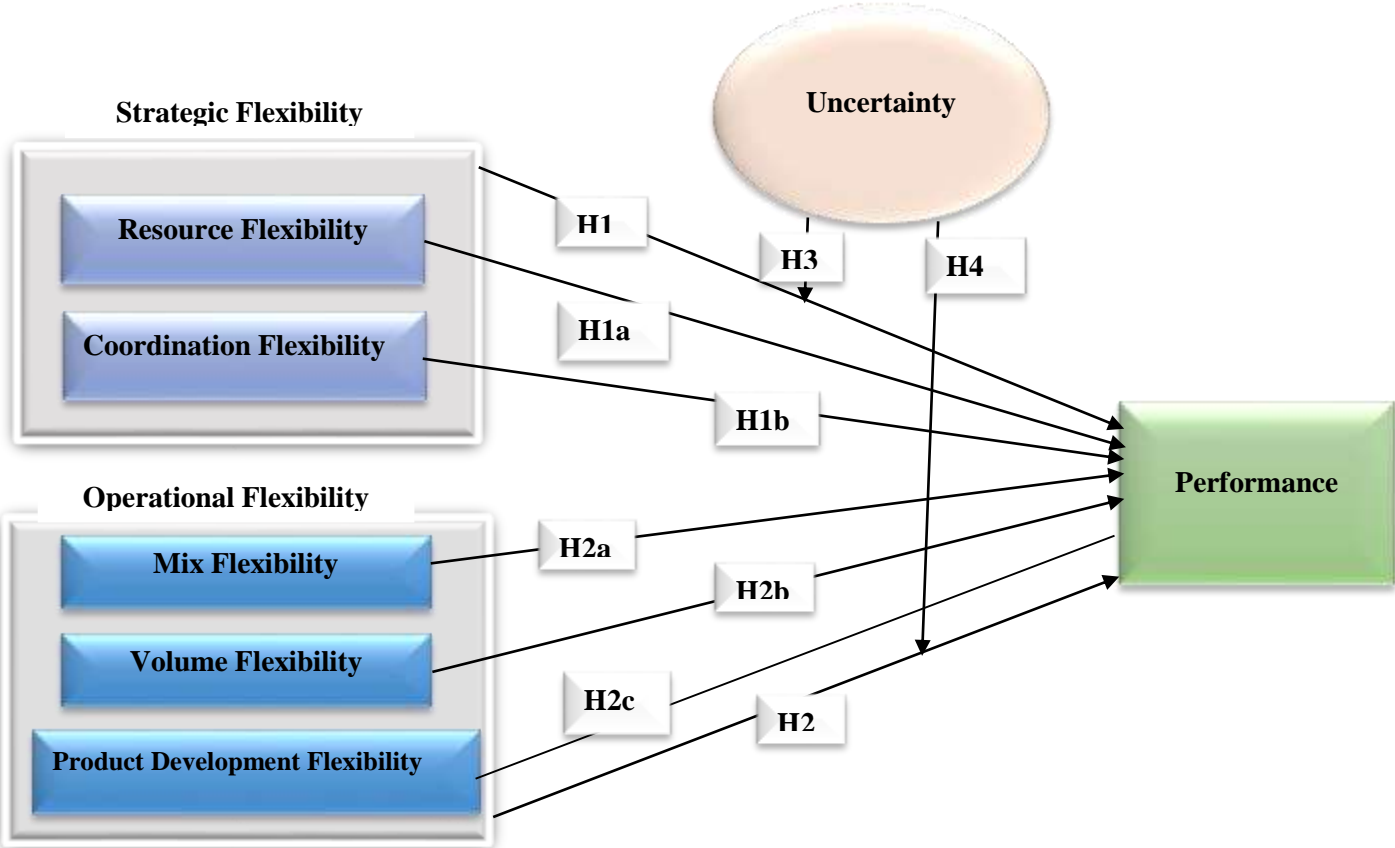
In the field of operations management, many researchers have referred to the fact that uncertainty is a source of instability for businesses and in a hyper changing business environment a high degree of uncertainty will motivate companies to concentrate more and more on flexibility in the supply chain (Vickery et al, 1999).

Operational flexibility helps companies to decrease the economically negative consequences of the difference between demand and supply by enabling them to reallocate their capacity according to changing demand (Goyal and Netessine, 2011).

Based on what has been mentioned above, we can formulate the fourth main hypothesis:

**H4:** *Uncertainty moderates the relationship between operational flexibility and the performance of pharmaceutical SMEs in Iran.*

The following (Figure 1-1) summarizes the previous hypotheses and the directions between research variables.



**Figure 1-1: Research model**

*Source: Authors' based on hypotheses development (2019)*

## 2. LITERATURE REVIEW

### 2.1 Flexibility in the Literature

Increasingly, businesses face a complex and uncertain work environment full of challenges and unremitting change. These include economic crises, new management practices, globalization, changes in business environments and regulations, changes in consumer predilections and shifts in power towards them, unforeseeable demand and supply fluctuations, and technological turbulences (Hitt *et al.*, 1998; Combe, 2012; Dreyer and Grønhaug, 2012; Thomas, 2014; Brozovic, 2018). Consequently, companies need to keep up to speed with changes in the business environment, and they should find mechanisms to deal with market changes. Flexibility could perhaps be one of the strategies for businesses to deal with unpredictable circumstances and to cope with uncertainty as well as possible.

Flexibility is a multi-dimensional concept (Stohr, 2013) it is taken as a simple word but, in fact, it is a nuanced and multi-faceted idea. The origin of flexibility as a concept dates back to (Hart, 1937), and then the theme became the topic of discussion in different research areas (Bahrami and Evans, 2011), including economics (Backman, 1940), decision analysis (Koopmans, 1964), military strategy (Eppink, 1978), organizational design (Ackoff, 1977), and information technology (Highsmith, 2001).

Overall, flexibility denotes a company's capability to deal with or respond to environmental fluctuations or uncertainties, and consequently acquire the opportunities to obtain a maintainable competitive advantage (Slack, 1987; Gerwin, 1993; Upton, 1995; Gupta and Somers, 1996; Sawhney, 2006; Tiwari et al, 2015; Chahala et al, 2018).

According to Suarez et al (1996) there are many reasons which affect the company's decision to adopt flexibility as a technique to respond to environmental changes, and what the required level of flexibility which should be adopted by the company is: 1 - a products mix strategy ; 2 - competitors' strategies and techniques; 3 - product demand ; 4 - industry life cycle . In the context of dynamic business environment, Chahala et al (2018) and Dreyer and Grønhaug (2004) considered flexibility a cause of obtaining a competitive advantage and something which plays an important role in non-static markets which are characterized by intense competition, short product life cycles, rapid changes in consumer needs, and/or technological turbulence. In a similar vein, Hallgren and Olhager (2009) cited that flexibility can be seen from two basic sides, firstly as a capability in itself, and secondly as a supporting factor which provides the manufacturing system with the capability to react rapidly to market changes and obtain

combative advantage. That opinion has been supported by other authors who have seen flexibility as a characteristic of a successful organization, which gives the organization the advantage of avoiding the changes and threats of the macro environment, or offers companies the chance to react successfully and rapidly to changes (Gomez and Verdú, 2005; Roberts and Stockport, 2009; Cingöz and Akdoğan, 2013).

Despite the wide spread of flexibility in the business and management literatures, there is no specific definition of the term, and authors have provided various definitions for flexibility according to the cases in which they investigate. In the same context, Oke (2005) and Koste and Malhotra (1999) mentioned clearly that despite the possible benefits of flexibility, it is still not clear enough and does not seem to be widely known, so the notion of flexibility itself is still not clear and it is really difficult to find a comprehensive consistent view of flexibility or its dimensions. Moreover, De Toni and Tonchia (2005) clarified that there is no widely accepted definition of flexibility in the literature, and the interpretation of the issue is a problematic one; in addition to the complexity of conceptual convergence of terms, there is also a great variation in the meaning of flexibility in the various fields of implementation. Beach et al (2000) suggested an appropriate solution to deal with the issue of the non-standardized and confusing definitions of flexibility by using a number of classifications to describe flexibility for different purposes.

Although the complexity and multidimensionality of the concept makes it difficult to define flexibility satisfactorily, we will mention some related general definitions. The most dominant definitions of flexibility focus on the relationship between the company and its environment and how the company can respond quickly to changes in its dynamic environment and deal with uncertain situations, and we will pay more attention to this kind of concept because of the aims of the research. Flexibility in general is defined as the ability to adapt to new, specific or changing needs (Fawcett et al, 1996), for which goal the company should respond quickly and in perfect time to these changes. From the resource point view, Wright and Snell (1998) note that flexibility means a company's capability to formulate resources and processes rapidly in order to respond effectively to new environmental situations. We can observe that this definition derives from Sanchez's (1993, 1995) perspective of strategic flexibility which relates to resources and coordination flexibility. Mascarenhas (1981) defined flexibility as organization's aptitude to acclimatize to or comply effectively with external changes. Stalk (1988) simply defined flexibility as "being responsive to the market". In the competitive environment, uncertainty makes flexibility worthwhile (Dreyer and Grønhaug, 2004). In the light of

environmental uncertainty, De Toni and Tonchia (1998) considered flexibility as an absorber for uncertainty. Swamidass and Newell (1987) considered flexibility as a response to environmental ambiguity. Moreover, Vickery et al (1999), working in the field of operation management, clarified that the relationship between uncertainty and flexibility is an essential concern, and the required level of flexibility in the supply chain is related to the levels of environmental uncertainty. Furthermore, many researchers have described flexibility simply as a reaction to business environment uncertainty (Jack and Raturi, 2002).

Based on what has been mentioned above, we can note that flexibility has been discussed widely from different perspectives, and because of this there is no specific definition of it, as pointed out by De Toni and Tonchia (1998). The author agrees with Stalk's (1988) definition of flexibility which states it is the means to react or respond to market changes, which expresses the core of flexibility as a mechanism to respond efficiently to unexpected and uncertain situations, and this also matches with the opinion of Dreyer and Grønhaug (2004). According to management and business literatures, flexibility is widely discussed in two main categories: strategic flexibility and operational or manufacturing flexibility. In this research, both Suarez et al (1996) and Sanchez's (1995;1997) perspectives on strategic flexibility and operational flexibility will be adopted, because to date there has been no study which considers these perspectives together to cover flexibility from both a strategic and an operational perspective, and compare the effect of each type on company performance.

## **2.2 Flexibility Approaches**

According to the literatures, flexibility is organized into four approaches: the economic, the organizational, the operational and the strategic approach.

The economic approach of flexibility was first launched by Stigler in 1939; he studied flexibility based on the cost (marginal and average) and production volume in the light of cost curves in the short-term; he mentioned that flexibility is greater when marginal cost curves and average cost curves are flatter. This idea was the precursor of the later emergence of volume flexibility (De Toni and Tonchia, 2005).

In the organizational approach, flexibility is discussed in the context of the organization as an integrated business unit, as well as how an organization can operate in a dynamic environment and respond to changes, including labor flexibility as a personnel capacity. Atkinson (1985) later considered flexibility in terms of HR flexibility. In this regard the most important contributions were provided firstly by Burns and Stalker (1961), with the concept of 'organic'

versus ‘mechanistic’, and secondly by Mintzberg (1979), with the concept of ‘adhocracy’, which means an organizational structure that is versatile, adaptable and informal, without bureaucratic rules or procedures.

In the context of operations management, the operational approach formulates manufacturing flexibility from an operational perspective. Zelenovich (1982) defined manufacturing flexibility as the capability of an industrial system to adjust to fluctuations in the business environment and in the required process to deal with the changes in dynamic situations.

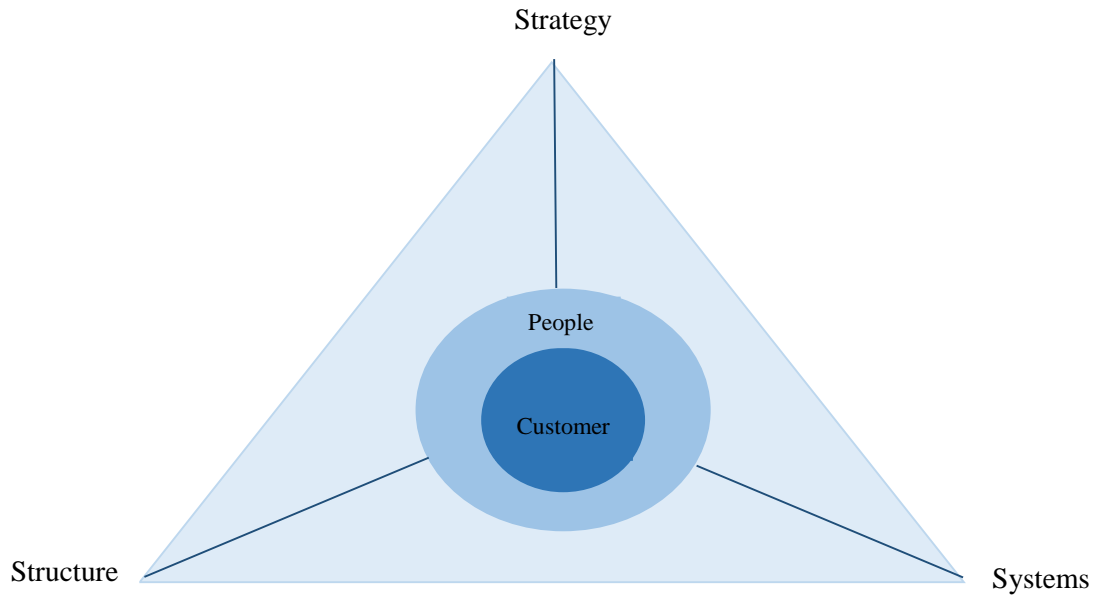
Finally, there is the strategic approach to flexibility which considers companies’ aptitude to adapt to changes in the business environment from a strategic perspective. Harrigan (1985) mentioned that strategic versatility refers to businesses’ willingness to reposition themselves on the market, adjust their plans or substitute their current strategies when targeted markets are no longer so appealing, or their products or services are no longer attractive to customers.

In this study both theoretical and practical sides will be discussed, mainly in the context of strategic and operational approaches to flexibility, but the organizational approach will be discussed theoretically as a preface to the strategic and operational approaches, because any company is an organizational unit which has a special structure which consists of a strategic level, a tactical level and an operational level; thus it is appropriate to start with the organizational approach as a preamble.

### **2.3 Organizational Flexibility**

From an organizational perspective Sushil (2000) discussed flexibility in the framework of “enterprise flexibility”, mentioning that enterprise flexibility relates to three main points: choice, change and liberty of choice. Choice relates to the creation of options at different levels in the enterprise, followed by the development of methods of change based on the number of available options. The final stage is choosing the right stakeholders within the organization who will be responsible for stratifying the needed changes at the optimal time (Sushil, 2001).

Sushil (2000) focused on three of the organizational elements: 1) systems, 2) strategy, and 3) structures (Figure 2-1).



**Figure 2-1: The Triangle of the Enterprise 1**

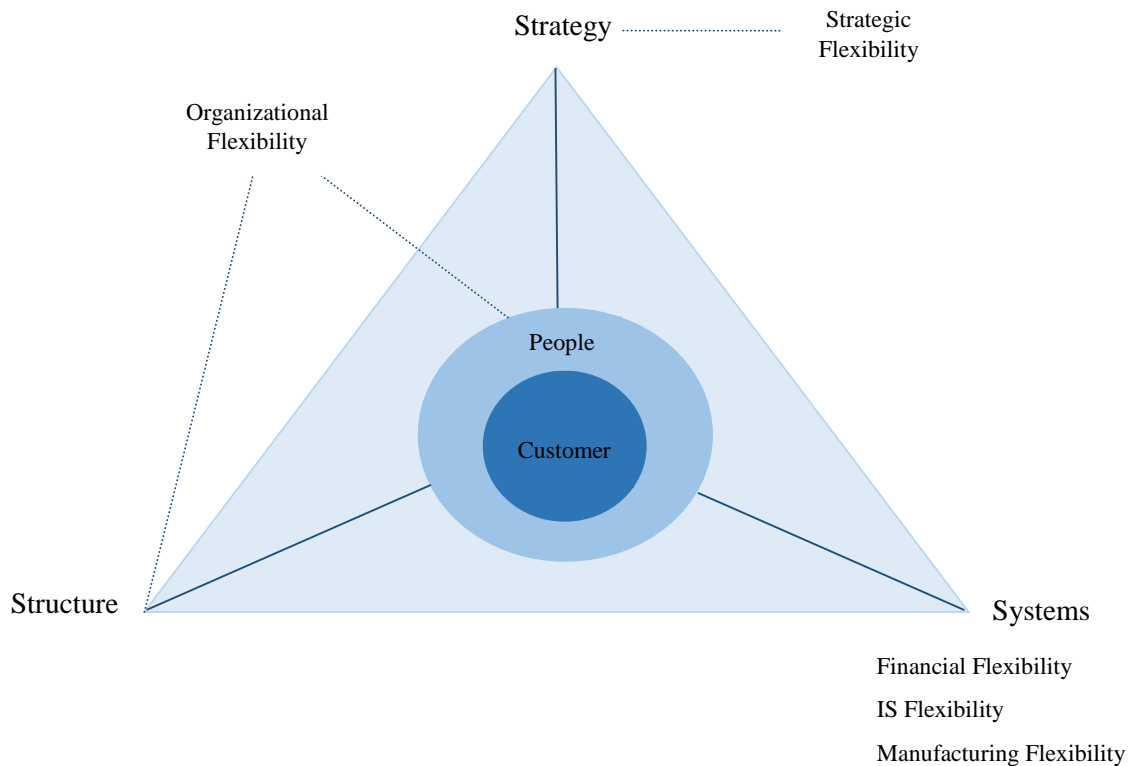
*Source: Sushil, 2014*

**Strategy** includes vision, strategies, dynamic balancing of paired reverses, paradoxical strategies, the LAP and SAP models, an open environment, FS strategy for change management.

**Structure** covers organizational structure, agile and flexible structure, flatter and networked organization, informal organization, open communication.

**Systems** involves process-oriented systems, knowledge-based learning systems, customer-oriented systems, systems thinking and self-organizing teams.

Sushil (2000) discussed flexibility based on SSS, so we have three different classifications of flexibility, which are: SF depending on the strategic dimension, OF which relates to systems (financial, information system, manufacturing and marketing flexibility) and flexibility which relates to people and structures (Figure 2-2). The different types of flexibilities act together in an integrated manner to create a flexible enterprise (Sushil, 2000).



**Figure 2-2: The Triangle of the Enterprise 2**

*Source: Sushil, 2014*

Furthermore, each category of flexibility could have different forms; for example, SF is divided into recourse flexibility and coordination flexibility (Sanchez, 1993, 1995) or proactive and reactive flexibility (Evans, 1991). Also, manufacturing flexibility, or operational flexibility as it is also referred to, is divided into various different types of flexibilities, including PF, VF, DF, MF, and QF (Slack, 1987).

Moreover, there are many kinds of flexibility, which will be introduced later in the appendices, according to different classifications.

According to Sushil (2000) model of enterprise flexibility, there are seven types of flexibility at an organization:

### 1. Strategic Flexibility

This refers to a company's capacity to move quickly, and change course to exploit an opportunity or to avoid a threat; in other word a company's ability to use a variety of capabilities based on a particular situation, absorb shocks and withstand adversity, all of which support the opinion that flexibility is a "polymorphous" concept (Bahrami and Evans, 2011). It provides many advantages for companies, such as perpetual renewal, creating the effective balance

between contradictory strategic choices, and making both strategy implementation and formulation more flexible (Sushil, 2014).

## 2. Organizational Flexibility

This is an organizational capability which enables the company to change its components, including organizational culture, people, structures and methods, in order to respond to the new situation by interplaying dynamically through organizational choices (Sushil, 2014). According to Quinn (1985) and Volberda (1999), it is a comprehensive notion and it is a necessary condition for innovation.

## 3. Financial Flexibility

According to Sushile (2014), this can be defined as companies' ability to choose freely among the optimal financial options in the light of monetary and fiscal policy, and the financial regulations established by the government, and moreover to choose the strategy which enables the company to improve its financial processes for best performance compared to its competitors. From Gamba and Triantis' (2008) perspective, financial flexibility relates to a company's ability to reform and reconfigure its financial structure with the lowest possible costs. Furthermore, companies who depend on financial flexibility could deal with the financial crises professionally to protect the interests of equity holders and grab the opportunity to start profitable investments before competitors do so. Moreover, this kind of flexibility is considered a very important technique to attract funding for start-up ventures (Trigeorgis, 1993).

## 4. Information Systems Flexibility

In general, an information system provides an effective support to business processes related to procurement and customer relationship management (Nandakumar et al, 2014). It is composed of systemic flexibility and usage flexibility which enable the company to respond to new circumstances, either internally or externally (Palanisamy and Sushil, 2003; Palanisamy, 2012). Moreover, there are a variety of options and alternatives that the information system offers before a major change is made (Sethi and Sethi, 1990).

## 5. Manufacturing Flexibility

Simply expressed, it means an industrial system's capability to deal with and adapt to the environmental uncertainties in the best time and easiest way (Sharma and Sushil, 2002).

## 6. Marketing Flexibility

In brief, marketing is a technique used by companies or people to promote the services or products which are produced by them and convince the potential or targeted customer to buy them. It refers to a company's aptitude to meet changing customer needs, deal with different market sections, and obtain advantages through a balance between international and domestic requirements (Sushil, 2014). It can be built by developing versatile marketing processes and frameworks, for example, companies can adopt marketing strategies in order to facilitate contact with their customers and include them in the activities and processes which will create added values, and as a result customers will be satisfied (Gurău, 2009).

## 7. HR flexibility

Human capital is considered an essential resource for any organization, especially in the service sector which depends mainly on human resources to provide services to customers. In this regard, Nandakumar et al (2014) clearly stated that maintaining HR flexibility is important for service sectors that are effected by technology, economic circumstances and competition. Moreover, HR flexibility is helpful in overcoming uncertainties related to the polarization of professional human capital and the decreasing use of outsourcing (Valverde et al, 2000). In addition, training programs and skills development for staff will help the company to keep HR more flexible (Wright and Snell, 1998).

### **2.4 Flexibility Maturity**

Flexibility as a mechanism to deal with uncertainty has become an essential and urgent need for organizations, especially in dynamic business environments, but it should be used in a structural way, and not randomly, because the need for flexibility differs from one organization to another, and within the same organization. In other words, to become more efficient and effectively manage uncertainty in the business environment, the required level and type of flexibility differs, based on the maturity level of the company.

According to Sushil (2012), there are six different levels of flexibility maturity at the organization, and flexibility can range from a lower level which relates to the operational processes to a higher level on the maturity scale which represents the ecosystem (Figures 2-3).



**Figure 2-3: A Typical Flexibility Maturity Model**

*Source: Sushil, 2014*

Figure (2-3) shows that there are six levels of flexibility maturity:

**Maturity level 1:** this level relates to various operational processes at the organization; it is considered the starting point of the flexibility maturity journey for any company. At this point of the pyramid many types of flexibility are created, such as manufacturing, marketing, financial and HR flexibility, by finding choices and modifying all techniques for different operational practices.

**Maturity level 2:** is considered very important because it will facilitate the emergence of multiple types of flexibility at the organization. Here we can find interaction between different processes, consequently creating flexibility at different levels later. This can include how marketing and manufacturing flexibility are integrated together, how technological flexibility is correlated with financial flexibility, and how HR flexibility will help to generate a flexible supply chain.

**Maturity level 3:** At this level, flexibility relates to the actors who will obtain benefits from it, such as stakeholders; indeed, in this stage all processes will be related to stakeholders. To achieve this, flexibility as an organizational capability can be boosted at different levels by the implementation of many managerial techniques such as learning orientation and flexible leadership. As a result, flexibility will be applied in different processes.

Maturity level 4: At this level flexibility from a strategic perspective will appear as strategic flexibility, to manage the paradoxes which emerge as a result of “the need of change versus continuity” (Sushil, 2012d). Other strategic contradictions might emerge at this stage, such as expansion–diversification, or exploitation–exploration, which were discussed in detail by Evans (1991) when he referred to the fact that strategic flexibility is divided into proactive (initiative) and reactive flexibility (expletive, corrective, protective). This level of flexibility maturity is considered the highest maturity level within the organizational context, since after this level flexibility will extend to networks.

Maturity level 5: At this level, the managers of the organization should think out of the box, which means extending the horizon of flexibility to include operations in the networks which are connected to organizational activities that will help the organization to establish relations, and boost the flexibility of processes and the relations with partners in order to be able to reach the appropriate level of flexibility in the supply chain. The importance of flexibility at this stage appears because rigidity will lead to constrained relations with partners and other parties outside the organization such as suppliers and customers. So as to apply flexibility effectively, all of the functional and administrative procedures in the networks should have flexibility simultaneously.

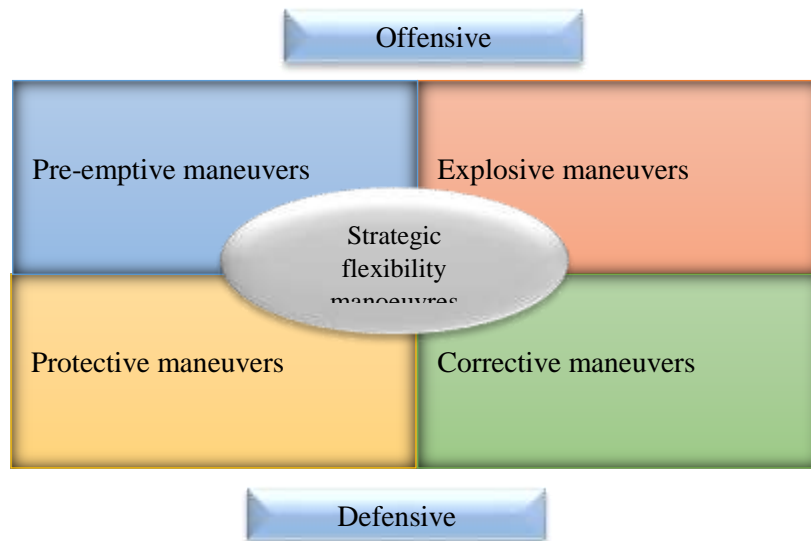
Maturity level 6: Finally, after establishing flexible networks with partners and other parties, the organization should think about transferring this flexibility to the macro business environment which encompasses all potential stakeholders (actors), and this will reflect positively on organizational performance and the macro environment, which includes all the parties including customers, government, competitors, and other industries.

## **2.5 Flexibility Dimensions**

According to Golden and Powell (2000), flexibility has four dimensions: 1) temporal, 2), range, 3) focus, and 4) intention.

1. The temporal dimension is related to the time needed for the company to respond to changes. In this regard Evans (1991) provided his model of strategic flexibility, which included two dimensions of flexibility - temporal and intentional. Based on this he suggested four types of strategic manoeuvres, which he later called the manoeuvres of strategic flexibility. According to the Evans model, the temporal dimension includes both an ex-ante mode (being ready for the potential transition beforehand) and ex-post

mode (the real changes made after the occurrence of the new situation), whereas the intentional dimension is composed of both offensive and defensive strategies (Evans, 1991; Figure 2-4).



**Figure 2-4: Strategic Flexibility Manoeuvres**

*Source: Authors based on Evans, 1991*

2. Range denotes the available choices for unpredicted shifts and how respond to them. In 1983 Slack introduced his model of flexibility, which consists of two main dimensions which are range and response; thus two types of flexibility emerged: the first range flexibility, and the second response flexibility. Range flexibility is considered a static aspect, related to the long-term, including both time and cost, whereas response flexibility is regarded as changeable, and it means the change from one situation to another within the short-term and with low costs. Range and response could be used together in a company, or they may be used with different factors which need flexibility, such as processes and production (De Toni and Tonchia, 2005).
3. Focus relates to the interior or exterior orientation of flexibility; in this regard, organizational flexibility and flexibility maturity levels can be useful to explain this point, and has been discussed above.
4. Intention is the organizational ability to be proactive or reactive towards environmental changes.

## 2.6 Strategic Flexibility

As mentioned previously, flexibility is a good mechanism to cope with uncertain situations and respond to fluctuations in the dynamic business environment. Flexibility has been discussed widely through strategic and operational management literatures; thus, we can note that flexibility is basically divided into strategic flexibility and operational flexibility. According to Yuan et al (2010), because of the importance of flexibility, it is considered a key strategic merit, and it is an alternative approach to manage an uncertain future in the light of product competition; moreover, it is used to develop companies' ability to react fast to the threats of technological change and to grab opportunities in the market (Sanchez, 1993, 1995). According to Katsuhiko and Hitt (2004) and Yuan et al (2010), strategic flexibility refers to three main points: 1) realizing the main changes in the market, 2) customizing resources quickly to emergency situations as a reaction to unexpected fluctuations, and 3) acting in the right time according to the new situation. This study agrees with Yuan et al's (2010) explanation of strategic flexibility because it expresses precisely the sense of SF as a reaction to uncertain situations and a customizing of available resources, which means "coordination flexibility" in order to enhance company performance, and that is exactly what this study aims to do.

In the context of the competition, Auh and Menguc (2005) clarified that companies should adapt according to the competitive situation; for example, when the company works in a market with a high level of competition, it has to change its strategies and be more flexible to react to urgent situations, but in stable situations, a company can keep using its current systems. So strategic flexibility could be a good mechanism to adapt to a competitive situation as well as market uncertainty. In the same direction, Yuan et al (2010) mentioned that SF affects a company's performance, especially in a highly competitive environment. However, companies should be very aware that strategic flexibility is not a magical key for any situation; it fits situations which are characterized by risk and uncertainty, but there is no need for it in stable cases. In this regard, Pagell and Krause (2003) mentioned that companies that apply flexibility as a strategic technique in stable environments or with a low level of uncertainty are likely to be able to afford higher costs.

Despite the importance of SF in competitive environments, this study - by considering resource flexibility and coordination flexibility as dimensions of SF - will focus on the importance of SF as a mechanism to deal with uncertain situations, not with market competition.

The extent to which an organization implements SF as a strategic option depends on the strategic orientation of the organization (Fawcett et al, 1996), and is also determined by competitive intensity (Nadkarni and Nareyanan, 2007). Strategic flexibility has been used to indicate a company's ability to deal with different circumstances in competitive complex systems (Sanchez, 1995). Consequently, companies should be aware of market changes and new opportunities arising out of changes in customers' preferences and respond to them before competitors, because companies which are strategically flexible are usually able to meet market requirements by evolving the services and products they produce (Yuan et al, 2010). Furthermore, the new competition trends reflect the importance of applying new types of flexibilities for companies so they can respond quickly to technological change and grab the available opportunities by using a product development strategy or a new product strategy (Sanchez, 1995). Companies can achieve a competitive advantage by using SF as a technique to create alternative tracks of strategic choices, especially in hyper-competitive markets (Sanchez, 1993). Miles et al (1978) mentioned that, in addition to effective marketing strategies and using an optimal marketing mix, SF may boost the performance of companies because it makes the connections between the parties and the plans more effective. Also, Grewal and Tansuhaj (2001) clarified that in the light of crises and instability, especially with technological difficulties, implementing SF impacted on companies' performance positively.

Many researchers have defined strategic flexibility from different perspectives. In the connection between strategic flexibility and company performance (Aaker and Mascarenhas, 1984) defined SF as the organizational capability to adapt in perfect time and cope with environmental fluctuations which have a considerable impact on the organization's performance.

In the context of production and marketing, Viswanadham and Raghavan (1997) defined SF as the company's ability to use the available resources in optimal ways to provide new products or develop current products, especially in a competitive market. Sanchez (1995) mentioned that SF in the framework of production systems consists of two basic integrated components which relate (1) to the available resources (resource flexibility) and (2) to how a company can use these resources in an optimal way (coordination flexibility). From a marketing perspective, strategic flexibility refers to the organizational capacity to handle macro-environment uncertainties by reacting immediately to market signals by avoiding threats and grabbing opportunities (Grewal and Tansuhaj, 2001).

In the context of a competition and market dynamism perspective, strategic flexibility is considered an essential mechanism to react to uncertainty and a core factor to help companies to survive and achieve success in markets which are intensely competitive (Yuan et al, 2010). Moreover, SF could be considered an effective mechanism to react to the competitive behavior of competitors in the same industry (Kurt and Hulland 2013; Sanchez, 1995). In a different meaning, companies who want to be leaders in the market and always have a competitive advantage, must be flexible in advance compared to competitors, to be able to dominate the market (Lau, 1996). Furthermore, SF is considered a key competency to react to massive competition in the market (Fernandez et al, 2012). It is a property that authorizes modern organizations to prepare for largely unpredictable changes (Radomska, 2015). Evans (1991) considered SF offensive procedures to dominate the market, or a defensive procedure against massive competition.

Because of the existence of many definitions of strategic flexibility from different perspectives, strategic flexibility has not been unanimously defined (Brozovic, 2018). Appendix 1 provides definitions of strategic flexibility based on different perspectives.

Based on what has been mentioned previously, this study will focus on SF from a strategic perspective as a means to deal with uncertain situations, as proposed by Aaker and Mascarenhas (1984), by using Sanchez's model, which is dependent on RBV theory and divides SF into RF and CF, because it is the most suitable model to be combined with operational flexibility, because RF and CF are related to the resources available to produce products that are related directly to the dimensions of OF which are considered in this study (MF, VF, and PDF). Finally, we can define SF as a strategic technique that enables companies to respond efficiently to unexpected situations.

### **2.6.1 Strategic Flexibility from a Resource-Based View Theory Perspective**

A company as a system consists of three basic components, which are inputs, processes and outputs. The inputs as resources are the cornerstone of production processes because without resources there are no processes or outputs, and companies should be rational in using the resources which are available for production processes, because resources are rare and their usage is unlimited. In this regard, Chauhan and Singh (2014) mentioned that every operation may need many resources, and a company can choose from a given set of them. So coordination is required as a complement to resources to ensure their optimal use. Based on this point, we can start to think about both resource flexibility and coordination flexibility. According to

Whipp et al (1989), Sanchez (1995, 1997), Fernandez et al (2012) and Brozovic (2018) flexible resources are considered one of the precedents of SF.

Sanchez (1995) used RBV theory to present his own model of SF. Based on his own perspective he divided SF into RF (related to the available resources) and CF (related to the optimal use of the available resources), and he clarified that an organization must be able to obtain the resources then coordinate the usage of them in alternative ways (Sanchez, 1997). For more detail, both RF and CF will be discussed in separate subchapters.

### **2.6.2 Resource Flexibility**

Resources are defined as all the inputs including tangible and intangible assets (capital, assets, information, processes, etc.) which the organization uses to implement the strategies and achieve the required aims (Barney, 1991). Because of the scarcity of resources, and the multi-use of them, companies can obtain many benefits and advantages by developing SF in order to share and use their rare resources in a flexible manner (Chan et al, 2016). In this regard, Slack (2005) argued that resource flexibility has an advantage as an enabler or antecedent for the flexibility of the operational system, which will lead to a boost in operational performance and, as a result, a competitive advantage.

From a strategic perspective, Sanchez (1995) described resource flexibility by using three dimensions: a) a range of alternatives, b) cost, c) time. He clarified that resource flexibility relates positively to a variety of alternative uses of the available resources. There are inverse relationships between both cost (the costs and difficulty of changing between alternatives) and time (which is needed for changing between the alternatives) and resource flexibility. Slack (1983, 1987) also presented a simple explanation for resource flexibility in the field of operational systems, mentioning that RF - like flexibility in technology, processes, and employment - is related to the available and applied tools used to obtain flexibility.

The importance of RF is showed by the ability to use available resources to efficiently conduct a wide range of operational activities, especially in reacting to changes in design and the introduction of new products (Chauhan and Singh, 2014). Moreover, RF reflects the variety of products which can be produced, developed, manufactured , distributed , or marketed by using a company 's resources effectively (Zhou and Wu, 2010). From their perspective, Chan et al (2017) mentioned clearly that resource flexibility leads to market leadership, because the time needed for searching for the required materials and resources for a production process will be lower if the company uses resource flexibility; consequently new products will enable the

company to achieve a competitive advantage. According to Tomlin and Wang (2005), RF is considered a useful way to meet uncertain demand by producing many products; at the same time using multi-sourcing will be useful for ensuring the production process continues in cases of uncertainty in supply. In the same context, Chod and Rudi (2005); Chod and Zhou (2013) used resource flexibility as a mechanism to decrease the gap between constrained (limited) supply and uncertain demand, so it has benefits in decreasing the gap between supply and demand. Moreover, resource flexibility is an ability to allocate resources between production stages (from one to another) in response to shifting bottlenecks, and it enables companies to deal with production turbulence; as a result providing new products and developing current products will be faster (Chauhan and Singh, 2014).

In the framework of the link between resource flexibility and performance, Daniels et al (1996, 2004) found that effective allocation and utilization of resource flexibility helps companies to improve operational performance. But according to Oke (2005), resource flexibility has not yet had such a durable impact on the advantages perceived by clients. In this context, Chauhan and Singh (2011, p. 33) mentioned that resource flexibility could be a good technique to achieve many things which will affect companies' performance positively, such as offering totally new products and making the production mix more diverse, and fulfilling customers' preferences faster. What was mentioned previously will lead rationally to customer satisfaction, because by increasing resource flexibility, the usage of existing resources will make it easier to achieve new production aims, as well as save time and reduce the cost of searching for new resources and moving from one alternative to another (Lieberman and Montgomery, 1988) thus enhancing company performance in general. Moreover, from the customer satisfaction side, RF also affects the number of customers because of its impact on consumer surplus, which is the gap between two prices, one being the price which the customer willing to pay and the other being what the customer really pays; this gap will affect the number of customers who pay for the product (Chod and Rudi, 2005). From the cost side, a higher level of resource flexibility enables companies to cope with uncertain factors faster with fewer costs; as a result, the value and importance of RF will be higher in the light of massive competition (Yuan et al, 2010). Consequently, this may well lead to higher profitability, which is one of the indexes used to measure financial performance.

Based on what has been mentioned previously, we can note that all the definitions and opinions of researchers are agreed on one essential issue, which is the importance of RF in enhancing company performance and enabling companies to face fluctuations in supply by using the

available resources in a different manner, by benefitting from a large range of alternative uses of the available resources, switching easily from one use of major resources to an alternative use, switching within a short time, and finally, switching at low cost from one use of major resources to another, or alternative, resource.

### **2.6.3 Coordination Flexibility**

In the previous subchapter, we highlighted the importance of resource flexibility, but its predicted advantages will improve when collaboration mechanisms are successful and innovative between all the internal sections of the company (Jamieson, 2014). In the context of coordination flexibility, we should search for details in coordination, beginning with Barnard (1966), who mentioned in his book “Theory of Cooperation and Organization” that coordination is the creative side of an organization. In the literature on management, coordination as a concept means an organization’s ability to combine all the different departments of an organization at one time (Van de Ven et al, 1976). As a mechanism, coordination enables managers from all organizational levels to communicate and share different opinions, knowledge and important decision information between different functional sections (Feifei, 2012). Moreover, Sanchez (1995) mentioned that coordination itself includes three main processes: a) defining both production and marketing strategies to determine the market segments it aims to reach by offering the products; b) determining the resources needed to produce and distribute the products in the light of both production and marketing strategies, and c) re-customizing resources by forming effective and suitable marketing channels which support the production strategies in the target markets. Therefore, companies should seek to achieve concurrent flexibilities in all three processes, especially in cases which require frequent adjustments in product strategies. Thus, coordination flexibility will help companies to organize the available resources and manage their use in the light of unlimited usage and rare resources.

Coordination flexibility could be used by companies to react to the changes in a dynamic environment and exploit the available opportunities (Cetindamara et al, 2009) and serve potential customers (Yuan et al, 2010), because by the implementation of CF, companies can combine the available resources (internal and external) efficiently and use them in an optimal way for better performance (Katsuhiko and Hitt, 2004). Furthermore, it can help companies to choose correctly from among the available alternative resources, minimize the cost of switching between the choices offered in order to achieve production modifications (Jamieson, 2014), and as a result enhancing company performance. Moreover, it enables the company to reconfigure

and redesign the usual administrative processes and apply them with a new method, in order to save the time needed and minimize the accompanying costs of production processes, and so enhance and improve the production strategies applied (Sanchez, 1995, 1997).

From the dynamic capability point of view, Yuan et al (2010, P.302) defined CF as “the ability of the organization to find new ways to combine and deploy internal and external resources effectively and efficiently between different business units within the organization, in order to get better value and quickly gain an exceptional advantage in the instable market”. It also expresses a company’s capability to discover new resources and how to use the existing resources rationally and efficiently for the long term, as well as decreasing the negative effects of environmental uncertainty (Yuan et al, 2010). Consequently, Yuan et al (2010) determined four dimensions of coordination flexibility: (1) new utilization of current resources or a recombination of internal resources in a different way, (2) new utilization of current resources or dependence on external resources, (3) the effective sharing and use of resources for an efficient response, and (4) an effective response to urgent problems.

Regarding the previous explanation of coordination flexibility, we note that all the opinions and perspectives agree on the importance of CR for improving performance; moreover, the idea of CF started from the notion of coordination which focuses on the sharing and deployment of resources and information between the internal departments at a company. We can summarize the steps of coordination flexibility as follows: determine the required resources for the production process by determining the optimal structure of resources, match the production plan with the available resources, then ensure collaboration between internal departments to find the optimal use of available resources, then search for an effective way to manage and use the available resources, and finally, redefine the new use of available resources to reconfigure the resource chain. Consequently, we can define coordination flexibility as a company’s ability to manage and use resources in different ways for better performance in the light of resource scarcity, by using and sharing available resources between production lines efficiently.

## **2.7 Operational Flexibility**

Operational flexibility is not new, and dates back to 1939, when Stigler (1939) highlighted fluctuations in output, factories’ ability to adapt to fluctuations, and flexibility in operations, and mentioned clearly that flexibility is not similar to adaptability; subsequently, the literature developed remarkably from 1980. OF is still a ‘new old topic’, which has been discussed for more than 30 years, and is still important and attractive for many researchers, especially those who work in industrial organizations. It has been discussed from different perspectives, so there

is no consensus on its dimensions. In this context Yu et al (2015) clarified that there are no limitations to operational flexibility, although generally, in the context of industrial systems, it means the capability of the industrial system to deal with fluctuations in the industry (Gupta and Buzacott, 1989). The previous definition is the simplest and clearest definition of OF, and the current study aims to consider operational flexibility from this perspective, specifically by considering flexibility as a technique to deal with fluctuations.

Operational flexibility and manufacturing flexibility as terms in the operations management literature had been used in a mutually interchangeable way to refer the same meaning: “the aptitude of industrial systems to deal with changes”. According to De Toni and Tonchia (2005), the concept of “operational flexibility” is deeper than “manufacturing flexibility”, and includes all processes (design, purchasing, distribution, marketing, services, etc.), not only manufacturing; however, the concept of “manufacturing flexibility” is often used to refer to all the operations related to production. Moreover, they have latterly been referred to as “manufacturing flexibility (or operational flexibility)” in a sign that there is no difference in meaning. However, according to the author's vision “operational flexibility” is more comprehensive, and we will consider it as a main variable in this research work, although both of them will be used in the literature review.

As an essential competitive strategy, manufacturing flexibility is considered the cornerstone of a company's operations strategy (Boyer and Leong, 1996). Organizational flexibility has been discussed above, and operational flexibility is considered one of the factors of organizational flexibility at the operational level at companies, and it has great importance because of its role in reconfiguring and reforming resources in order to provide new products and boost the performance of the company (Gerwin, 1993; Slack, 2005). Moreover, it is one of the essential features which the company must have to be successful (Scherrer-Rathje et al, 2014; Sáenz et al, 2018). It enables the company to control production levels and amounts, evolve current products, and react to competitors' strategies more quickly (Oke, 2005). Moreover, Chod and Rudi (2005) mentioned that manufacturing flexibility implementation leads to reduced costs. So operational flexibility may positively affect financial performance by enhancing profitability when costs are lower.

Kim (1991) and Yu et al (2015) highlighted two different meanings of manufacturing flexibility: the first is strategic manufacturing flexibility (which may be accompanied by a high cost of manufacturing), and the second is operational manufacturing flexibility which refers to a manufacturer's ability to respond to uncertainties and fluctuations, and also make changes in

industrial processes. So if we want to make a combination of these two perspectives we can say that manufacturing or operational flexibility means the ability to react to changes with a minimum level of time, cost and effort (Upton, 1994). It helps companies decrease the economically negative consequences of differences between demand and supply by enabling companies to reallocate their capacity according to changing demand (Goyal and Netessine, 2011). Furthermore, Huo et al (2018) mentioned that adopting flexibility as a technique at the operational level helps companies improve their performance and obtain a competitive advantage, because of its essential role in responding to changes and dealing with instability in a business environment effectively.

The current study adopts and supports the second meaning of OF provided by (Kim, 1991 and Yu et al, 2015) which refers to a manufacturer's ability to respond to uncertainties and fluctuations, especially demand and supply uncertainty, make changes in the industrial processes as a response to unexpected situations, including changes in production size or the production of different products, or the modification of current products in order to enhance company performance.

As a main classification of flexibility, Sarker et al (1994) point out that "it is unattainable to get a standard measurement for all the types of manufacturing flexibility". In the same context Slack (1983) mentioned that flexibility is fashionable. So there are no standard measurements for flexibility because it differs from case to case. However, manufacturing flexibility has attracted researchers as a capability which enables a company to effectively respond to dynamic markets (Sáenz et al, 2018). Consequently, we can find many definitions of operational flexibility by different authors; for example, Newman et al (1993) define manufacturing flexibility as a key tool to cope with company confusion within the business environment.

In the context of operation management, Upton (1994, 1995) defined flexibility as the ability to increase the offered product mix (here we can refer to mix flexibility), and respond quickly to changes in order to reach a high level of performance. Also, manufacturing flexibility is considered a technique to manage the resources used in production processes, and deal with uncertain situations in order to fulfil customer needs (Zhang and Lim, 2003). Furthermore, (Chauhan and Singh, 2011) regard it as an essential component in work strategies, such as costs and quality and price.

Based on what has been mentioned above, we can note many definitions of operational flexibility are formed by using different words, even though the researchers refer to one essential thing, which is that Operational Flexibility is a mechanism to deal with uncertainty,

fluctuations, and confusion in the business environment, to adapt to changes and to produce more to meet customers' needs. Consequently, we can offer the following definition of operational flexibility: "it refers to the industrial system's ability to respond effectively to the urgent changes in the production process and operations at the perfect time". Moreover, it describes a company's ability to reduce the negative consequences of the difference between demand and supply by enabling companies to reallocate their capacity according to changing demand and supply.

### **2.7.1 Operational Flexibility Dimensions**

Because of the importance of as a dynamic capability which enables companies to deal with uncertain situations either in an offensive or defensive manner (Stevenson and Spring, 2007), many researchers from different areas have discussed it from different perspectives and each one has considered different dimensions of; moreover, there is no a standard method to measure it. In this study, we will also focus on the operational approach to flexibility from a manufacturing perspective and consider only three dimensions of OP, which are MF, VF, and PDF, which are considered by Slack (1991) and Suarez et al (1996). However, there are many studies that have discussed operational flexibility based on a different points of view.

Appendix 2 explores information about the different classifications of operational flexibility.

According to Slack (1991), the flexibility of manufacturing systems has four types of flexibility, as follows:

(1) New product flexibility (NPF): either producing totally new products or modifying current products.

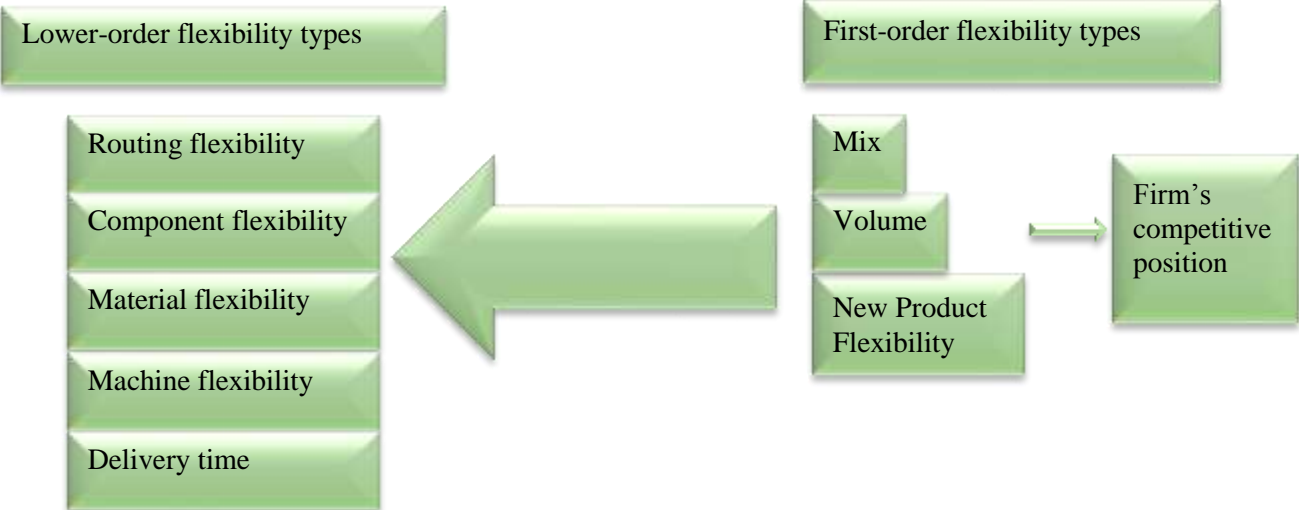
(2) Mix flexibility (MF): changing the scope of the production mix.

(3) Volume flexibility (VF): the ability to produce more or fewer products based on changes in demand circumstances.

(4) Delivery flexibility: the capability to modify the time and dates to deliver or transfer the produced products.

Suarez et al (1996) considered MF, NPF and VF as first-order types of flexibility, and he argued that these types have a significant impact on the company's ability to compete in the market. Then they referred to another category as "lower-order" flexibility (Figure 2-5), which relates to resource flexibility, and this does not have as much effect on the competitive situation of the company as the "first-order" group.

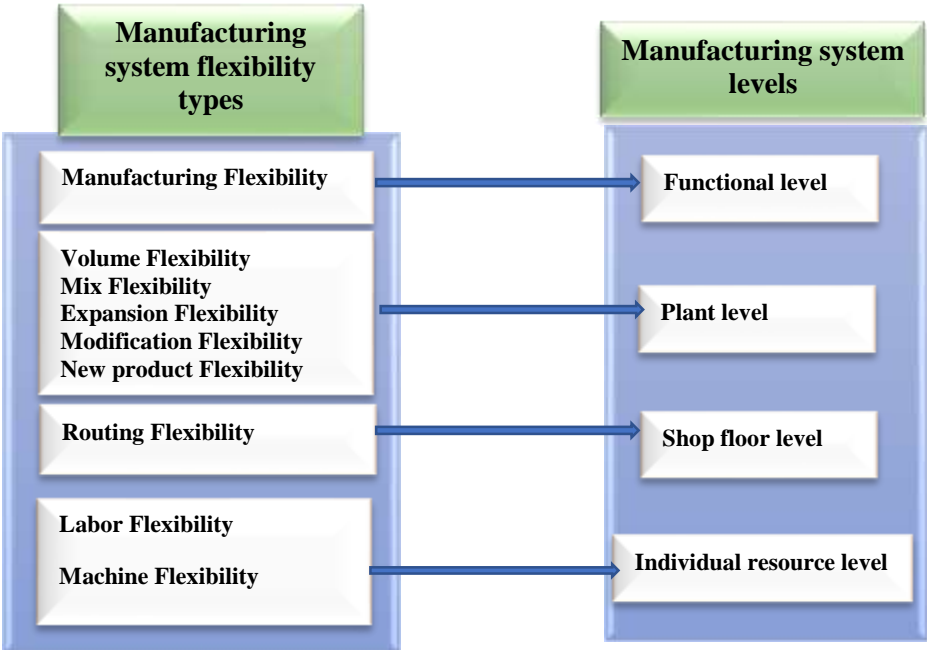
According to Suarez et al (1996), the types of flexibility are based on the various kinds of flexibility proposed in previous literature. They refer to the following order of types of flexibility: 1. MF; 2. VF; 3. NPF; 4. DF



**Figure 2-5: Operational Flexibility Dimensions**

Source: Based on Suarez et al, 1996

Koste and Malhorta (1999) also pointed out that with VF, MF, and NDF, the flexibility of expansion and the flexibility of modification are included at the factory level as the basic level of a manufacturing system (Figure 2-6).



**Figure 2-6: Manufacturing system levels and hierarchy of manufacturing flexibility types.**

Source: Pelaez and Ruiz, 2001

According to (Figure 2-6), the focus of this study will be on operational flexibility at the plant level, because the dimensions which are considered (Vf, MF, and PDF) are related to the production process in the plant.

### **2.7.2 Volume Flexibility**

Due to demand fluctuations, companies should find a way to meet demand changes and adapt production amounts to deal with fluctuations; according to the operation management literature, volume flexibility appeared as a solution to deal with this situation. Conventionally, volume flexibility is considered a response to demand fluctuations by altering production amounts (Dreyer and Grønhaug, 2004). According to Oke (2003), a company's failure to estimate demand amounts at specific times means it does not have volume flexibility in an operational sense, even if the company could acquire it later. Simply expressed, volume flexibility means the adjustment of production amounts to face the problem of demand instability by increasing or decreasing production levels. In this meaning, Goyal and Netessine (2011) noted that flexibility could be classified into two basic categories, the first being downside flexibility, which means producing less than the usual production capacity, and the second being upside flexibility, which means producing more than the usual production capacity. As a consequence, the main goal of volume flexibility is to customize capacity in response to demand volatility. Flexibility is not useful in all cases, because it is a mechanism to deal with uncertain situations; in this regard De Toni and Tonchia (1998) mentioned that in a situation of hyper uncertainty and minimum diversity, VF will be needed. In addition, Oke (2005) mentioned that VF is a method to obtain a competitive advantage by fulfilling customer needs and ensuring delivery; in this sense VF is not a goal, but rather a method to reach targets.

Also, VF has been discussed in the context of time scales; for example, Slack (1987; 1983) stated that VF is an effective technique to deal with demand fluctuations which are a type of uncertainty in the short-term, and VF is determined by the operational capacity of the industrial system in the short-term. However, in the longer term, the possibility of sustained market ambiguity will raise concerns about the required limits of production (volume flexibility as a range of products) based on the current capabilities of the company; so in this case, mix flexibility is required (Slack, 1987).

Many researchers have shown that volume flexibility positively affects a company's performance (Kekre and Srinivasan, 1990; Suarez et al, 1996; Vickery et al, 1999). It enhances

company performance by increasing customer satisfaction, because VF allows the company to modify production amounts in response to unexpected demand, and moreover, it reduces the time needed to fulfil customers' requirements (Sáenz et al, 2018), also reducing demand uncertainty through control of the production capacity, and as a result, of production amounts (Goyal and Netessine, 2011). It directly affects customers' perceptions by meeting their growing and sudden needs (Vickery et al, 1999), which will lead rationally to increasing customer satisfaction. Moreover, it helps companies to mitigate demand uncertainties through flexibility in both suppliers and production amounts (Goyal and Netessine, 2011). Hayes and Wheelwright (1984) focused on VF as a capability within highly fluctuating industries like "furniture", emphasizing the importance of the ability to modify production quickly according to demand variations. So from Vickery et al (1999) point view, to achieve better benefits of VF, a company should have very good links with its suppliers, in order to be able to deal with the increasing demand in the perfect time, and this may be a portal to the link between VF and both coordination and resource flexibilities.

Like other concepts which are related to flexibility, VF does not have a specific or standard definition (Jack and Raturi, 2002). Generally, flexibility as a word has been used as an equivalent for VF to express a company's capability in unstable situations to modify production size so as to meet external orders in the perfect time (Dreyer and Grønhaug, 2004). In the context of production size, the simplest definition of volume flexibility is provided by Slack (1987), who describes it as "the capability to modify the total output". Also, Upton (1994) defined it merely as a company's ability to modify production sizes, whereas Gerwin (1993) argues that VF is a mechanism used to change overall production. As a capability, VF is defined as "companies' capability to alter production amounts, within a logical cost and reasonable time" (Jack and Raturi, 2002, p. 535). Narasimhan and Das (1999) defined VF in terms of the time needed to make changes, as "increasing production size in a short time which may exceed the normal needed for normal production amounts." From Suarez et al's (1996) and Sethi and Sethi's (1990) perspective, VF means a company's ability to earn profits at all levels and amounts of production. In the light of demand uncertainty, Goyal and Netessine (2011, p. 180) defined VF as "modifying production amounts in an attempt to react to demand fluctuations". In a similar vein, VF is defined as the company's ability to change production sizes in response to different macro factors such as socio-economic conditions, with minimum costs or losses (Jack and Raturi, 2002, p. 519), and in response to customers' demands (Roth and Miller, 1990).

Based on what has been mentioned above, VF as a kind of operational flexibility has been discussed widely in terms of cost and time, and the importance of VF as a technique to deal with demand fluctuations and enhance companies' performance is clear; this study basically depends on the vision of Slack (1987; 1983) which identifies the purpose of adopting VF to deal with demand uncertainty by increasing or decreasing production amounts based on demand fluctuations, in the light of costs and time, in order to meet customers' needs in the optimal time. All the opinions of the various researchers mentioned are not different; all of them have discussed VF from a specific perspective based on different business environments, and all of them agree on the important role of VF as a mechanism to deal with demand fluctuations. Consequently, in general, the different perspectives provided us with a coherent context for VF, and helped the author to form the following definition of volume flexibility as a company's ability to modify production size (increase/decrease) and operate profitably at different production volumes in order to meet customers' demands and enhance company performance.

### **2.7.3 Mix Flexibility**

Because of changes in customer's preferences and unexpected trends in consumption, companies should find a way to fulfil their customers' needs and make them satisfied, otherwise they will transfer easily to more competitive companies. Production variety and a mix of products may help companies to meet different customer's needs. In this regard, MF is when a company serves different sectors of the market by providing a group of integrated products, in which case MF is needed and important. So in cases of multiple market segments, greater mix flexibility is needed, and vice versa (Suarez et al, 1996). According to Suarez et al (1996), MF is significantly linked to the production system because one of the techniques used to measure MF is to measure the production system's capacity to offer products at a specific time.

MF affects profitability and market share positively, according to Kekre and Srinivasan (1990) and Suarez et al (1996). According to Kekre and Srinivasan (1990), there is a link between the success of the company represented by earning more profits and a greater market share, and the ability to offer a variety of products without high costs. Similarly, Suarez et al (1996) stated clearly that mix flexibility means a wide range of products at a particular moment. MF also helps companies to offer the products required to meet customers' needs and preferences (Zhang et al, 2003; Sáenz et al, 2018). Moreover, MF as a basic type of flexibility has an effective and significant effect on customer satisfaction because it is related to the ability to offer a wide variety of products to meet customers' needs (Olhager, 1993; Grubbström and Olhager, 1997),

Bengtsson and Olhager, 2002); furthermore, it used as a technique to cope with uncertainty which relates to demand fluctuations in a specific time (Gerwin, 1993).

According to Bengtsson and Olhager (2002), we can find different words by using a variety of explanations to refer the same thing, which means MF can, for example, refer to (a) changing products within the same group of production, (b) changing production amounts within the same produced group, and (c) the ability to develop current products or produce novel products by using the same available resources (D'Souza and Williams, 2000; Gerwin, 1993).

Other researchers have demonstrated the concept of MF according to costs and time, including Slack (2005), who defined MF as the aptitude to modify production mix in a specific time, whereas Berry and Cooper (1999) defined it as the capability to produce a variety of product with the lowest possible costs.

Like other techniques, mix flexibility is not a magic key to deal with uncertain demand and meet customer preferences; to achieve this, companies should be able to develop and enhance the following capabilities to achieve mix flexibility: (a) human capital flexibility, (b) fast presentation of novel products, (c) managing the time of change, and (d) the operational procedures required to provide many products (Hutchison and Das, 2007).

In regard to what has been mentioned above, MF is an important kind of operational flexibility, and many definitions have mentioned MF; all of them are have the same range of meaning, referring to the ability to produce a variety of products. The definition provided by Suarez et al (1996) is the clearest in explaining the meaning of MF. Bengtsson and Olhager (2002) also referred to MF in different ways, but the most appropriate one, which matches the objective of the current research, refers to changing products within the same group of production. Berry and Cooper (1999) focused on an important aspect in their definition of MF, i.e. the cost of producing a variety of products, whereas Gerwin (1993) focused on the specific time needed to offer this variety of products. Based on this, both time and costs are very important considerations that must be taken into account in regards to MF. Consequently, we can provide the following definition of MF which serves the research objectives, i.e. a “company’s ability to produce a varied range of products. In other words, the number of different products that can be produced profitably at a specific point in time”.

#### **2.7.4 Product Development Flexibility**

Like other types of flexibility, PDF has an important role as a way to fulfill customers’ needs, because it enables companies to offer new products that match new trends in customers’

consumption, and consequently improve the company's performance and enhance its competitiveness. In this context, Cottrell and Nault (2004) found that introducing new products positively affects company performance because of increasing product diversity, whereas dependence on current products leads to low company performance. Providing modern products has become essential for many industries, especially with rapid technological advances and changes in customers' preferences, so introducing new products can give companies a significant competitive advantage (Suarez et al, 1996).

Basically NPF is linked to innovation, and unlike other types of flexibility, it requires extra inputs for all operational processes (Oke, 2005). According to Chandy and Tellis (2000) and Yuan et al (2010) product innovation is considered an essential issue for companies who are keen to maintain a competitive advantage. Slack (1983) provided an explanation of product flexibility in general, including both novel products and modified products, and he distinguished between "parts flexibility - adding new parts" and "design change flexibility - modifying the current design". Consequently, he explained the term "NPF" as a new type of. Suarez et al (1996) clarified that achieving NPF needs a long time and it occurs by providing totally new products or making changes in all production stages (from A to Z), not only by making simple changes within a short time.

Some researchers have mentioned new product flexibility, but using different terms, as did Gerwin (1993), who called it modification flexibility which means the "company's capability to do minor updates in the design of the product". Having modification flexibility enables the company to improve the ability of a production system in two different senses: a) updating the design of the product, and b) creating a custom product for specific customers (product customizing). Sanchez (1995) called it "product development flexibility", but in the same context he mentioned that modification flexibility is used to improve products when the same materials and resources can be used again to generate new or developed products, consequently saving time and reducing the costs of finding and developing the materials and components needed for the new products. So, new product flexibility includes both providing new updates for current products, and providing totally new products for the market.

In a similar vein, Oke (2005) mentioned that NPF is an essential form of MF which enlarges the production mix by offering and producing a new product to expand the current mixture of products, and he stated that NPF will be available when the company has a real capacity to produce more products and apply MF. In this regard, some researchers have clearly noted that it is difficult to differentiate between product modifications and offering a new product, and the

differences, in this case, are not clear enough; moreover, they consider that offering a modern product is an alternative to product adjustment (D'Souza and Williams, 2000). However, companies should distinguish between cases of changing between the current products and cases of offering novel products within reasonable costs without damaging the current mix of products.

As a result, Oke (2005) mentioned that flexibility in industrial systems can be introduced in three forms: NPF, MF, and VF. But Vickery et al (1999) referred to NPF by another name, i.e. "new product introduction" or (launch flexibility) and they defined it as "companies' capability to develop and improve the products or make a real difference between the current product and the new version of it or offering a novel product". In the context of product development, flexibility has also been linked to making changes to products, and introduced as PDF (Fahy and Smithee, 1999), while some researchers have mentioned that NPF or PDF are simply consequences of a manufacturer's capability to implement VF and MF, respectively (Oke, 2003; Zhang et al, 2003).

In general, product flexibility divides into new product flexibility and product development flexibility. In the previous paragraph, we referred to two main teams of researchers; the first considers new product flexibility (Slack, 1983; Suarez et al, 1996; Chandy and Tellis, 2000; Cottrell and Nault, 2004; Oke, 2005; Li and Liu, 2010), and the second product development flexibility (Gerwin, 1993; Sanchez, 1995). The current study focuses on PDF and supports the viewpoint of the second team of researchers because it is more suitable and appropriate to the empirical study which was conducted in small and medium-sized pharmaceutical companies in Iran. Because the pharmaceutical industry in Iran is very sensitive and operates under many limitations from different international organizations such as BP (British Pharmacopoeia), and is under the control of the JCPOA agreement (Joint Comprehensive Plan of Action), offering totally new products will take a long time and years of experiments because of the nature of the industry, and this is a view shared by the first team of researchers. Consequently, PDF is considered in the current study as a term which refers to modifying and developing current products by adding new features in the name of improvement or development, because providing totally new products comes under the umbrella of innovation. Based on the previous definitions provided by many researchers, we can define PDF as a company's ability to modify and improve current products to meet new trends in consumption and to efficiently shift production from products with low demand to newly developed products with a high demand which meet customers' needs.

## **2.8 Environmental Uncertainty**

Globalization has weighed heavily on the business environment, making it complex, risky and uncertain, and this has become a fact of the turbulent business environment, and the reason which has pushed organizations to look for mechanisms to adapt to emergency situations and changes in their work environment. Consequently, environmental uncertainty or uncertainty is an important topic for many researchers and has been the focus of many research papers that have investigated the link between the organization and its environment, especially considering ideas rooted in organizational theory. Pondy and Mitroff (1979) refer to the organization as a system (inputs, process, and outputs) linked with the environment in which it operates, which means it affects and is effected by the environment.

Generally, "uncertainty" as a notion has been discussed widely in the literature on strategy and organization. Early perceptions were provided by management researchers like Knight (1921), Barnard (1966), and Simon (1956), who mentioned that corporate business environments are inherently unstable (Knight, 1921; March and Simon, 1958). One of the earliest definitions of uncertainty comes from Knight (1921) who defined it as a case in which the possibility of the event is unclear because there is not enough information or a lack of knowledge in decision-making or about the business environment because of its intricacy, and this imperfection has later been considered as a factor that effects managers' comprehension of uncertainty (Lawrence and Lorsch, 1967; Duncan, 1972).

The literature of strategic management defines both the micro-environment and the macro-environment as sources of uncertainty by distinguishing between sectors that have a direct or indirect relationship with the company and which directly affect its business strategy (Dill, 1958). Furthermore, many researchers have addressed uncertainty through a variety of definitions. For example, uncertainty is seen as the result of unpredictability (Cyert and March, 1963), environmental turbulences, and the interactive nature of the variables that affect the organization's work and make it more complicated (Emery and Trist, 1965; Galbraith, 1974). Moreover, uncertainty has been described as an important aspect of the macro environment, and as a guide to a form of awareness in which managers explain the state of their decision (Milliken, 1987). Collis (1992) also assumed that uncertainty results from the complexity and lack of clarity in the relationship between the internal processes inside the company and its external environment.

According to Fahey and Narayanan (1986), the complexity and interdependence of the factors influencing the work environment lead to a division of uncertainty into four types, described as dimensions of uncertainty:

Firstly, macro- and micro-environmental uncertainty: macro represents uncertainty in the overall environment of the organization, including political, regulatory, legal and economical aspects. This type of uncertainty has the potential to reduce the organization's ability to design and keep track of strategic options (Miller and Friesen, 1984). In this context, environmental uncertainty is considered an indication of the increase in the level of environmental dynamics and complexity (Johnson and Scholes, 2008). The micro-environment, on the other hand, consists of competitors, customers, suppliers, potential customers, alternative products and complementary product providers (Porter, 1980). According to Bourgeois (1980) an organization's external environment is a source of both opportunities and challenges that follow from various events and the interaction between the organization and its environment. In the context of information and resource dependency views of the organization-environment relationship, there can be two kinds of environmental uncertainty; one that is based on resource scarcity and the other based on information complexity (Lawrence and Dyer, 1980).

Secondly, there is competitive uncertainty which occurs when the company cannot determine the level of competition in the market, or estimate competitors' ability to compete in the same industry and anticipate their strategies or techniques (Fahey and Narayanan, 1986).

Thirdly, there is market uncertainty (demand and supply) which occurs when the organization does not know what factors control the market and how they affect its activities and processes, in addition to uncertainty surrounding the supply and demand conditions in the industry (Fahey and Narayanan, 1986). In a similar vein, Davis (1993) categorized uncertainty into three types: demand uncertainty, supply uncertainty, and uncertainty in operational activities. He mentioned that both SU and DU affect operational activities and as a result, companies' ability to meet customers' requirements will also be affected.

Fourthly, there is technological uncertainty. This type of uncertainty relates to changes in resource and technological capabilities in the area of the organization's work. It plays an essentially negative role by disabling companies' ability to compete in the market compared with other competitors in the same industry (Anderson and Tushman, 1990).

In the context of uncertainty management, Simangunsong et al (2012) provided two methods to manage uncertainty.

- Uncertainty minimizing: by knowing the real source(s) of the uncertainty and working on reducing it by controlling those source(s).

- Adapting to uncertainty: unlike the previous method, this method tries to find techniques to cope with uncertain situations and reduce their destructive effects. In this case, flexibility, for example, will be a perfect technique to deal with and adapt to uncertainty.

In this context, companies which seek to improve their performance must be able to harmonize their activities with the business environment, in order to be able to respond quickly to changes and vice-versa (Miles et al, 1978). This view refers in an indirect way to the importance of flexibility as a mechanism to react to uncertain situations and respond quickly to environmental changes, consequently improving the company's performance. In this regard, flexibility is considered an effective mechanism to enhance operational performance and reduce the negative effects of uncertainty on it (Silva and Ferreira, 2017). Dreyer and Grønhaug (2004) referred to the fact that to achieve better performance and to apply flexibility as a mechanism to deal with uncertainty, companies must know which kind of flexibility it should choose as appropriate in an uncertain situation, which means the type of flexibility chosen must be in harmony with the case in question, because uncertainty is a problem related to the inability to adapt to new circumstances at a specific time and place.

Based on the previous explanation, we can note that uncertainty is a multi-perspective concept, discussed from different viewpoints and based on different aspects. In the current study Knight's (1921) definition of uncertainty as a general concept will be adopted. This definition refers to the confusing case in which, due to a lack of information, the likelihood of an event occurring is not clear for managers. The micro-environment is the source of uncertainty in the current study, and market uncertainty (supply and demand uncertainty) as discussed by Fahey and Narayanan (1986) and Davis (1993) will be considered. Adopting an uncertainty approach to manage uncertainty Simangunsong et al's (2012) ideas will be adopted, i.e. using flexibility as a mechanism to deal with uncertainty. This approach also chimes with that of Silva and Ferreira (2017), which presents flexibility as an effective mechanism to enhance performance and reduce the negative effects of uncertainty.

In this research we will focus on demand and supply uncertainty as factors which push companies to depend on flexibility as a mechanism to deal with uncertainty, and consequently enhance performance.

### **2.8.1 Demand Uncertainty**

The business environment has changed a great deal. Long ago, demand was steadier, because the product life cycle was longer and product variety was less (Hill and Chambers, 1991). Nowadays, the opposite case predominates in the market; demand uncertainty caused by demand fluctuations is considered one of the most important types of uncertainty which companies face. Due to demand uncertainty, companies should observe changes in customers' preferences and modify their products to match the new consumption trends (Fynes et al, 2004). So companies should be flexible enough to make the required adjustments in perfect time. According to Chod and Rudi (2005), companies will earn fewer profits because of demand fluctuations; in this case, the advantages of flexibility implementation will be valuable.

The uncertainty of demand refers to unexpected fluctuations in the timing and levels of demand (Fynes et al, 2004). The disparity between real and expected demand is calculated by the difference between quantities or order time, and uncertainty or timing uncertainty, to understand if there is an inventory surplus or deficit (Fynes et al, 2004). Simangunsong et al (2012), Van der Vaart et al (1996) and Gupta and Maranas (2003) suggested that uncertainty in customer demand is widely considered the most critical type of uncertainty because it arises from volatile demand or inaccurate predictions; consequently, companies will face higher demand or lack demand.

In this regard, Petkov and Maranas (1997), referred to the fact that the failure of predicted demand fluctuations leads to unsatisfied customers. Patel (2011) notes that demand uncertainty relates to variations in sales based on customer preferences, price sensitivity, changing needs for products, and forecasting problems, which occur because of inaccurate estimates and patchy orders (Davis, 1993). Similarly, Hu and Feng (2017) stated that it is not an easy task to estimate demand quantity in the light of the uncertainty of consumers' preferences.

In accordance with the relationship between DU and flexibility, Chen and Paulraj (2004) and Bengtsson and Olhager (2002) mentioned that a higher level of DU will push companies to focus more and more on two essential issues - productivity and flexibility. Flexibility has been measured and investigated in terms of uncertainties such as fluctuations and differences in demand. Frazelle (1986) clarified that flexibility is necessary and is a requirement to sustain competitiveness in a dynamic business environment which is characterized by unstable demand, where customers desire to acquire new products. Moreover, Goyal and Netessine (2011) mentioned that manufacturing flexibility enables companies to reduce the negative

effects of a demand-supply mismatch by reorganizing production in accordance with demand in an appropriate way.

The previous paragraph shows the meaning of demand uncertainty and the techniques used to deal with it. The current study is based on the opinion of Chod and Rudi (2005), i.e. that demand fluctuations lead to less profit, and a failure to predict demand fluctuations leads to unsatisfied customers (Petkov and Maranas, 1997). The notion of uncertain demand as discussed by Fynes et al (2004) was adopted to refer to the unexpected fluctuations in the time and amount of demand. As a result, this study supports and adopts the opinions of Bengtsson and Olhager (2002), Chen and Paulraj (2004); Goyal and Netessine (2011) who argue that flexibility could be a useful and effective mechanism to deal with demand fluctuations, especially resource flexibility and volume flexibility.

### **2.8.2 Supply Uncertainty**

As a system, any company is basically structured on input, process and output; therefore, a company's ability to provide reliable outputs and fulfil customer needs depends on obtaining the inputs at the perfect time and in the required quality. Consequently, companies should consider the supply-side and the uncertainty related to it. According to Xu and Lu (2013), supply uncertainty has become a fact and a problem facing all the companies which obtain the required inputs for the processes by outsourcing, regardless of the nature of the activities or the field that the company operates in. Hu and Feng (2017) also emphasized that supply uncertainty has become a major challenge in the field of supply chain management.

In general, there are many reasons for supply uncertainty, such as the average of lateness, manufacturing downtime, order-entry errors, the degree of inconsistency and on-time performance, quality standards, logistics errors, inaccurate forecasting (Davis, 1993; Walker and Weber, 1987), timeliness and the selection criteria of the suppliers (Chen and Paulraj, 2004).

Supply uncertainty affects many parties, including buyers and suppliers, in addition to its affect on the supply chain in general. And if we compare two of the supply chains, we can note clearly that the one which has SU will have problems such as low profits, a reduced quantity of supplies, and a low level of logistic services (Hu and Feng, 2017).

As in the case of DU, SU is also linked to two main issues: time and the amount of supplies (Fynes et al, 2004). As a solution to supply problems, companies must obtain enough information about the market and especially about suppliers (Begen et al, 2016), and they

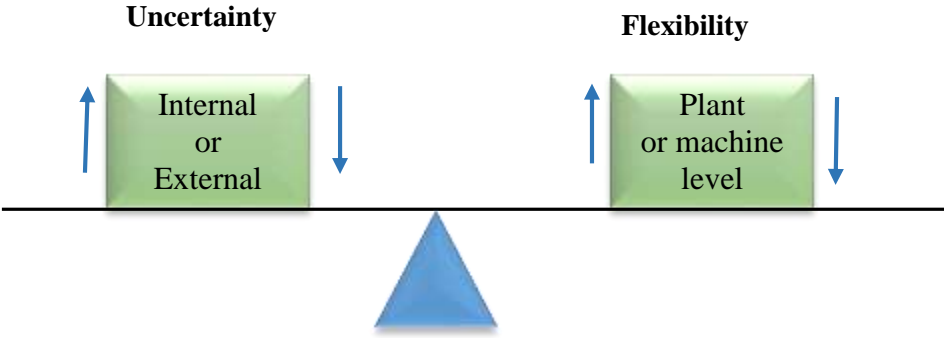
should try to focus on the problem of SU and DU, since controlling demand uncertainty and trying to reduce it is much more effective - and enhances the performance of the industrial system more - than controlling supply uncertainty.

Like other types of uncertainty, supply uncertainty has many negative effects on companies' performance, especially on financial performance represented by costs and profits. In this regard, Begen (2016) found that, (a) SU is more costly than DU, (b) reducing SU is more profitable than reducing DU, and (c) because of SU, companies will produce less, and this leads to demand uncertainty, and so it will affect customer satisfaction negatively.

The current study supports and adopts Hua and Feng's (2017) opinion that SU leads to low profits and a low level of logistic services, and generally, it affects company performance negatively. Thus flexibility (especially resource flexibility) will be an effective mechanism to reduce the negative effects of SU and enhance company performance. Based on what has been mentioned before, flexibility as a mechanism to deal with uncertainty could be useful to reduce the negative effects of supply uncertainty on company performance, and that is what this research tries to investigate.

### 2.9 The Balance Between Flexibility and Uncertainty

Flexibility is costly and not a magic key for all cases, so companies have to determine the type of flexibility which should be used to face unpredictable events; therefore Newman et al (1993) mentioned that companies should seek to reach a balance between the required level of applied flexibility and the existing level of uncertainty, and then try to keep that balance (Figure 2-7). Furthermore, it is not easy to determine the standard level of production which meets customers' anticipations, because customer satisfaction is an unpredictable issue and is not standardized all the time; what is good for a customer today may not be so tomorrow, so using the same products and strategies will not be useful all the time.



**Figure 2-7: Balance between Uncertainty and Flexibility**

*Source: Newman et al, 1993*

In this regard, we have to distinguish between the short and the long term. In the short term, manufacturing companies must keep an equilibrium between their manufacturing capabilities and environmental prospects by using some method beyond processes or major infrastructure changes, such as inventories, or production modification.

In the long-term, however, companies must change and modify their manufacturing strategy as an attempt to create a balanced situation between operational flexibility and market requirements over the long-term (Hill and Chambers, 1991).

## **2.10 Company Performance**

Company performance is the old issue of modern times, and is still attractive for the researcher in the field of business and management, perhaps because there is no standard measurement of a company's performance, so it can be measured with different methods. Company performance is an essential issue for all organizations and it involves many antecedents (Bendickson et al, 2018). Performance is considered a measurement which expresses the extent to which the company is able to run its activities and process efficiently and effectively, and then to judge if it is successful or not, if it can survive in the market or has to leave (Chan et al, 2017). According to Combs et al (2005), organizational performance is considered a cornerstone in the literature on strategy.

In general, a company's performance is divided into two main categories, financial and non-financial measurements.

According to Huang et al (2006) and Nadkarni and Narayanan (2007), financial performance is one of the most important measurements of performance, despite the fact that FP is not suitable to measure the effectiveness from an organizational perspective, thus it is a bounded indicator and should not be used alone to evaluate company performance (Santos and Brito, 2012). In the same context Neely et al (1997) noted that, despite some criticisms, FP is used to evaluate the financial aspects which relate to strategic decisions, but that accounting indicators are not sufficient for this, because some processes must be evaluated by using strategic alignment when the company works within an uncertain environment.

Non-financial performance measures can encompass different indicators for measuring the objectives in the long-term, such as customer satisfaction, efficiency and effectiveness, and operational performance to measure internal operations (Lau and Sholihin, 2005). Moreover, many non-financial performance measures have been widely used to evaluate companies' performance, such as market share, quality, and customer satisfaction (Ittner et al, 1998). Some

researchers have argued that non-financial measures are considered more effective for measuring future performance because it depends on cause-and-effect (Banker et al, 2000). However, Kaplan and Norton (1992) and Hauser et al (1994) mentioned that administrative procedures in the short-term which relate, for example, to operational activities, quality, and innovation will enhance and reflect positively on financial performance in the future. However, in the short-term, financial aspects do not reflect the importance of the administrative procedures in the long-term (Hemmer, 1996).

In this study, we will focus on subjective measurement of financial performance, and non-financial performance measurements, such as operational performance, and customer satisfaction.

## **2.10.1 Non-Financial Performance Measurements**

### **2.10.1.1 Operational Performance**

An important performance measurement for companies, OP expresses the results of the implementation of operational activities provided through operational metrics (Karlsson and Ahlstrffom, 1996; Sánchez and Perez, 2001). OP relates to the measurable outcomes of daily processes, the production cycle and the aspects of the inventory (Voss et al, 1997). In the context of the link between flexibility and performance, a good OP is considered the result of outcomes of supply chain flexibility (Yu et al, 2018). According to McKone et al (2001) and Abdallah et al (2016), in order to measure operational performance, especially in empirical studies, subjective measurements are widely used. At industrial companies, quality, delivery, cost, and flexibility are the most common measurements to evaluate OP (Wheelwright and Hayes, 1978; Schmenner, 1984; Hill, 1989; Vickery et al, 1997). According to Dora et al (2013), operational performance relates to 1) stock/inventory reduction, 2) quality improvement, 3) productivity growth, 4) the production cycle and 5) delivery effectiveness.

In the context of performance measurements, there are links between these measurements; for example, Voss et al (1997) noted that both customer satisfaction and market share as business performance measurements are affected by OP. Also, OP is considered an essential factor to achieve high profitability (Schefczyk, 1993). Furthermore, OP relates to other measurements such as innovation and the ability to offer novel products, quality and added value in the industry (Silva and Ferreira, 2017). According to Venkatraman and Ramanujam (1986), operational measurements indicate that the operational procedures at the company are going well (Fantazy et al, 2009).

Researchers used operational performance as a non-financial measurement in addition to financial measurements, to evaluate the company's performance more accurately. In all cases, both kinds of measurements are considered the key indicators of the company's effectiveness.

The current study agrees with the approaches taken by Abdallah (2016) and McKone et al (2001) in order to measure operational performance subjectively. Moreover, this study will consider, quality, delivery, cost, and fast response to orders to evaluate the OP. Regarding the relationship between flexibility and operational performance, this study adopts the option of Kuo et al (2003) that flexibility is a workable and effective mechanism to improve the operational performance of a company that operates in a risky and unstable business environment.

### **2.10.1.2 Customer Satisfaction**

In a competitive environment, customers are the focal point of companies' attention, especially with companies' race to obtain a higher market share. So customer satisfaction is one of the highest priorities for companies. A higher level of customer satisfaction enables companies to keep current customers because of customer loyalty and to attract new clients, and thus obtain a competitive advantage (Sethi et al, 2007). Accordingly, customer satisfaction is affected by different factors such as price, quality, service, and delivery, so customer satisfaction is determined by customers' realization of the expected benefits of the product or service and the extent to which they are willing to pay and obtain these benefits in the light of previous factors (Zhang et al, 2003; Yao et al, 2009; Jayaram et al, 2010).

Customer preferences are very changeable and not stable (Shepetuk, 1991). Consequently, companies should always be able to know their needs and produce what their customers are looking for. In this context Takeuchi and Quelch (1983) mentioned that companies must regularly estimate and guess customers' desires and modify their processes accordingly, as responsiveness to changes in customers' requirements and market trends is an essential condition for success in all industries (Chan et al, 2017). Also, Draaijer (1992) noted that industrial companies face more and more pressure because of increasing demand for a variety of specific products in the short-term (so this will be a justification for using both mix and volume flexibility).

According to Yu et al (2018), flexibility is an essential capability for businesses in order to react to uncertainty factors such as changing customer requirements. Based on this consideration, flexibility in industrialization by adapting production size and accurate delivery time enhances

customer satisfaction. In addition, MF is considered a supporting factor for customer satisfaction by offering different products that meet customers' aspirations with a minimum delivery time, at reasonable prices and at the preferred level of quality (Zhang et al, 2003; Sáenz et al, 2018). Moreover, OF is classified as a competence which enhances companies' performance represented by customer satisfaction (Zhang et al, 2003). However, managers should be aware that the affirmative and significant effect of flexibility on CS differs according to the product's nature, i.e. whether it is dynamic or stable (Sáenz et al, 2018).

Customer satisfaction is considered one non-financial measurement of performance, which can be run by using data based on three levels: the customer level, the business-unit level, and the company level (Ittner and Larcker, 1998).

Based on what has been mentioned above, we can say that CS is a measurement that determines how happy customers are with a company's products, services, and capabilities and it refers to a company's ability to win customers' loyalty by providing products which meet or surpass customer expectations. The current study agrees with the opinions of Zhang et al (2003), Yao et al (2009) and Jayaram et al (2010) that price, quality, services, and delivery are the most important elements which affect CS. According to the relationship between flexibility and CS, this study depends on the perspectives of Zhang et al (2003), Yu et al (2018) and Sáenz et al (2018) that flexibility is an essential capability to achieve customer satisfaction by offering different products that meet customers' aspirations with a minimum time for delivery, reasonable prices and the preferred level of quality.

### **2.10.2 Financial Performance**

Financial performance is considered an important indicator of companies' success; it refers to a company's ability to achieve its financial goals, and how the financial activities run efficiently at the company. From Borba's (2005, p. 39) perspective, financial performance can be defined as "the maximizing of the owners' wealth".

Financial performance has received the lion's share of the discussion in the empirical research on strategy (Venkatraman and Ramanujam, 1986). According to Orlitzky et al (2003), financial performance is represented in three ways: the first deals with market measures reflecting shareholders' level of satisfaction; the second depicts the level of business efficiency through accounting measures; the third refers to a survey with estimated financial performance.

Generally, FP can be divided into two basic categories: the first relates to the return to the investor; the second refers to accounting return (profit) (Cochran and Wood, 1984). Moreover,

both profitability and sales growth are considered the most common financial indicators to evaluate the performance of industrial companies (Bourgeois, 1980).

Financial performance is measured in two ways: subjectively and objectively. For example, Santos and Brito (2012) mentioned many items or indicators for subjective financial performance, including sales growth, market share, profitability, and return on investment. On the other hand, the following indicators are considered objective measurements for FP (return on assets, return on sales, earnings per share, return on net worth, sales growth, asset growth) (Vij and Bedi, 2016).

This study uses the subjective measurement of financial performance based on Vij and Bedi’s (2016) concept of the possibility of measuring FP subjectively, and it considers profitability, sales growth and market share growth as indicators which show the real financial situation of a company.

**2.11 The interpretation and use of the terms in the current study**

Based on the previous literature review, we can note that there is a wide range of concepts which are related to the variables considered in the current study. Because of that, Table 2-1 shows the use of the considered concepts of the variables in the current study according to its objectives.

**Table 2-1: The interpretation and use of the terms in the current study**

<b>Terms</b>	<b>The interpretation</b>
Strategic flexibility	A strategic technique enables companies to respond efficiently to unexpected situations. Empirically it refers to company’s abilities to respond to changes in dynamic competitive environments.
Resources flexibility	Company’s ability to determine and get the resource which offers strategic options for a company to follow alternative courses of action in responding to environmental changes. Moreover, the ability to use the available resources and allocate them between production’s stages in response to shifting bottleneck.
Coordination flexibility	Company’s ability to manage and use the resources in different ways for better performance in light of resource scarcity, by use and share the available resources between production lines efficiently.

Operational flexibility	It refers to the industrial system's ability to respond effectively to the urgent changes in the production process and operations at the perfect time. Moreover, company's ability to decrease the negative consequences of the difference between demand and supply by enabling companies to reallocate their capacity according to demand and supply changing.
Mix flexibility	Company's ability to the capability to produce a varied range of products. In other words, the number of products that can be produced at any point in time.
Volume flexibility	Company's ability to modify the production size and operate profitably at different production volumes.
Product development flexibility	Company's ability to modify and improve the current products to meet the new trends of consumption, and to efficiently shift production from products with low demand to new developed products with high demand which meet customers' needs.
Uncertainty	It expresses the situation when the possibility of the event is not clear because of the lack of information.
Demand Uncertainty	Unexpected fluctuations in the time and amount of demand.
Supply uncertainty	Unexpected fluctuations in the time and amount of supply.
Performance	Performance express the extent to which the company able to run its activities and processes efficiently and effectively. It is an indicator of company's success or failure.
Financial performance	A measurement of how well a company can use assets profitably and generate revenues.
Operational performance	It refers to measure how dependable the company is when it comes to (cost, quality, speed, and reliability), and company's ability to operate (doing the processes) in an effective manner to achieve goals efficiently.
Customer satisfaction	A measurement that determines how happy customers are with a company's products, services, and capabilities. It refers to a company's ability to get customers loyalty by providing products which meet or surpass customer expectation.

*Source: The author's compilation based on the literature review*

### **3. MATERIALS AND METHODS**

#### **3.1 Research Design**

After hypotheses development, the current chapter will provide the required methods for data collection in order to test the hypotheses after analysis.

According to Flynn et al (1990), research methodology starts by setting the objectives of the study, then chooses an adequate structure for the study and then finds the best method for data collection.

In general, there are three classifications for research, according to their purpose: explanatory, descriptive and exploratory studies (Saunders et al, 2007). Other researchers have referred to them as causal, descriptive and exploratory studies (Ghauri and Gronhaug, 2005; Cooper and Schindler, 2006).

This study is causal or explanatory, the aim of which is to investigate the link between flexibility and company performance by considering the moderating effect of environmental uncertainty on the link between the variables, in order to test the previous hypotheses. This matches the explanations for causal or explanatory studies provided by Baarda and De Goede (2001) and Saunders et al (2007).

This study is a survey study, and to achieve the study objectives data were collected by questionnaires; using survey studies is a good technique to get the maximum possible amount of data from many respondents (Saunders et al, 2007). The data collection process will be explained in the following paragraphs.

#### **3.2 Research Methodology of the Study**

This study is a quantitative one. In general, we can find two kinds of data: primary and secondary data. The data used in this research is primary, a questionnaire adapted from the literature has been used to collect primary data, with the questionnaire being forwarded to all SME pharmaceutical companies in Iran. The total number of small and medium-sized pharmaceutical companies is 113, and 228 managers participated in the survey. Regarding the statistical analysis, the following techniques were used: descriptive analysis, linear regression analysis, and moderation analysis (Hayes, 2013).

### 3.3 Quantitative Research Approach

The aim of this study is to investigate the link between flexibility and the performance of small and medium-sized pharmaceutical companies in Iran, in the light of uncertainty and to test the theoretical background to know if flexibility affects companies' performance, and if uncertainty moderates this relationship.

Its objectives are achieved by using a deductive method through the synergy between the review of the literature and the empirical study.

The model measures the relationship between the variables by using linear regression analysis and moderation analysis (Hayes, 2013).

The following paragraphs will explain the techniques used to collect and analyse the data in this research.

**Classification of the Study:** This study is both causal and quantitative, and has a structure based on specific steps. Moreover, its aims correspond with the aims of the standard causal studies which are: firstly, specify the variables of cause and result, and secondly investigate the relationship between these variables. It aims to test the effect of flexibility on company performance and also to understand the moderating effect of uncertainty on that relationship.

**Study Setting:** The study was carried out in normal conditions in the natural business environment. The questionnaires were forwarded to the target population and responses were then received in the normal way.

**Questionnaire tool:** This is a survey study, with primary data collected by using an adopted questionnaire from different studies. The Table 3-1 shows the source of the scales used to measure the variables. The original questions were used to measure each variable, then the scales were adapted to fit the aims of the present study based on the language and length of the questionnaire, and to fit the business environment in Iran. The questionnaire included questions which measure the variables only in order to serve the research aims; there was no need for demographic data because this is not relevant for the research objectives.

**Table 3-1: Variables Measurement**

Nu	Variable	Number of Items	Source	Used Scale
1	Supply Uncertainty	2	(Fynes et al, 2004) based on (Chen and Paulraj, 2004)	Five -point Likert scale (1 Strongly Disagree 5 Strongly Agree ).
2	Demand Uncertainty	3	(Fynes et al, 2004) based on (Chen and Paulraj, 2004)	Five -point Likert scale (1 Strongly Disagree 5 Strongly Agree ).
3	Resourse Flexibility	5	(Yuan et al, 2010)	Five -point Likert scale (1 Strongly Disagree 5 Strongly Agree ).
4	Corrdination Flexibility	5	(Yuan et al, 2010)	Five -point Likert scale (1 Strongly Disagree 5 Strongly Agree ).
5	Mix Flexibility	6	Zhang et al (2001, 2003)	Five -point Likert scale (1 Strongly Disagree 5 Strongly Agree ).
6	Volume Flexibility	6	Zhang et al (2001, 2003)	Five -point Likert scale (1 Strongly Disagree 5 Strongly Agree ).
7	Product Development Flexibility	8	Zhang et al (2001, 2003)	Five -point Likert scale (1 Strongly Disagree 5 Strongly Agree ).
8	Financial Performance	3	(Flynn et al , 2010) (Narasimhan and Kim, 2002)	Five -point Likert scale (1 Strongly Disagree 5 Strongly Agree ).
9	Operational Performance	6	(Flynn et al , 2010)	Five -point Likert scale (1 Strongly Disagree 5 Strongly Agree ).
10	Customer Satisfaction	5	Zhang et al. (2001, 2003)	Five -point Likert scale (1 Strongly Disagree 5 Strongly Agree ).

Source: Author's Own Construction (2019)

**Analysis Unit:** This research applies to people who work at pharmaceutical companies in Iran; the people selected for the study were managers of specific departments (production manager, marketing manager, and sales manager).

**Time Horizon:** This study a cross-sectional one, which means the study was carried out at a specific time and it does not cover a time series.

It tries to understand the link between uncertainty, flexibility, and performance at small and medium-sized pharmaceutical companies in Iran in a specific period of time.

### 3.4 Population and Sample

Pharmaceutical companies in Iran can be categorized into small, medium and large, based on the maximum annual income or turnover.

Table 3-2 shows the categorization of pharmaceutical companies in Iran, according to the value of sales.

**Table 3-2:** Categorization of companies in Iran

Categorization	Annual income – USD
Small	Less than 3 000 000
Meduim	Less than 15 000 000
Large	More than 15 000 000

*Source: The Iranian Chamber of Commerce (2008)*

**Sample:** a purposive (selective) sampling technique was used to collect the data, targeting three managers from each company: the production manager, the marketing manager, and the sales manager from each company were asked to fill in the questionnaires, because it is these managers who have enough experience, information, and knowledge to respond to the questions rationally and accurately.

### 3.5 Data and Data Collection Process

For the current research, an adopted questionnaire was used to collect the data needed for this research, which is primary.

The questionnaire was forwarded to the target sample at the SME pharmaceutical companies in large cities in Iran (Tehran, Mashhad, Qazvin, Isfahan, and Shiraz). The respondents answered the questions without mentioning their names, following confidentiality standards at the target companies. The questionnaire was designed to be only 5 pages in length to make the

respondents feel comfortable and to answer it easily within 30 minutes. Most of the managers gave serious attention to answer the questions and provided some advice relating to their business, according to their particular vision. On the other hand, some of them were not serious and chose to answer most of the questions in a neutral fashion. Some of them did not answer many of the questions in the questionnaire and we could not consider them because of the large numbers of this kind of missing value in each questionnaire. The uncompleted questionnaires were not used at all because this would have damaged the results of the study.

The total number of responses that were valid for statistical analysis was 228; we were supposed to receive 339 responses from 113 companies (three questionnaires for each company). The response rate was 67.25%. Table 3-3 shows the details of the sample.

**Table 3-3: Population and Sample Details**

Number of the small companies	77
Number of the medium companies	36
The expected number of respondents	339
The actual number of respondents	228
Response rate	67.25%

*Source: Author's own construction (2019)*

### 3.6 Data Analysis

SPSS 25 was used as the software for data analysis and Table 3-4 shows the statistical analysis used to test the hypotheses and obtain the results.

**Table 3-4: Statistical Analysis**

Sr.no	Analysis	Software used
1.	Reliability test	SPSS 25
2.	Descriptive analysis	SPSS 25
3.	Correlation analysis	SPSS 25
4.	Linear regression analysis	SPSS 25
5.	Moderation Analysis	SPSS 25

*Source: Author's own construction (2019)*

1. Reliability is the degree to which an assessment tool produces stable and consistent results. It refers to how dependably or consistently a test measures a characteristic. If a person takes the test again, will he or she get a similar test score or a much different score? Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability.
2. A descriptive analysis is an important first step for conducting statistical analyses. It gives an idea of the distribution of data, helps researchers to detect many outcomes that enable researchers to conduct further statistical analyses, in this study (mean and standard deviation) are only used to achieve research purposes.
3. Correlation analysis is a statistical method used to evaluate the strength of the relationship between two quantitative variables. A high correlation means that two or more variables have a strong relationship with each other, while a weak correlation means that the variables are hardly related.
4. In statistics, linear regression is a linear approach to modelling the relationship between a scalar response (and dependent variable) and one or more explanatory variables (or independent variables). The case of one explanatory variable is called a simple linear regression.
5. in statistics and regression analysis, moderation occurs when the relationship between two variables depends on a third variable. The third variable is referred to as the moderator variable or simply the moderator.

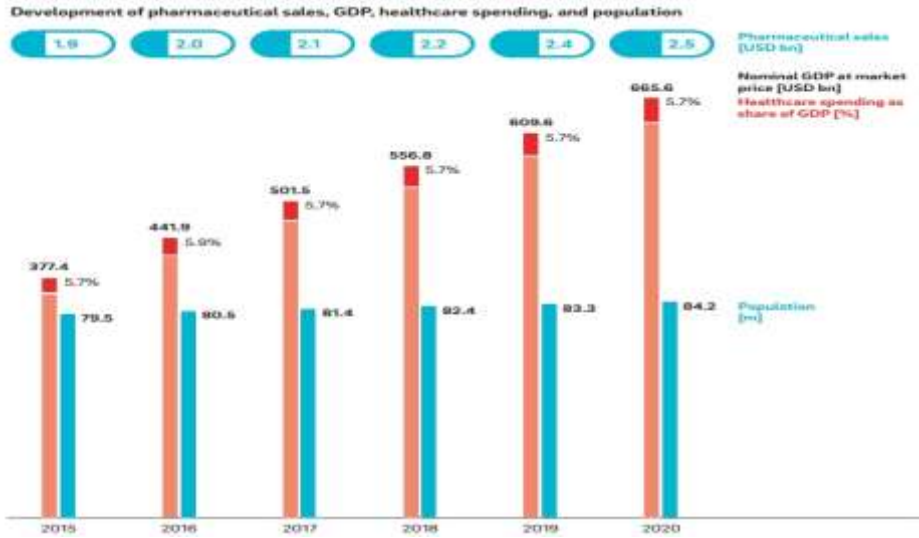
### **3.7 The Pharmaceutical Market in Iran**

Iran is a developing country located in the Middle East which has suffered much political and economic turbulence. After the Islamic revolution in 1979 which was a turning point in Iran, the Iranian government paid great attention to the resources of the national healthcare system, especially in the pharmaceutical industry. Many procedures were carried out by the Ministry of Health (MOH) to improve health indicators, such as providing the best quality of medicines at reasonable prices for the whole population. As a result, the pharmaceutical industry has improved considerably over the few last decades and Iran has adopted a full, mostly generic-based, drug system, and native production of medicines and vaccines has become one of the goals of national drug policy (Cheraghali, 2010). Iran's pharmaceutical market is considered an unstable market that suffers from fluctuations over time (Shabaninejad, 2019), and these fluctuations could be a source of uncertainty.

According to the report by Roland Berger GmbH (2017), an international company located in Germany with thirty-six branches in fifty countries, and whose main activity is providing strategic consultations, Iran has one of the world’s longest medical histories, dating back to the ancient Persian civilization. The Iranian political atmosphere has changed and became more developed and the Iranian government signed an agreement called JCPOA (The Joint Comprehensive Plan of Action) which aimed to keep the market more stable and attractive for foreign companies. Reducing the level of sanctions has obviously provided a kind of protection against policy aberrations which follow administrative changes. Consequently, if international companies can deal with the uncertain situation in Iran, then there is a good opportunity for foreign investments to start in Iran. There are many reasons motivating foreign investments to enter the Iranian market, especially the pharmaceutical market, which provides attractive growth opportunities. These reasons include the following:

**1) Positive market dynamics**

Despite sanctions and turbulence in Iran, its economy is rated as good, because of positive economic indicators. For example, GDP is expected to grow 12% (at market prices) per year, to reach USD 665 billion in 2020. 6% of overall spending will be on healthcare to reach nearly USD 40 billion in 2020 (Figure 3-1). Iran's pharmaceutical sector (valued at USD 1.9 billion in 2015) is expected to expand at a compound annual growth rate of six per cent to 2025, to become the fourth-ranked in the Middle East and North Africa after Turkey, Egypt, and Saudi Arabia. And the demand for pharmaceutical products will increase significantly over the next few years, as will GDP (Roland Berger GmbH, 2017)

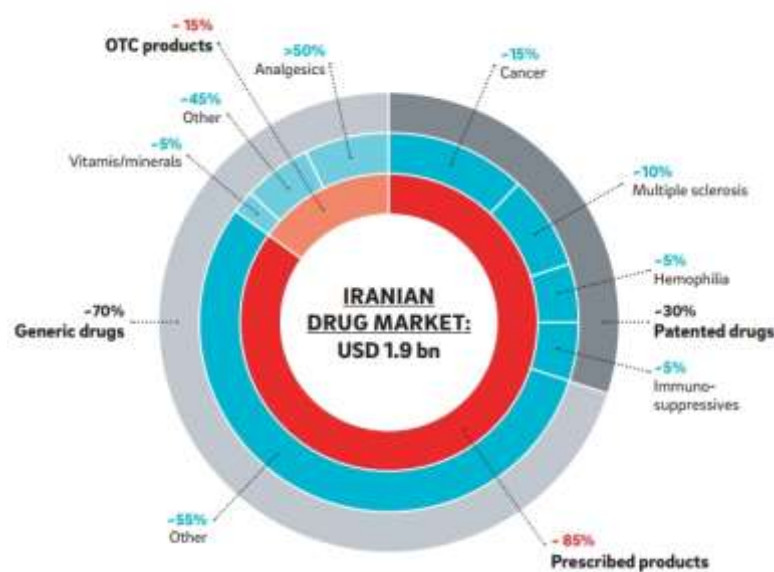


**Figure 3-1: Pharmaceutical Sales Growth in Iran**

Source: Roland Berger, (2017)

## 2) An established pharmaceutical infrastructure

Because of sanctions, Iran has established a substantial, self-sufficient medicine production infrastructure. The pharmaceutical companies manufacture approximately forty billion medicine units annually, an amount which meets ninety-six percent of local demand. This production covers the normal kind of drugs for normal diseases. Since 2000 R&D departments at pharmaceutical companies have started to invest in new drugs for chronic diseases like cancer, diabetes and diseases of the immunological system. (Figure 3-2) shows the market of pharmaceutical products in Iran and the percentage of production for each kind of medicine (Roland Berger GmbH, 2017).



**Figure 3-2: Iranian Pharmaceutical Products Market**

*Source: Roland Berger (2017)*

## 3) A skilled workforce

Iranian human capital is well-educated and qualified enough to run processes in different sectors, and the pharmaceutical sector is one of these. In 2012, Scopus ranked Iran 17th in the world in terms of published scientific papers and 23rd in 2011 in terms of highly cited medical papers. Iran has many scientific research institutes in different disciplines and the Pasteur Institute of Iran (established in 1921) is internationally recognized as a research centre for pharmaceutical and medical studies (Roland Berger GmbH, 2017).

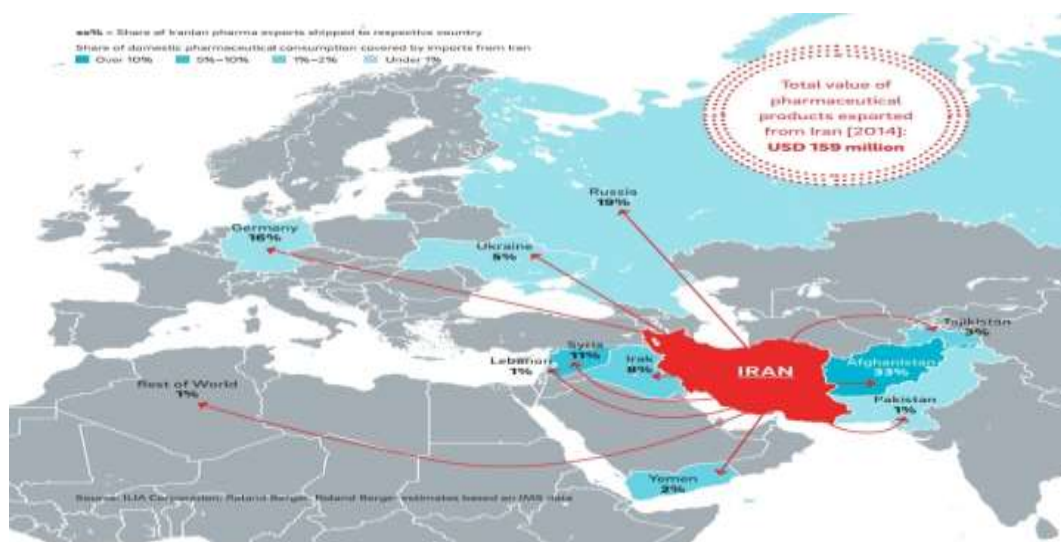
#### 4) Competitiveness

The Iranian pharmaceutical market is a dynamic one. According to the Iranian MOH, this sector has 166 companies, most of which focus on pharmaceutical products. The pharmaceutical sector is, however, largely unified. The companies' active in the sector generated revenues of over USD 3.3 billion in 2018, and most of these companies are registered on the Tehran stock market.

#### 5) The geographical location

Since the beginnings of history until the present day, from the former SILK ROAD to the current ONE BELT, ONE ROAD project, Iran as a country has had a competitive advantage because of its geographical location on international trade routes. Because of its geographical location, Iran is a strategic export platform for Central Asia, a situation strengthened by economic zones and easy entry to 15 countries by commercial agreements (400 million population benefit from these) (Roland Berger GmbH, 2017). According to the Iranian pharmaceutical export organization, Afghanistan gets (33 %) of the pharmaceutical products it needs from Iran, and based on the agreements with the Syrian government, the amount of Iranian pharmaceutical exports to Syria are worth (159) million USD which represents (11%) of the total. (16%) goes to Germany, and Iran is currently trying to establish new links overseas to increase pharmaceutical exports, in addition to its current relationships.

The following (Figure 3-3) shows the exporting map of Iranian pharmaceutical products to international destinations.



**Figure 3-3: Iranian Pharmaceutical Products Exports**

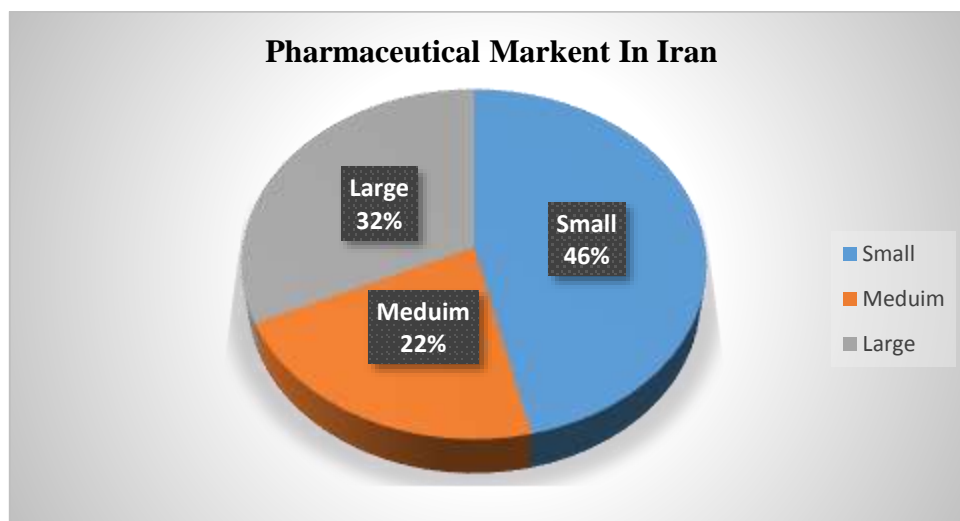
Source: Roland Berger (2017)

### 3.8 Pharmaceutical companies in Iran

In order to generalize and ensure the usability of the research results, it was essential to determine the population and the sample used in the study, as well as to determine the most suitable variables to fit the nature of the industrial companies in order to achieve better harmony between the research and the sector chosen.

Flexibility is new topic for Iranian companies, especially in the light of the uncertainty in the business environment, and it could be useful for them to help them improve their performance. Therefore, for the current study, small and medium-sized pharmaceutical companies were considered target companies, because SMEs make up more than 65 % of the pharmaceutical sector in Iran, and it was easier to reach the managers who work at these companies through personal relationships. According the Ministry of Public Health in Iran (2019), there are 168 pharmaceutical companies active in the country.

The following (Figure 3-4) shows the share of the pharmaceutical companies in the Iranian market.



**Figure 3-4:** Iranian Pharmaceutical Market

*Source: Author's own construction based on Ministry of Public Health in Iran (2019)*

## 4. THE RESULTS OF THE RESEARCH

### Quantitative Study Findings

#### 4.1 Test of Reliability

In order to check the reliability of the questionnaire and the extent to which it is consistent, the Cronbach Alpha test - which is a measure of internal consistency - was used to measure the reliability of the variables used in the questionnaire and the degree of homogeneity in the measurement.

Table 4-1 : The Results of Reliability Test

Sr. No	Scale	Cronbach 's Alpha	No Of Items
1.	Uncertainty	0.719	5
2.	Resource Flexibility – RF	0.745	5
3.	Coordination Flexibility - CF	0.704	5
4.	Mix Flexibility - MF	0.764	6
5.	Volume Flexibility - VF	0.769	6
6.	Product Development Flexibility - PDF	0.814	8
7.	Financial Performance - FP	0.924	3
8.	Operational performance - OP	0.754	6
9.	Customer satisfaction - CS	0.770	5

*Source: Based on Author's Calculation (2019)*

The results of the Cronbach alpha test for each variable are summarized in Table 4-1.

We can note that the value of the Cronbach alpha values of the current study is located in the range 0.704 - 0.924, which means the scale or the questionnaire used to measure the variables is a reliable and steady one, because according to Santos (1999), the value of the alpha is bound between 0 and 1 and it can be used with questionnaires which have scale from 0 as the worst value, to 5 as the best, and if the alpha value is 0.70 this can be acceptable; indeed, lower values have also been accepted in some of the literature.

## 4.2 Descriptive Analysis

For the descriptive analysis, the mean and standard deviation was calculated. Table 4-2 presents the summary of the results of descriptive analysis, and the results are provided in (Figure 4-1).

**Table 4-2 : Descriptive analysis**

Variables	Minimum	Maximum	Mean	Std. Deviation	N
SU	3	5	3.825	0.5005	228
DU	3	5	3.84	0.516	228
RF	3	5	4.044	0.457	228
CF	3	5	3.992	0.559	228
MF	3	5	4.125	0.571	228
VF	3	5	3.975	0.558	228
PDF	3	5	3.968	0.591	228
FP	3	5	4.10	0.617	228
OP	3	5	3.78	0.562	228
CS	3	5	3.86	0.624	228

*Source: Author's Calculation (2019)*

According to supply uncertainty, we note that ( $M = 3.825$ ,  $SD = 0.5005$ ), which means there is an agreement among the respondents that the target companies face SU.  $M$  equals  $3.82 \approx 4$  matches the value for "agree" on the used scale. St.d Deviation refers to the extent to which the values are far or close to the mean. Accordingly, the value for SU will range between  $3.825 \pm 0.5005 = \{3.32 ; 4.325\}$ . In other words, all the responses are between neutral and agree based on the used scale. Moreover, the minimum value of SU equals 2 and the maximum equals 5, it means all the responses ranged between 2 and 5 according to the used scale.

Demand uncertainty: we note that ( $M = 3.84$ ,  $SD = 0.516$ ), which means there is an agreement among the respondents that the target companies face DU.  $M$  equals  $3.84 \approx 4$  matches the value for "agree" on the used scale. St.d Deviation refers to the extent to which the values are far or close to the mean. Accordingly, the value for DU will range between  $3.84 \pm 0.516 = \{3.324; 4.356\}$ . In other words, all the responses are between neutral and agree based on the used scale.

Moreover, the minimum value of DU equals 2 and the maximum equals to 5, it means all the responses ranged between 2 and 5 according to the used scale.

Resource flexibility: we note that ( $M = 4.044$ ,  $SD = 0.457$ ), which means there is an agreement among the respondents that the target companies apply RF as a mechanism to deal with uncertainty.  $M$  equals 4.044 matches the value for "agree" on the used scale. St.d Deviation refers to the extent to which the values are far or close to the mean. Accordingly, the value for RF will range between  $4.044 \pm 0.457 = \{3.58; 4.501\}$ . In other words, all the responses are between agree and strongly agree based on the used scale, that means RF is applied at the target companies. Moreover, the minimum value of RF equals 3 and the maximum equals to 5, it means all the responses ranged between 3 and 5 according to the used scale.

Coordination flexibility: we note that ( $M = 3.992$ ,  $SD = 0.559$ ), which means there is an agreement among the respondents that the target companies apply CF as a mechanism to deal with uncertainty.  $M$  equals  $3.992 \approx 4$  matches the value for "agree" on the used scale. St.d Deviation refers to the extent to which the values are far or close to the mean. Accordingly, the value for CF will range between  $3.992 \pm 0.559 = \{3.433, 4.551\}$ . In other words, all the responses are between agree and strongly agree based on the used scale, that means CF is applied at the target companies. Moreover, the minimum value of CF equals 3 and the maximum equals to 5, it means all the responses ranged between 3 and 5 according to the used scale.

Mix flexibility: we note that ( $M = 4.125$ ,  $SD = 0.571$ ), which means there is an agreement among the respondents that the target companies apply MF as a mechanism to deal with uncertainty.  $M$  equals 4.125 matches the value for "agree" on the used scale. St.d Deviation it refers to the extent to which the values are far or close to the mean. Accordingly, the value for MF will range between  $4.125 \pm 0.571 = \{3.554 - 4.7\}$ . In other meaning all the responses are between agree and strongly agree based on the used scale, it means MF is applied at the target companies. Moreover, the minimum value of MF equals 3 and the maximum equals to 5, it means all the responses ranged between 3 and 5 according to the used scale.

Volume flexibility: we note that ( $M = 3.975$ ,  $SD = 0.558$ ), which means there is an agreement among the respondents that the target companies apply VF as a mechanism to deal with uncertainty.  $M$  equals  $3.975 \approx 4$  matches the value for "agree" on the used scale. St.d Deviation it refers to the extent to which the values are far or close to the mean. Accordingly, the value for VF will be range between  $3.975 \pm 0.558 = \{3.417, 4.533\}$ . In other words, all the responses are between agree and strongly agree based on the used scale, that means VF is applied at the

target companies. Moreover, the minimum value of VF equals 3 and the maximum equals to 5, it means all the responses ranged between 3 and 5 according to the used scale.

Product development flexibility: we note that ( $M = 3.968$ ,  $SD = 0.591$ ), which means there is an agreement among the respondents that the target companies apply PDF as a mechanism to deal with uncertainty.  $M = 3.968 \approx 4$  matches the value for "agree" on the used scale. St.d Deviation refers to the extent to which the values are far or close to the mean. Accordingly, the value for PDF will range between  $3.968 \pm 0.591 = \{3.337, 4.559\}$ . In other words all the responses are between neutral and strongly agree based on the used scale, that means PDF is applied at the target companies. Moreover, the minimum value of PDF equals 3 and the maximum equals to 5, it means all the responses ranged between 3 and 5 according to the used scale.

Financial performance ( $M = 4.10$ ,  $SD = 0.617$ ), which means there is an agreement among the respondents that the financial performance of the target companies rated as good.  $M = 4.10$  matches the value for "agree" on the used scale, according to St.d Deviation it refers to the extent to which the values are far or close of the mean. Accordingly, the value for FP will range between  $4.10 \pm 0.617 = \{3.483, 4.717\}$ . In other words all the responses are between neutral and strongly agree based on the used scale, that means financial performance of the target companies is rated as good in general. Moreover, the minimum value of FP equals 3 and the maximum equals to 5, it means all the responses ranged between 3 and 5 according to the used scale.

Operational performance ( $M = 3.78$ ,  $SD = 0.562$ ), which means there is an agreement among the respondents that the operational performance of the target companies rated as good.  $M = 3.78 \approx 4$  matches the value for "agree" on the used scale. St.d Deviation refers to the extent to which the values are far or close to the mean. Accordingly, the value for OP will range between  $3.78 \pm 0.562 = \{3.21, 4.342\}$ . In other words, all the responses are between neutral and good based on the used scale, that means the OP rmance of the target companies is rated as good in general. Moreover, the minimum value of OP equals 3 and the maximum equals to 5, it means all the responses ranged between 3 and 5 according to the used scale.

Customer satisfaction ( $M = 3.86$ ,  $SD = 0.624$ ), which means there is an agreement of the respondents that CS rated as good.  $M = 3.78 \approx 4$  matches the value for "agree" on the used scale. St.d Deviation refers to the extent to which the values are far or close to the mean. Accordingly, the value for CS will range between  $3.86 \pm 0.624 = \{3.236, 4.484\}$ . In other words, all the responses are between neutral and good based on the used scale, that means CS of the target

companies is rated as good in general. Moreover, the minimum value of CS equals 3 and the maximum equals to 5, it means all the responses ranged between 3 and 5 according to the used scale.

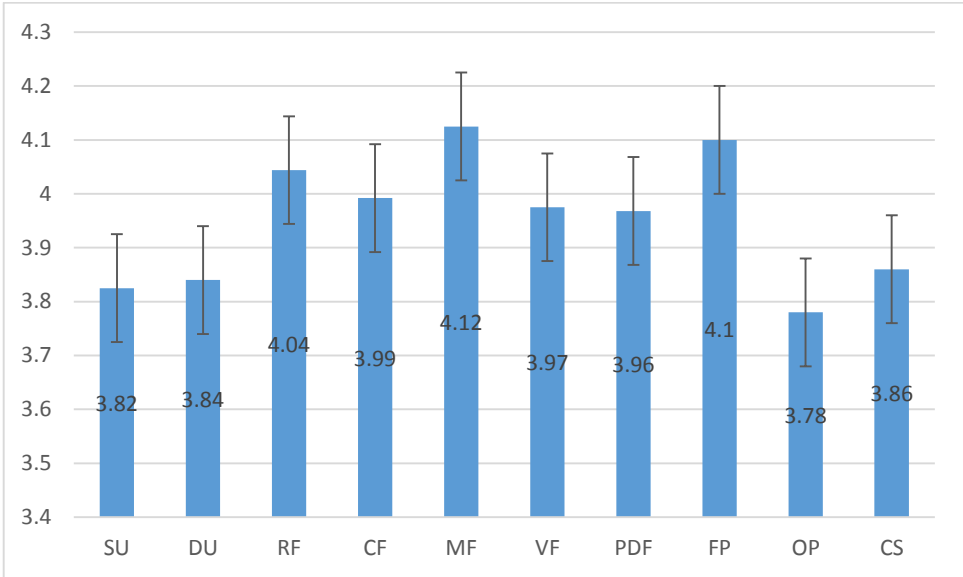


Figure 4-1: Results of Descriptive Analysis

Source: Author’s Calculation (2019)

**4.3 Correlation Analysis**

The correlation test was carried out with the Pearson correlation test, in order to understand the degree of correlation between the variables. Table 4-3 explains that the correlation between the variables is either moderate or low, but all the correlation relations were significant. The correlations between the independent variables (RF, CF, PDF, VF, and MF) and dependent variables (FP, OP, and CS) were significantly correlated.

In more detail, the results showed that uncertainty is significantly positively related with RF, CF, MF, VF, and PDF. This provides an evidence that uncertainty affects managers' decision of adopting flexibility as a mechanism to deal with unexpected situations. And UN positively with companies performance, in this point of view, the performance of the target companies still good despite uncertainty, due to the implementation of flexibility as a mechanism to deal with uncertain situations. This implies clearly the importance of flexibility as a mechanism to enhance companies' performance despite uncertainty. In this case, uncertainty could not affect companies' performance negatively.

RF, CR, MF, VF, and PDF are linked to company performance significantly and positively, this indicates obviously the significance of SF and OF as effective techniques to enhance companies'

performance. Additionally, the synergistic role of strategic and operational flexibility as effective mechanisms to reduce the negative effects of uncertainty on performance. Along with that, it clarifies the possibility of controlling the negative effect of uncertainty by using perfect techniques such as flexibility.

**Table 4 – 3: Correlations Results**

	UN	RF	CR	MF	VF	PDF	Performance
UN	1						
RF	0.358**	1					
CR	0.270**	0.469**	1				
MF	0.467**	0.602**	0.520**	1			
VF	0.533**	0.264**	0.425**	0.607**	1		
PDF	0.599**	0.582**	0.564**	0.675**	0.588**	1	
Performance	0.538**	0.537**	0.449**	0.545**	0.600**	0.643**	1

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).

Source: Author's Calculation (2019)

#### 4.4 Regression Analysis

In order to test the first and second main hypotheses and the sub-hypotheses are related to, linear regression analysis was used to investigate the causal relationship between strategic flexibility and companies' performance, and operational flexibility and companies' performance.

**Table 4 – 4: Regression results of different dimensions of flexibility – Total performance**

Independent Variables	Dependent Variable	
	Performance	Performance
	Model 1	Model 2
Constant	0.784 ***	0.911 ***
RF	0.534 *** (0.418)	
CF	0.244 *** (0.253)	
MF		0.080 (0.084)
VF		0.296*** (0.313)
PDF		0.377*** (0.402)
R	0.582	0.702
Adjusted R <sup>2</sup>	0.332 (33.2%)	0.485 (48.5%)

Levels of significance: \*p < 0.1; \*\*p < 0.05; \*\*\*p < 0.001

Source: Author's Calculation (2019)

According to the results in Table 4-4, strategic flexibility effects company performance positively, and strategic flexibility explains 33.2% of performance variance.

Also, operational flexibility effects company performance positively, and operational flexibility explains 48.5% of performance variance.

Depending on the summarized results in Table 4-4, we can agree with the first main hypothesis, i.e. that “strategic flexibility positively affects the performance of SME pharmaceutical companies in Iran”.

Also, we can accept the second main hypothesis that “operational flexibility positively affects the performance of SME pharmaceutical companies in Iran”.

Table 4-4 shows that resource flexibility affects company performance positively, and it has a greater effect on company performance (41.8%). So the sub-hypothesis 1a that “resource flexibility positively affects the performance of SME pharmaceutical companies in Iran” is accepted.

Moreover, coordination flexibility affects company performance positively, and its effect on it is equivalent to 25.3%. So the sub- hypothesis 1b that “coordination flexibility positively affects the performance of SME pharmaceutical companies in Iran” is accepted.

Based on the coefficient results, we can form a regression equation, as follows:

$$Y = 0.784 + 0.534X_1 + 0.244 X_2$$

Where  $X_1$ : RF,  $X_2$ : CF,  $Y$ = companies Performance.

Mix flexibility does not affect company performance. So the sub- hypothesis 2a that “Mix flexibility positively affects the performance of SME pharmaceutical companies in Iran” is rejected.

Volume flexibility effects company performance positively, and its effect is equivalent to 31.3%. So the sub-hypothesis 2b that “Volume flexibility positively affects the performance of SMEs pharmaceutical companies in Iran” is accepted.

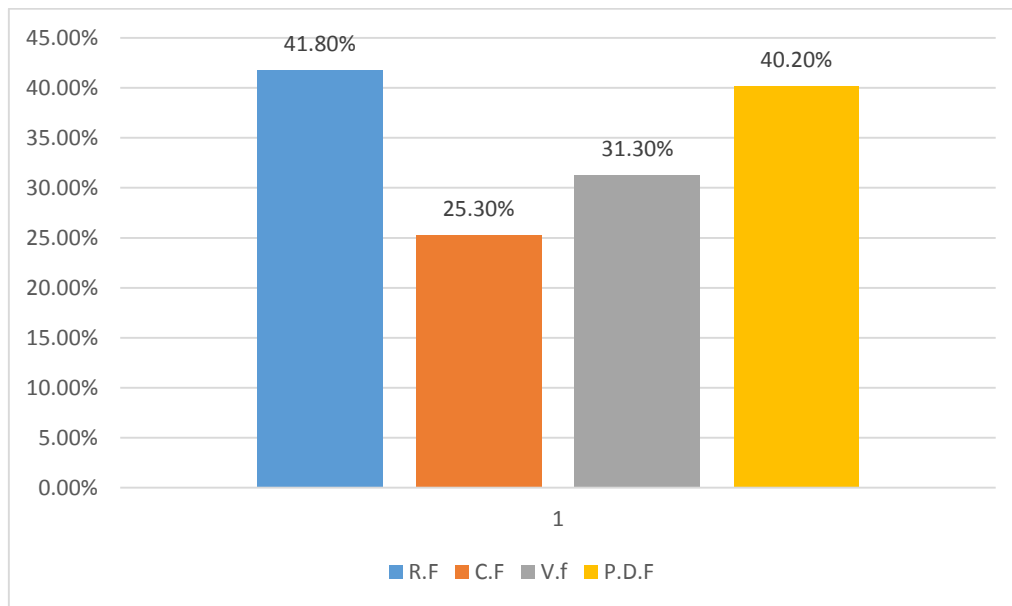
Product development flexibility effects company performance positively, and it has the second greatest effect on company performance (40.2%). So the sub-hypothesis 3c that “PDF positively affects the performance of SME pharmaceutical companies in Iran” is accepted.

Based on coefficient results, we can form regression equation as following:

$$Y = 0.911 + 0.296 X_1 + 0.377 X_2$$

Where  $X_1$ : VF,  $X_2$ : NPF, Y: Performance.

Based on the above-mentioned, the following (Figure 4-4) summarizes the effect of different dimensions of flexibility on the performance of SME pharmaceutical companies in Iran.



**Figure 4-2:** The Effect of Flexibility Dimensions on Companies' Performance

*Source: Author's Calculation (2019)*

- Resource flexibility affects the performance of SME pharmaceutical companies in Iran positively, and it has the highest impact on performance 41.8%.
- Product development flexibility affects the performance of SME pharmaceutical companies in Iran positively, it ranks second in terms of impact on performance 31.3%. 40.20%.
- Volume flexibility affects the performance of SME pharmaceutical companies in Iran positively, it ranks third in terms of impact on performance 31.3%.
- Coordination flexibility affects the performance of SME pharmaceutical companies in Iran positively, and it has the lowest impact on performance 25.3%.

For more details about the relationship between different dimensions of flexibility and different dimensions of performance, Table 4-5 shows the details of the causal relationship between the variables.

**Table 4 – 5:** Regression Analysis of Different Dimensions of Flexibility – Different Dimensions of Performance

Independent Variables	Dependent Variable					
	Performance			Performance		
	Model 1			Model 2		
	FP	CS	OP	FP	CS	OP
Constant	1.171**	0.450	0.730*	0.878*	0.786*	1.070***
RF	0.764*** (0.382)	0.534*** (.339)	0.303*** (.231)			
CF	-0.039 (0.026)	0.313*** (0.263)	0.259*** (0.463)			
MF				0.218* (0.147)	0.137 (0.118)	-0.116 (0.120)
VF				0.626*** (0.421)	0.198** (0.169)	0.066 (0.068)
PDF				-0.041 (0.028)	0.434*** (0.374)	0.740*** (0.766)
R	0.370	0.518	0.607	0.505	0.584	0.730
Adjusted R <sup>2</sup>	0.129	0.262	0.362	0.245	0.332	0.527

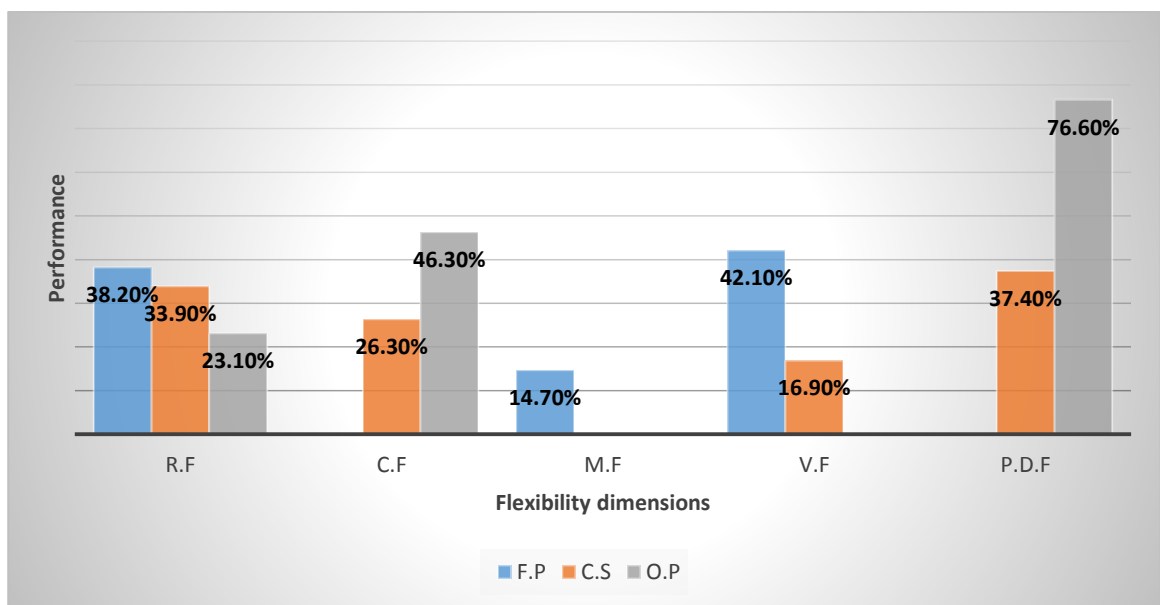
Levels of significance: \*p < .05; \*\*p < .01; \*\*\*p < .001

Source: Author's Calculation (2020)

Based on Table 4-5 we can provide more details about the direct effects of SF dimensions and the dimensions of on the dimensions of performance.

- Resource flexibility affects financial performance positively.
- Resource flexibility affects customer satisfaction positively.
- Resource flexibility affects operational performance positively.
  
- Coordination flexibility does not affect financial performance.
- Coordination flexibility affects customer satisfaction positively.
- Coordination flexibility affect operational performance.
  
- Mix flexibility affects financial performance positively.
- Mix flexibility does not affect customer satisfaction.
- Mix flexibility does not affect operational performance.

- Volume flexibility affects financial performance positively.
- Volume flexibility affects customer satisfaction positively.
- Volume flexibility does not affect operational performance.
  
- Product development flexibility does not affect financial performance.
- Product development flexibility affects customer satisfaction positively.
- Product development flexibility affects operational performance positively.



**Figure 4-3:** The Effect of Flexibility Dimensions on The Dimensions of Companies' Performance

Source: Author's Calculation (2019)

**Table 4 – 6:** Regression Analysis of Different Dimensions of Flexibility – Different Dimensions of Performance

Independent Variables	Dependent Variable					
	Performance			Performance		
	Model 1			Model 2		
	FP	CS	OP	FP	CS	OP
Constant	1.797**	0.623***	0.608***	0.923**	0.785** *	0.991***
SF	0.573*** (0.286)	0.805*** (0.511)	0.791*** (0.603)			
OF				0.788** * (0.460)	0.771** * (0.573)	0.695 (0.620)
R	0.286	0.511	0.603	0.460	0.573	0.620
Adjusted R <sup>2</sup>	.078	0.258	0.360	0.209	0.326	0.382

Levels of significance: \*p < .05; \*\*p < .01; \*\*\*p < .001

Source: Based on Author's Calculation (2019)

According to Table 4- 6, we can note that total strategic flexibility positively affects all performance dimensions (financial performance, operational performance, and customer satisfaction), whereas total operational flexibility affects only financial performance and customer satisfaction positively, and does not affect operational performance.

**4.5 Moderation analysis**

In order to test hypotheses 3 and 4 related to moderation, Moderation Analysis was conducted using SPSS 25, by using the PROCESS introduced by Andrew Hayes (Hayes, 2013). For this purpose, the new edition was presented in 2018. Add-on macros were installed in the SPSS program, as this was helpful to analyse the interaction effects.

First a regression model is fitted predicting the outcome variable (performance) from both the predictor variable (strategic flexibility) and the moderator variable (uncertainty). Then, the interaction effect is added to the previous model (block 2) and a check is carried out for a significant R2 change, as well as a significant effect by the new interaction term. If both are significant, then moderation is occurring. The same with operational flexibility.

**Table 4 – 7: Regression Analysis of Flexibility – Performance**

Independent Variables	Dependent Variable	
	Performance	Performance
	Model 1	Model 2
Constant	1.009 ***	0.894***
SF	0.723 *** (0.566)	
OF		0.751*** (0.689)
R	0.566	0.689
R <sup>2</sup>	0.321	0.405

Statistical significance: \*\*p < 0.05; \*p < 0. 1; \*\*\*p < 0.001

Source: Author’s Calculation (2019)

Based on Table 4-7, strategic flexibility is positively related to company performance. The relationship is significant, and strategic flexibility explains 32.1% of the variance of company performance.

Operational flexibility is positively related to company performance. The relationship is significant and strategic flexibility explains 40.5% in the variance of company performance.

#### 4.5.1 The Moderating Effect of Uncertainty on the Relationship Between Strategic Flexibility and Performance

Table 4-8 shows the result of the moderating effect of uncertainty on the link between SF and the performance of SMEs Pharmaceutical companies in Iran.

**Table 4 – 8: The Results of Moderated Regression Analysis (Uncertainty as Criterion)**

	$\beta$	R	R <sup>2</sup>	T	P
Constant	8.54*** [3.56 , 13.51]			3.381	0.0009
SF	-1.6775*** [-2.96 , - 0.38]	0.6906	0.4769	-2.561	0.0111
Uncertainty	-1.97*** [-3.37 , - 0.566]			-2.76	0.0062
SF * Un	0.62*** [0.265 , 0.98]		0.0272***	3.41	0.0008

Levels of significance; \*p < .01, \*\*p < .05, \*\*\*p < .001

Source: Based on Author's Calculation (2019)

According to the previous Table 4-8, we can note that all P values are significant: P < 0.001, P < 0.05, and according to the following ranges [3.56, 13.51], [-2.96, - 0.38], [0.265, 0.98], there is no (0) value between the lower and the upper value for each one of them. Consequently, we can say that uncertainty moderates the relationship between strategic flexibility and company performance, on the basis of which we accept the third main hypothesis that “uncertainty moderates the relationship between strategic flexibility and company performance”.

For more details based on the Appendix 5, the interaction term was statistically significant (b=.6269, s.e.=.1836, p=.0008) in our model, indicating that uncertainty significantly moderates the effect of flexibility on company performance.

Since the interaction term in the model was statistically significant, we have to probe the interaction in order to better interpret the nature of the moderated relationship between strategic flexibility and company performance, at three levels of the moderator.

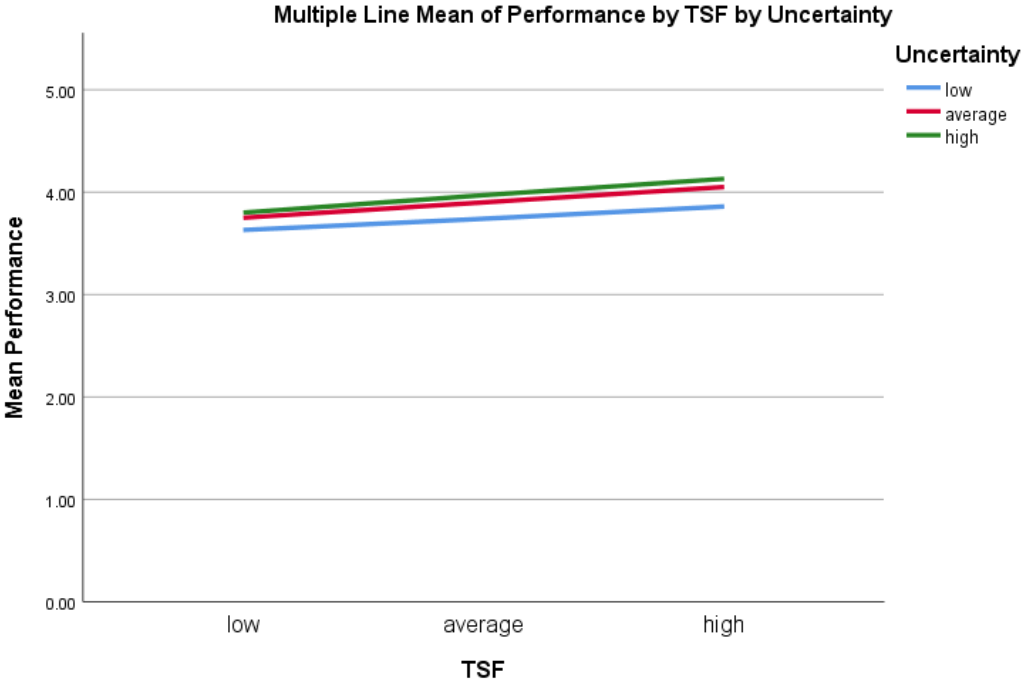
At level 1 (i.e. 3.5834) on the lowest level of uncertainty, the relationship between strategic flexibility and company performance was positive and significant. b = 0.5690, se=.0664, t= 8.56, P=.0000 < .001.

At level 2 (i.e. 3.8750) on the average level of uncertainty, the relationship between strategic flexibility and company performance was positive and significant. b = 0.7518, Se=.0892, t= 8.4277, P=.0000 < .001.

At level 3 (i.e. 4.0000) on the highest level of uncertainty, the relationship between strategic flexibility and company performance was positive and significant  $b = 0.8302$ ,  $Se=.1060$ ,  $t=7.8323$ ,  $P=.0000 < .001$ .

This result shows that in uncertain situations if the pharmaceutical companies use strategic flexibility as a mechanism to deal with uncertainty it will reflect positively on their performance. So in uncertain business environments when companies carry out strategic flexibility, the performance of these companies will be improved due to the fact that flexibility is an effective technique to adapt to an uncertain environment.

The following (Figure 4-4) shows the moderating effect of uncertainty on the relationship between strategic flexibility and performance, at different levels of uncertainty.



**Figure 4-4:** The Moderating effect of uncertainty on the relationship between strategic flexibility and companies’ performance

*Source: Author’s Calculation (2019)*

The result of Table 4-8 shows that in uncertain situations, if pharmaceutical companies use strategic flexibility as a mechanism to deal with uncertainty, it will reflect positively on their performance. So in uncertain business environments when companies carry out strategic flexibility, the performance of these companies will improve due to the fact that flexibility is an effective technique in adapting to an uncertain environment.

According to (Figure 4-4), we can note that there is a positive relationship between SF and companies' performance in light of uncertainty. The values of performance ranged between 3 and 4, whereas the values of TSF ranked as low, average and high (for more details the moderation tables are available in Appendix 5). We can note there are three lines with different colours, the blue one shows the positive relationship between SF and companies' performance moderated by a low level of uncertainty. The same goes with the red colour which refers to the positive relationship between SF and companies' performance moderated by the average level of uncertainty. Finally, the red colour shows the positive relationship between SF and companies' performance moderated by a high level of uncertainty. The direction of the slopes shows the positive relationship between SF and companies performance in light of uncertainty.

In the three different cases shown by the three different colours, we can note that by each increase of SF level the performance of the companies increases in light of different levels of uncertainty.

#### 4.5.2 The Moderation Effect of Uncertainty on the Relationship between Operational Flexibility and Performance

According to Table 4-9, we can note that there is no effect of uncertainty as a moderator variable on the link between OF and companies' performance because all P values > 0.01. Moreover, we can note that (0) value is located in the following ranges [-1.4827, 6.0034] [-.7857, 1.158] [-1.2616, .7719] [-.1407, .3788]. So, the fourth main hypothesis “uncertainty moderates the relationship between operational flexibility and performance of SMEs pharmaceutical companies in Iran” is rejected.

**Table 4 – 9:** Moderated Regression Analysis (Uncertainty as Criterion)

	$\beta$	R	$R^2$	T	P
Constant	2.2604 [-1.4827 , 6.0034]			1.19	0.2353
OF	.1866 [-.7857 , 1.158]	0.7052	0.4974	.3781	0.7057
Uncertainty	-.2448 [-1.2616 , .7719]			-.4754	
OF * Un	.1191 [-.1407 , .3788]		0.0018	.90310	.03674

Source: Author's Calculation (2019)

## 4.6 Research Results and their Explanation

- **Strategic flexibility and company performance**

SF affects the performance of SME pharmaceutical companies in Iran positively. According to the results, both RF and CF positively affect the performance of the target companies, and it seems clear that carrying out strategic flexibility can be considered an effective mechanism to deal with uncertainty and to enhance the performance of SME pharmaceutical companies in Iran. For more details about the effect of SF dimensions on performance dimensions, the results showed that RF positively affect the FP, CS and OP of the target companies. Also, coordination flexibility positively affects both customer satisfaction and operational performance, but does not affect financial performance.

- **Operational flexibility and company performance**

According to the analysis, OF affects the performance of Iranian SME pharmaceutical companies positively. But this result is not valid for all dimensions of operational flexibility. Both VF and PDF positively affect the performance of the target companies and the relationship between each one of them and performance is significant ( $p < 0.01$ ). Despite the positive effect of MF on the performance of target companies, this effect is not significant ( $p > 0.1$ ). For more details about the effect of operational flexibility dimensions on performance dimensions, the results show that MF affects only financial performance positively but does not have a significant effect on customer satisfaction or operational performance. VF positively affects financial performance and customer satisfaction, whereas it does not have a significant effect on operational performance. PDF affects customer satisfaction and operational performance positively, whereas it does not have a significant effect on financial performance.

- **The moderation effect of uncertainty on the relationship between strategic flexibility and company performance.**

Based on moderation analysis, uncertainty moderates the link between SF and company performance, which means that in uncertain situations, the effects of SF on company performance will be greater, and this indicates the importance of SF as a mechanism to deal with environmental uncertainty.

- **The moderation effect of uncertainty on the relationship between operational flexibility and company performance.**

Based on moderation analysis, uncertainty does not moderate the link between operational flexibility and company performance, which means that in uncertain situations the relationship

between operational flexibility and company performance will not be affected or changed. We can also state that operational flexibility relates to the manufacturing process inside the company, which means it will be limited to the internal business environment which is totally under the control of company management, especially because of the result that uncertainty moderates the link between strategic flexibility and company performance.

So, it is logical that strategic flexibility represents a cover for operational flexibility from a strategic perspective because it refers to the relationship between the company and the external environment (suppliers and customers), and logically, if the company could control the negative effects of supply and demand uncertainties from the external environment this will reflect positively on the manufacturing process inside the company and the dimensions of operational flexibility which are mainly related to these processes. Consequently, the existence of SF is enough to react to the uncertainties of the external environments, and the role of operational flexibility appears as an internal mechanism to improve company performance.

## 5. CONCLUSIONS AND RECOMMENDATIONS

### 5.1 Conclusion

In a hyper-changeable business environment, businesses should try to manage all these changes and respond to them by being agile and trying to control unexpected situations as much as they can. As a result a company will be able to deal with uncertain situations, avoid threats and grab opportunities. Flexibility relies on two fundamental elements: first, the speed of reaction, second, the availability of information in uncertain situations.

In general, the results indicate that Iranian SME pharmaceutical companies work in an uncertain business environment, and they carry out both SF and OF as mechanisms to deal with uncertain situations. The performance of these companies is rated as good. Both SF and OF effect positively the performance of SME pharmaceutical companies in Iran.

Strategic flexibility, represented by RF and CF, affects positively and significantly the performance of SME pharmaceutical companies in Iran, and this result matches the results of Chauhan and Singh (2013, p.33) that resource flexibility is a way to meet customers' demands faster, will lead to customer satisfaction, and will enhance the financial performance of the company (Chod and Rudi, 2005; Yuan et al, 2010). It also matches the results of Daniels et al (2004) who found that an effective allocation and utilization of resource flexibility helps companies to improve performance.

Environmental uncertainty moderates the link between SF and the performance of target companies but does not moderate the link between OF and the performance of those companies.

SF and OF as mechanisms to deal with uncertainty can be integrated together and work synergistically to improve the performance of SMEs pharmaceutical companies in Iran, and strategic flexibility works as an umbrella for operational flexibility, which means that when strategic flexibility represented by resource flexibility and coordination flexibility exists, it will reflect positively on performance and it is a realistic mechanism to cope with external environmental uncertainty which is represented by supply uncertainty and demand uncertainty. When resource flexibility is high and affects company performance positively, these companies will have good techniques to deal with different suppliers and obtain the required resources for production processes. Despite the importance of resource flexibility in enhancing companies' performance, there is no benefit if the company cannot manage the available resources in an economical way to reach the optimal level of resource usage, because resources are limited and they should be used rationally. Consequently, coordination flexibility will be a perfect

mechanism to achieve this, especially when the outcomes clarify that CF positively effects the performance of SME pharmaceutical companies in Iran.

The dimensions of operational flexibility which are considered in the current study are in harmony with the dimensions of strategic flexibility; for example, MF and VF and PDF are directly related to manufacturing processes and at the same time to the available resources and how to use them efficiently, and the results have shown that VF affects companies' performance positively. This is a logical result because volume flexibility refers to a company's ability to modify the production size (increase or decrease) to meet demand fluctuation, in this case to meet customer needs on the time, which will lead to customer satisfaction, and as a result, more profits when the sales are higher. On the other hand, it will act as a guarantee to avoid increasing variable costs when demand is low by controlling the level of production. This result matches Oke's (2005) result, which found that VF is not the final goal of companies, but is rather a technique that enables companies to acquire a competitive advantage by achieving CS, especially if the company uses an effective delivery system. Moreover, many researchers, such as (Kekre and Srinivasan, 1990; Suarez et al, 1996; Vickery et al, 1999; Goyal and Netessine, 2011; Sáenz et al, 2018) mention that volume flexibility positively affects a company's performance because it allows an increase in production in response to unexpected customer preferences and this enhances CS.

Product development flexibility effects companies' performance positively as well, because it is related to meeting customer needs, and if the company is customer-oriented this automatically means an increase in customer satisfaction, and an increase in sales and profits as well. The current study shows that PDF positively affects both the FP and CS of the target companies. In this context, Cottrell and Nault (2004) found that introducing new products or developing current products to meet the new trends of consumption affects company performance positively because it creates increased product diversity, whereas dependence on traditional current products leads to low company performance.

Mix flexibility effects company performance positively, but it is not a significant effect ( $P > 0.1$ ), so it was ignored. We can justify this by the great effect of both VF and PDF on company performance when companies modify their production and develop current products to meet customer needs, which will enhance their performance, Moreover, MF means many production lines which are difficult and costly for small and medium-sized companies, but much easier for larger companies which have the capital to set up many production lines and then create a wide mix of products. In detail, mix flexibility only affects financial performance and this effect was

significant, and this result matches Suarez et al, 199; Kekre and Srinivasan, 1990; in their opinion mix flexibility affects profitability and market share positively.

We can say that Iranian pharmaceutical SMEs are flexible and they have information about the market; because of this they control the negative effect of uncertainty and this is reflected positively in their performance.

Consequently, directors must have the ability to determine various methods to obtain the required information about the market and its components, and understand how they can use this information in an optimal way, and choose the best time to respond to market changes and uncertain situations to avoid threats and grasp opportunities in the face of massive competition.

We provide empirical evidence that both operational and strategic flexibility improve the (financial – non-financial) performance of small and medium-sized companies. Dynamic business environments present great opportunities as well as threats, so companies should be careful about their performance, and they should find the best techniques to avoid threats and exploit opportunities, especially in the context of intense competition; this aspect was not considered in this study, but will be a recommended area for future research. Moreover, the link between OF, SF, and performance still needs further investigation and effort so that researchers and managers can be aware of how they can use their findings efficiently to enhance company performance, especially in the light of the high cost of applying different choices and moving from one plan to another in uncertain situations. The results showed that the positive effects of SF and OF on financial performance are the less than the effect of SF and OF on other types of performance because flexibility as a mechanism is costly and this result matches the perspective of Das and Elango (1995).

Finally, SF and OF are key mechanisms for effective performance in uncertain situations, but they are not a miracle solution to enhance company performance; they must be applied in synergy with other strategies and techniques.

The following Table 5-1 summaries the results of hypothesis testing. Based on it, three main hypotheses are accepted, one main hypothesis is rejected. Regarding the sub-hypotheses, 4 sub-hypotheses, are accepted, whereas one sub-hypothesis is rejected.

**Table 5-1: Summary of Quantitative Study Results**

<b>N</b>	<b>Hypotheses</b>	<b>Result</b>
<b>1</b>	<b>Strategic flexibility positively affects the performance of pharmaceutical SMEs in Iran</b>	<b>Accepted</b>
	A: Resource flexibility positively affects the performance of pharmaceutical SMEs in Iran	<b>Accepted</b>
	B: Coordination flexibility positively affects the performance of pharmaceutical SMEs in Iran.	<b>Accepted</b>
<b>2</b>	<b>Operational flexibility positively affects the performance of pharmaceutical SMEs in Iran.</b>	<b>Accepted</b>
	A: Mix flexibility positively affects the performance of pharmaceutical SMEs in Iran.	<b>Rejected</b>
	B: Volume flexibility positively affects the performance of pharmaceutical SMEs in Iran.	<b>Accepted</b>
	C: Product development flexibility positively affects the performance of pharmaceutical SMEs in Iran.	<b>Accepted</b>
<b>3</b>	<b>Uncertainty moderates the relationship between strategic flexibility and the performance of pharmaceutical SMEs in Iran.</b>	<b>Accepted</b>
<b>4</b>	<b>Uncertainty moderates the relationship between operational flexibility and the performance of pharmaceutical SMEs in Iran.</b>	<b>Rejected</b>

*Source: The author's based on the results*

## **5.2 Recommendations**

Regarding the previous results, this study has many recommendations and implications for implementing flexibility and its role in enhancing company performance in the light of environmental uncertainty.

This study presents a framework featuring two main types of flexibility - strategic and operational -, and their synergistic impact on enhancing the performance of pharmaceutical companies operating in what is considered one of the most important economic sectors in Iran.

- Regarding the managers

One of the most important implications of this study is for managers at small and medium-sized pharmaceutical companies in Iran, i.e. for their way of thinking, by drawing their attention to the valuable role of flexibility as a dual mechanism to improve company performance and deal with environmental uncertainty, and how they can apply flexibility from strategic and operational perspectives, in order to obtain the required results. To do this requires reconfiguring the managerial policies at these companies, thinking out of the box and expanding their vision for the future of their companies. Moreover, there is a need to introduce flexibility as a business culture for managers, by showing the positive effect of flexibility on different dimensions of performance. Because if the company uses the same techniques for a long time in a rapidly changing business environment, it will necessarily be a reason for it to drop out of the market. Managers themselves must be flexible in their attitudes and ways of planning so as to be able to implement flexibility as a strategic and operational mechanism to deal with an unexpected situation and react to unpredictable cases in the appropriate time.

- Regarding the production processes

Pharmaceutical companies in Iran have to work more and more in the field of R & D to improve production methods and to be able to produce drugs for chronic diseases, which are currently imported from other countries. By producing such drugs, companies will be able to enhance the impact of MF on performance, because the results show that the effect of MF on company performance is currently not significant. In other words, the target companies in Iran should widen the variety of drugs available by using mix flexibility.

Due to sanctions, pharmaceutical companies in Iran must think about outsourcing flexibility to solve the problem of acquiring the raw materials required to produce more pharmaceutical products and enhance the product mixture.

- Recommendation for the production costs

Companies should be careful about the cost of production of the new products, or develop their current products and carry out feasibility studies before making the decision to produce or launch novel products on the market, because in the case of the failure of a new product, the costs will be higher, despite applying flexibility, because flexibility as a mechanism is costly, especially when a company wishes to change from one strategic choice to another. This is clear from the result that showed that the impact of SF on FP was positive and significant, but had the least effect when compared to the effect of flexibility on other dimensions of performance.

- Regarding the harmony between flexibility and other marketing techniques

Inevitably, flexibility is an effective method to cope with urgent situations, but it is not a magic key to maximize profits and enhance performance or solve problems immediately. It must be introduced in synergy with other management practices, such as market research, managing the supply chain efficiently and adopting marketing techniques to get the best results from it.

Small and medium-sized pharmaceutical companies in Iran should be careful about competitors' actions because the large companies in the same industry are very strong and they have a higher proportion of sales. So the target companies must be market-oriented by using both MARKOR (intelligence generation, intelligence dissemination, and responsiveness) and MAKTOR (customer orientation, competitor orientation, and inter-functional coordination) measures of market orientation, because if a company is not market-oriented then it is impossible to be flexible and apply flexibility as a mechanism to deal with uncertainty or respond to market changes.

Flexibility as a response to market changes represents the final step of market orientation "responsiveness", because strategic flexibility could be proactive and reactive, and the importance of being market-oriented is summarized by obtaining information about the market. Without being competitor-orientated, companies will not be able to react to competitors' actions in time.

- Regarding government policies

The Iranian MOH should modify the pricing policy of pharmaceutical products because it is not possible for pharmaceutical companies to produce novel products unless the price increases favourably, and here, the Iranian MOH can work in parallel to protect people against the high price of drugs by an insurance program, and at the same time provide pharmaceutical companies with some margins to increase the prices within a reasonable range.

According to the development of existing products, there are many restrictions, because all the pharmaceutical companies are working under the regulations of B.P. (British Pharmacopoeia), which is an organization responsible for determining and defining the formula of each pharmaceutical product, and no company can make any basic changes to develop existing products unless the B.P. agrees. So, in this case, introducing new product flexibility is a much more workable solution than product development flexibility. The MOH in Iran need to find a way to deal with such restrictions by trying to renew and modify the agreements with the international parties in order to allow the Iranian pharmaceutical companies to innovate and

produce new pharmaceutical products which are needed to the local, regional and international markets.

### **5.3 Research Limitations**

Like other research, this study has many limitations.

- In the beginning, the study considered one manufacturing sector, i.e. pharmaceutical companies, and moreover, it only dealt with SMEs. So for future studies, researchers can consider large companies as well, and make a comparative study between different industrial sectors to investigate the impact of flexibility on performance, because this relationship still needs much investigation.
- Second, the current study used two dimensions of SF, and three dimensions of OF. Other researchers can use different dimensions from a different perspective, and environmental uncertainty and performance can be considered from different perspectives by using different dimensions of both of them. Moreover, different factors can be considered as moderators or mediators for this relationship.
- Third, this study considered Iran as a country; future studies can make comparative studies between different countries because different countries mean different business environments, different sources of uncertainty, and logically different results.
- Fourth, this study is a cross-sectional one, so perhaps a larger research project could use long term series to make comparisons based on time differences.
- Finally, it would be beneficial to consider the synergistic effect of another practice, such as market orientation with flexibility to enhance company performance.

## 6. THE MAIN CONCLUSION AND NOVEL FINDINGS

The main goal of this thesis was to investigate the relationship between flexibility and company performance and consider the moderating effect of uncertainty on this relationship.

The new element in this study is testing the theoretical model and linking it to the empirical study by considering the synergy between strategic and operational flexibility on company performance and moderating it by using uncertainty as a moderating variable, which has not been tested before.

- The main outcomes of the research can be summarized in a basic sentence: “When a company applies flexibility as a strategic and operational mechanism, this will lead to an enhancement of its performance, especially in the light of environmental uncertainty”.
- The link between SF and company performance can be more effective in the light of environmental uncertainty, where uncertainty moderates this relationship. Since SF is related to the external business environment it is logical that resources and the way they are used are affected by the uncertainty which derives from the external environment. And the evidence is clear that resource flexibility has the greatest effect on company performance compared to other dimensions of flexibility.
- Operational flexibility affects companies’ performance positively and the relationship is significant, but environmental uncertainty does not affect this relationship. This means that operational flexibility, represented by MF, VF, and PDF, enhances company performance even in the absence of the effect of environmental uncertainty, because operational flexibility with the considered dimensions is related directly to the production process, which occurs within the organization and so there is no effect of the external business environment. Moreover, strategic flexibility creates an umbrella for operational flexibility and a defensive wall against environmental uncertainty. In other words, when a company has resource flexibility and coordination flexibility, it automatically follows that its operational activities will be going smoothly without problems.
- Mix flexibility as a dimension of does not have a considerable impact on company performance, perhaps because volume and new product flexibility are more important to meet market needs, and so far the small and medium-sized pharmaceutical companies

in Iran have not been able to expand their production mixture because of sanctions and restrictions on outsourcing for raw materials.

Novel research topics and ideas for future research have been revealed in this current study, by using different perspectives of strategic flexibility and different dimensions of operational flexibility, and also considering technological uncertainty as a source of uncertainty. Also, combination flexibility and other marketing techniques, such as market orientation have been considered in the interests of achieving a flexible orientation for companies, and using flexible orientation as an approach to enhance company performance, because both flexibility and market orientation are the new dynamic capabilities of modern companies.

The study provided an analysis of the topic in the context of small and medium-sized pharmaceutical companies in Iran. The results showed that flexibility as a strategic and operational mechanism is an active strategy, and that it reflects positively on the performance of the target companies. Some of the detailed results match those of international studies, while some do not, which is logical because of the differences in the business environment of each country. In general, the Iranian pharmaceutical sector is a very attractive area for further management and business studies.

## SUMMARY

This research can be classified as a causal study because it tried to search for a link between flexibility and company performance, and use uncertainty as a moderating variable on this relationship. Moreover, it assumed a causal relationship between flexibility and performance theoretically, and then tested the relationship empirically. The thesis is composed of six chapters.

**Chapter 1** clarifies the research objectives and questions, and highlights the details related to theories that lead to the research hypotheses.

**Chapter 2** provides a consecutive and coherent theoretical background on flexibility in management literature in general by providing a review of previous research related to strategic flexibility and operational flexibility, performance, and environmental uncertainty, and the relationships with these variables in a conceptual framework.

**Chapter 3** describes the research methodology and the techniques used to achieve the research goals, and demonstrates the data collection method and the analytical techniques and statistical tools used to analyse the data. The primary data for this study were collected by using a questionnaire tool, with a sample consisting of 228 managers from 113 small and medium-sized companies in Iran. These companies are operating in the pharmaceutical sector.

**Chapter 4** presented the results of the quantitative study, using figures summarized in tables. A group of statistical analytical tools was applied, including descriptive analysis, reliability analysis, correlation analysis, regression analysis, and moderation analysis.

According to the descriptive analysis results, all the variables were rated as good, in other words the companies are implementing strategic flexibility and operational flexibility as mechanisms to enhance their performance. Company performance was rated as good, and environmental uncertainty is also present.

Regression analysis was used to test the link between SF, OF and company performance. The results showed that both SF and OF positively affect company performance and the relationship is significant; to be more specific, RF, and PDF have the greatest positive impact on company performance, followed by volume flexibility, while coordination flexibility has the least positive and significant effect on company performance, and MF has no impact on company performance.

Moderation analysis was used to test the third and fourth hypotheses. The results clarified that uncertainty as a moderating variable has an effect on the link between SF and company performance, but there is no effect of uncertainty on the link between OF and company performance.

**Chapter 5** includes the final conclusion of the study, followed by the recommendations and some possible insights for future research at the end.

**Chapter 6** details the main conclusion, and the significant results of the study.

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## LIST OF PUBLICATIONS

12/15/2019 Yousuf Allam Ali Ahmed (business administration) (MTMT)  
<https://m2.mtmt.hu/gui2/?type=authors&mode=browse&sel=10061274> ½

### **Yousuf Allam Ali Ahmed (business administration)**

1.

Allam, Yousuf ; János, Felföldi

The effect of environmental turbulence on strategic flexibility adoption: A survey study on insurance companies in Syria

In: WSB, University (szerk.) 6th International Scientific Conference New Trends in Management and Production Engineering - Regional, Cross-border and Global Perspectives : Book of Abstracts Dąbrowa Górnicza, Lengyelország : WSB University, (2019) p. 67

Közlemény:30791099 Jóváhagyott Forrás Egyéb konferenciaközlemény (Konferenciaközlemény )

2.

Allam, Yousuf ; Hossam, Haddad ; Miklós, Pakurár ; Serhii, Kozlovskiy ; Felföldi, János

The Effect of Operational Flexibility on Performance: A Field Study on Small and Medium-sized Industrial Companies in Jordan. MONTENEGRIN JOURNAL OF ECONOMICS 15 : 1 pp. 47-60. , 14 p. (2019) DOI Teljes dokumentum

Közlemény:30415111 Jóváhagyott Forrás Folyóiratcikk (Szakcikk )

3.

Kozlovskiy, Serhii ; Bolhov, Vladyslav ; Yousuf, Allam ; Batechko, Albina ; Hlushchenko, Larisa ; Vitka, Nataliia

Marketing analysis of the electro mobile market as a factor in the innovation of the national Economy Innovative Marketing 15 : 1 pp. 42-53. , 12 p. (2019) DOI Egyéb URL

Közlemény:30616755 Jóváhagyott Forrás Folyóiratcikk (Szakcikk )

4.

Lavrov, Ruslan ; Beschastnyi, Viktor ; Nikolenko, Liudmyla ; Yousuf, Allam ; Kozlovskiy, Serhii ; Sadchykova, Iryna Special aspects of the banking institutions rating: a case for Ukraine BANKS AND BANK SYSTEMS 14 : 3 pp. 48-63. , 16 p. (2019)

DOI Egyéb URL Közlemény:30791094 Admin láttamozott Forrás Folyóiratcikk (Szakcikk )

5.

Allam, Yousuf ; János, Felföldi

The Effect of Credit Risk Management on Profitability: An Empirical Study of Private Banks In Syria ORADEA JOURNAL OF BUSINESS AND ECONOMICS 2 : 3 p. m.a (2018)

Közlemény:3404051 Jóváhagyott Forrás Folyóiratcikk (Szakcikk ) 12/15/2019 Yousuf Allam Ali Ahmed (business administration) (MTMT)

<https://m2.mtmt.hu/gui2/?type=authors&mode=browse&sel=10061274> 2/2

6.

Allam, Yousuf ; János, Felföldi

The Relationship Between Transaction Costs and Flexibility in Outsourcing: A Conceptual Framework ANNALS OF THE UNIVERSITY OF ORADEA ECONOMIC SCIENCE 26 : 1 pp. 883-891. , 9 p. (2017) DEA Teljes dokumentum Közlemény:3277186 Érvényesített Forrás Folyóiratcikk (Szakcikk )

7.

Allam, Yousuf

Supply and Demand in the Syrian Labor Market: Case Study SEA: PRACTICAL APPLICATION OF SCIENCE 5 : 13 pp. 65-71. , 7 p. (2017) DEA Teljes dokumentum Közlemény:3277185 Érvényesített Forrás Folyóiratcikk (Szakcikk )

8.

A, Yousuf

Transaction Costs: A Conceptual Framework

INTERNATIONAL JOURNAL OF ENGINEERING AND MANAGEMENT SCIENCES / MŰSZAKI ÉS MENEDZSMENT TUDOMÁNYI KÖZLEMÉNYEK 2 : 3 pp. 131-139. , 9 p. (2017) DOI DEA Teljes dokumentum Közlemény:3277184 Érvényesített Forrás Folyóiratcikk (Szakcikk )

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## Appendix 1 Strategic Flexibility Definitions

Roberts and Stockport (2009)	As strategic choice available to company and the company's ability to take advantage of those choices.
Sushil (2005)	Organizations that are under high continuity forces as well as high change forces are 'Synthesizers' and are supposed to exhibit strategic flexibility to integrate the opposing forces acting simultaneously.
Johnson et al 2003)	The fir company m's intent and capabilities to generate company -specific real options for the configuration and reconfiguration of appreciably superior customer value propositions.
Volberda (1999)	Strategic flexibility or non-routine steering capacity consists of managerial capabilities related to the goals of the organization or the environment.
Buckley and Casson (1998)	Ability to reallocate resources quickly and smoothly in response to change.
Lau (1996)	Strategic flexibility refers to a company's ability to respond to uncertainties by adjusting its objectives with the support of its superior knowledge and capabilities.
Upton (1995)	Whether one is referring to products, production volumes or manufacturing processes, flexibility is about increasing range, increasing mobility, or achieving uniform performance across a specific range.
Bahrami (1992)	The ability to precipitate intentional changes, to continuously respond to unanticipated changes, and the ability to adjust to unexpected consequences of predictable changes.
Evans (1991)	Capability to modify strategies.
Ansoff (1965)	Flexibility can be measured by two proxy objectives: external flexibility achieved through a diversified pattern of product-market investments, and internal flexibility through liquidity of Resources.

Eppink (1978)	“Flexibility makes an organization less vulnerable to or better able to respond successfully to, unforeseen environmental changes”. (p.10)” .Flexibility can be seen as a characteristic of an organization that makes it less vulnerable to unforeseen external changes or puts it in a better position to respond successfully to such a change” (p. 42).
Aaker and Mascarenhas (1984)	“The ability of the organization to adapt to substantial, uncertain and fast-occurring (relative to required reaction time) environmental changes that have meaningful impact on the organization’s performance” (p.74).
Harrigan (1985)	“The ability of companies to reposition themselves in a market, change their game plans, or dismantle their current strategies when the customers they serve are no longer as attractive as they once were” (p.1).
Kogut (1985)	“Flexibility is gained by decreasing the company’s dependence on assets already in place” (p.27).
Bahrami (1992)	“Capability to modify strategies” (p.77) “The ability to precipitate intentional changes, to continuously respond to unanticipated changes, and the ability to adjust to unexpected consequences of predictable changes” (p.36).
Hayes and Pisano (1994)	“The capability to switch gears-from, for example, rapid product development to low cost relatively quickly and with minimal resources” (p.78).
Das and Elango (1995)	“The ability of an organization to respond to changes in the environment in a timely and appropriate manner with due regard to competitive forces in the marketplace” (p.62).
Sanchez (1997)	“The condition of having strategic options that are created through the combined effects of an organizations co-ordination flexibility in acquiring and using flexible resources” (p. 71).
Lei et al, (1996)	“Strategic flexibility suggests that companies will need to become more adept at responding to competitor moves while engaging in opportunistic searches for under-served or un-located market segments and niches” (p.512).

Buckley and Casson (1998); Hitt et al, (1998)	“Ability to reallocate resources quickly and smoothly in response to change” (p.23). “The capability of the company to proact or respond quickly to changing competitive conditions and there by develop and/or maintain competitive advantage” (p.27).
Matusik and Hill (1998); Volberda (1996)	“A company’s ability to respond quickly to changing market conditions” (p.682). “Flexibility is the degree to which an organization has a variety of managerial capabilities and the speed at which they can be activated, to increase the control capacity of management and improve the controllability of the organization” (p. 361).
Volberda (1998)	“A company has to develop flexible capabilities for speed and surprise. These capabilities derive from broad knowledge bases, generalizable resources, and core competencies that can be applied in various ways.” (p. 89).
Young and Wiersema (1999)	“The flexibility to modify the alliance and the flexibility to exit the alliance relationship when the alliance is performing poorly” (p.440).
Grewal and Tansuhaj (2001)	“Strategic flexibility represents the organizational ability to manage economic and political risks by promptly responding in a proactive or reactive manner to market threats and opportunities” (p. 72).
Johnson et al, (2003)	“The company’s intent and capabilities to generate company -specific real options for the configuration and reconfiguration of appreciably superior customer value propositions” (p. 77).
Shimizu and Hitt (2004)	“Strategic flexibility can be defined as an organization’s capability to identify major changes in the external environment (e.g., introduction of disruptive technologies), to quickly commit resources to new courses of action in response to change, and to recognize and act promptly when it is time to halt or reverse such resource commitments” (p. 45).
Combe and Greenley (2004)	“Is used to denote the ability of the companies to respond and successively adapt to environmental change” (p. 1458).”The extent to which new and alternative options in strategic decision making are generated and considered” (p. 1458).

Source: Roberts and Stockport (2009).

## Appendix 2 Operational Flexibility Definitions

Different dimensions operational flexibility	Authors	Classification
<p><b>Resource flexibility</b> (machines and human resources)</p> <p><b>Production system flexibility</b> (which varies according to the type of production and the managerial criteria).</p>	<p>Buzacott (1982);</p> <p>Gerwin (1982)</p>	
<ul style="list-style-type: none"> <li>Plant and machine level.</li> <li>Production function and work department level.</li> <li>Product (or product line) level.</li> <li>Global level of the company (extending the concept to other functions, such as distribution, purchasing, design, maintenance, etc.).</li> </ul>	<p>Gerwin (1987)</p>	<p>According to the level</p>
<ul style="list-style-type: none"> <li><b>Micro level</b>, characterized by the flexibility of workers, machines and organization; level of factory flexibility.</li> <li><b>Macro level</b> of flexibility of the corporation's network ('the global network of flexi-factories').</li> </ul>	<p>Mair (1994)</p>	<p>According to the level</p>
<ul style="list-style-type: none"> <li><b>Machine-level</b> : is exclusively technological, plant-level flexibility takes into account the company's skills, the procedures adopted, managerial systems, etc.</li> </ul>	<p>Swamidass (1988)</p>	
<p><b><u>Manufacturing resources</u></b></p> <ul style="list-style-type: none"> <li>the technology followed,</li> <li>the work power,</li> <li>the services supporting production ('infrastructures'),</li> </ul> <p><b><u>The aim of production</u></b></p> <ul style="list-style-type: none"> <li><b>Product flexibility</b> (regards new products launching or modifying pre-existing ones, both in qualitative terms and in terms of different features/functionality of the products);</li> </ul>	<p>Slack (1987, 1988)</p>	<p>Four categories of flexibility are described concerning:</p> <ul style="list-style-type: none"> <li>Manufacturing resources;</li> <li>the aims of production;</li> </ul>

<ul style="list-style-type: none"> <li>• <b>Mix flexibility</b> (both in terms of range and of response)</li> <li>• <b>Volume flexibility</b> (regards the capability of varying the production volume);</li> <li>• <b>Delivery flexibility</b> (regards the capability of changing the scheduled dates).</li> </ul> <p><b><u>The production function</u></b></p> <p>Flexibility of the production function determines delivery reliability customer oriented.</p>		<p>. the production function; . the whole company.</p>
<p><b><u>Component or basic flexibilities</u></b> (machine, material handling, and operation flexibility)</p> <p><b><u>System flexibilities</u></b> (process, routing, product, volume, and expansion flexibility);</p> <p><b><u>Aggregate flexibilities</u></b> (program flexibility,; production flexibility, market flexibility, )</p>	<p>Sethi and Sethi (1990)</p>	<p>Eleven types of flexibility ( three levels)</p>
<p>Short-term or adaptation flexibility , medium and long-term flexibility</p>	<p>Zelenovich (1982)</p>	<p>Temporal classification</p>
<ul style="list-style-type: none"> <li>• Instantaneous flexibility</li> <li>• Very short-term flexibility</li> <li>• Short-term flexibility</li> <li>• Short- to medium-term flexibility</li> <li>• Medium-term flexibility</li> <li>• Medium- to long-term flexibility</li> <li>• Long-term flexibility</li> </ul>	<p>Merchant (1983),</p>	<p>Temporal classification</p>

### Appendix 3. Descriptive Analysis

#### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
RF1	228	3	5	4.07	.469
RF2	228	3	5	4.18	.442
RF3	228	3	5	3.85	.468
RF4	228	3	5	4.09	.410
RF5	228	3	5	4.03	.496
Valid N (listwise)	228				

#### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CF1	228	3	5	4.02	.567
CF2	228	3	5	4.01	.555
CF3	228	3	5	3.93	.623
CF4	228	3	5	4.07	.615
CF5	228	3	5	3.93	.435
Valid N (listwise)	228				

#### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
MF1	228	3	5	4.07	.450
MF2	228	3	5	4.04	.600
MF3	228	3	5	4.17	.549
MF4	228	3	5	4.14	.561
MF5	228	3	5	4.16	.617
MF6	228	3	5	4.17	.649
Valid N (listwise)	228				

### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
VF1	228	3	5	3.77	.741
VF2	228	3	5	3.84	.665
VF3	228	3	5	4.11	.532
VF4	228	3	5	4.10	.444
VF5	228	3	5	3.95	.499
VF6	228	3	5	4.08	.472
Valid N (listwise)	228				

### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
PDF1	228	3	5	3.88	.573
PDF2	228	3	5	3.85	.626
PDF3	228	3	5	4.12	.622
PDF4	228	3	5	3.97	.574
PDF5	228	3	5	4.18	.507
PDF6	228	3	5	4.17	.554
PDF7	228	3	5	3.81	.667
PDF8	228	3	5	3.77	.611
Valid N (listwise)	228				

### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
DU1	228	2	5	3.82	.477
DU2	228	2	5	3.78	.529
DU3	228	2	5	3.93	.543
Valid N (listwise)	228				

### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
SU1	228	2	5	3.83	.480
SU2	228	2	5	3.82	.521
Valid N (listwise)	228				

### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
FP1	228	3	5	4.16	.572
FP2	228	3	5	4.11	.628
FP3	228	3	5	4.04	.652
Valid N (listwise)	228				

### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
CS1	228	3	5	3.75	.583
CS2	228	3	5	3.85	.673
CS3	228	3	5	3.98	.711
CS4	228	3	5	4.04	.578
CS5	228	3	5	3.68	.577
Valid N (listwise)	228				

### Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
OP1	228	3	5	3.88	.555
OP4	228	3	5	3.82	.575
OP3	228	3	5	3.87	.523
OP4	228	3	5	3.77	.579
OP5	228	3	5	3.73	.598
OP6	228	3	5	3.65	.547
Valid N (listwise)	228				

## Appendix 4

### Regression analysis of different dimensions of flexibility – Total performance

- Strategic flexibility (Resource flexibility – coordination flexibility) – companies' performance

#### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.582 <sup>a</sup>	.338	.332	.300

a. Predictors: (Constant), Coordination Flexibility, Resource Flexibility

#### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.349	2	5.175	57.491	.000 <sup>b</sup>
	Residual	20.252	225	.090		
	Total	30.602	227			

a. Dependent Variable: Performance

b. Predictors: (Constant), Coordination Flexibility, Resource Flexibility

#### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.784	.294		2.666	.008
	Resource Flexibility	.534	.078	.418	6.811	.000
	Coordination Flexibility	.244	.059	.253	4.123	.000

a. Dependent Variable: Performance

- **Operational flexibility (Product Development Flexibility, Volume Flexibility, Mix Flexibility) – companies' performance**

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.702 <sup>a</sup>	.492	.485	.263

a. Predictors: (Constant), Product Development Flexibility, Volume Flexibility, Mix Flexibility

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.061	3	5.020	72.360	.000 <sup>b</sup>
	Residual	15.541	224	.069		
	Total	30.602	227			

a. Dependent Variable: Performance

b. Predictors: (Constant Product Development Flexibility, Volume Flexibility, Mix Flexibility)

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.911	.210		4.345	.000
	Mix Flexibility	.080	.065	.084	1.224	.222
	Volume Flexibility	.296	.060	.313	4.973	.000
	Product development Flexibility	.377	.064	.402	5.934	.000

a. Dependent Variable: Performance

## Regression Analysis of Different Dimensions of Flexibility – Different Dimensions of Performance

- **Strategic flexibility (Coordination Flexibility, Resource Flexibility – Financial Performance)**

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.370 <sup>a</sup>	.137	.129	.5376066

a. Predictors: (Constant), Coordination Flexibility, Resource Flexibility

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10.317	2	5.158	17.848	.000 <sup>b</sup>
	Residual	65.030	225	.289		
	Total	75.346	227			

a. Dependent Variable: Financial Performance

b. Predictors: (Constant), Coordination Flexibility, Resource Flexibility

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.171	.527		2.223	.027
	Resource Flexibility	.764	.140	.382	5.442	.000
	Coordination Flexibility	-.039	.106	-.026	-.372	.710

a. Dependent Variable: Financial Performance

- **Strategic flexibility (Coordination Flexibility, Resource Flexibility – Customer satisfaction)**

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.518 <sup>a</sup>	.268	.262	.3889604

a. Predictors: (Constant), Coordination Flexibility, Resource Flexibility

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.475	2	6.238	41.230	.000 <sup>b</sup>
	Residual	34.040	225	.151		
	Total	46.516	227			

a. Dependent Variable: Customer Satisfaction

b. Predictors: (Constant), Coordination Flexibility, Resource Flexibility

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.450	.381		1.181	.239
	Resource Flexibility	.534	.102	.339	5.258	.000
	Coordination Flexibility	.313	.077	.263	4.075	.000

a. Dependent Variable: Customer Satisfaction

## Strategic flexibility (Coordination Flexibility, Resource Flexibility) – Operational Performance

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.607 <sup>a</sup>	.368	.362	.3012971

a. Predictors: (Constant), Coordination Flexibility, Resource Flexibility

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.897	2	5.948	65.524	.000 <sup>b</sup>
	Residual	20.425	225	.091		
	Total	32.322	227			

a. Dependent Variable: Operational Performance

b. Predictors: (Constant), Coordination Flexibility, Resource Flexibility

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.730	.295		2.474	.014
	Resource Flexibility	.303	.079	.231	3.848	.000
	Coordination Flexibility	.459	.059	.463	7.719	.000

a. Dependent Variable: Operational Performance

- **Operational flexibility (Product development Flexibility, Volume Flexibility, Mix Flexibility) – Financial Performance**

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.505 <sup>a</sup>	.255	.245	.5005045

a. Predictors: (Constant), Product Development Flexibility, Volume Flexibility, Mix Flexibility

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	19.233	3	6.411	25.593	.000 <sup>b</sup>
	Residual	56.113	224	.251		
	Total	75.346	227			

a. Dependent Variable: Financial Performance

b. Predictors: (Constant), Product Development Flexibility, Volume Flexibility, Mix Flexibility

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.878	.399		2.203	.029
	Mix Flexibility	.218	.124	.147	1.762	.080
	Volume Flexibility	.626	.113	.421	5.525	.000
	Product Development Flexibility	-.041	.121	-.028	-.338	.736

a. Dependent Variable: Financial Performance

- **Operational flexibility (Product development Flexibility, Volume Flexibility, Mix Flexibility) – Customer Satisfaction**

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.584 <sup>a</sup>	.341	.332	.3698757

a. Predictors: (Constant), Product Development Flexibility, Volume Flexibility, Mix Flexibility

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.871	3	5.290	38.669	.000 <sup>b</sup>
	Residual	30.645	224	.137		
	Total	46.516	227			

a. Dependent Variable: Customer Satisfaction

b. Predictors: (Constant), Product Development Flexibility, Volume Flexibility, Mix Flexibility

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.786	.295		2.667	.008
	Mix Flexibility	.137	.091	.118	1.503	.134
	Volume Flexibility	.198	.084	.169	2.363	.019
	Product Development Flexibility	.434	.089	.374	4.854	.000

a. Dependent Variable: Customer Satisfaction

- **Operational flexibility (Product development Flexibility, Volume Flexibility, Mix Flexibility) – Operational Performance**

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.730 <sup>a</sup>	.533	.527	.2594769

a. Predictors: (Constant), Product development Flexibility, Volume Flexibility, Mix Flexibility

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	17.240	3	5.747	85.355	.000 <sup>b</sup>
	Residual	15.082	224	.067		
	Total	32.322	227			

a. Dependent Variable: Operational Performance

b. Predictors: (Constant), Product development Flexibility, Volume Flexibility, Mix Flexibility

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.070	.207		5.180	.000
	Mix Flexibility	-.116	.064	-.120	-1.814	.071
	Volume Flexibility	.066	.059	.068	1.120	.264
	Product Development Flexibility	.740	.063	.766	11.803	.000

a. Dependent Variable: Operational Performance

## Regression Analysis of Different Dimensions of Flexibility – Different Dimensions of Performance

### Strategic Flexibility - Financial Performance

#### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.286 <sup>a</sup>	.082	.078	.5532754

a. Predictors: (Constant), Strategic Flexibility

#### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.165	1	6.165	20.139	.000 <sup>b</sup>
	Residual	69.182	226	.306		
	Total	75.346	227			

a. Dependent Variable: Financial Performance

b. Predictors: (Constant), Strategic Flexibility

#### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.797	.515		3.493	.001
	Strategic Flexibility	.573	.128	.286	4.488	.000

a. Dependent Variable: Financial Performance

## Strategic Flexibility - Customer Satisfaction

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.511 <sup>a</sup>	.261	.258	.3898893

a. Predictors: (Constant), SF

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.161	1	12.161	79.997	.000 <sup>b</sup>
	Residual	34.355	226	.152		
	Total	46.516	227			

a. Dependent Variable: Customer Satisfaction

b. Predictors: (Constant), Strategic Flexibility

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.623	.363		1.717	.087
	Strategic Flexibility	.805	.090	.511	8.944	.000

a. Dependent Variable: Customer Satisfaction

## Strategic Flexibility – Operational Performance

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.603 <sup>a</sup>	.363	.360	.3017826

a. Predictors: (Constant), Strategic Flexibility

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.740	1	11.740	128.903	.000 <sup>b</sup>
	Residual	20.582	226	.091		
	Total	32.322	227			

a. Dependent Variable: Operational Performance

b. Predictors: (Constant), Strategic Flexibility

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.608	.281		2.168	.031
	Strategic Flexibility	.791	.070	.603	11.354	.000

a. Dependent Variable: Operational Performance

## Operational Flexibility – Financial Performance

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.460 <sup>a</sup>	.212	.209	.5125429

a. Predictors: (Constant), Operational Flexibility

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.976	1	15.976	60.815	.000 <sup>b</sup>
	Residual	59.370	226	.263		
	Total	75.346	227			

a. Dependent Variable: Financial Performance

b. Predictors: (Constant), TOPF

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.932	.408		2.287	.023
	Operational Flexibility	.788	.101	.460	7.798	.000

a. Dependent Variable: Financial Performance

## Operational Flexibility – Customer Satisfaction

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.573 <sup>a</sup>	.329	.326	.3717072

a. Predictors: (Constant), Operational Flexibility

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	15.290	1	15.290	110.665	.000 <sup>b</sup>
	Residual	31.226	226	.138		
	Total	46.516	227			

a. Dependent Variable: Customer Satisfaction

b. Predictors: (Constant), TOPF

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.758	.296		2.564	.011
	Operational Flexibility	.771	.073	.573	10.520	.000

a. Dependent Variable: Customer Satisfaction

## Operational Flexibility – Operational Performance

### Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.620 <sup>a</sup>	.385	.382	.2966157

a. Predictors: (Constant), TOPF

### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.438	1	12.438	141.375	.000 <sup>b</sup>
	Residual	19.884	226	.088		
	Total	32.322	227			

a. Dependent Variable: Operational Performance

b. Predictors: (Constant), TOPF

a. Dependent Variable: Operational Performance

### Coefficients<sup>a</sup>

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.991	.236		4.202	.000
	Operational Flexibility	.695	.058	.620	11.890	.000

**As a first step for moderation analyses:**

**Total strategic flexibility – Total performance**

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.566 <sup>a</sup>	.321	.318	.303

a. Predictors: (Constant), Total SF

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.009	.282		3.578	.000
	TotalSF	.723	.070	.566	10.327	.000

a. Dependent Variable: Total performance

**Total operational flexibility – Total performance**

**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.638 <sup>a</sup>	.407	.405	.283

a. Predictors: (Constant), TotalOF

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.188	.220		5.411	.000
	TotalOF	.674	.054	.638	12.466	.000

a. Dependent Variable: Totalperformance

## Appendix 5

### Moderation effect of uncertainty on the relationship between strategic flexibility and performance:

Run MATRIX procedure:

\*\*\*\*\* PROCESS Procedure for SPSS Version 3.4  
\*\*\*\*\*

Written by Andrew F. Hayes, Ph.D. [www.afhayes.com](http://www.afhayes.com)  
Documentation available in Hayes (2018).  
[www.guilford.com/p/hayes3](http://www.guilford.com/p/hayes3)

\*\*\*\*\*  
\*\*\*\*\*

Model : 1  
Y : Performance  
X : Strategic Flexibility  
W : Uncertainty  
Sample  
Size: 228

\*\*\*\*\*  
\*\*\*\*\*

OUTCOME VARIABLE:  
Performa

Model Summary

	R	R-sq	MSE	F	df1	df2
p	.6906	.4769	.0715	68.0704	3.0000	224.0000
	.0000					

Model

	coeff	se	t	p	LLCI
ULCI					
constant	8.5392	2.5255	3.3812	.0009	3.5624
13.5159					
SF	-1.6775	.6550	-2.5612	.0111	-2.9682
-.3868					
Uncertain	-1.9721	.7135	-2.7638	.0062	-3.3782
-.5660					
Int_1	.6269	.1836	3.4142	.0008	.2651
.9888					

Product terms key:

Int\_1 : TSF x Uncertain

Covariance matrix of regression parameter estimates:

	constant	TSF	Uncertain	Int_1
constant	6.3780	-1.6471	-1.7924	.4608
SF	-1.6471	.4290	.4618	-.1197
Uncertain	-1.7924	.4618	.5091	-.1305
Int_1	.4608	-.1197	-.1305	.0337

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0272	11.6570	1.0000	224.0000	.0008

-----

Focal predict: TSF (X)  
 Mod var: Uncertain (W)

Conditional effects of the focal predictor at values of the moderator(s):

	Uncertain	Effect	se	t	p	LLCI
ULCI						
	3.5834	.5690	.0664	8.5681	.0000	.4381
.6999						
	3.8750	.7518	.0892	8.4277	.0000	.5760
.9277						
	4.0000	.8302	.1060	7.8323	.0000	.6213
1.0391						

Data for visualizing the conditional effect of the focal predictor:  
 Paste text below into a SPSS syntax window and execute to produce plot.

```
DATA LIST FREE/
  TSF      Uncertain  Performa  .
BEGIN DATA.
  3.8000   3.5834     3.6347
  4.0000   3.5834     3.7485
  4.2000   3.5834     3.8623
  3.8000   3.8750     3.7543
  4.0000   3.8750     3.9047
  4.2000   3.8750     4.0551
  3.8000   4.0000     3.8056
  4.0000   4.0000     3.9716
  4.2000   4.0000     4.1377
END DATA.
GRAPH/SCATTERPLOT=
  TSF      WITH      Performa BY      Uncertain .
```

\*\*\*\*\* ANALYSIS NOTES AND ERRORS \*\*\*\*\*

Level of confidence for all confidence intervals in output:  
 95.0000

W values in conditional tables are the 16th, 50th, and 84th percentiles.

NOTE: Variables names longer than eight characters can produce incorrect output.  
 Shorter variable names are recommended.

----- END MATRIX -----

## Moderation effect of uncertainty on the relationship between operational flexibility and performance

Run MATRIX procedure:

\*\*\*\*\* PROCESS Procedure for SPSS Version 3.4  
\*\*\*\*\*

Written by Andrew F. Hayes, Ph.D. [www.afhayes.com](http://www.afhayes.com)  
Documentation available in Hayes (2018).  
[www.guilford.com/p/hayes3](http://www.guilford.com/p/hayes3)

\*\*\*\*\*  
\*\*\*\*\*

Model : 1  
Y : Performa  
X : Operational Flexibility  
W : Uncertain

Sample  
Size: 228

\*\*\*\*\*  
\*\*\*\*\*

OUTCOME VARIABLE:  
Performa

Model Summary

	R	R-sq	MSE	F	df1	df2
P	.7052	.4974	.0687	73.8810	3.0000	224.0000
	.0000					

Model

	coeff	se	t	p	LLCI
ULCI					
constant	2.2604	1.8994	1.1900	.2353	-1.4827
6.0034					
OF	.1866	.4934	.3781	.7057	-.7857
1.1588					
Uncertain	-.2448	.5160	-.4745	.6356	-1.2616
.7719					
Int_1	.1191	.1318	.9031	.3674	-.1407
.3788					

Product terms key:

Int\_1 : TOPF x Uncertain

Covariance matrix of regression parameter estimates:

	constant	TOPF	Uncertain	Int_1
constant	3.6079	-.9279	-.9710	.2485
TOPF	-.9279	.2434	.2470	-.0645
Uncertain	-.9710	.2470	.2662	-.0674
Int_1	.2485	-.0645	-.0674	.0174

Test(s) of highest order unconditional interaction(s):

	R2-chng	F	df1	df2	p
X*W	.0018	.8156	1.0000	224.0000	.3674

-----

Focal predict: TOPF (X)  
Mod var: Uncertain (W)

Data for visualizing the conditional effect of the focal predictor:  
Paste text below into a SPSS syntax window and execute to produce  
plot.

```
DATA LIST FREE/  
  TOPF      Uncertain  Performa  .  
BEGIN DATA.  
  3.6806    3.5834     3.6398  
  4.0000    3.5834     3.8357  
  4.3750    3.5834     4.0656  
  3.6806    3.8750     3.6962  
  4.0000    3.8750     3.9032  
  4.3750    3.8750     4.1461  
  3.6806    4.0000     3.7204  
  4.0000    4.0000     3.9321  
  4.3750    4.0000     4.1806  
END DATA.  
GRAPH/SCATTERPLOT=  
  TOPF      WITH      Performa BY      Uncertain .
```

```
***** ANALYSIS NOTES AND ERRORS  
*****
```

Level of confidence for all confidence intervals in output:  
95.0000

NOTE: Variables names longer than eight characters can produce  
incorrect output.  
Shorter variable names are recommended.

----- END MATRIX -----

## Appendix 6 Correlation Matrix

		Correlations						
		UN	RF	CF	MF	EVF	PDF	performance
UN	Pearson Correlation	1	.358**	.270**	.467**	.533**	.599**	.538**
	Sig. (2-tailed)		.000	.000	.000	.000	.000	.000
	N	228	228	228	228	228	228	228
RF	Pearson Correlation	.358**	1	.469**	.602**	.264**	.582**	.537**
	Sig. (2-tailed)	.000		.000	.000	.000	.000	.000
	N	228	228	228	228	228	228	228
CF	Pearson Correlation	.270**	.469**	1	.520**	.425**	.564**	.449**
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000
	N	228	228	228	228	228	228	228
MF	Pearson Correlation	.467**	.602**	.520**	1	.607**	.675**	.545**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.000
	N	228	228	228	228	228	228	228
VF	Pearson Correlation	.533**	.264**	.425**	.607**	1	.588**	.600**
	Sig. (2-tailed)	.000	.000	.000	.000		.000	.000
	N	228	228	228	228	228	228	228
PDF	Pearson Correlation	.599**	.582**	.564**	.675**	.588**	1	.643**
	Sig. (2-tailed)	.000	.000	.000	.000	.000		.000
	N	228	228	228	228	228	228	228
performance	Pearson Correlation	.538**	.537**	.449**	.545**	.600**	.643**	1
	Sig. (2-tailed)	.000	.000	.000	.000	.000	.000	
	N	228	228	228	228	228	228	228

\*\* . Correlation is significant at the 0.01 level (2-tailed).

## Appendix 7



**UNIVERSITY OF DEBRECEN**



### **SURVEY ON THE EFFECTS OF FLEXIBILITY ON PERFORMANCE OF COMPANIES IN BUSINESS**

Company Name ..... Main activity of the company.....

Gender: Male / Female ..... Age..... Position.....

How many years of experience do you have in this field? 

1-5	6-10	11-15	Over 15
-----	------	-------	---------

How many years have you been working for this company? 

1-5	6-10	11-15	Over 15
-----	------	-------	---------

Company size 

Small	Medium	Large
-------	--------	-------

Number of the employees 

Less than 50	Less than 250	More than 250
--------------	---------------	---------------

Yearly sales (Annual turnover) 

≤ \$ 3 million	≤ \$15 million	> \$15 million
----------------	----------------	----------------

Age of the company 

1-5	6-10	11-15	Over 15
-----	------	-------	---------

The **purpose** of this survey is to analyze the degree of the effects of **flexibility** on **performance** in food industry in light of uncertainty. This information will be strictly **confidential** and these data will always be aggregated in the eventual case of publication.

- 1) Please indicate the degree of importance allocated in your company to each of the following flexibility dimensions, in comparison to other company in your specific sector of competition. Use the five -point Likert scale (1 Strongly Disagree “SD”) (2 Disagree “D”) (3 Neutral “N”) (4 Agree “A”) (5 Strongly Agree “SA”).

- **Strategic flexibility:** company's abilities to respond to changes in dynamic competitive environments.
- **Resource flexibility:** company's ability to determine and get the resource which offers strategic options for a company to follow alternative courses of action in responding to environment changes.
- **Coordination flexibility:** company's capabilities to manage and use the resources in different ways for better performance in light of dynamic environments.

Q	Strategic Flexibility (Resource Flexibility)	Scale				
1	There is a large range of alternative uses to which our major resources can be applied.	1	2	3	4	5
2	The difficulty of switching from one use of our major resources to an alternative use is low.	1	2	3	4	5
3	The time required to switch to an alternative resource use is short.	1	2	3	4	5
4	The major resources can be allocated to develop, manufacture, and deliver a diverse line of products.	1	2	3	4	5
5	We have the ability to get new resources as alternative resources the available resources.	1	2	3	4	5
Q	Strategic Flexibility (Coordination Flexibility)	Scale				
1	We have the ability to determine the required resources for production process.	1	2	3	4	5
2	We have the ability to form and determine the optimal structure of resources which match with production plan.	1	2	3	4	5
3	Internal unites often collaborate with each other to find the optimal use of available resources.	1	2	3	4	5
4	We have the ability to manage and use our resources in an efficient way to match with production plan.	1	2	3	4	5
5	We have the ability to redefine the new use of available resources to reconfigure resource chain.	1	2	3	4	5

2) Please indicate the degree of importance allocated in your company to each of the following flexibility dimensions, in comparison to other companies in your specific sector of competition. Use the five -point Likert scale (1 Strongly Disagree “SD”) (2 Disagree “D”) (3 Neutral “N”) (4 Agree “A”) (5 Strongly Agree “SA”).

- **Operational flexibility:** company’s ability to decrease the negative consequences of difference between demand and supply by enabling companies to reallocate their capacity according to demand changing.
- **Mix flexibility:** the number of products that can be produced at any point in time.
- **Volume Flexibility:** the ability to operate profitably at different production volumes.
- **Product development flexibility:** the ability to develop the current products and to efficiently shift production from products with low demand to new developed products with high demand which meet customers’ needs.

Q	Operational Flexibility (Mix Flexibility)	SD	D	N	A	SA
1	We can produce a wide variety of products in our plants.	1	2	3	4	5
2	We can produce different product types without major changeover.	1	2	3	4	5
3	We can build different products in the same plants at the same time.	1	2	3	4	5
4	We can vary product combinations from one period to the next.	1	2	3	4	5
5	We can changeover quickly from one product to another.	1	2	3	4	5
6	We have the ability to modify the mix of production (produce many types of each product) to meet the needs of largest segment of consumers.	1	2	3	4	5
Q	Operational Flexibility (Volume Flexibility)	SD	D	N	A	SA
1	We can operate efficiently at different levels of output.	1	2	3	4	5
2	We can economically run various batch sizes.	1	2	3	4	5
3	We can quickly change the quantities for our products produced.	1	2	3	4	5
4	We can vary aggregate output from one period to the next.	1	2	3	4	5
5	We can easily change the production volume of a manufacturing process.	1	2	3	4	5

6	We have the ability to modify the volume of production (increase or decrease) to meet demand fluctuation.	1	2	3	4	5
<b>Operational Flexibility (Product development flexibility)</b>		<b>SD</b>	<b>D</b>	<b>N</b>	<b>A</b>	<b>SA</b>
1	We can quickly modify product design in response to customer requests	1	2	3	4	5
2	We can take the lead in new product introduction	1	2	3	4	5
3	We can modify products by adding new (ingredients) and/ or packaging	1	2	3	4	5
4	We can better meet customer needs by quickly modifying existing products	1	2	3	4	5
5	We are very keen on new product development.	1	2	3	4	5
6	We are under a hard market pressures to put innovative products forward the market.	1	2	3	4	5
7	Our supply chain suppliers and relationships allow us to quickly introduce new product in the market.	1	2	3	4	5
8	We have the ability to modify the products faster than main competitors.	1	2	3	4	5

3) Please indicate the degree of importance allocated in your company to each of the following uncertainty dimensions. Use the five -point Likert scale (1 Strongly Disagree “SD”) (2 Disagree “D”) (3 Neutral “N”) (4 Agree “A”) (5 Strongly Agree “SA”).

Demand Uncertainty		SD	D	N	A	SA
1	The volume and/or composition of demand is difficult to predict.	1	2	3	4	5
2	Our demand fluctuates drastically from week to week.	1	2	3	4	5
3	Demand and consumer preferences are almost unpredictable.	1	2	3	4	5
Supply uncertainty		SD	D	N	A	SA
1	The suppliers consistently meet our requirements	1	2	3	4	5
2	The suppliers produce materials with consistent quality.	1	2	3	4	5

- 4) Please indicate the comparative performance of your company in relation to other competitive companies in your industry. Use the five-point Likert scale (1 Strongly Disagree “SD”) (2 Disagree “D”) (3 Neutral “N”) (4 Agree “A”) (5 Strongly Agree “SA”).

**Financial performance:** company’s ability to use assets from its primary mode of business and generate revenues.

**Customer Satisfaction:** company’s ability to get customers loyalty by providing products and services which meet or surpass customer expectation.

**Operational Performance:** company’s ability to operate (doing the processes) in effective manner to achieve goals efficiently.

Q	Business Performance (Financial)	SD	D	N	A	SA
1	My company is profitable.	1	2	3	4	5
2	My company sales are growing.	1	2	3	4	5
3	My company market share is growing.	1	2	3	4	5
Business Performance (Customer Satisfaction)		SD	D	N	A	SA
1	We have high customer retention rate (customers keep doing business with us).	1	2	3	4	5
2	Customers are satisfied with ration of price and function of our products.	1	2	3	4	5
3	Customers perceive their money’s worth when the purchase our products.	1	2	3	4	5
4	Our company has a good reputation for our products.	1	2	3	4	5
5	We able to satisfy our customers much better than main competitors.	1	2	3	4	5
Operational Performance		SD	D	N	A	SA
1	Our company can quickly modify products to meet our major customer’s requirements.	1	2	3	4	5
2	Our company can quickly respond to changes in market demand.	1	2	3	4	5
3	Our company has an outstanding on-time delivery record to our major customer.	1	2	3	4	5

4	The lead time for fulfilling customers' orders (the time which elapses between the receipt of customer's order and the delivery of the goods) is short.	1	2	3	4	5
5	Our company provides a high level of customer service to our major customer.	1	2	3	4	5
6	Our operational performance better than the performance of main competitors in the industry.	1	2	3	4	5

**THANK YOU VERY MUCH FOR YOUR KINDLY COOPERATION**

## **ACKNOWLEDGEMENT**

First and foremost, praises and thanks to the God, for His blessings and giving me the patience to complete the PhD.

I would like to express my deep and sincere gratitude to my supervisor, Dr. Felföldi János, Head, The department of Logistics management at faculty of Economics and Business at University of Debrecen. For supporting me scientifically and morally in last 4 years to finish the PhD with his invaluable guidance throughout this research.

I express my sincere and deepest gratitude Prof. Dr. Péter Balogh the head of Károly Ihrig Doctoral School of Management and Business, faculty of economics and Business at University of Debrecen.

I am extremely grateful to my mother, sisters and brother for their love, prayers, caring for educating and preparing me for my future. I also would like to gratitude my father's soul who was wishing me to reach this level of education since I was a child.

I am very much thankful to my dearest friend Dr. Sehar Zulfiqar for her the keen interest, sincerity and motivation shown during PhD journey.

I am really grateful and many thanks to my dearest friend Mr. Vahid Zeynvand Lorestani for his moral support.

My thanks go to my friends Mr. Mohammad Mahmadan, Ms. Imran Sarihasan, Mrs. Rabeea Sadaf and Ms. Bachemeg Baieara, and all the people who have supported me to complete the research work directly or indirectly.

**Allam Yousuf**

## DECLARATION

I, undersigned (name: Allam Yousuf , date of birth: 04/04/1989) declares under penalty of perjury and certify with my signature that the dissertation, I submitted in order to obtain doctoral (PhD) degree is entirely my own work.

Furthermore, I declare the following:

- I examined the Code of the Károly Ihrig Doctoral School of Management and Business Administration and I acknowledge the points laid down in the code as mandatory;
- I handled the technical literature sources used in my dissertation fairly and I conformed to the provisions and stipulations related to the dissertation;
- I indicated the original source of other authors' unpublished thoughts and data in the references section in a complete and correct way in consideration of the prevailing copyright protection rules;
- No dissertation, which is fully or partly identical, to the present dissertation was submitted to any other university or doctoral school for the purpose of obtaining a PhD degree.

Debrecen, 11/03/2020

Allam Yousuf

*ALLAM YOUSUF*

Name

Signature