POLITECNICO DI TORINO

Master's Degree in Engineering and Management

Master's Degree Thesis

Sustainable Agri-food supply chain in Italy

Supervisors

Prof. Mangano Giulio
Prof. Bhattacharya Arijit (External supervisor)

Candidate

Mahsa Jamshidi dolatabad

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Summery

Supply chain management is the key factor for creating and maintaining the competitive advantage of farmers' products in the market, experts and professors place special emphasis on supply management in the agricultural sector. They believe that supply chain management is the key factor to create and maintain the competitiveness of agricultural products in the market. Considering the importance of agriculture in Italy, this research has been started with the aim of identifying various factors to achieve sustainability in the supply of agricultural products in this country. The statistical population of this research was selected from 200 people active in the field of agriculture and agricultural products in Italy. The desired indicators were identified through library studies and the review of published articles around the subject area of the research, and finally, the cause-and-effect relationship of the factors was determined with a semi-structured interview method. The conceptual model was analysed using structural equation modelling with SPSS and Amos tools. The results of the structural model analysis showed that social and environmental indicators had a positive and significant impact on the marketing of agricultural products. Also, the relationship between marketing index and efficiency, flexibility, reliability, convenience and product features were also considered positive and significant. The relationship between the indicators of flexibility and reliability, comfort and product features has also been positive and significant with the responsiveness index. Also, the obtained results showed that there was no relationship between economic and marketing indicators, as well as between efficiency index, flexibility, and responsiveness. Finally, the mediating role of indicators of efficiency and flexibility, reliability, comfort, and product features were also tested by Baron and Kenny. The results have reported the partial mediating role of reliability index, convenience and product characteristics between marketing index and responsiveness.

Keywords: Supply chain, Sustainability, Marketing, Agri-food

Table of Contents

List of Tables ..... **VI**

List of Figures ..... **VIII**

Chapter 1 ..... **1**

Introduction **1**

1.1 Introduction 1

1.2 Research questions and research objective 2

1.3 Structure of the dissertation 3

Chapter 2 ..... **4**

Literature Review **4**

2.1 Introduction 4

2.2 Definition of terms and variables 4

2.3 Supply chain management 5

2.3.1 Main components of supply chain management 6

2.3.2 Measuring and evaluating the supply chain 6

2.3.3 The necessity of performance measurement in a supply chain 7

2.3.3.1 Absence of a balanced method 7

2.3.3.2 Lack of clear distinction between criteria at strategic, tactical, and operational levels 8

2.4 Supply chain complications 8

2.5 performance indicators and measures in a supply chain 9

2.5 Sustainable Supply Chain 10

2.5.1 Importance of supply chain sustainability 11

2.5.2 Elements of supply chain sustainability 12

2.6 Supply chain performance measurement and evaluation 12
2.8 literature review 17
2.8.1bibliometrics analysis and network analysis..... 20
2.5.2 Keywords mapping..... 24
2.6. Measurement model..... 26
2.7. Research Gap 29
Chapter 3 30
Research design 30
3.1. Introduction..... 30
3.2. research methods..... 30
3.3 Research instrument design 31
3.3.1 The statistical population of the research 31
3.3.2 statistical samples of the research 31
3.3.3 methods of data collection..... 32
3.3.4 information gathering tools 32
3.4. Introducing the measurement ranges of variables 32
3.5 Data analysis 33
Chapter 4 34
Hypotheses and model development..... 34
4.1 introductions 34
4.2 Research Hypotheses 35
4.2.1 H1: Social aspects positively affect marketing. 35
4.2.2 H2: Economic considerations have positive impact on marketing. 35
4.2.3 H3: Environmental consideration has positive impact on marketing..... 36
4.2.4 H4: Marketing has positive impact on Efficiency and Flexibility. 36
4.2.5 H5: Marketing has positive impact on Product Reliability, Convenience and 37
4.2.6 H6: Efficiency and Flexibility have positive impact on responsiveness. 37
4.2.7 H7: Product Reliability, Convenience and Characteristics has positive impact on responsiveness. 37
4.2.8 H8: Marketing has positive impact or direct impact on responsiveness. 38

4.2.9 H9: efficiency and flexibility mediate the effects of marketing on responsiveness. 38
4.2.10 H10: product reliability, convenience, and characteristics, mediates the effects of, marketing on responsiveness. 39
4.3 Model development 39
Chapter 5 42
Model estimation and results 42
5.1 Introduction 42
5.2 Model estimation method 43
Chapter 6 45
Analysis and Discussion 45
6.1 Introduction 45
6.1 Demographic information 45
6.1.1 Age 46
6.1.2 Agricultural land area 46
6.1.3 Number of farmers working on agricultural land 47
6.1.4 Years of activity in agricultural land 48
6.3 Descriptive statistics 49
6.3.1 Descriptive statistics of questionnaire questions 50
6.3.2 Descriptive Statistics of conceptual model 51
6.3.3 Measure of sampling adequacy KMO and Bartlett 52
6.3.4 Checking the normality with the Kolmogorov-Smirnov test 52
6.4 Inferential statistics 54
6.4.1 Measurement model 55
6.4.2 Measurement equations 58
6.4.2.1 Equations for measuring variable 58
6.4.3 Initial measurement model Fitness 61
6.4.4 Modified measurement model 62
6.4.4.1 The fitness of the modified measurement model 66
6.4.5 Checking the validity and reliability of the structure 67
6.5 Structural model 69
6.5.1 Structural equation 70
6.6 Mediating variable analysis 74
6.7 Conclusion 79
Chapter 7 79
Conclusion 79

7.1 Introduction 79
7.2 Answers to research questions 79
References: 86

List of Tables

Table 2.1: Some prominent reviews on sustainable agri-food supply chains 20
Table 2.2: Summary of used methodology 21
Table 2.3: Journals with the highest number of articles 22
Table 2.4: Top 10number of documents authors and countries 23
Table 2.5: Top 10number of documents authors and countries 23
Table 2.6: Measurement model 28
Table 3.1: Likert scale 33
Table 6.2: The status of the agricultural land area of the statistical population 47
Table 6.3: The status of the number of farmers engaged in agricultural land 48
Table 6.4: Frequent activity in agricultural land 49
Table 6.5: Descriptive statistics of questionnaire 50
Table 6.6: Descriptive statistics of questionnaire 51
Table 6.8: Kolmogorov-Smirnov Test 53
Table 6.9: Correlation coefficient between the variables of the research conceptual model 54
Table 6.10: Regression Weights 59

Table 6.11: Standardized Regression Weights 60
Table 6.12: Initial measurement model fit indices 61
Table 6.13: Regression Weights 65
Table 6.14: Standardized Regression Weights 66
Table 6.15: The fit indices of the modified measurement model 67
Table 6.16: Reliability check 67
Table 6.17: Examining the validity of Fornell-Larcker 68
Table 6.18: Significance of research assumptions 71
Table 6.19: Standard path coefficients of research hypotheses 71
Table 6.20: The results of research hypotheses 72
Table 6.21: Direct, indirect, and total path 77
Table 6.22: Mediating variable analysis 78
Table 7.1: Questionnaire items 81
Table 7.2: Standard path coefficients of research hypotheses 82

List of Figures

Figure 1.1: Illustrates the detailed research process framework..... 3
Figure 2.1: Bibliographic coupling of countries..... 24
Figure 2.2: Co-occurrence of author keywords of evaluated documents... 25
Figure 2.3: Timeline visualization of co-occurrence of author keywords of evaluated documents 26
Figure 4.1: Hypotheses relationship and model development 41
Table 6.1: Age characteristics of the statistical population 46
Figure 6.1: Age of the statistical population chart..... 46
Figure 6.2: Land area of the owners..... 47
Figure 6.3: Number of farmers working on agricultural land..... 48
Figure 6.4: Frequency related to years of activity 49
Table 6.7: KMO and Bartlett's Test 52
Figure 6.5: Primary measurement model in non-standard coefficient estimation mode..... 56
Figure 6.6: Primary measurement model in standard coefficient estimation mode 57
Figure 6.7: Modified measurement model in non-standardized coefficient estimation mode..... 63

Figure 6.8: Modified measurement model in standard coefficient estimation mode 64
Figure 6.9: Structural model in non-standard coefficient estimation mode 69
Figure 6.10: Structural model in standard coefficient estimation mode 70
Figure 6.11: The structural model of mediation analysis at the zero level in the estimation mode of unstandardized coefficients 75
Figure 6.12: Structural model of mediation analysis at the zero level in the mode of estimation of standard coefficients 75
Figure 6.13: Structural model of mediation analysis with the presence of mediator variable in non-standard estimation mode 76
Figure 6.14: Structural model of mediation analysis with the presence of mediator variable in standard estimation mode..... 77
Figure 7.1: model development..... 81

Chapter 1

Introduction

1.1 Introduction

The purpose of supply chain management is to increase revenue or minimize costs. However, this problem dismissed the organization's detrimental effects on the environment, including resource depletion, ecosystem destruction, and environmental damage, all of which ensure sustainable growth. Any country's ability to maintain its growth relies on its ability to protect and utilize its finite and irreplaceable resources. The use of environmentally friendly raw materials in manufacturing and industrial areas, a reduction in the use of fossil and petroleum-based energy sources, and refuse recycling are just a few of the steps governments have taken to address this problem. The movement of products from the stage of raw materials to the distribution of goods to final customers is referred to as the supply chain. Government laws and regulations are being expedited to achieve environmental standards and the growing demand of consumers to supply green products. As a result, the idea of "green supply chain management" has emerged. In fact, the green supply chain management model is about protecting the environment, and by utilizing it, businesses can minimize negative environmental effects and achieve optimum resource and energy use.
In the agricultural sector, supply chain management is given particular attention by academics and researchers because they think that it is the primary driver of the competitive advantage that farmers' goods enjoy in the market. the presence of intermediaries as hubs linking a farmer with the city sector as well as challenges and issues like rivals with low-cost products, changes in the price of agricultural products, rising customer demands, the unstable economic situation of producers; to give close attention to the agricultural goods supply network. When all the resources required to provide services from the field to consumption are given, the supply chain for agricultural goods becomes effective and efficient; therefore, the supply chain of agricultural products consists of various requirements and resources, financial, information and physical institutions. By analysing the supply chain part by part, relying on market science, it is possible to show the problems in the supply chain of Italian products. A supply chain includes procurement of raw materials, production of goods, transportation of materials and providing services and distribution of products to customers and satisfying customers and it is effective to pay

attention to all parts of the supply chain in a coherent manner to ensure the mutual benefits of different members of the supply chain.
It has been proposed that supply chain management is one of the structural foundations of business implementation around the globe. Supply chain management is crucial for establishing and maintaining the economic edge of farmers' goods in the market. To increase the supply chain's competitiveness, supply chain management is tasked with merging organizational divisions along the supply chain and organizing material, information, and financial flows to satisfy consumer demand. Design, production, and marketing are just a few of the many diverse actions that make up the value chain. By forming new alliances between farms, producers, and merchants, novel value chain configurations can be produced. A value chain is a market that emphasizes cooperation, where various people and businesses cooperate to create and sell goods in an efficient way. In actuality, the value chain can be compared to a large, complex business.

1.2 Research questions and research objective

RQ 1: What are the different factors for achieving sustainability in Italy's agri-food supply chains?

- RO 1: Identification of the factors from the existing literature.
- RO 2: Consultation with the experts to understand the existing factors affecting sustainability in Italy's agri-food supply chains.

RQ 2: How are the factors related to each other for achieving the sustainability dimensions in Italy's agri-food supply chains?

- RO 1: Determining a sample size for collecting primary data.
- RO 2: Adopting a quantitative methodological stance for understanding the causal relationships between the factors.
- RO 3: Designing a survey questionnaire and a set of interview questions for collecting primary data.
- RO 4: Development of a structural equation model considering the factors.
- RO 5: Designing a data analysis process in statistical software.

RQ 3: What recommendations can be made to improve sustainability in the supply chain of agri-food products in Italy?

- RO 1: Examining the type of relationship between the factors to achieve sustainability dimensions in the supply of agri-food products.
- RO 2: Providing solutions to improve sustainability in agri-food products considering the intensity of the relationship between factors.

1.3 Structure of the dissertation

This thesis contains of seven chapters, in chapter one; the generalities of the research and its problem are explained. In the second chapter, an overview of the previous research and research gaps has been reviewed. The third chapter of the research is dedicated to the implementation method and the analysis method. The fourth chapter Hypotheses and model development, the fifth chapter includes the analysis of the obtained results, The sixth chapter analysis of the results and validation of hypothesis and finally the seventh chapter expresses the final conclusions and suggestions.

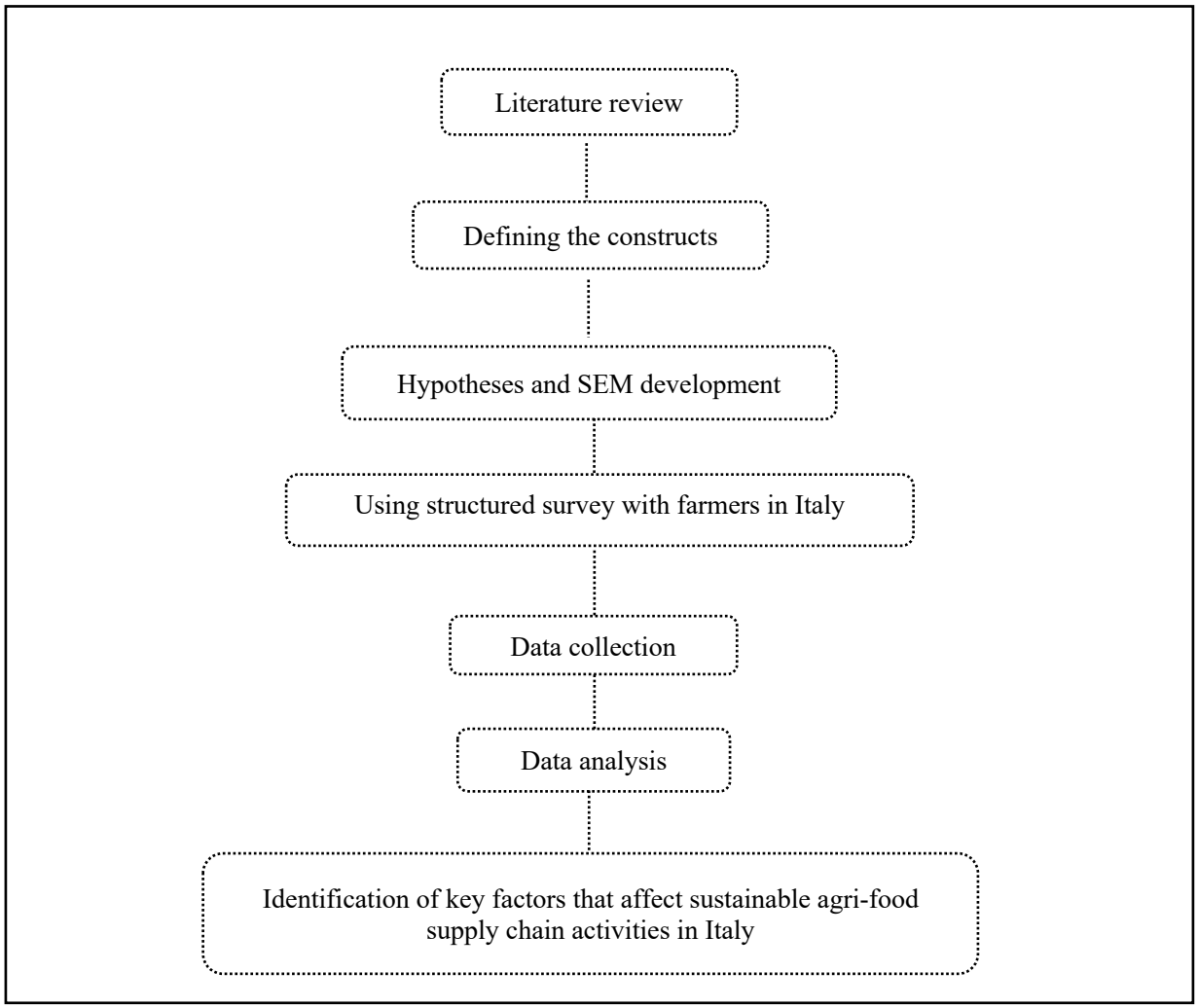

Figure 1.1: Illustrates the detailed research process framework

Chapter 2

Literature Review

2.1 Introduction

Supply chain management is one of the most significant management fields that has generated many helpful subjects in this area. By expanding the information sharing with business partners like raw material suppliers, product distributors, and contractors for goods delivery, the organization will be able to grow its business relationships. By doing this, the business's economic enterprise will be able to sell its product in a shorter period of time, minimize cost of production, and avoid wasting resources.(Lambert and Cooper, 2000).

2.2 Definition of terms and variables

Organizational resource planning definition: Organizational resource planning is a technology-based approach that places all an organization's resources under the control of managers at various organizational levels through a networked system with high speed, accuracy, and quality, allowing the planning process and managing the organization's operations (Stadtler, 2008).

Supply chain management performance: The purpose of supply chain performance is to produce products at a lower cost and deliver the product on time to the customer and increase his satisfaction level. In this regard, some supply chain strategies, such as information sharing, integration of organizational processes, reduce supply chain changes, improve client reaction times, and use information tools that are compatible to boost the efficiency of the supply chain (Houlihan, 1985).

Integration: it means that several systems are placed next to each other and managed as a unit(Houlihan, 1985).

Production planning: Modelling and presenting a production plan for a system based on demand, production limits, warehouse, budget, etc(Houlihan, 1985).

Control: Control is the process of monitoring activities to ensure that they are carried out as planned; and correcting significant and important deviations(Houlihan, 1985).

Material management: The main goal of material management is that, firstly, when needed, materials and parts are available in the required amount, and secondly, the amount of goods and parts is in the right amount(Lambert and Cooper, 2000).

Workflow management: The assessment and improvement of business processes from an administrative viewpoint can be supported by a collection of methodologies, techniques, and instruments known as business process management. (Lambert and Cooper, 2000).

2.3 Supply chain management

The supply chain is an integrated system of interrelated processes that are aimed at:
1. procure the necessary materials and parts; 2. turn raw materials into products; 3. value products; 4. distribute products to customers; and 5. facilitate the exchange of information between supply chain components. The supply chain is made up of suppliers, manufacturers, distributors, intermediaries, retailers, and customers. The main goal of this chain is to increase profits for all its stakeholders by reducing expenses, enhancing efficacy and efficiency, and frequently doing all three at once. The straight flow of goods from the raw material supplier to the consumer and the backward flow of data and materials from the consumer to the suppliers are the two opposing flows in this network. The supply chain is appropriately defined as the movement and transformation of products from the raw material (extraction) stage to distribution to the end user, as well as associated information processes. The term "supply chain" is used to refer to all activities involved in the trade of products and materials, from the preparation of raw materials to the distribution of the finished product to the customer (Stadtler, 2008).
In order to obtain a dependable and long-lasting economic benefit, supply chain management entails integrating supply chain operations and associated information processes through improved chain connections. By streamlining and coordinating activities in the manufacturing and product supply networks, supply chain management integrates supply chain activities and associated information movements (Min, 2019). Suppliers and consumers must collaborate in a coordinated way with informational and dialogic contact for supply chain management to be successful. This refers to the quick exchange of information that some businesses use to build extremely effective supply networks between consumers and vendors, distribution hubs, and transportation systems. Customers and suppliers must share common objectives and respect one another (Naik, 2018). Consumers have faith in their vendors to deliver high-quality goods and services. Additionally, in order to accomplish shared objectives and improve communication and information movement, suppliers and customers should collaborate when planning the supply chain. Some businesses aim to take overall control of their supply chain by taking ownership of and integrating all the various supply chain components, from the acquisition of raw materials and services to the distribution of the finished product and service to the consumer (Devaux, 2021). Different tasks and operational units could still be out of sync even with this organizational framework. The organizational structure should strongly emphasize job coordination in order to achieve the company's overall goals (Min, 2019).

2.3.1 Main components of supply chain management

Three key steps make up supply chain management (Hofmann, 2019):
1) Management of information, 2) Transportation administration, 3) Partnership administration. information administration Today, everyone is aware of the function, value, and location of knowledge. The processes become more effective and efficient and are simpler to handle when information is circulated and transferred correctly (Hofmann, 2019). Increased impacts in speed, accuracy, quality, and other factors will result from partners managing their information in a coordinated and suitable manner (Lambert, 2000).
Management of logistics: When analysing production systems, the logistical issue also includes the physical part of the supply chain. This part manages a sizeable percentage of the supply chain activities, which span from the stage of raw material preparation to the stage of completed product. These physical activities include transit activities, storage, and production scheduling. The emphasis of supply chain activities is where logistics comes into play, with relationships and information serving as its auxiliary instruments for enhancing activities, in addition to the flow of materials and products (Frazelle, 2002).
Relationship management: Due to the way it is built and organized, relationship management in the supply chain serves as a compass that points us in the right direction and may be the most crucial component of supply chain management. The supply chain's success across the board and in all categories is significantly impacted by relationship management (Koberg, 2019). Many times, the technology and information systems needed for supply chain management tasks are easily accessible and can be finished and applied in a reasonably brief amount of time. However, a lot of the early supply chain failures are brought on by a bad transfer of standards and goals, as well as by behaviours that happen between the chain's participants. Additionally, trustworthy contact between chain stakeholders is crucial for effective supply chain management (Frazelle, 2002).

2.3.2 Measuring and evaluating the supply chain

In today's markets, the competition between companies and the use of different techniques is increasing and changing drastically. In order not to lag behind this scene, fundamental changes in the organization are necessary (Nunes, 2020). A company's survival depends on its ability to respond to customer needs. It is very difficult for the company to meet all the requirements; As a result, the outsourcing strategy is one of the main strategies to reduce this difficulty (Gunasekaran, 2004).
Today, managers of the country are facing a serious problem of measuring the performance of their organization. Using the right tools and having performance indicators in different industries allows them to know their performance position compared to the performance range of other competitors inside or outside the country (Gunasekaran, 2004).
The success of the supply chain is crucial to an organization's success and the long-term accomplishment of its objectives, particularly revenue. In order to constantly enhance the performance of the supply chain, it is advised to set up a performance monitoring system. A proper supply chain means on-time production, on-time delivery, and controlled costs from supplier to customer. Therefore, creating a performance measurement system in the supply chain can be an effective help in the way of production and delivery on time and cheap for an organization (Bagherzadeh, 2017). Therefore, performance measurement in the supply

chain is a process to analyse performance management, reduce costs, reduce risk, and create the possibility of continuous improvement in value creation and operations (Gunasekaran, 2004).
If something cannot be measured, it cannot be managed. In fact, the main rules of performance measurement systems include a deep look at the nature of value-added processes, guiding organizational progress in achieving goals, and providing important and key feedback related to organizational strategy successes (Croom, 2000). More importantly, the performance measurement framework crystallizes not only in the behaviour of managers who are responsible for development in a competitive situation, but also includes all executive personnel. However, the concept of performance measurement almost always precedes the achievement of strategic goals (Bichou, 2004).
The stages of an organization's growth and advancement will be determined by identifying its mode of operation and, as a result, evaluating its success. The company is able to do the following thanks to the supply chain's performance assessment method (Mathur, 2018):
• To review, evaluate and control the performance of the organization.
• To be able to benefit from the same methodology and criteria in evaluating the levels of the organization.
• Be able to make decisions in a systematic framework. In other words, decisions can be made in the chain that move towards the goals of lean production (Bichou, 2004).

2.3.3 The necessity of performance measurement in a supply chain

The creation of assessment instruments is necessary for the scientific growth of a coherent and orderly supply chain. The need for supply chain success measures and indicators research (Bichou, 2004).

2.3.3.1 Absence of a balanced method

The majority of businesses are aware of the value of both financial and non-financial success metrics, but they have not integrated these standards into a balanced structure. While some managers and academics have concentrated on practical indicators, the majority have concentrated on financial performance indicators. These distinctions prevent the development of metrics that clearly depict corporate success (Ondersteijn, 2004). Financial performance indicators, which are significant in strategy choices and external reports, as well as non-financial performance indicators, which are better able to oversee everyday production and distribution operations, should both be considered in order to have a balanced approach (Soni, 2014).
Choosing the number of factors to use is another factor that contributes to imbalance. Companies typically use many performance indicators, and they frequently add more as a result of recommendations from staff members and consultants. However, performance assessment can be improved by using a limited number of factors that are essential to success (Soni, 2014).

2.3.3.2 Lack of clear distinction between criteria at strategic, tactical, and operational levels

It can be challenging to differentiate between the strategic, tactical, and practical levels because the performance assessment criteria have an impact on these choices. This method allows each element to be categorized according to its importance. To be effective, a supply chain's management must take into consideration all of its objectives and the standards it employs. The performance of the company should be accurately captured by the metrics used to evaluate and enhance performance. The chosen variables should balance financial and non-financial criteria that can be linked to the strategic, tactical, and practical levels of management and decision-making. The standards should represent the evaluation's goals (Zouari, 2020).
In fact, a comprehensive performance management system includes a large number of management processes, including identifying indicators, setting goals, planning, communicating and measuring indicators, monitoring, reporting and receiving feedback from the current situation, which ultimately helps to identify the main problems of the organization and improve them in this regard, studies related to performance evaluation systems will either lead to the creation of conceptual models, documentation, and troubleshooting reports, or lead to the implementation of information-operational systems. In these systems, all the main processes of a comprehensive performance management system can be found in an integrated manner. These information systems measure and monitor key performance indicators (KPIs), which are critical to optimizing supply chain performance (Tordecilla, 2021).

2.4 Supply chain complications

Organizations in every chain are looking for improvements in operational structures. In this direction, two important questions are raised, first, "What opportunities are there for improvement?" And secondly, "Which opportunity will create more value for the organization according to the existing limitations?". In this regard, problem solving by answering these questions helps the organization in gaining value and making improvements. Diagnosing the complications of an organization is like diagnosing the complications of a patient by a doctor. People go to the doctor for three reasons: 1- for a routine check-up, 2- when they see symptoms of illness, or 3- when they have a serious problem and an emergency. In this situation, the doctor tries to diagnose the patient's disease and prescribe the appropriate treatment for his various pains. Organizations can also use a similar method to diagnose their organization. On the other hand, one of the most important processes in general organizations can be the processes related to supply chain management. Therefore, supply chain troubleshooting helps organizations to efficiently evaluate and review the supply chain and ultimately improve it (Ino, 2021).
In simple terms, a supply chain review consists of a series of disciplined and structured assessments of the supply chain. Problem solving is done to identify applicable improvement opportunities and improves the performance of the organization by providing solutions. In fact, problem solving helps the organization to efficiently evaluate and investigate the supply chain and finally improve it (Ino, 2021). In other words, supply chain troubleshooting is

done to identify improvement opportunities that are applicable; to provide solutions to improve the organization's performance, and this process can be done in the following four steps:
1) Definition and program.
2) Measuring and evaluating the efficiency of the current chain.
3) Identifying improvement situations and their value.
4) Finalize the business mode.
Of course, there are many similarities between the two concepts of complication diagnosis and performance assessment, and some sources have assumed the terms Diagnosis and Assessment to be the same and equivalent. Meanwhile, in the upcoming project, an attempt has been made to differentiate between these two terms. This means that troubleshooting can be considered an in-depth process to identify opportunities for system improvement, which becomes possible after measuring and evaluating system performance (Huang, 2020).

2.5 performance indicators and measures in a supply chain

The design of performance evaluation indicators is one of the things that are of special interest both in academic circles and in applied societies. The suitability of these indicators with organizational goals is of particular importance, and Fortin and Parker have conducted many studies in this regard (Huang, 2020).
Value of the supply chain to require the following steps (Khan, 2019):

- First step: A team consisting of representatives of members in the supply chain should be formed. operational basis of this team is the integration of supply chain and business processes. This team is responsible for identifying the current state of business processes.
- Second stage: In this stage, the said team analyses its findings and then extracts critical performance indicators. Therefore, it can be said that the current situation is carefully examined and introduced in the form of a series of indicators.
- Third stage: In this stage, the evaluation team tries to cover the weaknesses identified from the previous stage.

These indicators allow the organization to have a closer look at the real state of its business and define a standard line for performance, performance scales and definitions of feedback goals for the future through the definition of criteria.
By defining the right set of criteria, the performance of activities in a supply chain is measured and efforts are made to improve and build faster diagnostic and decision-making facilities.
performance indicators have three functions (Khan, 2019):

1) Control: It means that with the help of performance indicators, managers and employees can control and manage the performance of resources.
2) Communication: The performance of the organization becomes meaningful for other people through performance indicators and can be expressed.
3) Improvement: Improvement is achieved when it is possible to identify the gap between the performance of the organization and the expectations from the organization. As a result, the organization can be improved with the help of performance indicators.

In a performance measurement system (PMS), choosing the right indicators is very important. In this regard, many models have categorized processes and indicators related to supply chain performance. The advantage of using these evaluation models can be considered from the following aspects:

- These models have generally been used by a large number of successful organizations and companies and therefore have passed the test.
- The use of these models prevents mistakes such as ignoring some activities or other mistakes and will lead to clear and simpler implementation conditions.
- Some of these models specialize in evaluating and measuring the processes of a field. For example, the SCOR model can be used in a specialized way to manage processes related to organizations that are widely related to the category of supply chain management.

Finally, due to the implementation of these well-known models in large organizations and in various business fields, it will be possible to model and compare the organization with the top organizations in a simpler way (Khan, 2019).

2.5 Sustainable Supply Chain

All corporate processes must take social and environmental issues into consideration in order to have a viable supply chain. These procedures cover every stage of the supply chain's life cycle, from the acquisition of raw materials to the design and production of the final product to its storage, transit, and release.
Risk, product waste management, and environmental considerations are the foundations of supply chain sustainability, a business problem that impacts the organization's supply chain and transportation network. It is now essential to incorporate environmental efforts into the organization's supply chain management.

In recent years, the novel approach that has dominated operations management has been the supply chain sustainability strategy.
The definition of sustainability is putting equal emphasis on today's income as well as the long-term impacts of a company's operations and the viability of its resource base for future use. Sustainability has emerged as a key strategy for guaranteeing both social accountability and a competitive edge in the literature on organization and management. Numerous organizing subjects now end with the sustainability suffix. One of these subjects that is closely linked to the idea of a green supply chain is sustainable supply chain. These ideas were developed to highlight the significance of social and environmental issues in supply chain planning in addition to commercial ones.
Based on environmental considerations, risk, and the control of production waste, supply-chain sustainability is a business problem that has an impact on the organization's supply chain and corporate transportation network. The necessity of integrating environmental activities with the organization's supply chain management has grown significantly. The supply chain sustainability method is the novel strategy that has ruled operations management in recent years (Zulqarnain et al., 2021).
Most businesses undermanaged their supply networks in the past. They preferred to concentrate instead on their own businesses and their close suppliers. But for businesses that actively control their supply chains, several reasons make supply chain management desirable. Many businesses have adopted techniques like lean production and overall quality management over the past ten years. They will be able to accomplish better quality while drastically cutting expenses as a result. Get rid of extras from your body. Even though there is still space for growth, the chance now primarily resides in supply chain support, marketing, and buying (Zulqarnain et al., 2021).
Companies that incorporate societal and environmental concerns into their business strategies now prioritize sustainability as a key problem (Zulqarnain et al., 2021).

2.5.1 Importance of supply chain sustainability

Most businesses undermanaged their supply networks in the past. They preferred to concentrate instead on their own businesses and their close suppliers. But for businesses that actively control their supply chains, a number of reasons make supply chain management desirable. Many businesses have adopted techniques like lean production and overall quality management over the past ten years. They will be able to accomplish better quality while drastically cutting expenses as a result. Get rid of extras from your body. Even though there is still space for growth, the chance now primarily resides in supply chain support, marketing, and buying (Zulqarnain, 2021). Since the early 1920s, there has been an increase in worries about environmental regulations and demand on manufacturing companies to lessen the environmental effect of their operations. Laws are one of the most significant forms of pressure on companies, and one of the methods to accomplish this is by applying pressure to the supply chain. Researchers in the area of supply chain management have become interested in sustainability in the supply chain as a novel and highly influential component. This problem has received more attention outside of the scholarly community from societies, governments, foreign organizations, and non-profits. Companies that incorporate societal and environmental concerns into their business strategies now prioritize sustainability as a key problem (Zulqarnain, 2021).

2.5.2 Elements of supply chain sustainability

Review and discussion of the essential components of supply chain management are possible. The motivating factor is the first component, which are the clients. Marketing typically involves figuring out what consumers want and forecasting how much and when they will require it. Design of the product and service is in line with operational skills and customer needs. Processing is the primary emphasis of every company throughout the entire supply chain. The company that creates the good or service for the end consumer performs a sizable portion of the handling (Rohmer et al., 2019).
Inventory is a key element of the majority of transportation networks. The balance of the inventory amount is the primary objective. The timetable can be disrupted and delayed by having too little or too much merchandise, respectively. needless addition. The channel of contact between a company and its vendors is purchasing. It is the responsibility of this task to purchase the goods and/or services needed to create goods or offer services to clients of the company. sourcing vendors. establishes alliances with suppliers, makes selections, and serves as a point of contact between them and different corporate divisions.
Proximity to the market or proximity to sources of supply, or proximity to both, may be possible. In total quality management (TQM) benchmarking is referred to, i.e., the assessment of the position that the company currently contracts and uses. Use it as a guide to where the company sees itself in the future. Instead of focusing only on the company itself, a company should assess performance and set overall goals for the entire supply chain.

2.6 Supply chain performance measurement and evaluation

In this section, we examine and review important research and articles that have been published in reputable journals over the past years. The authors of these articles have presented materials regarding performance measurement systems and evaluation and complication detection of supply chain and pharmaceutical supply chain, some of which are mentioned below. It should be noted that the amount of detailed content of each of the following articles is different according to the importance of that article and the availability of the full text of the articles. (Achillas, 2018) In 1999, in his article, after reviewing the literature on the management and measurement of supply chain performance, Beamon expressed the problems in performance evaluation systems based on an indicator such as cost, and then in the main part of his article, he categorized the indicators Performance in three categories: 1. resources (inputs), 2. Outputs, 3. Flexibility, Paid. Then, for each of the above three categories of performance indicators, it gives an example, of course, the indicators related to flexibility have been discussed in detail in this article. Overall, this article can be considered one of the first and most serious researches related to the systematic design of a framework for supply chain measurement (Achillas, 2018).
After introducing the Balanced Scorecard (BSC) model and stating its relationship with supply chain performance measurement, Klijnen and Smith have discussed the importance and need of supply chain performance forecasting in 2003. In this article, the simulation method is introduced as an effective method in the analysis of performance indicators of the supply chain, and the 4 methods required for simulation are introduced as follows:

1) Spreadsheet simulation: In this method, by defining the relationship between indicators, various scenarios can be easily investigated. For example, if we define the index of the amount of new inventory in the form of equation (1-2), then by changing each of the three indicators of sales, old inventory, and production, we can analyse the changes in the amount of new inventory.

New inventory=old inventory + production – sales

2) System dynamics (SD): With the help of this simulation method, complex relationships and continuous time between various variables can be modelled, which is one of the best uses of SD in the field of leather whip effects analysis.
3) Discrete dynamic event simulation: This simulation method defines entities and analyses their possible behaviour in various environments. The discrete event simulation method is used as an important tool in MRP and ERP modules to measure the costs and benefits of various operational and strategic policies.
4) Business games: These simulation models generally simulate a real-world including supply chains and the environment in interaction with it, taking into account complex social and human behaviours. These engaging simulations can be called management or business games.
Then the article presents a statistical methodology based on the design of experiments in order to find the important and fundamental factors affecting the performance indicators of the supply chain. Also, this article examines the research conducted in the field of system optimization based on the simulation method and presents the important features of the optimal solution, including stability and flexibility. This research actually offers a different proposal in the field of creating a PMS for the supply chain by reviewing various articles. Based on the proposal presented in this article, it is possible to analyse supply chain performance indicators by simulation method and this can be very useful in optimizing decisions and re-engineering business processes. The four main steps proposed in Klijnen's article can be summarized as follows:

1) Choosing a supply chain.
2) Selecting and determining a list of performance indicators and sub-indices and then using the BSC model in order to achieve the most important indicators.
3) Designing a simulation model to explain how supply chain performance indicators change in the face of environmental changes and managerial control factors.
4) Performing sensitivity analysis, optimizations, and other analyses to better understand supply chain behavior.

(Achillas, 2018), Evolution of performance measurement and provided recommendations for designing and improving systems and a framework for performance measurement, as follows:

- It should be based on the policy and strategy of the organization.
- It should be based on various criteria and criteria (important and vital activities).
- These criteria should evaluate the work as a group, not individually.

- Special goals should be set and revised continuously.
- Measurement should be simple and understandable.
- Information should be collected from the place whose performance is evaluated.
- Charts and graphs are the main method for informing.
- Documents should always be accessible for inspection.
- Weekly or everyday performance reports should be made.
- Performance in terms of quality and dispatch should be used to assess suppliers.
- In the creation of PM systems, development, dynamism, continuous progress, and learning are stressed.
- The gap between bookkeeping and performance evaluation needs to be closed.
- PM systems need to be in line with key success factors and company goals.
- It ought to be able to direct and transmit data in signs.
- PM systems should make it clear how client expectations and requirements are fulfilled.
- Pay attention to visible signs to the client.
- Giving everyone in the organization access to signs that help them comprehend how their actions affect the company's bottom line.
- The system contains clear and quantifiable guidelines and standards for the company.
- Work routines need to be created in order to assess signs.
- Feedback from performance assessment tools should be communicated to the organization's various levels.
- In order to guarantee support and prevent plan implementation from being hindered, feedback from performance measurement tools should connect various duties.
- It ought to make it possible for managers to concurrently evaluate performance across several areas.
- Non-financial data should be added to financial indicators as a complement.
- Analyzing the supplier-to-customer product delivery strategy is crucial.
- The performance measurement system designed now adapts to production goals at different levels of measurement standards.

- The performance measurement system is designed so that in the factory and other levels of evaluation performance measurement standards are compatible with the production environment.
- The performance measurement system is designed so that information related to the company's strategic goals is shared between the plant and various other levels to create an organizational focus.
- Performance measurement system information related to the strategic goals of different departments should be shared in different tasks in order to create organizational focus in factories and departments.
- The performance measurement system should be implemented in such a way that it does not provoke or impose policies and destroy them.
- The performance measurement system should be designed to facilitate the audit.

Smith and Platts, from the management of the leading company in the field of performance measurement, propose a structured and managed performance measurement system as the missing link between strategic plans and implementation. They also cite Neely et al. as saying that a significant amount of basic literature on frameworks for systems and performance evaluation, as well as the connection between those frameworks and the environment. In their research on performance assessment, Chou, and coworkers present logistics performance as a set of efficiency and efficacy. They believe that in order to recognize the seven criteria—effectiveness, efficiency, quality, output, work-life balance, creativity, revenue, and budgeting skills—a thorough understanding of logistics is required (Achillas, 2018).

Beamon continues his proposed framework for performance measurement by pointing out that logistics performance cannot be fully measured by a single metric, that a performance measurement system should emphasize three distinct types of performance measurement.

In 2007, Aramian et al presented a conceptual model to measure the effectiveness of the supply chain for the food business. They have classified the indicators in accordance with their case study (the Netherlands-Germany tomato supply chain), and their model for the study of the supply chain's four major categories are as follows:

1.Efficiency, 2. Flexibility, 3. Accountability, 4. Food quality.

Also, in this study, the indicators are composed of two financial and non-financial aspects and according to the unique structure of food supply chains.

Min et al. in 2009 presented a coherent framework for evaluating supply chain performance for small and medium-sized organizations. Their proposed framework combines two models, BSC and SCOR, and they have provided the necessary guidance on how to use this model. This research has finally introduced a set of supply chain performance indicators for medium and small organizations. It has also shown the relationship of the indicators introduced in this research with various cycles in the supply chain, such as procurement, production, ordering, etc (Achillas, 2018). In 2011, Sabrino et al., after providing a preliminary presentation of supply chain evaluation and BSC and SCOR models, presented

the traditional performance management cycle, which then increased its efficiency by adding a small loop to this cycle. Also, a multi-criteria approach is presented in order to determine the weight of each index and calculate the overall evaluation score of each dimension of the supply chain. The steps introduced by Sobrino to evaluate the performance of supply chains are as follows:

1. Creating, organizing, and training a work team: This step is considered as the first step in evaluating the performance of supply chains. Also, in order to determine the optimal number of experts, Sobrino presented a relationship based on the level of accuracy required, estimating the level of experts' mistakes, etc (Belaya, 2012).
2. Determining the dimensions of indicators and key indicators of performance related to each dimension: after determining the work team, it is necessary to determine various dimensions and key indicators according to the state of the supply chain, following examples from other companies, experts' opinions, the literature on the subject, and the goals of the organization (Joshi, 2020). Performance related to those payment dimensions. The important and significant point regarding the definition of KPIs is that there should not be too much focus on the operational aspects of the supply chain, but the goals and strategies of the organization should also be seen in these KPIs. On the other hand, it is very important to determine how to measure each of the performance indicators. Also, the relationship between KPIs and supply chain processes should be well defined (Choirun, 2020).
3. Determining and allocating the ideal value for each KPI: The work team created in the first phase, according to the nature of the supply chain, past data trends, modelling, subject literature, and experts' opinions in this part, determines the values that each of the KPIs should reach (Ali, 2021).
4. Future analysis of KPIs and costs related to it: This part analyses the possibility of achieving the goals set for KPIs and the costs of achieving them based on data-based methods, simulation, subject literature and expert opinion (Tomasiello, 2021)
5. Identifying critical KPIs and improving them: After part 4 (Analysing KPIs), it is necessary to identify unattainable or costly indicators and design a model to improve them (Tomasiello, 2021).
6. Changing the goals of indicators: In this section, if needed, we will redefine the goal value for KPIs whose unattainability has been confirmed with a high probability in steps 4 and 5. In fact, the three stages 4, 5 and 6 as an outer ring provide the possibility of improving the efficiency of the traditional performance management cycle (Tomasiello, 2021).

In the continuation of the article, a method for determining the weight and priority of KPIs in the overall evaluation of the supply chain is presented, which provides the possibility of checking the consistency of the judgments made by the evaluation team (Chen, 2020).

Coopervalram presented a comparison between supply chain management and a well-balanced and well-functioning reinforcement team in 2013 due to the significance of coordination between different actors in the supply chain and its effects on the efficacy of supply chain management. The advantages of good supply chain management are endless. A few benefits of efficient supply chain management include reduced inventories, lower costs, better output, enhanced capacity to respond to demand shifts, and shorter wait periods (Samuel, 2012).2.7 Management models and performance evaluation.

According to the mentioned advantages regarding the use of well-known and popular models of process evaluation and management, in the rest of this chapter, we will first categorize these models and then briefly define some of the models (Pérez-Mesa, 2021), Despite the fact that a large number of different models in the field of performance measurement, few

people have categorized and compared different models. Some studies have categorized various models and evaluations according to the following points of view (Young, 2002):

- From a balanced scorecard perspective (considering financial aspects, customers, internal processes and growth and training)
- From the perspective of performance measurement components (such as resources, outputs, and flexibility)
- From the perspective of the measurement position in the supply chain (such as planning, procurement, manufacturing, and delivery)
- From the perspective of the decision-making level (strategic, tactical, and operational)
- From the perspective of the nature of measurement (financial/non-financial)
- From the perspective of the basis of measurement (quantitative/non-quantitative)
- From the perspective of traditional or modern measurement (based on performance/based on value) (Achillas, 2018).

2.8 literature review

Today, the complexity and uncertainty of the environment has a deep impact on the activities of companies, especially their supply chain. The supply chain is an integrated process between different entities that considers the product from the initial stages of raw materials to delivery to the final customer. Sustainable supply chain management addresses economic, social, and environmental needs that arise in the flow of materials and services between suppliers, manufacturers, and customers. The increasing and effective importance of sustainability in the supply chain of goods in today's turbulent world has led us to investigate the impact of sustainable supply chain as an effective factor on the quality of products, the proper provision of social services, and the proper use of renewable resources. In this article, by reviewing the literature related to the sustainability of the supply chain, we investigated the importance of the sustainability of the supply chain as a new approach in the current era. After reviewing the researches done in this field, the comparison of these researches was presented from the point of view of attention to different parts of the supply chain(Gupta and Palsule-Desai, 2011).

In this part of the thesis, the most important research published in the field of agricultural supply chain sustainability is reviewed and a summary of its results is presented (Table 2-1).

SI.NO	Author(s) and year	Research Objective	Method	Major Finding
1	(Dania et al., 2018)	Collaboration behavioral factors for sustainable agri-food supply chains: A systematic review	Study and review	In order to allow an effective process of cooperation for sustainable agri-food supply chain management, 10 important behavioral variables are found.
2	(Rana et al., 2021)	Blockchain technology for a sustainable agri-food supply chain	To find academic papers for the SLR, specific parameters were used.	The review analysis shows that the use of BCT or BCT assisted by ICT/IoT adds to sustainability of agri-food production.
3	(Chiaraluce et al., 2021)	Circular Economy for a Sustainable Agri-Food Supply Chain: A Review for Current Trends and Future Pathways	Utilizing the program VOSviewer, conduct a literature study and bibliometric analysis on the circular economy model in the agri-food industry, paying special attention to the reuse and valuing of wastes and byproducts.	Some elements, like the creation of a new circular economic model and some of the shortcomings of the present policies, merit further research.
4	(Bastian and Zentes, 2013)	Supply chain transparency as a key prerequisite for sustainable agri-food supply chain management	131 supply networks with lead companies were included in an empirical survey using partial least squares regression in German-speaking nations (Germany, Austria, and Switzerland)	Higher SCT improves all four dimensions significantly, while the effect on operational performance is lowest.
5	(Rejeb et al., 2021)	Big data for sustainable agri-food supply chains: a review and future research perspectives	review the potentials of big data for sustainable AFSCs	Big data's potentials for AFSC sustainability were gathered in a system that highlights the key tools and initiatives that can be improved with big data.
6	(Prima Dania et al., 2016)	Collaboration and Sustainable Agri-Food Supply Chain: A Literature Review	Examine the most recent study on the agri-food industry's collaborative supply chain and sustainable supply chain.	there are few studies focusing on the integrated collaboration to achieve sustainable supply chain system. Additionally, not all sustainable aspects are covered thoroughly.
7	(Liu et al., 2020)	Investment decision and coordination of green agri-food supply chain considering information service based on blockchain and big data	proposed a supply chain framework that would work better in the fusion application setting for blockchain and big data.	Results can provide producers and retailers with theoretical advice for engaging in ISBD, making pricing decisions, and coordinating the supply chain after implementing ISBD.

SI.NO	Author(s) and year	Research Objective	Method	Major Finding
8	(Tasca et al., 2017)	Environmental sustainability of agri-food supply chains	In northern Italy, an LCA was conducted to compare two different methods of producing and distributing endive.	The lack of disposable packaging and industrial processing is mainly responsible for the observed reductions in total supply chain effects, which typically vary between 20% and 48%.
9	(Zecca and Rastorgueva, 2014)	Supply Chain Management and Sustainability in Agri-Food System: Italian Evidence	This essay analyzes various influential factors, provides a conceptual foundation for modern farming supply chain processes, and addresses problems with supply chain sustainability in accordance with the Triple Bottom Line concept.	Analyze Italy's current agri-food supply chain. The study of Italian data based on various indicators characterized the agricultural supply chain both directly and tangentially.
10	(Coluccia et al., 2021)	Effects of COVID-19 on the Italian agri-food supply and value chains	provides a thorough collection of important macroeconomic information about the state of the agri-food sector from a demand side viewpoint, as well as a summary of the price changes for food producers and consumers following the shock.	the susceptibility of the harvest and production stages, which had an impact on the supply of fresh and perishable goods, and the resiliency of transportation and operations, which instead made sure that storable goods were provided to the end customer.
11	(Saputri et al., 2019)	Sustainable Agri-Food Supply Chain Performance Measurement Model for GMO and Non-GMO Using Data Envelopment Analysis Method	using Adjusted Profit (AP) with Total Price Recovery (TPR) indicators and Total Factor Productivity (TFP) by utilizing the Data Envelopment Analysis (DEA) Method	proposed model can be applied to measure the sustainability of GMO and Non-GMO agri-food supply chain performance
12	(Hu et al., 2019)	Introducing of Online Channel and Management Strategy for Green Agri-food Supply Chain based on Pick-Your-Own Operations	First, it built the demand functions for green agri-food by taking into account customer utility, agri-food freshness, and transit costs. Second, five decision models are developed to represent five operational modes: pure PYO, self-	the green food brand effect of online channels is does not necessarily improve with scale, and the initial freshness has a positive relationship to the profit, demand, and price of farmer cooperatives and online retailers

SI.NO	Author(s) and year	Research Objective	Method	Major Finding
			operated dual-channel, autonomous dual-channel, controlled dual-channel, and contractual collaboration.	
13	(Negra et al., 2020)	Sustainable agri-food investments require multi-sector co-development of decision tools	This paper implies new guidelines and tactics for the scientific community to help with the development of scientific indicators and other decision tools that will make it easier for agribusinesses and investors to incorporate concerns about the sustainability of the food system into management and capital allocation.	Early lessons from multi-sector involvement in the creation of indices, like the Agrobiodiversity Index (ABDI), will be presented, and novel ways for academic organizations to collaborate with the commercial sector will be discussed.

Table 2.1: Some prominent reviews on sustainable agri-food supply chains

2.8.1bibliometrics analysis and network analysis

According to Pourkhani et al. (2019), "bibliometrics" is a word that typically refers to a collection of methods for statistically analyzing bibliographic data (Pritchard, 1969; Merigó et al., 2018). These bibliometric studies are based on accurate, quantifiable data (i.e., indexed publications). Even though the literature review and other publications provide helpful information on the status of the research on sustainable supply networks, there is still a significant need for a bibliometric approach for studying this material (Amirbagheri et al., 2018). This paper's bibliometric study is based on works listed in the Scopus citation database, as can be seen in table number 1 in the paper (www.scopus.com).

The keywords "supply chain," "agri-food," and "sustainability" were originally entered into the Scopus search engine to obtain a preliminary inventory of works with these three terms in the title, abstract, or keywords. The keywords from these early findings were used to create a new and comprehensive search equation (i.e., query string) (see Table 2.2). The findings were then sorted by topic area, keywords, and year using Scopus's tools. The VOSviewer text mining tool developed by van Eck and Waltman (2010) was also used to identify and eliminate repeated terms that were not pertinent. Through the use of text mining and Scopus filtering techniques, the number of results was constantly lowered until text mining stopped revealing pointless groups of words.

Although the use of the idea of sustainability in supply networks dates back to 1996, this search turned up 169 publications that were released between 2011 and 2022. Bibliometrics blends two important approaches. Science planning and performance study (Noyons et al (1999). Using information such as the co-occurrence of terms in documents, co-citation analysis using pairs of documents that are frequently referenced together, the most significant journals, etc., this bibliometric component illustrates the dynamic and structural aspects of scientific research (Gaviria-Marin et al., 2019).

Unit of analysis	**Relevant journal articles whose main content focuses on the links between supply chains, sustainability, and agri-food**
Period of analysis	2011-2022
Search engines	Scopus
Query string	USING THE KEYWORDS THAT WERE ASSOCIATED WITH EACH OF THE CONCEPTS OF THIS RESEARCH, THE FOLLOWING QUERY STRING WAS CREATED: TITLE-ABS-KEY (("supply chain" OR "food chain" OR "logistics") AND ("sustainable" OR "green" OR "closed loop") AND ("agri food" OR "agri-food")) AND PUBYEAR > 2010 AND (LIMIT-TO (SRCTYPE , "j")) AND (LIMIT-TO (SUBJAREA , "engi") OR LIMIT-TO (SUBJAREA , "busi") OR LIMIT-TO (SUBJAREA , "econ") OR LIMIT-TO (SUBJAREA , "deci")) AND (LIMIT-TO (LANGUAGE , "english"))
Total number of articles evaluated	169

Table 2.2: Summary of used methodology

The best 10 publications are listed in Table 2.3. The journal with the most articles is "Journal of Cleaner Production" (TP=29 documents); it is also the most significant journal that was devoted to sustainability in the supply networks; there, the general dataset's greatest number of citations (TC=1896) emerged. Among the sources cited, the International Journal of Production Economics had the greatest average citations per document and the largest impact factor SJR (Scimago Journal & Country Rank, 2019). Environmental signs and resources, conservation, and recycling are two additional publications with significant total citations per document.

Journal name	**TP**	**TC**	**CPP**	**CiteScore**	**SNIP**	**SJR**

journal of cleaner production	29	1896	65	15.8	2.444	1.921
sustainability (switzerland)	13	138	11	5.0	1.31	0.664
sustainable production and consumption	7	35	5	8.1	2.008	1.361
resources, conservation and recycling	7	201	29	14.5	2.681	2.304
british food journal	6	83	14	4.3	0.984	0.609
international food and agribusiness management review	4	86	21	2.8	0.721	0.415
international journal of production economics	4	569	142	14.3	2.877	2.808
ecological indicators	3	96	32	8.4	1.665	1.284
production planning and control	3	37	12	11.1	1.869	1.661
economia agro-alimentare	3	58	19	1.3	0.355	0.21

Table 2.3: Journals with the highest number of articles

Explanation. SJR= Scimago Journal Rank in 2017; TP= Total papers; TC= Total citations; C/D= average citation per document

Data on the authors and nations of articles citing the particular subject provide a useful perspective. Important information about supply chain sustainability is presented in this study. Table 2-4 Table 2-5 lists the top 10 based on the total number of citations (TC).

n	Author	TP	TC	Country	TP	TC

1	sharma m.	4	37	ITALY	51	1385
2	Joshi s.	3	37	United Kingdom	21	759
3	Kumar a.	3	10	India	19	834
4	Mangla s.k.	3	221	Netherlands	17	509
5	Luthra s.	3	221	United States	14	683
6	Yadav s.	2	26	China	13	450
7	Raut r.d.	2	66	France	12	340
8	Kumar v.	2	21	Spain	11	703
9	Kaur h.	2	26	Australia	8	465
10	Dwivedi y.k.	1	155	Germany	6	165

Table 2.4: Top 10number of documents authors and countries

N	**Author**	**TP**	**TC**	**Country**	**TP**	**TC**
1	Notarnicola b.	3	494	Italy	51	1385
2	Sala s.	3	476	India	19	834
3	Anton a.	2	444	United Kingdom	21	759
4	Sonesson u.	2	444	Spain	11	703
5	Saouter e.	2	444	United States	14	683
6	Mclaren s.j.	2	444	Netherlands	17	509
7	Kamble s.s.	2	295	Australia	8	465
8	Mangla s.k.	3	221	New zealand	4	464
9	Luthra s.	3	221	Sweden	4	452
10	Van der vorst j.g.a.j.	3	220	China	13	450

Table 2.5: Top 10number of documents authors and countries

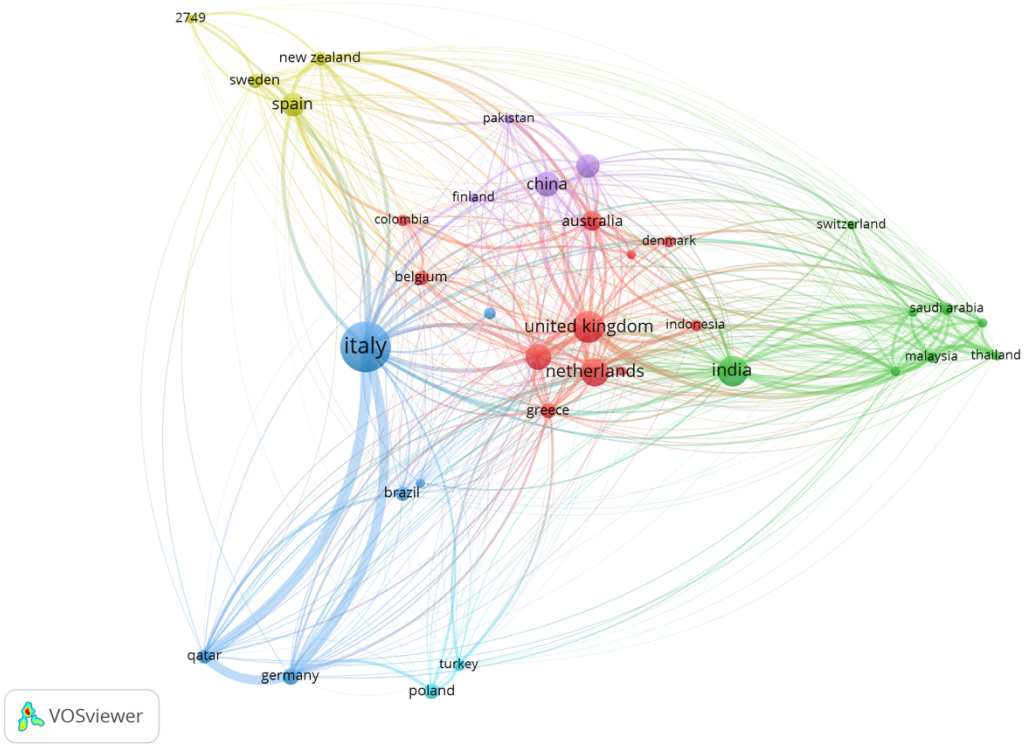

Figure 2.1: Bibliographic coupling of countries

Authors and countries with the largest number of documents do not necessarily have the highest number of citations. for instance, majority of articles on sustainable supply chains was published by sharma m. but the most cited author is notarnicola b. with 494 TC. But the important point is Italy is in first place in both tables with 51 total publications and 1385 total citations. This result is in line with the Bibliographic coupling of countries using VOSviewer software (see Fig. 2.1).

2.5.2 Keywords mapping

In this section we used analysis of keywords (we consider both the keywords provided by authors and indexed keywords); this analysis is useful to inspect co-occurrence of keywords.

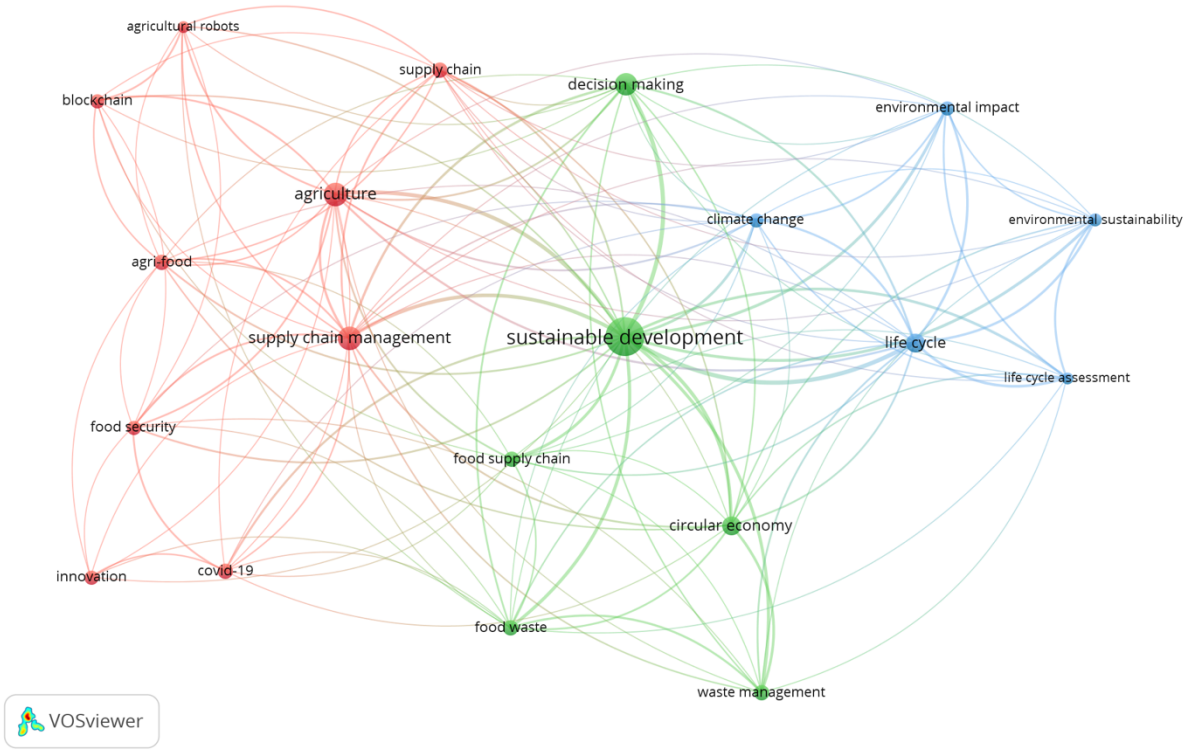

Figure 2.2: Co-occurrence of author keywords of evaluated documents

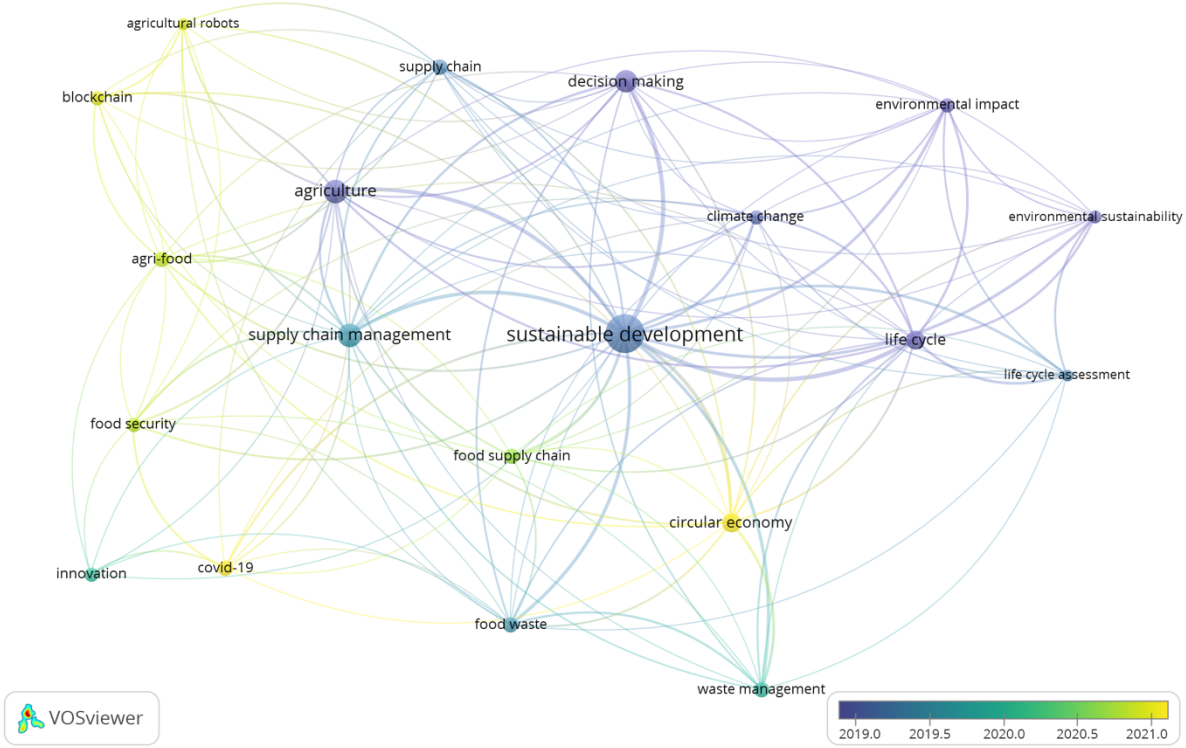

Figure 2.3: Timeline visualization of co-occurrence of author keywords of evaluated documents

In this research, a total of 1421 terms were found. The top 20 terms that have appeared at least six times each are shown in Fig. 2.3 These 32 keywords were divided into 3 distinct groups, which are identified by various colours. Agriculture occurs more than 23 times in cluster 1, supply chain management occurs 22 times, sustainable development occurs 60 times in cluster 2, and life cycle occurs 15 times in cluster 3. Additionally, and to provide further context for the findings in Fig. 2.2, Fig. 2. 3 displays the timeline depiction of the co-occurrence of author terms in the assessed documents. Currently, terms have changed to accommodate new technologies (i.e., agricultural robots and blockchain)

2.6. Measurement model

Each construct in this research had numerous measurement items that were modified from earlier studies' measurement items. Table 2.6 lists the products and constructs in depth. 6 constructs have been introduced for this research, environmental aspects, social aspects and economic aspects, triple bottom line approach to sustainability takes. Other 3 constructs are important because of their impact on sustainable supply chain, Efficiency and flexibility is one on the most important aspects because the ability the ability to easily adjust production levels, raw-material purchases, and inventory management have direct impact on supply chains, Product reliability, convenience and characteristics is another important aspect

because it has impact on consumers health and at the end Marketing, because making good customer services is crucial for the supply chain.

Constructs	Ref.	Items	Ref.
Environmental aspects	Chrisovalantis Malesios(2020) Su-Yol, L. (2008)	• irrigation management • Reducing the amount of greenhouse gas emissions in the production of any agricultural product • Recycling/ reuse • Reducing the use of chemical fertilizers per hectare (kg) • Cultivation pattern of agricultural products • Sustainable use of soil resources • The amount of water used per hectare (cubic meters) • Energy consumption • No use of pesticides	Yuhan Guo(2019), Jules Pretty (2014), Abdul Rashid(2017), Yudi Fernando (2022), Sasikumar P.(2010), Liu, Xiaolian(2022), Jules Pretty (2014), S.K. Sun (2019), Jules Pretty (2014), Xinyu Kang(2022), Yuhan Guo(2019), B. Chen(2018), AbdulRashid(2017), Taghikhah,Firouzeh(2021) , Liu, Xin(2021).
social aspects	Chrisovalantis Malesios(2020), Devins(2004), Groves(2011)	• Availability of necessary inputs and equipment agriculture • Protection and protection of people's health • Agricultural expert and skilled workforce • Integrated pest management technologies • Average transportation distance for key resources (water, energy, food and raw materials)	Amir Karbassi Yazdi(2022), Chia-Nan Wang(2018), Chia-Nan Wang(2018), Groves(2011), Reddy(2017), Yuhan Guo(2019), Chia-Nan Wang (2018).

Constructs	Ref.	Items	Ref.
Economic aspects	Chrisovalantis Malesios(2020) Testa, Riccardo (2022), Rodney W. Thomas (2022)	• Agricultural income • Product yield level per hectare • The rate of use of renewable energy sources	Jules Pretty (2014), Testa, Riccardo (2022), Rodney W. Thomas (2022)
Efficiency and flexibility	Quah(2011), Benjamin R. Tukamuhabwa(2015), MasoudKamalahmadi (2016), Kathryn E. Stecke(2009)	• Production costs/distribution costs and transaction costs • Profits and return on investments • Inventory management • Disposal costs • Recycling cost = transport + storage costs	Rodney W. Thomas (2022). Yuhan Guo(2019) Rodney W. Thomas (2022), Yuhan Guo(2019). Becerra, Pablo(2021), Guo, Hao(2018) Amir Karbassi Yazdi(2022), Sasikumar P.(2010) Yuhan Guo(2019), Guo, Hao(2018)
Product reliability, convenience, and characteristics	MasoudKamalahmadi(2016), Mohd Nishat Faisa(2006)	• Product safety and health • packaging • Storage and transport conditions	Zhao(2011), H. K. Dilhani Mallikarathna(2020), Zhang Yu(2022) Panousopoulou P.(2010), Liu, Caiyun (2022), Vlajic, Jelena V.(2021) Pik-Yin Foo(2018), Becerra, Pablo(2021)
Marketing	Wolff(2006)	• Customer service • Reverse logistics • Complaint redressal	Pala(2014) Nguyen(2013) Chia-Nan Wang(2018) Yudi Fernando (2022), Gardas, Bhaskar B.(2019) Erkan Arı(2017)

Table 2.6: Measurement model

2.7. Research Gap

A review of past research in the field of agricultural supply chain sustainability shows that even though many studies have been conducted, most of these include review studies and summaries of government reports. Most studies are reviews of past research that include old reports. Fewer academic and research studies are available to investigate the sustainability of agricultural supply chain, which can provide comprehensive information on strategy design, modelling methods, accuracy of information used and accuracy of its results. Also, the research conducted on the concepts of sustainability in the supply chain of agricultural products have evaluated the general indicators and defined the existing general indicators around the concepts of sustainability as identified indicators. Since the concepts of sustainability in the supply chain of food products are different according to the area and type of products, as a result, indicators should be provided that are specific to the same area and based on the type of product. There have been a lot of research in the field of sustainability in food products, but there has not been research that has presented specific indicators of sustainability in agricultural products, and the lack of specialized articles in the field of sustainability in agricultural products is strongly felt. On the other hand, since the indicators presented in the field of sustainability in agricultural products are mainly general indicators, as a result, we need to be a small research source that leads the general indicators of sustainability in the supply chain to agricultural products. Also, since each country with its own geographic characteristics and weather conditions must present different indicators, as a result there are always research gaps based on different climate and weather conditions. The review carried out on the articles presented on the concepts of the sustainability of the supply chain of agricultural products shows that so far no research has been done with the aim of investigating the sustainability index in the food supply chain in Italy, and according to the weather conditions of Italy, which is on the continent There is always a need to carry out such projects, and for this reason, the current research aims to identify and provide sustainability indicators in the supply chain of agricultural products specific to Italy, and tries to cover this knowledge gap.

Chapter 3

Research design

3.1. Introduction

This chapter seeks to express the research method of the present thesis according to the goals set for sustainability indicators in the supply chain of agri-food products in Italy. Hence, first the type of research method and based on that the society and the sampling method are determined. In the following, the data collection tool and its method will be discussed according to the statistical population, which is the people active in the field of agricultural production in Italy. Due to the use of the questionnaire, the measurement range of the variables will be stated, and at the end, the methods used to analyse the data obtained from the questionnaire will be stated. The research method of the research question shows everything that should be evaluated and analysed in the fourth chapter of the research, which is stated below.

3.2. research methods

The current research is practical in terms of its purpose and according to the nature of goal setting and the means to achieve these goals, it is a survey-style, detailed essay. In order to address realistic and real issues, user research applies theories, laws, principles, and methods established in basic research. This study's goal is to find answers for pressing issues of a practical nature, so it has a practical component (the study's findings are precise and objective, and frequently the researchers are engaged in putting the findings to use).
Descriptive survey research also involves collecting information directly from a group of people. This method is based on selecting a random and representative sample from the people of the research community and answering a set of questions using a survey questionnaire or other methods to study the current situation including attitudes, opinions, behaviours and generally extracting information about it deals with life conditions and categories that make people certain and distinct. In the survey, the unit of analysis can be the individual as well as the group, organizations and even the whole society.

In this research, the field method will be used to collect research data. Field research studies subjects in their natural environment and includes collecting primary data or new information from the subjects themselves. In actuality, "field methods refer to the methods where the researcher has to go out to the environment to gather information and by referring to people or the environment, as well as establishing direct communication with the unit of analysis, i.e., people, including people, institutions, residences, items, etc., to collect the desired information". In this research, by distributing the questionnaire among the people who will be selected as a sample and collecting it to the available information, the conclusion will be made by analysing this information.

3.3 Research instrument design

The research used a dual strategy. In the initial stage, we used SEM to examine the connections that had been modelled. Data were gathered from Italian farms in order to implement SEM.
A closed-ended form that was adapted from the prior sources was used to gather the data. The Likert scale, which ranges from 1 for strongly disagree to 5 for strongly concur, was used to score every question. For being more accurate we write questionnaire in both Italian and English. In supplement No. 1, there is a questionnaire.
In the second part, we did semi-structured interviews with 5 experts, taking a total of 20 minutes per expert, using farmers and university scholars as our sources. The full transcripts of each of the five interviews were created after the conversation was conducted, and the transcripts were then examined and noted where necessary.
You can find the interviews questions in appendix No. 2.

3.3.1 The statistical population of the research

The statistical population consists of all the elements and people who have one or more common characteristics in a specific geographic scale (global or regional). The statistical population of this research consists of people who are active in the field of agriculture and agricultural products in Italy.

3.3.2 statistical samples of the research

A statistical sample is a smaller group of the population that is selected according to certain rules for observation and analysis and should be representative of the population. Because it is not possible to examine all people in the society in this research, random sampling is used. For this purpose, using Cochran's formula, we want to obtain the number of statistical samples of this research:
N is the size of the statistical population, n is the size of the statistical sample, Z is the standard normal variable, which is equal to 1.96 at the confidence level of 0.95. p is the success ratio, which is 0.5, and this is to estimate the maximum sample size, which is considered to this extent to generalize the statistical results to the society. ε is the researcher's accuracy (considered error rate), which is 0.05.

$$n = \frac{NZ^2p(1-p)}{N\varepsilon^2 + Z^2p(1-p)} = 200$$

Therefore, the number of the statistical sample of the upcoming research is 200 people.

3.3.3 methods of data collection

In this research, the library research method will be used to collect information in the field of research literature and the background of the research conducted in the fields related to the research, in addition, the Internet will be used as a source of current scientific information to review the articles and research conducted around the research topic. Collecting data for this research is field research. The questionnaires are distributed in paper form, email, or direct message to the farmers and after understanding the dependent and independent variables, the questionnaires are collected through the mentioned methods.

3.3.4 information gathering tools

The data collection tools in this thesis are divided into two general categories. The first category is related to the review of the researchers' previous research and the identification of the research variables, which has been done through the internet tool and searching in reliable scientific publications. The second category is a tool for collecting research information, which is used to collect data due to the advantages of the questionnaire (being cheap, fast, more accurate, eliminating the application of personal opinions, etc.). The questionnaire of this research includes questions related to each of the research variables, which are used to check the relevant data to test the determined hypotheses.

3.4. Introducing the measurement ranges of variables

A five-point Likert scale will be used to determine the importance of each variable for the questionnaire of this research. “The Likert scale is a rating system in which participants are requested to voice their agreement or disagreement with a statement regarding an opinion, behaviour, belief, etc. based on objective or subjective factors. Additionally, worth is measured using a scoring system". This scale is a common method or scale for evaluating an attribute or characteristic, behaviour, personality, group, or institutional characteristics.
In this research, the statistical community of the research determines the importance value of each question by marking one of the determined grades. The obtained information is evaluated by checking in Amos and SPSS software and with statistical tests and it determines the rejection or acceptance of research hypotheses. The Likert scale used in this research is considered in the form of the following table 3.1.

Choice option	Very low	Low	Medium	High	Very high
Score	1	2	3	4	5

Table 3.1: Likert scale

3.5 Data analysis

After collecting the raw data related to the subjects, the descriptive analysis of the data will be done using descriptive statistics indicators by SPSS software, methods such as: multiple tests such as averages, percentages, standard deviations, tables, and graphs. There are also inferential statistics tests used, including the Kolmogorov-Smirnov test, the Pearson correlation coefficient, the sample size sufficiency test, etc.

Chapter 4

Hypotheses and model development

4.1 introductions

Hypothesis is a test statement that clearly states the expected relationship between two or more variables. A research hypothesis is an educated guess about the relationship between two or more variables. After clarifying the research problem, the researcher expresses an answer as a research hypothesis(Pond, Frost, & Muse, 2005). A hypothesis is a reasonable, possible, and temporary answer to a research question, which is tested for its correctness or incorrectness in the next stages of the research. In general, a research hypothesis can be considered a scientific guess or prejudice that is tested by collecting facts that lead to the acceptance or rejection of that hypothesis. As mentioned, the hypothesis explains the relationship between the variables or is a guess about the community parameter. If the hypothesis is proposed in the expression of the relationships of the variables, it can be directional or non-directional. If the direction of the relationship can be guessed in the expression of the relationships of the variables, the directional hypothesis is proposed(Wilcox, 2011). Inference and statistical hypothesis testing are an inductive method. It means that we understand the general law by using small things. Using the information provided by a sample of the statistical population to reach a general law about this population are the stages of a statistical analysis(Klein, Moeschberger, Klein, & Moeschberger, 2003). In this chapter, the aim is to design the desired research model by stating the Hypotheses and issues surrounding it, and then test the Hypotheses.

4.2 Research Hypotheses

4.2.1 H1: Social aspects positively affect marketing.

Social aspect of marketing is the development of a program which will plan, price, promote and distribute product and services to satisfy consumers' wants and considering the social consequences of the marketing program(Kubacki, Rundle-Thiele, Pang, & Buyucek, 2015). Social aspect of marketing considers social benefits and social costs. In general, it can be said that it is a social environment to change people's daily behaviour. How does society market a behaviour or way of life that helps society rather than a commodity to effect the desired change? Social marketing competes with ideas, behaviours, or negative change rather than demonstrating how a product is superior to rival goods (Vaaland, Heide, & Grnhaug, 2008). A customer economy is driven by marketing, which influences marketing choices. It establishes a sustainable circle by allowing businesses to deliver essential services and goods while generating employment that enables more people to buy more goods and services (Drumwright, 1996).

4.2.2 H2: Economic considerations have positive impact on marketing.

Demand and availability are two of the most important economic variables that impact marketing. A marketing campaign's main objective is frequently to increase demand. A product's price may be high in times of strong demand, boosting a company's revenue. When demand is weak, prices also decline (Chaturvedi, Srinivas, Joseph, & Singh, 2012). Marketing is frequently considered to be a branch of business. The behaviour of various product vendors is directly impacted by the state of the economy. Business owners can better allocate marketing resources and adapt to changing economic circumstances by understanding the effect of the connection between economics and marketing. The rule of diminishing returns is a notion used by economists to explain how to optimize return on investment. Over time, you might discover that a product's marketing or promoting expenses are significantly greater than its sales. This occurs when a rival enters the market, when customer preferences shift, or when you charge an excessively low or high price. Your rivals are a part of the solution to the economy's shifts (Ottosson & Parment, 2015). Even if you are successful in business, which is rare, your rivals probably have comparable goods and rates, if not cheaper ones. Customers might be tempted to purchase from your rivals if you fail to adapt to these economic adjustments. Customers make purchases to boost their level of happiness. Economic usefulness significantly contributes to the market dominance of luxury and premium items. Economic advantage is especially important from a marketing perspective because it serves as a caution for flimsy sales. You must take the economic effect on the price and the consumer into account when marketing your goods (Lusk, Tonsor, & Schulz, 2021).

4.2.3 H3: Environmental consideration has positive impact on marketing.

Nowadays, it seems that every product has a specific social cause. Currently, marketing is based on social considerations. The environment has become one of the most important activities of companies. Since the first years of the 80s, marketing with social and environmental considerations Reputation is a lot of information (Cutler-Armstrong, 1999). Marketing data itself is green. It seems that every individual and industry is more environmentally conscious(McDaniel & Rylander, 1993). It can be said that there is no way to return to the production of products that are harmful to the environment, because of the pressures of the government and competition. The change in the customer's perspective forces the companies to follow and apply the marketing approach. Licenses for the production and design of goods and services of the automobile position strengthen your competitiveness; It can be said that the green marketing approach does not focus only on satisfying the customer's needs. Rather, according to this approach, the needs of Customers should be served in ways that are beneficial to society as a whole. Different principles to create more positive Going to Switzerland, there are many opportunities(Shabbir, Bait Ali Sulaiman, Hasan Al-Kumaim, Mahmood, & Abbas, 2020). The efficiency of the source of energy is found, therefore, it reduces the level of participation in the structure, and the company's competitive position is adjusted to the competition. Secondly: the greenness of marketing activities makes the company able to present new products in new markets through the additional advantages of commercial products will manifest themselves more clearly(Su, Tsai, Chen, & Lv, 2019). This will make the company more attractive to customers. Increase and customer loyalty will increase intuition and ultimately profitability will increase. Companies in short-term results and it are possible to commit to the least necessary organizational processes in the direction of fundamental change. Therefore, it is possible a tendency to have the lowest costs of receiving the strategic approach of green marketing. So it can be said that in green marketing In order to achieve all the results, it is necessary to spend time, commitment and resources(Rahman & Nguyen-Viet, 2022).

4.2.4 H4: Marketing has positive impact on Efficiency and Flexibility.

One of the capabilities that a business must have for success is efficiency and flexibility. The more flexible a business is, the better it can adapt to changes in the technological environment (Hoberg and Phillips, 2010). Marketing is one of the options that can affect efficiency and flexibility in businesses. On the other hand, efficiency and flexibility in marketing also improve the situation of businesses in selling and presenting products to customers. As a result, these two factors are always connected and influence each other (Bloom, Chankerman, Renan, 2013).

4.2.5 H5: Marketing has positive impact on Product Reliability, Convenience and Characteristics.

The reliability of a product is the percentage of confidence that a product can provide to customers according to its features. On the other hand, the convenience and ease of using or preparing the product is another indicator that can lead customers to use that product (Farsard, 2010). In general, product features play a very important role in their marketing and sales. For the purpose of marketing, marketers usually look for the positive features of the product and highlight it in the eyes of the customer so that this strategy leads to the interest of the customers in the product. As a result, the role of marketing cannot be ignored in highlighting the characteristics of the products produced (Jabroud and Muller, 2010).

4.2.6 H6: Efficiency and Flexibility have positive impact on responsiveness.

Product efficiency is an economic term that describes the level at which an economy or business unit can no longer produce greater quantities of a good without reducing the level of output (Bhatt, Emdad, Robert, & Grover, 2010). Product flexibility can be defined as the degree of responsiveness (or adaptability) to any future changes in product design, including new products and derivatives of existing products. The mentioned indicators are among the characteristics of the products and as defined, they are considered important in relation to responding to the needs of customers (Jang, Gang, Wai and Jia, 2013).

4.2.7 H7: Product Reliability, Convenience and Characteristics has positive impact on responsiveness.

Customers always have different options. If they can get the same service or product elsewhere with better customer service, they often do. Customers of any product or field of work always have high expectations in response (Choi and Mai, 2018). Companies that have developed systems for excellent customer relationships find that they can more easily build brand loyalty. As a result, responsiveness can be considered as one of the key indicators in attracting customers (Chen, Lee and Florence, 2021). On the other hand, responding to customers is one of the basic challenges for product providers. One of the indicators that can prevent customers from coming to fulfil their demands is providing a product with high functionality and reliability. . As a result, the more reliable the product is and the easier it is to use, the more customers are attracted to it. Customers are usually looking for more hassle-free products. Certainly, no one is interested in spending time to solve their problem after buying a product (Kim, Choi and Lee, 2015).

4.2.8 H8: Marketing has positive impact or direct impact on responsiveness.

A new model in marketing has emerged, known as relationship marketing. Despite the fact that friendship marketing has become increasingly popular worldwide (Pisharodi, Angur, & Shainesh, 2003). Market sensing moderates the relationships between coordination capability and potential absorptive capacity, whereas market openness moderates the relationships between organizational systems, socialization processes, and real absorptive capacity. The results have significant ramifications for absorption capacity development and realization in theory and practice (Bouguerra, Mellahi, Glaister, Hughes, & Tatoglu, 2021). Companies with excellent sensing capabilities are better able to communicate with the market and receive the strategic information they need. Evidence shows that sensor organizations have a higher level of critical capabilities (sales capability, management capability, market research, product development capability, pricing capability, usability, promotion capability) than other organizations. Research results show that organizations with higher sensitivity were able to provide creative and timely strategies. Therefore, activations in the industry should pay to strengthen these capabilities in order to increase the level of innovation of planning as well as the timeliness of these strategies (Atuahene-Gima, Slater, & Olson, 2005).

4.2.9 H9: efficiency and flexibility mediate the effects of marketing on responsiveness.

In order to completely utilize the profit potential of product lines, contemporary operations management strategies advise effective firms to align supply chain assets with product demand characteristics. Observational data, however, indicates that decisions about product lines frequently have a lengthier lifespan than supply chain assets. This indicates that the period of initial market entrance is when congruence between supply chain assets and demand traits is most likely to occur (Randall, Morgan, & Morton, 2003). Flexibility tactics must go beyond a firm's limits as supply chain management does as well (Duclos, Vokurka, & Lummus, 2003). Nowadays, the supply chain viewpoint is widely used, which acknowledges the chain of processes occurring across organizations to satisfy client requirements. Nevertheless, some theory ideas, like customer responsiveness, continue to seem to have their roots more in corporate contexts than in SC perspectives. CR is concerned with how swiftly and successfully businesses adapt to shifts in consumer demand. Previous studies have recognized the role of flexibility as an allowing factor to improve reactivity, showing a distinct difference between these two ideas (Jafari, Ghaderi, Malik, & Bernardes, 2022). Organizational accountability variables, innovation in company products and services, and document management on information systems, have significant and positive values that show greater organizational accountability on information systems. they do and the services they provide to choose, they guarantee the quality of their work and always seek to improve their functions and priorities.

4.2.10 H10: product reliability, convenience, and characteristics, mediates the effects of, marketing on responsiveness.

Empirical proof from management and marketing shows that organizational culture affects a variety of actions within businesses and that it has an effect on performance. Using an expanded version of the resource-based view as our theoretical framework, we examine how organic kinds of organizational culture (i.e., adhocracy and clan) serve as a strategic resource to impact marketing efficacy and performance in a developing economy (Wei, Samiee, & Lee, 2014). Prior to the launch of a new product, marketers must forecast how demand will respond to various quantities of marketing-mix factors in order to develop an effective marketing strategy. The fact that managers' private knowledge of the varied effects of marketing-mix factors on sales had an impact on the observed choices presents a significant challenge in approximating marketing-mix reactivity from past data. This issue is known as the "slope endogeneity" dilemma by the writers. In contrast to the "intercept endogeneity" issue, this endogeneity is different. New digital marketing platforms, like the Internet and mobile devices, are seen from the perspective of marketing communication as potent chances to reach customers because they enable interaction and personalization of the message's context and content. However, the proliferation of media has intensified the struggle for customers' focus (Heinonen & Strandvik, 2007).

4.3 Model development

In order to develop a suitable research model, a semi-structured interview was conducted with 5 experts, including university professors and a farmer familiar with the supply chain of agricultural food products in Italy. The results of the interview are given below.

1. What is your impression about Italy’s domestic and global agri-food supply chains? How are those doing in recent years, i.e., pre-Covid and post-Covid situations?

The opinion of most of the participants in the interview about the domestic and global supply chain of agricultural products in Italy was positive and sometimes sceptical. The participants stated that Italy has a good reputation for agricultural production and exports its products to countries around the world. They agreed that Italy is the leader in the production of organic products. However, one of the problems of producing non-organic products is the traditional method of its production. They also stated that the cost of producing agricultural products in Italy is high and this problem causes the import of agricultural products from other countries due to their lower prices. Also, in terms of green supply chain sustainability, Italy has many problems. Most of the participants pointed to the huge problems of energy costs that have disrupted the supply chain of agricultural products. Also, the use of digital technologies and the existence of small plots of land have made it difficult to increase the efficiency of inputs in the supply chain of agricultural products. Regarding the pre-Covid conditions, the participants stated that it was better because they could see and touch the agricultural products, but after the Covid it was back to the same routine.

2. Italy's agri-food supply chains should have certain key drivers and barriers. What are those and how do you see those?

In response to this question, most of the respondents had common opinions. They first presented the key players in the Italian farming industry's supply chain, emphasizing the importance of product quality, which can have a significant impact on how well a product is sold. The expense of production, transit, contact and collaboration between various agricultural sectors, and technology are a few other elements that encourage the supply chain of agricultural goods in Italy. Also, according to the participants, the fragmentation of land and small farms and the government's less support for small farms are among the key obstacles in the supply chains of agricultural products.

3. What is your view about Italy's agri-food supply chain networks' sustainability standards? Do Italy's agri-food supply chain networks comply the domestic and global sustainability standards? (Here, "sustainability" refers to environmental, social and economic standards of agri-food production.)

Regarding the answer to this question, most of the respondents had a positive view of the sustainability of Italian agricultural product supply chain networks. However, they did not evaluate the sustainability of Italian agricultural product supply chain networks in different parts of the country and stated that in some areas the sustainability is weak and in some areas the sustainability is strong and in general the mountainous areas are more sustainable than the plain areas. are. Regarding the compatibility of the sustainability of the supply chain of Italian agricultural products with domestic and global standards, the participants stated that there is no specific domestic standard in this field, and there is practically no comparison and matching of the domestic standard with the global one.

4. Italy's sustainable agri-food supply chain networks are driven by certain factors. What are the factors that help drive the supply chain networks? How do you see these factors?

Regarding the answer to this question, the participants stated that each supply chain has its own characteristics, so that it also has unique characteristics in geographical areas. They introduced the guiding factors of sustainable agricultural and food supply chain networks in Italy as supporting factors, innovation, knowledge transfer, economic values, environmental values, production costs and by-product valuation. They stated that increasing sustainability with technology increases costs.

5. Do you think that Italy's agri-food supply chains can become more robust for achieving sustainability? What are your recommendations for future growth?

In response to this question, the majority of participants had a positive opinion about the achievement of stronger sustainability in Italian agricultural supply chains. They stated that in Italy there are all the legal requirements to strengthen the supply chains of agricultural products. Participants stated that in order to achieve strong sustainability in Italian agricultural supply chains, there must be knowledge transfer. There should also be coordination between the government and farmers and farmers with farmers. They stated that for future growth, rules and regulations should be clarified. Also, the infrastructure should be improved. The government should also put financial support for farmers on the agenda for future growth.

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The results deduced from the interview along with the assumptions led to the presentation of the conceptual model reported in Figure 4.1.

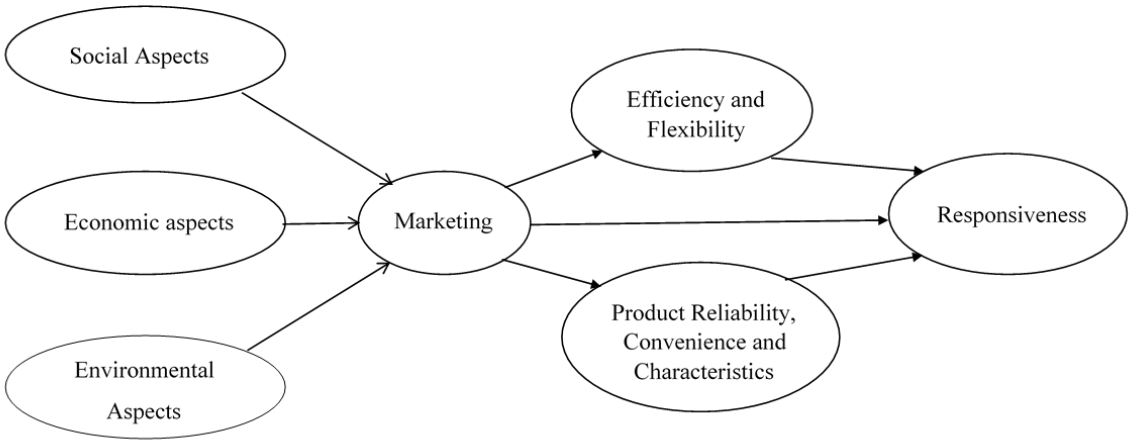

Figure 4.1: Hypotheses relationship and model development

Chapter 5

Model estimation and results

5.1 Introduction

Structural equation modelling is a perspective in which hypothesized patterns of direct and indirect relationships among a set of observed and variables are examined. In SEM, statistical concepts such as variance and covariance are used as measures to measure dispersion or dependence between variables. Structural Equation A multivariate regression study using numerous variables is known as a model (SEM). With the aid of this method, multiple regression models can be tested concurrently. In structural equation modelling, a collection of observed and variables are investigated to see if any patterns of direct and indirect connections exist. Structural equation modelling is a combination of path models and confirmatory factor analysis models. Path analysis is done based on independent and dependent variables. It looks at how the independent and dependent factors are related causally. Fit scores are used to verify that these models are accurate (Ullman & Bentler, 2012). The model was validated using the first iteration of structural equation modelling with a covariance-based strategy, a large sample size, the normality of the data gathered, and the reflectiveness of the measurement models. In this first-generation method of structural equation modelling, four popular and extensively used softwares include Lisrel, Amos, EQS, and MPlus. Researchers should look for a different strategy to get around the shortcomings of the aforementioned approach in order to replace this method (first iteration). a strategy also referred to as partial least squares or second-generation structural equation modelling. The second generation of structural equation modelling, known as the partial least squares approach or the variance-based approach, presented a similar but different process for analysing the collected data, relying on the limitations of the covariance-based approach. The ability of this approach to work with small data, insensitivity to the normality of the data, the ability to predict and support very complex models, as well as the ability of the combined and reflective measurement model at high speed became popular among

researchers, and as a result, the soft Various software were introduced to implement this approach(Klem, 2000). Software such as Smart PLS and XLSTAT, Warp-PLS, PLS-Graph, Visual-PLS run the second-generation SEM model. SMARTPLS software was introduced in 2005, it is the most famous and widely used software. Some people believe that because the data is non-normal and the sample size is small, instead of AMOS, LISREL, EQS and generally software with SEM-CB capability, software with SEM-VB capability such as SmartPLS and WarpPLS should be used(Mueller & Hancock, 2018).

5.2 Model estimation method

Data collection in statistical analysis is one of the serious issues in data analysis. The way of recording and scoring the answers in the questionnaires created based on qualitative variables is the basis for creating different scales or spectrums for coding qualitative data and converting them into numbers. Of course, we note that converting these qualitative values into numbers does not mean quantifying them, and for this reason, research methods on qualitative and quantitative data are very different. Meanwhile, the Likert scale is very popular among researchers. "Likert scale" is a measure of psychology that is used in many research and surveys and is based on a questionnaire. Sometimes, the Likert spectrum or scale is also used as a "Rating Scale", because the options related to the Likert scale have an order and are coded from small to large. In most psychological research, there are standard questionnaires that usually use the Likert scale or "Guttman scale" to collect data(Albaum, 1997).

As it is known, the Likert scale can be used in SPSS to determine the score of the questionnaire as well as infer and perform statistical tests and interpret the results. The methods based on parametric and non-parametric statistics are applicable on the results and answers collected with Likert scale, and even based on the binomial or polynomial distribution, interesting results can be observed based on the consensus table. Anyway, since the questionnaire is a desirable and economical tool for data collection, the Likert scale also plays an important role in questionnaire analysis. Displaying and describing data with a Likert spectrum is also considered as one of the important aspects in displaying and transferring the information load of data(Albaum, 1997).

All spectrums and numerical scales for qualitative data have an order. This means that they determine the importance of qualitative values from small to large. Unfortunately, not all the items (questions) in the questionnaires have the same direction in determining the characteristic of the research. For example, the first item may have classified the satisfaction of the work environment from low to high, and the second item may have raised a question about the amount of stress in the work environment. It is clear that in the first group of items, the value of 1 indicates dissatisfaction, but in the second group (for example, stress in the work environment), the value of 1 indicates the comfort of the person in the work environment. In this way, it is clear that the direction of the answers in these two types of questions is not the same. In such cases, we should align the responses in the range and scale of qualitative data measurement(Bertram, 2007).

In the review of questionnaires related to statistical research, a measure known as "Cronbach's alpha" (Cronbach's α) is used to measure the validity of the answers provided in the items (each question in the questionnaire). This index is sometimes known as alpha

coefficient. The mentioned index was introduced by "Lee Cronbach" (Lee Cronbach), a scientist of psychology and educational sciences in 1951. Cronbach's alpha can be considered as a correlation coefficient between two questions that are used to measure the achievement of a goal. This measure is the average covariance between item pairs and the variance of questionnaire results as a function of the number of items in the questionnaire (Tavakol & Dennick, 2011).
Consider a multiple-choice "questionnaire" whose first k questions are designed to measure a specific concept or dimension. Suppose this value (variable X) can be measured based on the sum of these few questions (items) that exist in the questionnaire. If the items with Yi To show their relationship with X, we write as follows:
X=Y1+Y2+…+Yk
Also suppose that the variance for the i-th item, according to the results of the questionnaire, is also with σ2Yi and the variance of X is also represented by σ2X. In this case, the value of Cronbach's alpha can be calculated from the following equation:

$$\alpha_k = \frac{k}{k-1}(1 - \frac{\sum_{i=1}^{k} \sigma_{Y_i}^2}{\sigma_X^2})$$

If the items in the questionnaire were two-choice (for example, 0 and 1), the above relationship can be obtained in a simpler form as seen below:

$$\alpha_k = \frac{k}{k-1}(1 - \frac{\sum_{i=1}^{k} P_i Q_i}{\sigma_X^2})$$

where Pi is the percentage of correct answers (with a value of 1) and Qi is the percentage of wrong answers (with a value of 0). It is clear that in this case the relationship Qi=1−Pi It is established between them(Tavakol & Dennick, 2011).

If there is no relationship between the objects, the expression inside the parentheses will be equal to zero in both cases. Because the total variance of items (Yi) is equalled with the variance of X, as a result, their ratio is one. So the parentheses will be zero and Cronbach's alpha will be zero(Tavakol & Dennick, 2011). Cronbach's alpha value is obtained in most statistical calculation software as follows.

$$\alpha_k = \frac{k\bar{c}}{\bar{v} + (k-1)\bar{c}}$$

Chapter 6

Analysis and Discussion

6.1 Introduction

Since the results of each research are determined after analyzing the data related to it, as a result, this part of the research is very important. In the previous chapters, the research method was determined and then the data analysis methods were also determined. A questionnaire was designed and distributed among the determined statistical sample and its results were collected. In this chapter, first, preliminary tests are conducted in order to check the normality and correlation between the structures, and the basic conditions of the structural equations are examined, and then the tests related to each of the indicators of the conceptual model are analyzed. At the end, the research hypotheses are also tested.

6.1 Demographic information

In this section, the characteristics of the respondents to the questionnaires were investigated. The respondents were asked to answer the questions related to age, area of agricultural land, number of farmers working on agricultural land and number of years they work on agricultural land. The information related to the frequency percentage of demographic characteristics of the questionnaire is separated as follows.

6.1.1 Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 40	32	16.0	16.0	16.0
	Between 40 – 60	116	58.0	58.0	74.0
	Older than 60	52	26.0	26.0	100.0
	Total	200	100.0	100.0	

Table 6.1: Age characteristics of the statistical population

As can be seen, the greatest frequency is associated to the average age between 40 and 60 years (58%). The next ranks were respectively given to people over 60 years old (26 percent) and finally to people under 40 years old (16 percent). The chart related to the age of the respondents are shown in Figure 6.1.

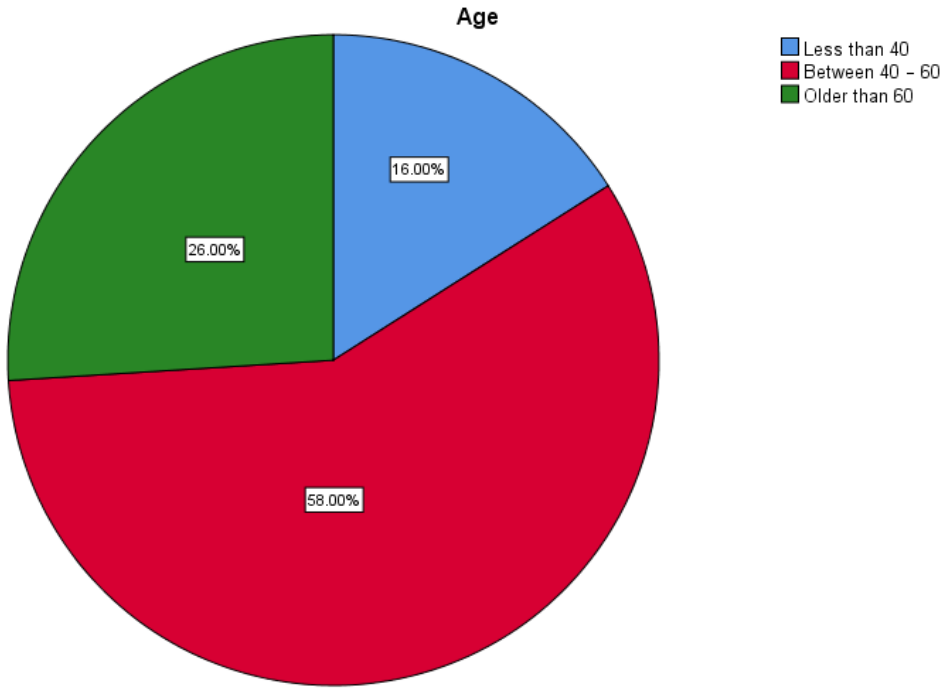

Figure 6.1: Age of the statistical population chart

6.1.2 Agricultural land area

In this section, the status of the statistical community has been examined based on the agricultural land area index of the respondents. The information is shown in Table 6.2.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than a hectare	33	16.5	16.5	16.5
	Between 2- 5 hectars	116	58.0	58.0	74.5
	Between 5-10	31	15.5	15.5	90.0
	More than 10 hectars	20	10.0	10.0	100.0
	Total	200	100.0	100.0	

Table 6.2: The status of the agricultural land area of the statistical population

As demonstrated, the highest frequency is related to landowners with an area of 2 to 5 hectares (58%). The next ranks were respectively awarded to the owners of land with an area of less than a hectare (16.5%), between 5 and 10 hectares (15.5%) and finally less than 10 hectares (10%). Changes related to land area are shown in Figure 6.2.

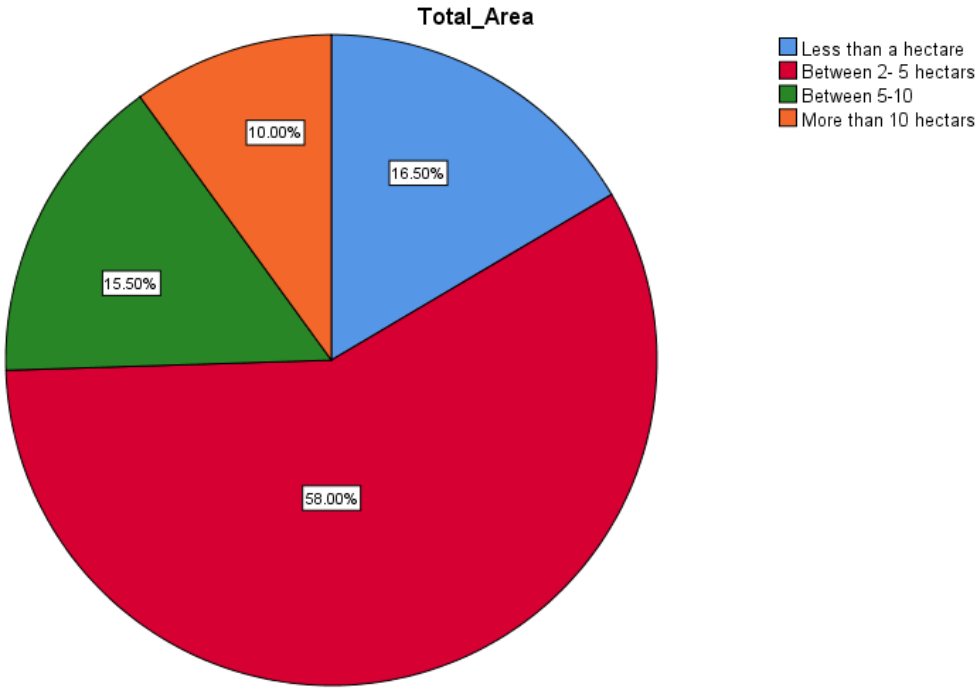

Figure 6.2: Land area of the owners

6.1.3 Number of farmers working on agricultural land

In this section, the status of the statistical community has been investigated based on the index of the number of farmers working on agricultural land. The information is shown in Table 6.3.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less that 5 person	112	56.0	56.0	56.0
	Between 6-10 person	61	30.5	30.5	86.5
	More than 10 peron	27	13.5	13.5	100.0
	Total	200	100.0	100.0	

Table 6.3: The status of the number of farmers engaged in agricultural land

As can be seen, the highest frequency is related to the number of less than 5 people (56%). The next ranks are respectively between 6 and 10 farmers (30.5 percent), more than 10 farmers (13.5 percent). The changes related to the number of farmers of each Kashlaruzi mine are shown in Figure 6.3.

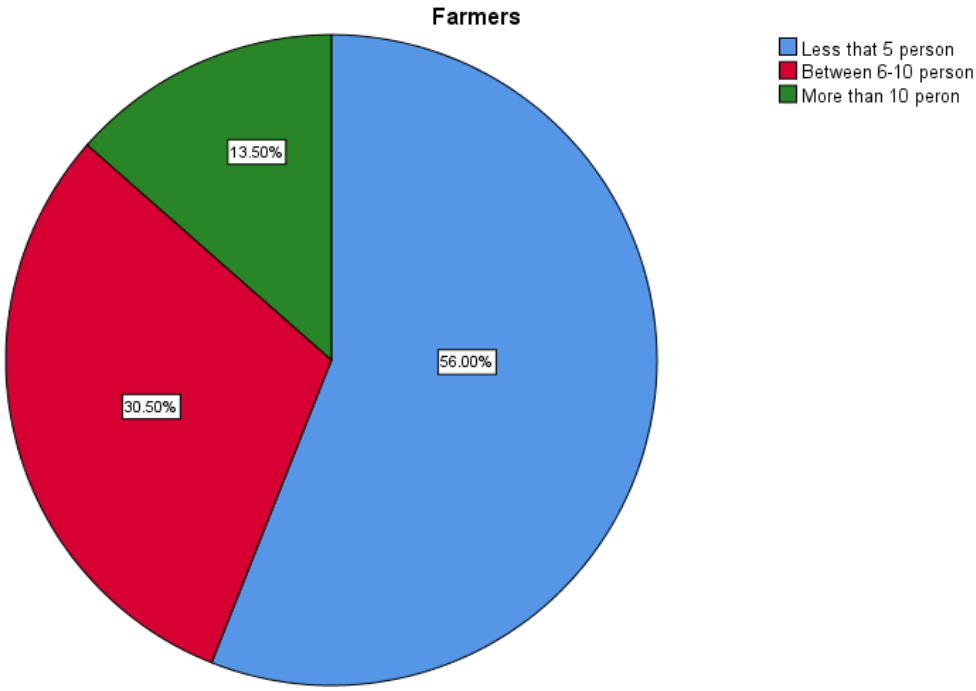

Figure 6.3: Number of farmers working on agricultural land

6.1.4 Years of activity in agricultural land

In this section, the status of the statistical community has been examined based on the index of years of repeated activity in agricultural land. The information is shown in Table 6.4.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 5 years	35	17.5	17.5	17.5
	Between 6 to 10 years	122	61.0	61.0	78.5
	More than 10 years	43	21.5	21.5	100.0
	Total	200	100.0	100.0	

Table 6.4: Frequent activity in agricultural land

As demonstrated, the highest frequency is related to the years of activity between 6 and 10 years (61%). The next ranks were assigned to years of activity less than 5 years (17.5 percent), more than 10 years (21.5 percent), respectively. The changes related to the years of activity in agricultural land are shown in Figure 6.4.

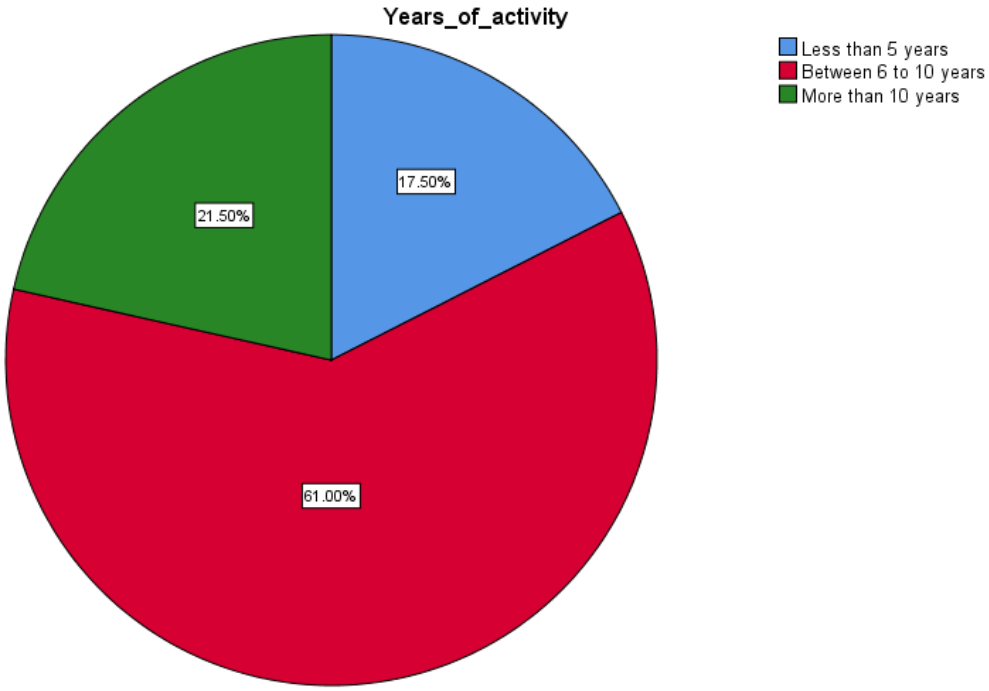

Figure 6.4: Frequency related to years of activity

6.3 Descriptive statistics

Descriptive statistics examines the characteristics of the research sample in the form of classification and interpretation of data, data collection tools in appropriate tables and

drawing diagrams appropriate to these tables (Steven, 2002). In the following, descriptive statistics indicators for variables and research questions will be examined.

6.3.1 Descriptive statistics of questionnaire questions

In this section, the descriptive statistics of the questionnaire questions have been investigated. The results are shown in Table 6.5.

Descriptive Statistics									
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
q1	200	1	5	3.44	1.120	-.100	.172	-1.074	.342
q2	200	1	5	3.41	1.220	-.325	.172	-.804	.342
q3	200	1	5	3.37	1.175	-.059	.172	-1.042	.342
q4	200	1	5	3.53	1.227	-.518	.172	-.604	.342
q5	200	2	5	3.52	1.046	-.053	.172	-1.176	.342
q6	200	1	5	3.21	1.084	-.509	.172	-.300	.342
q7	200	1	5	2.43	.984	.148	.172	-.850	.342
q8	200	1	5	3.51	.967	-.568	.172	.064	.342
q9	200	1	5	3.63	.942	-.472	.172	-.206	.342
q10	200	1	5	3.48	.929	-.188	.172	-.529	.342
q11	200	1	5	3.50	.919	-.373	.172	-.114	.342
q12	200	1	5	3.64	.992	-.642	.172	.177	.342
q13	200	1	5	3.58	1.081	-.390	.172	-.530	.342
q14	200	1	5	3.45	1.120	-.329	.172	-.560	.342
q15	200	1	5	3.61	.907	-.317	.172	-.116	.342
q16	200	1	5	3.56	1.059	-.402	.172	-.441	.342
q17	200	1	5	4.10	1.169	-1.225	.172	.558	.342
q18	200	1	5	3.85	1.069	-.967	.172	.384	.342
q19	200	1	5	3.10	.904	-.333	.172	.255	.342
q20	200	1	5	3.68	1.264	-.694	.172	-.480	.342
q21	200	1	5	3.36	.971	-.598	.172	.124	.342
q22	200	1	5	3.57	1.217	-.371	.172	-.930	.342
q23	200	1	5	3.83	1.227	-.753	.172	-.543	.342
q24	200	1	5	3.63	1.192	-.546	.172	-.713	.342
q25	200	1	5	3.28	1.138	-.062	.172	-.731	.342
q26	200	1	5	3.62	1.222	-.574	.172	-.781	.342
q27	200	1	5	3.61	1.263	-.663	.172	-.669	.342
q28	200	1	5	2.89	1.148	.207	.172	-.839	.342
q29	200	2	5	3.37	.841	-.239	.172	-.770	.342
q30	200	2	5	3.61	1.011	-.127	.172	-1.071	.342
q31	200	1	4	3.36	.757	-1.129	.172	1.035	.342
q32	200	1	5	3.70	.992	-.863	.172	.687	.342
q33	200	1	5	4.03	.997	-1.044	.172	.756	.342
Valid N (listwise)	200								

Table 6.5: Descriptive statistics of questionnaire

In 2016, Klein, quoting Steven, Giffen, Breen, etc., stated that the only criterion for detecting the normality of data distribution for spectra such as the Likert spectrum is the skewness and kurtosis (Klein, 2016). In this research, these two factors have been investigated. Studies have shown that the necessary condition to confirm this importance is that the indices have skewness of -3 and 3 and kurtosis in the range of -5 and 5, and the sufficient condition is that the variables must also meet these limits. According to the results obtained from the two columns on the right side of Table 6.5, this condition is also met, and the data distribution is normal**.**

6.3.2 Descriptive Statistics of conceptual model

In this section, the descriptive statistics of the research variables have been investigated. The results are shown in Table 6.6.

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
A1	200	1.57	4.57	3.2743	.69390	-.306	.172	-.920	.342
A2	200	1.33	5.00	3.5400	.84576	-.413	.172	-.176	.342
A3	200	1.67	4.67	3.6000	.59882	-.677	.172	.190	.342
A4	200	1.00	5.00	3.5350	.92782	-.642	.172	-.419	.342
A5	200	1.40	4.80	3.5950	.94695	-.983	.172	-.224	.342
A6	200	2.00	4.67	3.2900	.83496	-.107	.172	-1.184	.342
A7	200	1.00	4.67	3.6967	.80353	-1.285	.172	1.401	.342
Valid N (listwise)	200								

Table 6.6: Descriptive statistics of questionnaire

The results from Table 6.6 show that the average of all research variables is greater than 3. This shows the relative agreement of people about the variables in the sample. On the other hand, Stevens, in 2002 has stated that when field research is successful, that he has been able to remove indifferent people from the data set in addition to collecting appropriate data. He states that if the standard deviation within the variables is less than 0.5, the field research is invalid (Stevens, 2002). Fortunately, all coefficients are above 0.5. At the end of the descriptive statistics section, it should be stated that, the coefficients of skewness and kurtosis of the variables have also been able to meet the permissible limits of -3 and 3, as well as -5 and 5, and this is a sufficient condition for there is a normality of data distribution and we are allowed to use parametric statistics tests and software due to the following of the data distribution to the normal bell shaped distribution.

6.3.3 Measure of sampling adequacy KMO and Bartlett

The key to using exploratory and confirmatory factor analysis is to test the adequacy of sample size and sphericity of relationships. This test consists of two tests, KMO and Bartlett. If KMO is greater than 0.7, it means that appropriate sample size for factor analysis. But Bartlett's test does not have an interpretability value, but sig must be significant for it to confirm the sphericity of the relationships.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.793
Bartlett's Test of Sphericity	Approx. Chi-Square	3108.136
	df	528
	Sig.	.000

Table 6.7: KMO and Bartlett's Test

As can be seen, the value of KOM is more than 0.7 and also the value of sig has the quorum, so the sample size is sufficient.

6.3.4 Checking the normality with the Kolmogorov-Smirnov test

In this part, the normality of the variables of the research conceptual model is examined. For this, the Kolmogorov-Smirnov test is used. This test is based on the following two assumptions:
The research variables have a normal distribution: h0
Research variables do not have a normal distribution: h1

One-Sample Kolmogorov-Smirnov Test								
		Efficiency and flexibility	Product reliability, convenience and characteristics	Environmental aspects	Marketing	Social aspects	Economic aspects	Responsiveness
N		200	200	200	200	200	200	200
Normal Parameters[a,b]	Mean	3.2743	3.5400	3.6000	3.5350	3.5950	3.2900	3.6967
	Std. Deviation	.69390	.84576	.59882	.92782	.94695	.83496	.80353
Most Extreme Differences	Absolute	.142	.135	.087	.147	.211	.154	.195
	Positive	.091	.118	.054	.086	.134	.114	.114
	Negative	-.142	-.135	-.087	-.147	-.211	-.154	-.195
Test Statistic		.142	.135	.087	.147	.211	.154	.195
Asymp. Sig. (2-tailed)		.000[c]	.000[c]	.001[c]	.000[c]	.000[c]	.000[c]	.000[c]
a. Test distribution is Normal.								
b. Calculated from data.								
c. Lilliefors Significance Correction.								

Table 6.8: Kolmogorov-Smirnov Test

The null hypothesis is accepted because, as shown in Table 15, each variable in the study model has a significance level value higher than 0.05 and a sig value less than 0.05. as a consequence, the research's incorporated variables are typical. The initial requirement for structural equation modeling is thus given.6.3.5 Linear relationships of variables.

In this part, Pearson's test for research variables is discussed. This test is the second prerequisite for performing calculations in SEM (structural equation modeling). The results obtained from this test are given in Table 6.9.

Correlations								
		Efficiency and flexibility	Product reliability, convenience and characteristics	Environmental aspects	Marketing	Social aspects	Economic aspects	Responsiveness
Efficiency and flexibility	Pearson Correlation	1	.179*	.294**	.227**	.342**	.235**	.146*
	Sig. (2-tailed)		.011	.000	.001	.000	.001	.040
	N	200	200	200	200	200	200	200
Product reliability, convenience and characteristics	Pearson Correlation	.179*	1	.276**	.205**	.214**	.106	.348**
	Sig. (2-tailed)	.011		.000	.004	.002	.135	.000
	N	200	200	200	200	200	200	200
Environmental aspects	Pearson Correlation	.294**	.276**	1	.330**	.391**	.205**	.326**
	Sig. (2-tailed)	.000	.000		.000	.000	.004	.000
	N	200	200	200	200	200	200	200
Marketing	Pearson Correlation	.227**	.205**	.330**	1	.444**	.232**	.309**
	Sig. (2-tailed)	.001	.004	.000		.000	.001	.000
	N	200	200	200	200	200	200	200
Social aspects	Pearson Correlation	.342**	.214**	.391**	.444**	1	.162*	.382**
	Sig. (2-tailed)	.000	.002	.000	.000		.022	.000
	N	200	200	200	200	200	200	200
Economic aspects	Pearson Correlation	.235**	.106	.205**	.232**	.162*	1	.224**
	Sig. (2-tailed)	.001	.135	.004	.001	.022		.001
	N	200	200	200	200	200	200	200
Responsiveness	Pearson Correlation	.146*	.348**	.326**	.309**	.382**	.224**	1
	Sig. (2-tailed)	.040	.000	.000	.000	.000	.001	
	N	200	200	200	200	200	200	200
*. Correlation is significant at the 0.05 level (2-tailed).								
**. Correlation is significant at the 0.01 level (2-tailed).								

Table 6.9: Correlation coefficient between the variables of the research conceptual model

Table 16 shows that the factors of the conceptual study model have a linear relationship, and the magnitude of these relationships is all significant at the 99% level. This also establishes the second requirement for carrying out computations in a structural equation model.

6.4 Inferential statistics

Inferential statistics deals with discovering patterns in the sample and generalizing them to society. In the current research, the researcher seeks to discover the impact measurement patterns between the variables and generalize it to the target population, so the conceptual model first performs confirmatory factor analysis operations in the form of a measurement model, and this operation seeks to evaluate the validity and reliability of the construct as well as the agreement of the observations. In the sample with the reality of the statistical population (Stevens, 2002). Then, the final model for hypothesis testing is executed in the form of a structural model in Amos software and the results of rejecting and confirming the hypotheses are specified.

6.4.1 Measurement model

The primary measurement model of the research is implemented in Amos software, and then the model is reported in two figures 6.5 and 6.6.

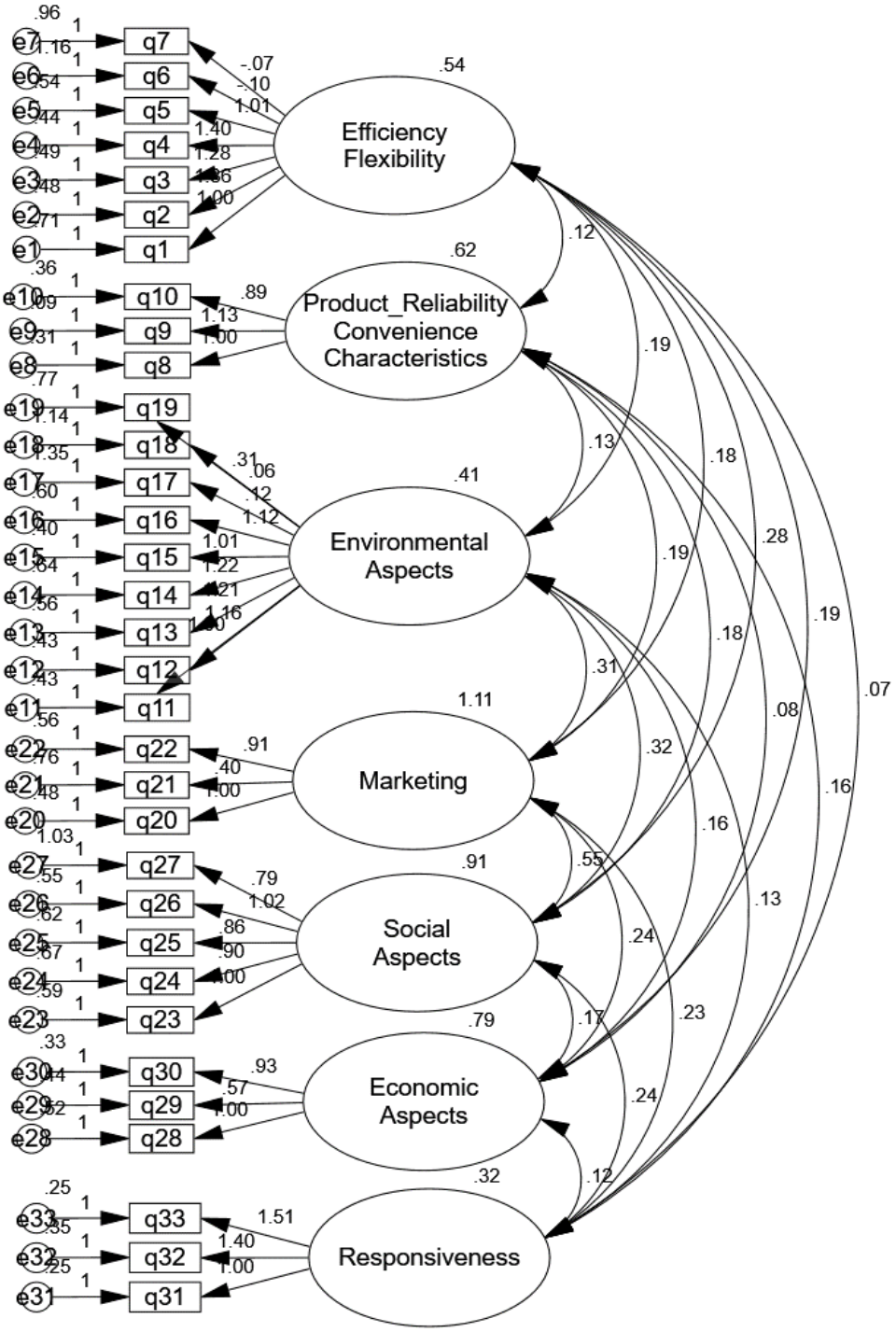

Figure 6.5: Primary measurement model in non-standard coefficient estimation mode

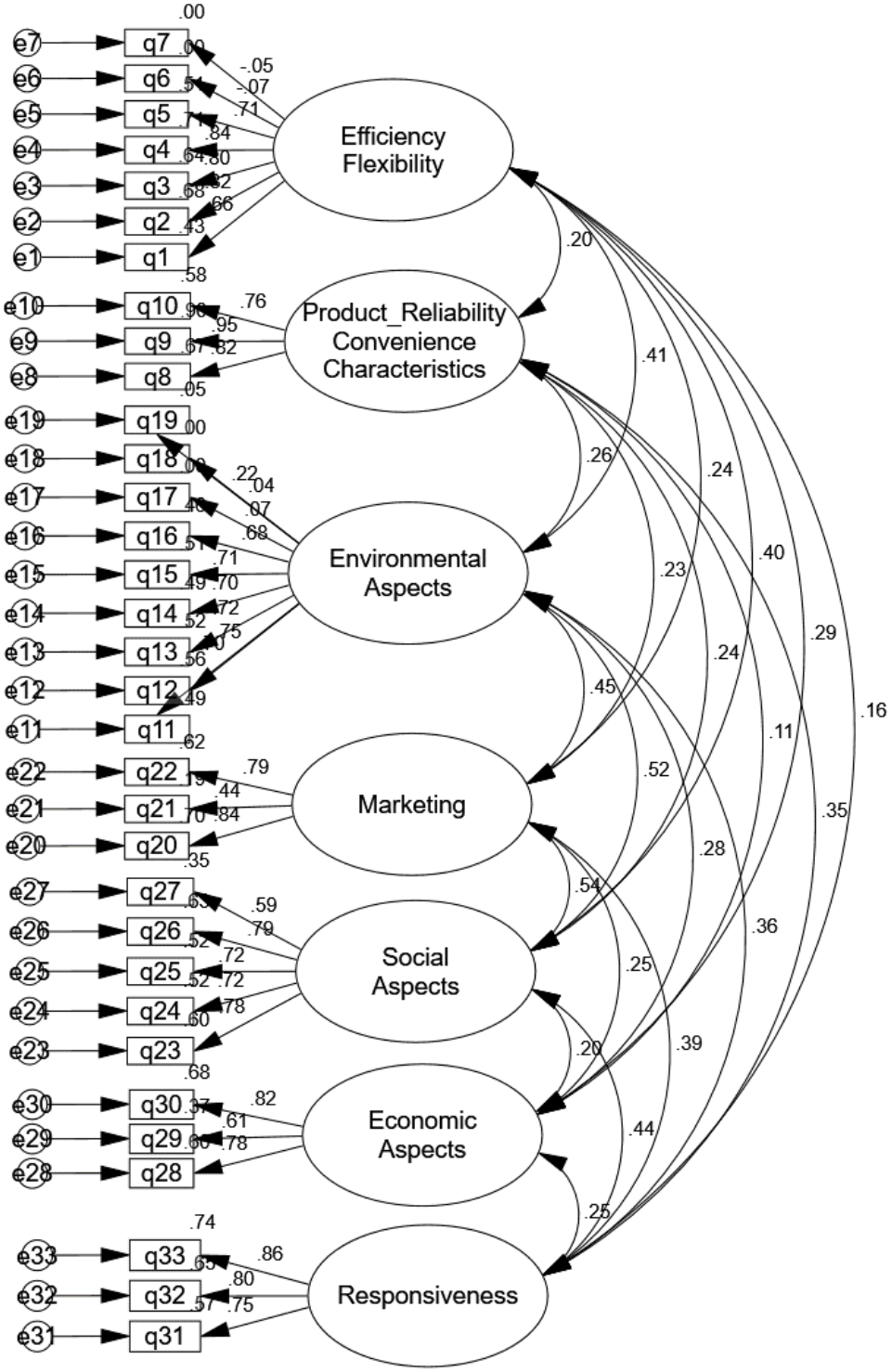

Figure 6.6: Primary measurement model in standard coefficient estimation mode

6.4.2 Measurement equations

Now, the initial measurement model has been implemented for confirmatory factor analysis (CFA) and the researcher is looking to examine the measurement contribution of questions or indicators of each variable to make sure that all indicators have a suitable contribution in measuring their corresponding variable. On the other hand, the task of a suitable measurement model is to ensure the validity (validity) and generalizability (reliability) of the model results. Also, this model should have a suitable condition in terms of matching the observations in the sample with the real population (Fitness) (Sarstedt, 2021).
The measurement model must be implemented for all variables at once so that the validity of the construct can be measured for those results, but when interpreting the results of each variable, it is interpreted separately and in detail. In fact, the interpretation of the results is based on two conditions necessary to establish convergent and divergent validity, i.e., the significance of the factor loadings and the fact that the factor loading is greater than the cut-off point of 0.4. If the two necessary conditions are met, the question or indicator remains in the model, otherwise, since the other conditions disturb the validity and reliability of the structure, those indicators should be removed from the research model.

6.4.2.1 Equations for measuring variable

			Estimate	S.E.	C.R.	P
q1	<---	Efficiency Flexibility	1.000			
q2	<---	Efficiency Flexibility	1.362	.140	9.752	***
q3	<---	Efficiency Flexibility	1.279	.134	9.576	***
q4	<---	Efficiency Flexibility	1.401	.141	9.912	***
q5	<---	Efficiency Flexibility	1.013	.116	8.716	***
q6	<---	Efficiency Flexibility	-.101	.110	-.913	.361
q7	<---	Efficiency Flexibility	-.066	.100	-.657	.511
q8	<---	Product Reliability Convenience Characteristics	1.000			
q9	<---	Product Reliability Convenience Characteristics	1.127	.080	14.171	***
q10	<---	Product Reliability Convenience Characteristics	.892	.074	12.091	***
q11	<---	Environmental Aspects	1.000			
q12	<---	Environmental Aspects	1.157	.123	9.435	***
q13	<---	Environmental Aspects	1.209	.133	9.092	***
q14	<---	Environmental Aspects	1.222	.137	8.892	***
q15	<---	Environmental Aspects	1.006	.112	9.022	***
q16	<---	Environmental Aspects	1.124	.130	8.668	***
q17	<---	Environmental Aspects	.125	.138	.901	.367
q18	<---	Environmental Aspects	.063	.127	.498	.618
q19	<---	Environmental Aspects	.313	.107	2.911	.004
q20	<---	Marketing	1.000			
q21	<---	Marketing	.402	.071	5.645	***
q22	<---	Marketing	.907	.100	9.038	***
q23	<---	Social Aspects	1.000			
q24	<---	Social Aspects	.904	.089	10.112	***
q25	<---	Social Aspects	.860	.085	10.069	***
q26	<---	Social Aspects	1.018	.091	11.153	***
q27	<---	Social Aspects	.787	.096	8.157	***
q28	<---	Economic Aspects	1.000			
q29	<---	Economic Aspects	.572	.075	7.666	***
q30	<---	Economic Aspects	.931	.107	8.667	***
q31	<---	Responsiveness	1.000			
q32	<---	Responsiveness	1.396	.129	10.811	***
q33	<---	Responsiveness	1.507	.135	11.203	***

Table 6.10: Regression Weights

			Estimate	R^2
q1	<---	Efficiency Flexibility	.658	0.433
q2	<---	Efficiency Flexibility	.822	0.675
q3	<---	Efficiency Flexibility	.802	0.643
q4	<---	Efficiency Flexibility	.841	0.707
q5	<---	Efficiency Flexibility	.713	0.509
q6	<---	Efficiency Flexibility	-.068	0.005
q7	<---	Efficiency Flexibility	-.049	0.002
q8	<---	Product Reliability Convenience Characteristics	.819	0.671
q9	<---	Product Reliability Convenience Characteristics	.947	0.897
q10	<---	Product Reliability Convenience Characteristics	.760	0.577
q11	<---	Environmental Aspects	.699	0.488
q12	<---	Environmental Aspects	.749	0.56
q13	<---	Environmental Aspects	.718	0.515
q14	<---	Environmental Aspects	.701	0.491
q15	<---	Environmental Aspects	.712	0.507
q16	<---	Environmental Aspects	.681	0.464
q17	<---	Environmental Aspects	.068	0.005
q18	<---	Environmental Aspects	.038	0.001
q19	<---	Environmental Aspects	.222	0.049
q20	<---	Marketing	.837	0.701
q21	<---	Marketing	.538	0.192
q22	<---	Marketing	.788	0.621
q23	<---	Social Aspects	.777	0.604
q24	<---	Social Aspects	.724	0.524
q25	<---	Social Aspects	.721	0.52
q26	<---	Social Aspects	.794	0.631
q27	<---	Social Aspects	.594	0.353
q28	<---	Economic Aspects	.778	0.605
q29	<---	Economic Aspects	.607	0.369
q30	<---	Economic Aspects	.822	0.676
q31	<---	Responsiveness	.754	0.568
q32	<---	Responsiveness	.803	0.645
q33	<---	Responsiveness	.863	0.745

Table 6.11: Standardized Regression Weights

According to the T-VALUE values for all the questions of the variables, a significant value is established at the 99% confidence level, except for questions 6, 7, 17, 18, 19, because the t-value values are outside the critical range of -196 and 1.96, so the first condition is necessary for the questions to remain in the model except for the mentioned subjects. But the second condition, which refers to factor loading, is still valid for all questions except

questions 6, 7, 17, 18, 19, because all factor loadings are greater than 0.4, so according to confirmatory factor analysis, only questions 6, 7, 17, 18, 19 are removed from the conceptual model.

Summarizing the results of confirmatory factor analysis in the primary measurement model shows that questions 6, 7 of the underlying variable Efficiency and Flexibility and questions 17, 18 and 19 of the variable Environmental Aspects unfortunately do not have one of the two necessary conditions for establishing validity and reliability of the construct. They should be removed from the set of research models and the model unfortunately does not have construct validity and reliability. Now that the model does not have construct validity and reliability, the researcher examines the second task of the measurement model, i.e., the conformity of the model's observations in the sample with the expected reality in the society, which is called Fitness.

6.4.3 Initial measurement model Fitness

Fit indices	Limit	The amount obtained
CMIN/df	<3	1.776
RMSEA	<0.08	0.062
PNFI	>0.5	0.669
GFI	>0.8	0.811
AGFI	>0.8	0.777
NFI	>0.9	0.745
TLI	>0.9	0.852
CFI	>0.9	0.867
RFI	>0.9	0.716
IFI	>0.9	0.870

Table 6.12: Initial measurement model fit indices

In order to match the observations of the research model in the sample with the expected model in the real society, an index was first introduced called Chi-Square, but Chi-Square did not have the necessary stability in high sample sizes, so other fitting indices emerged over the years. which matched the observed model (sample) with the expected model. These indicators are divided into three main categories. Economic indicators that provide us with the maximum fitting information with minimum information. Absolute indices that are compared with a specific cut-off point, and if they are higher than that point, the fit is appropriate, and if they are smaller, the fit is inappropriate. Comparative indices that are relatively compared with a hypothetical ideal model in society, and the closer they are to it,

the better the model will fit. Then Hadamjazi was determined for each of these indicators so that it can be interpreted in the primary measurement model of the research. Therefore, the research model has an inappropriate fit and the model should be modified in terms of fit in addition to validity and reliability.

Unfortunately, the initial model is not suitable in terms of fit index in any of the three categories of frugal, absolute, and comparative, and the model should be modified in terms of fit index.

6.4.4 Modified measurement model

The initial research model has structural problems both in the validity and reliability of the structure and in the fitting part, so the measurement model should be modified. Therefore, the measurement model was modified by removing questions 6, 7, 17, 18, and 19, as well as applying the fitting suggestions arising from the software's suggestions, and the model was modified in two modes of estimating non-standard coefficients, standard and two you can see figures 6.7 and 6.8.

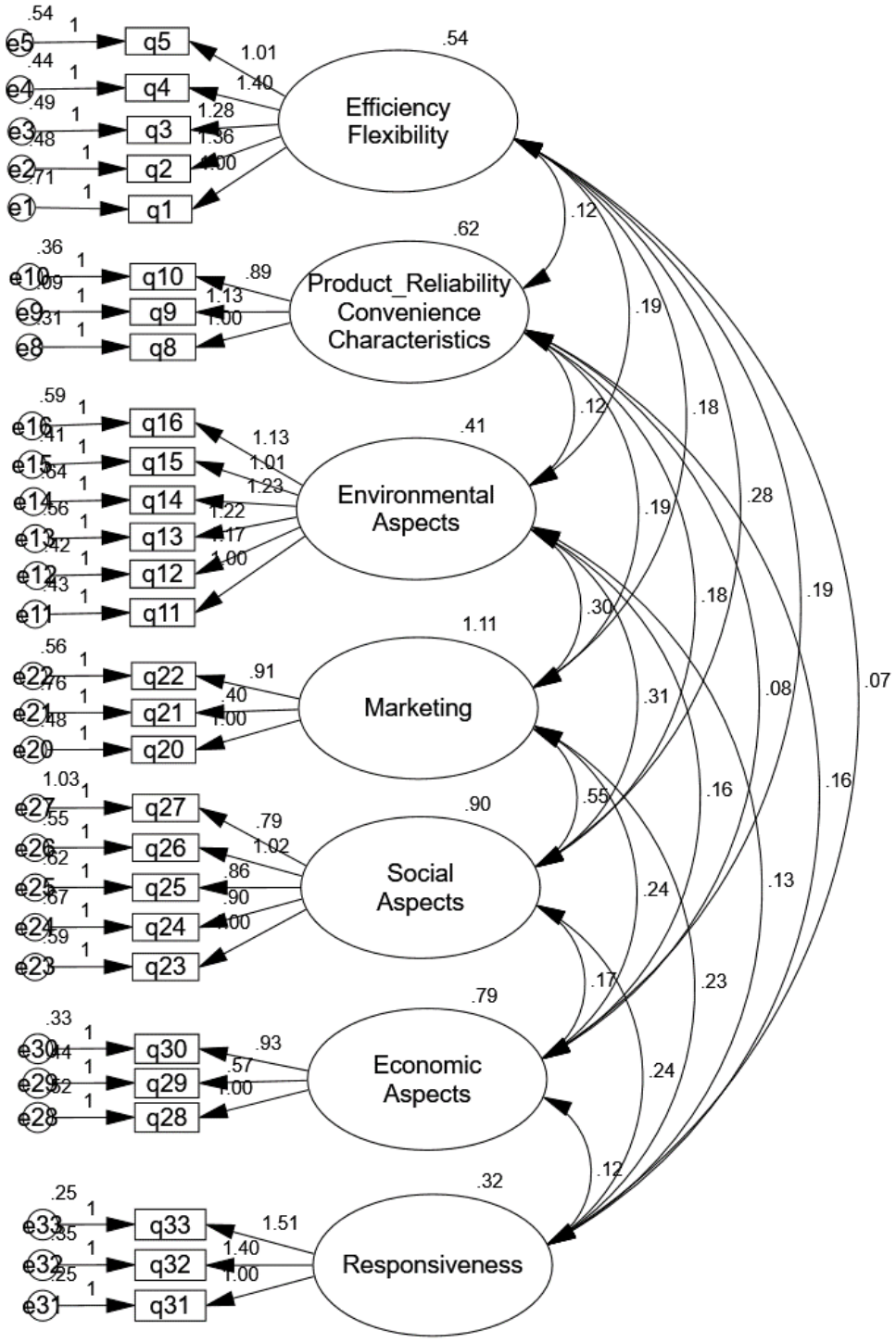

Figure 6.7: Modified measurement model in non-standardized coefficient estimation mode

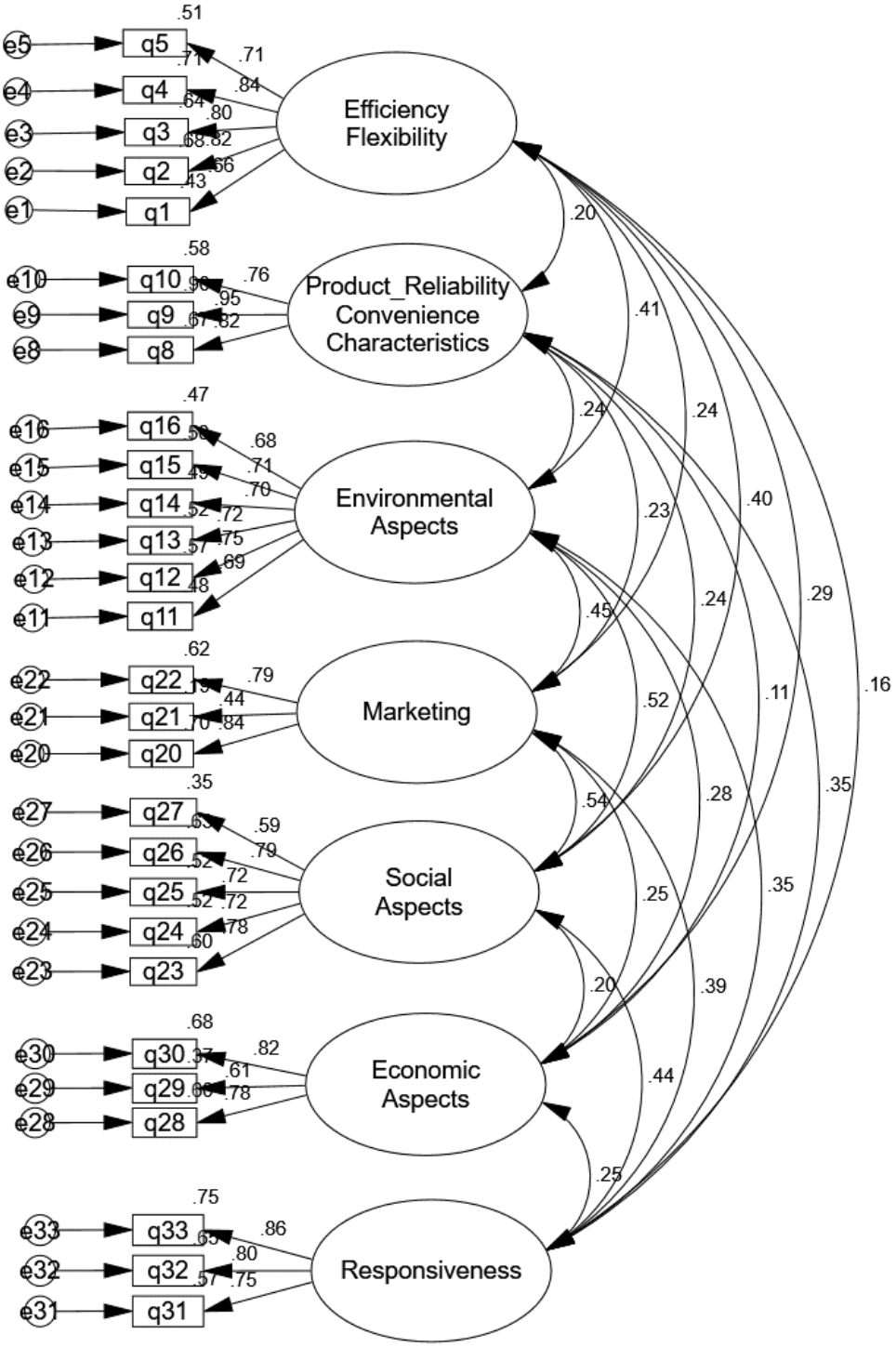

Figure 6.8: Modified measurement model in standard coefficient estimation mode

Measurement equations of the variables in the modified stated.
Now the factor load and significant coefficients of the questionnaire questions in the modified measurement model are examined. The results are shown in Tables 6.13 and 6.14.

			Estimate	S.E.	C.R.	P
q1	<---	Efficiency Flexibility	1.000			
q2	<---	Efficiency Flexibility	1.363	.140	9.756	***
q3	<---	Efficiency Flexibility	1.279	.134	9.571	***
q4	<---	Efficiency Flexibility	1.401	.141	9.905	***
q5	<---	Efficiency Flexibility	1.014	.116	8.714	***
q8	<---	Product Reliability Convenience Characteristics	1.000			
q9	<---	Product Reliability Convenience Characteristics	1.127	.080	14.164	***
q10	<---	Product Reliability Convenience Characteristics	.892	.074	12.091	***
q11	<---	Environmental Aspects	1.000			
q12	<---	Environmental Aspects	1.170	.124	9.427	***
q13	<---	Environmental Aspects	1.220	.135	9.067	***
q14	<---	Environmental Aspects	1.227	.139	8.833	***
q15	<---	Environmental Aspects	1.007	.113	8.931	***
q16	<---	Environmental Aspects	1.134	.131	8.650	***
q20	<---	Marketing	1.000			
q21	<---	Marketing	.402	.071	5.642	***
q22	<---	Marketing	.908	.100	9.041	***
q23	<---	Social Aspects	1.000			
q24	<---	Social Aspects	.905	.090	10.110	***
q25	<---	Social Aspects	.861	.086	10.064	***
q26	<---	Social Aspects	1.018	.091	11.151	***
q27	<---	Social Aspects	.787	.097	8.155	***
q28	<---	Economic Aspects	1.000			
q29	<---	Economic Aspects	.573	.075	7.668	***
q30	<---	Economic Aspects	.932	.107	8.670	***
q31	<---	Responsiveness	1.000			
q32	<---	Responsiveness	1.397	.129	10.809	***
q33	<---	Responsiveness	1.508	.135	11.200	***

Table 6.13: Regression Weights

			Estimate	
q1	<---	Efficiency Flexibility	.658	0.433
q2	<---	Efficiency Flexibility	.823	0.677
q3	<---	Efficiency Flexibility	.802	0.643
q4	<---	Efficiency Flexibility	.840	0.706
q5	<---	Efficiency Flexibility	.713	0.509
q8	<---	Product Reliability Convenience Characteristics	.819	0.671
q9	<---	Product Reliability Convenience Characteristics	.947	0.897
q10	<---	Product Reliability Convenience Characteristics	.760	0.577
q11	<---	Environmental Aspects	.695	0.483
q12	<---	Environmental Aspects	.753	0.568
q13	<---	Environmental Aspects	.721	0.519
q14	<---	Environmental Aspects	.700	0.49
q15	<---	Environmental Aspects	.709	0.502
q16	<---	Environmental Aspects	.684	0.468
q20	<---	Marketing	.837	0.7
q21	<---	Marketing	.537	0.191
q22	<---	Marketing	.789	0.622
q23	<---	Social Aspects	.777	0.604
q24	<---	Social Aspects	.724	0.524
q25	<---	Social Aspects	.721	0.52
q26	<---	Social Aspects	.795	0.631
q27	<---	Social Aspects	.594	0.353
q28	<---	Economic Aspects	.778	0.605
q29	<---	Economic Aspects	.608	0.369
q30	<---	Economic Aspects	.822	0.676
q31	<---	Responsiveness	.754	0.568
q32	<---	Responsiveness	.803	0.645
q33	<---	Responsiveness	.863	0.745

Table 6.14: Standardized Regression Weights

As can be seen, the two necessary conditions for establishing convergent and divergent validity, i.e., the significance of the factor loadings and the fact that the factor loading is greater than the cut-off point of 0.4, are confirmed for the research questions. As a result, it is possible to check the fit indices of the model.

6.4.4.1 The fitness of the modified measurement model

Fit indices	Limit	The amount obtained
CMIN/df	<3	1.535
RMSEA	<0.08	0.052
PNFI	>0.5	0.722
GFI	>0.8	0.854
AGFI	>0.8	0.820
NFI	>0.9	0.829
TLI	>0.9	0.922
CFI	>0.9	0.932
RFI	>0.9	0.804
IFI	>0.9	0.933

Table 6.15: The fit indices of the modified measurement model

Fortunately, the revised measurement model of the research is in the minimum possible fitting state in terms of absolute and comparative (adaptive) indicators. Because they met the minimum requirements to confirm the desired limit and we can claim that the research model has a good fit and our observations in the sample are consistent with the desired reality in the society. But now, before implementing the structural model, we go to the main task of a measurement model, which is to confirm the reliability and validity of the structure.

6.4.5 Checking the validity and reliability of the structure

To check the validity and reliability of the structure, the following conditions must be met.

	CR	AVE	MSV	ASV
Economic Aspects	0.783	0.550	0.084	0.056
Efficiency Flexibility	0.879	0.593	0.168	0.089
Product, Reliability, Convenience Characteristics	0.882	0.715	0.123	0.057
Environmental Aspects	0.859	0.505	0.267	0.150
Marketing	0.741	0.505	0.296	0.137
Social Aspects	0.846	0.527	0.296	0.168
Responsiveness	0.849	0.653	0.192	0.112

Table 6.16: Reliability check

There are two basic conditions for establishing this type of model validity. The first condition is about the average variance extraction and the second condition is comparing it with composite reliability.
AVE>0.5
All the average values of extracted variance are greater than the cut point of 0.5 and the first condition of convergent validity is established.
CR>AVE
All the variables have the condition of convergent validity, and now according to the first condition, it can be claimed that the external modified model of the research has convergent validity, that is, the indicators of each variable of the research are convergent and collinear.
CR>0.7
All CR values are greater than 0.7.
MSV
The square root of AVE should be greater than intra-structural correlation, which is also an obvious condition.
Fortunately, all the conditions between the indicators are met.

	Economic Aspects	Efficiency Flexibility	Product Reliability Convenience Characteristics	Environmental Aspects	Marketing	Social Aspects	Responsiveness
Economic Aspects	0.742						
Efficiency Flexibility	0.290	0.770					
Product Reliability Convenience Characteristics	0.107	0.199	0.846				
Environmental Aspects	0.283	0.410	0.240	0.711			
Marketing	0.253	0.236	0.232	0.450	0.710		
Social Aspects	0.197	0.398	0.235	0.517	0.544	0.726	
Responsiveness	0.246	0.159	0.350	0.354	0.385	0.438	0.808

Table 6.17: Examining the validity of Fornell-Larcker

In 1981, Fornell and Larcker devised a method for the divergence of variables (CR and ... from the table above was the divergence of the questions), a method in which a correlation table was used between the variables. And the correlation of variables should not be more than 70% (Fornell, and Larcker, 1981), But in 2006, Fornell and Mithas improved the earlier technique by substituting the square root of AVE for 1 on the primary diameter. They did this because they thought that if the square root of a variable was higher, the association of that variable with other variables would also be higher (Fornell, and Mithas, 2006) Thankfully, if we take a look at this chart from the current research, the square root of the AVE of each variable is higher than the correlation of that variable with other variables.

The summation of the results of both tables of validity and reliability of the construct shows that fortunately the modified measurement model has both construct reliability and construct validity, and now the modified measurement model has fulfilled both of its intended tasks and we can test the assumptions of the research.

6.5 Structural model

In fact, the structural model is the same conceptual model from the research literature review, that deals with the relationship between the existing variables. This model has no task other than testing hypotheses and examining their rejection and confirmation as the main results of this research. Figures 6.9 and 6.10 show the structural model of the research in standard and non-standard mode. The results of the significance of the path between the variables as well as the coefficients of the path are shown in Tables 6.18 and 6.19.

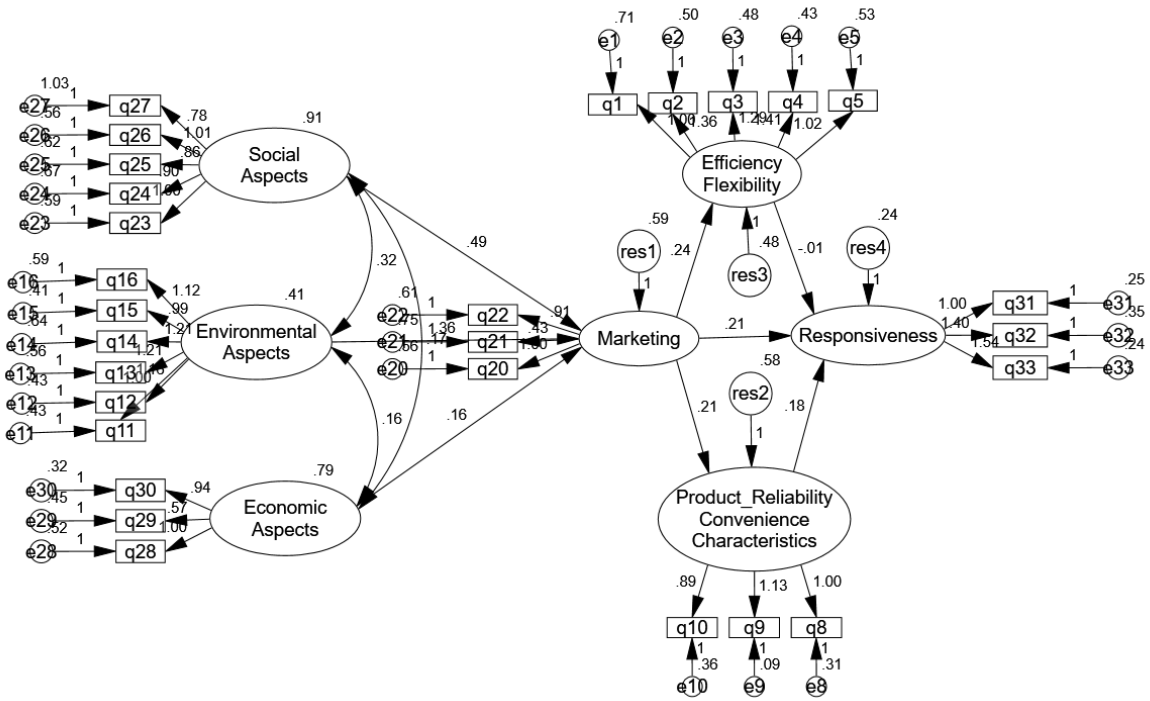

Figure 6.9: Structural model in non-standard coefficient estimation mode

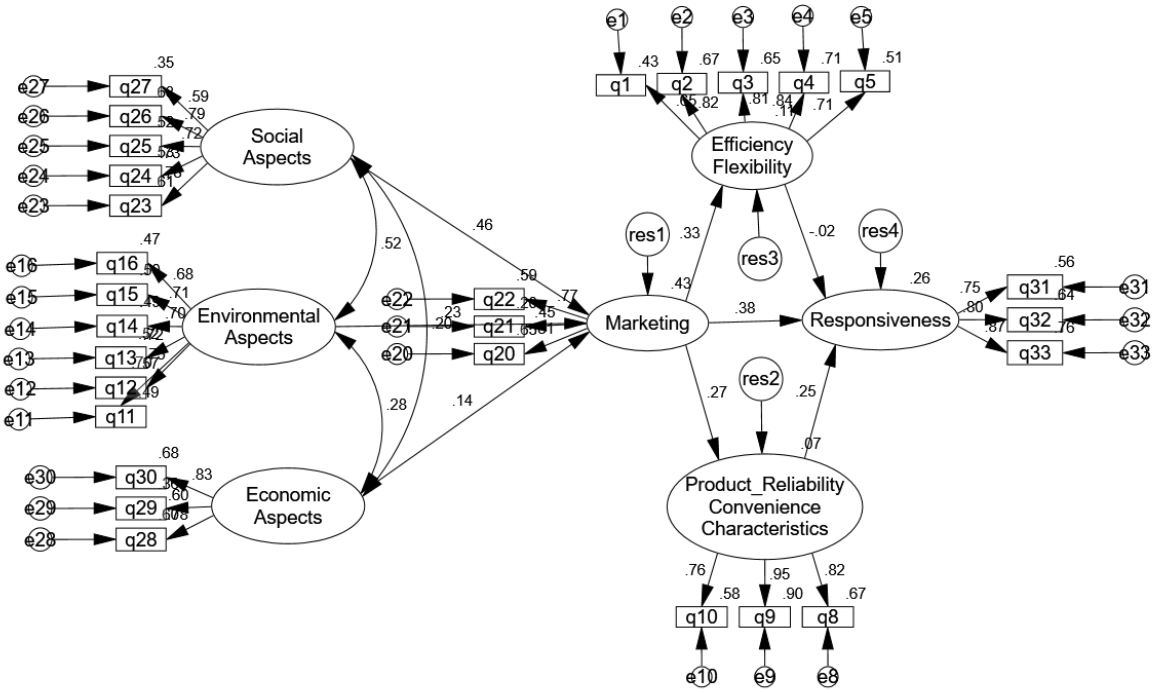

Figure 6.10: Structural model in standard coefficient estimation mode

6.5.1 Structural equation

In Tables 6.18 and 6.19, the values related to the significant coefficients and the path related to the path between the variables are presented. The results show that the variables whose relationship is confirmed at the significance level of 99% with three stars and the variables whose sig value is less than 0.05 and the significant path coefficients between them are between 1.96 and -1.96 are not at the significance level of 95%. The percentage has been approved.

variables	Hypothesis	variables	Estimate	S.E.	C.R.	P	Hypothesis status
Marketing	<---	Social Aspects	.487	.101	4.836	***	confirmed
Marketing	<---	Economic Aspects	.160	.090	1.783	.075	rejected
Marketing	<---	Environmental Aspects	.363	.146	2.480	.013	confirmed
Efficiency Flexibility	<---	Marketing	.236	.063	3.759	***	confirmed
Product Reliability Convenience Characteristics	<---	Marketing	.212	.064	3.299	***	confirmed
Responsiveness	<---	Efficiency Flexibility	-.012	.061	-.195	.845	rejected
Responsiveness	<---	Product Reliability Convenience Characteristics	.176	.056	3.159	.002	confirmed
Responsiveness	<---	Marketing	.213	.052	4.116	***	confirmed

Table 6.18: Significance of research assumptions

variables	Hypothesis	variables	β	Hypothesis status
Marketing	<---	Social Aspects	.458	confirmed
Marketing	<---	Economic Aspects	.140	rejected
Marketing	<---	Environmental Aspects	.230	confirmed
Efficiency Flexibility	<---	Marketing	.328	confirmed
Product Reliability Convenience Characteristics	<---	Marketing	.274	confirmed
Responsiveness	<---	Efficiency Flexibility	-.015	rejected
Responsiveness	<---	Product Reliability Convenience Characteristics	.247	confirmed
Responsiveness	<---	Marketing	.384	confirmed

Table 6.19: Standard path coefficients of research hypotheses

According to the results of the above two tables, the results of the research hypotheses are presented in Table 6.20.

H1: Social consideration has positive impact on marketing.
H2: Economic aspects positively affect marketing.
H3: Environmental considerations have positive impact on marketing.
H4: Marketing has positive impact on Efficiency Flexibility.
H5: Marketing has positive impact on Product Reliability, Convenience and Characteristics.
H6: Efficiency Flexibility have positive impact on responsiveness.

H7: Product Reliability, Convenience and Characteristics has positive impact on responsiveness.
H8: Marketing has positive impact or direct impact on responsiveness.

Hypothesis	β	t-value	result
H1	.458	4.836	confirmed
H2	.140	1.783	rejected
H3	.230	2.480	confirmed
H4	.328	3.759	confirmed
H5	.274	3.299	confirmed
H6	-.015	-.195	rejected
H7	.247	3.159	confirmed
H8	.384	4.116	confirmed

Table 6.20: The results of research hypotheses

According to the present results, the second and sixth hypotheses have been rejected and the rest of the hypotheses have been confirmed. Now the research hypotheses are examined.
H1: Social aspects positively affect marketing.
According to the value of T-value that is outside the range of -1.96 and 1.96, the statistical hypothesis h0 is rejected and the statistical hypothesis h1 is confirmed at the level of probability or confidence of 99%.

H0=β=0 و H1: β≠0

social aspects have a significant impact on marketing. Now, based on the value of the path coefficient or beta, we evaluate its intensity and direction. The positive beta value is 0.458, which shows that social aspects influence marketing as much as 0.458 and its direction is positive, so, if the exogenous variable of social aspects changes by 1 unit, marketing changes by 0.458 units and in the same direction. In other words, the second hypothesis is confirmed because social factors have a positive and significant impact on marketing.
H2: Economic considerations have positive impact on marketing.
According to the value of T-value which is in the range of -1.96 and 1.96, at the level of probability or confidence of 99%, the statistical hypothesis h0 is confirmed and the statistical hypothesis h1 is rejected.
H0=β=0 و H1: β≠0

As a result, the third hypothesis is rejected, and economic aspects do not affect marketing.

H3: Environmental consideration has positive impact on marketing.

According to the value of t-value that is outside the range of -1.96 and 1.96, the statistical hypothesis h0 is rejected and the statistical hypothesis h1 is confirmed at the level of probability or confidence of 99%.
H0=β=0 و H1: β≠0
environmental aspects have a significant impact on marketing. Now, based on the value of the path coefficient or beta, we evaluate its intensity and direction. The positive beta value

is 0.238, which shows that environmental aspects have an effect on marketing as much as 0.238 and its direction is positive, so, if the external variable of environmental aspects changes by 1 unit, marketing changes by 0.238 units and in the same direction. In other words, environmental aspects have a positive and significant effect on marketing, and the third hypothesis is confirmed.
H4: Marketing has positive impact on Efficiency and Flexibility.

According to the value of t-value that is outside the range of -1.96 and 1.96, the statistical hypothesis h0 is rejected and the statistical hypothesis h1 is confirmed at the level of probability or confidence of 99%.
H0=β=0 و H1: β≠0

marketing has a significant effect on efficiency and flexibility. Now, based on the value of the path coefficient or beta, we evaluate its intensity and direction. The beta value is positive 0.328, which shows that marketing influences efficiency and flexibility as much as 0.328, and its direction is positive, so, if the marketing exogenous variable changes by 1 unit, efficiency and flexibility will change by 0.328 units and in the same direction. In other words, marketing has a positive and significant effect on efficiency and flexibility, and the fourth hypothesis is confirmed.

H5: Marketing has positive impact on Product Reliability, Convenience and Characteristics.

According to the value of t-value that is outside the range of -1.96 and 1.96, the statistical hypothesis h0 is rejected and the statistical hypothesis h1 is confirmed at the level of probability or confidence of 99%.
H0=β=0 و H1: β≠0

marketing has a significant effect on Product Reliability, Convenience and Characteristics. Now, based on the value of the path coefficient or beta, we evaluate its intensity and direction. The positive beta value is 0.274, which shows that marketing has an effect of 0.274 on Product Reliability, Convenience and Characteristics, and its direction is positive, that is, if the marketing exogenous variable changes by 1 unit, Product Reliability, Convenience and Characteristics. 0.274 units and changes in the same direction. In other words, marketing on Product Reliability, Convenience and Characteristics. It has a positive and significant effect, and the fifth hypothesis is confirmed.

H6: Efficiency and Flexibility have positive impact on responsiveness.

According to the value of t-value which is in the range of -1.96 and 1.96, at the level of probability or confidence of 99%, the statistical hypothesis h0 is confirmed and the statistical hypothesis h1 is rejected.
H0=β=0 و H1: β≠0

efficiency and flexibility do not affect responsiveness.
H7: Product Reliability, Convenience and Characteristics has positive impact on responsiveness.

According to the value of t-value that is outside the range of -1.96 and 1.96, the statistical hypothesis h0 is rejected and the statistical hypothesis h1 is confirmed at the level of probability or confidence of 99%.
H0=β=0 و H1: β≠0
Product Reliability, Convenience and Characteristics have a significant effect on responsiveness. Now, based on the value of the path coefficient or beta, we evaluate its intensity and direction. The positive beta value is 0.247, which shows that Product Reliability, Convenience and Characteristics influences responsiveness to the extent of 0.247 and its direction is positive, so, if the exogenous variable Product Reliability, Convenience and Characteristics changes by 1 unit, responsiveness will change by 0.247 units and in the same direction. he does. In other words, Product Reliability, Convenience and Characteristics have a positive and significant effect on responsiveness, and the seventh hypothesis is confirmed.
H8: Marketing has positive impact or direct impact on responsiveness.

According to the value of t-value that is outside the range of -1.96 and 1.96, the statistical hypothesis h0 is rejected and the statistical hypothesis h1 is confirmed at the level of probability or confidence of 99%.
H0=β=0 و H1: β≠0

marketing has a significant effect on responsiveness. Now, based on the value of the path coefficient or beta, we evaluate its intensity and direction. The positive beta value is 0.384, which shows that marketing influences responsiveness as much as 0.384, and its direction is positive, so, if the exogenous variable of marketing changes by 1 unit, responsiveness changes by 0.384 units and in the same direction. In other words, marketing has a positive and significant effect on responsiveness, and the eighth hypothesis is confirmed.

6.6 Mediating variable analysis

Due to the covariance-oriented nature of the research structural model, the most appropriate method for analysing the mediating role of efficiency and flexibility and reliability, convenience and product features is to use Baron and Kenny's approach in 1986. They believe that a mediating variable is a variable that conveys all or part of the effect between the independent and dependent variables. First, based on Baron and Kenny's model (Baron, and Kenny, 1986), we first run the model without the presence of the mediator variable so that we can calculate c values.

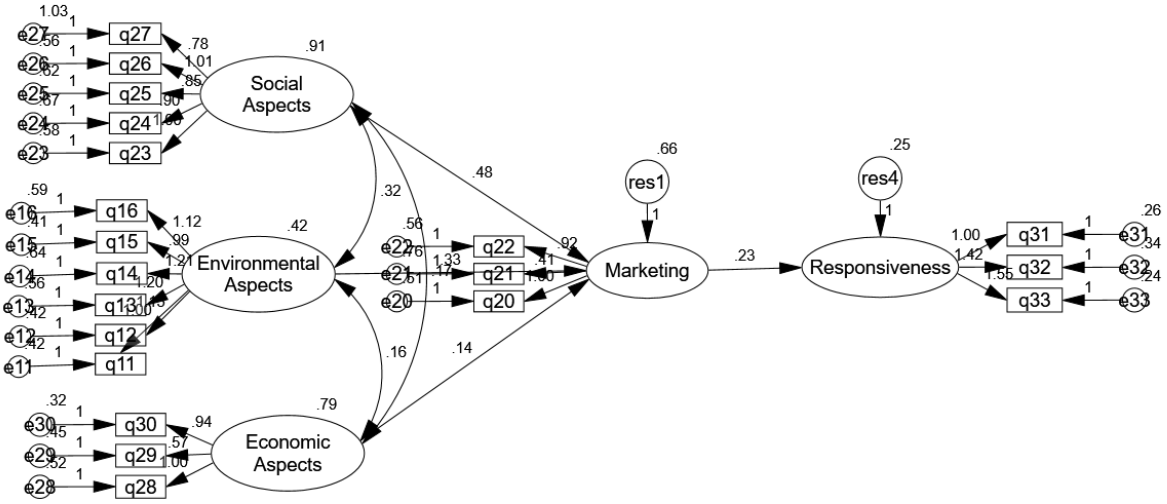

Figure 6.11: The structural model of mediation analysis at the zero level in the estimation mode of unstandardized coefficients

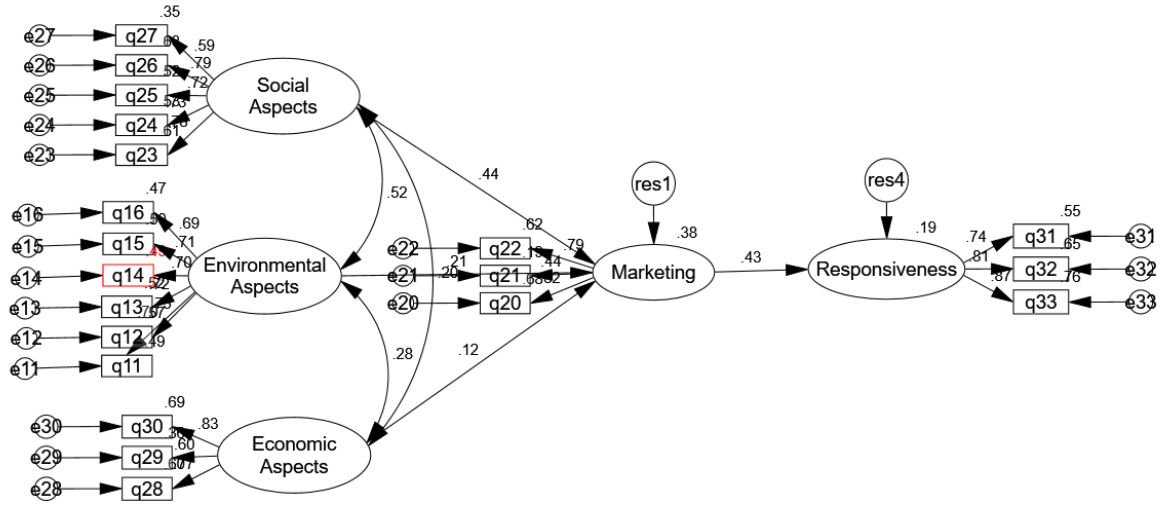

Figure 6.12: Structural model of mediation analysis at the zero level in the mode of estimation of standard coefficients

After running the model at zero level, then we calculate the obtained direct values (c) for mediation analysis. Now we run the model with the presence of the mediator variable so that we can calculate the values of a, b, and c', and then it analyses the loyalty mediator variable based on Baron and Kenny's table.

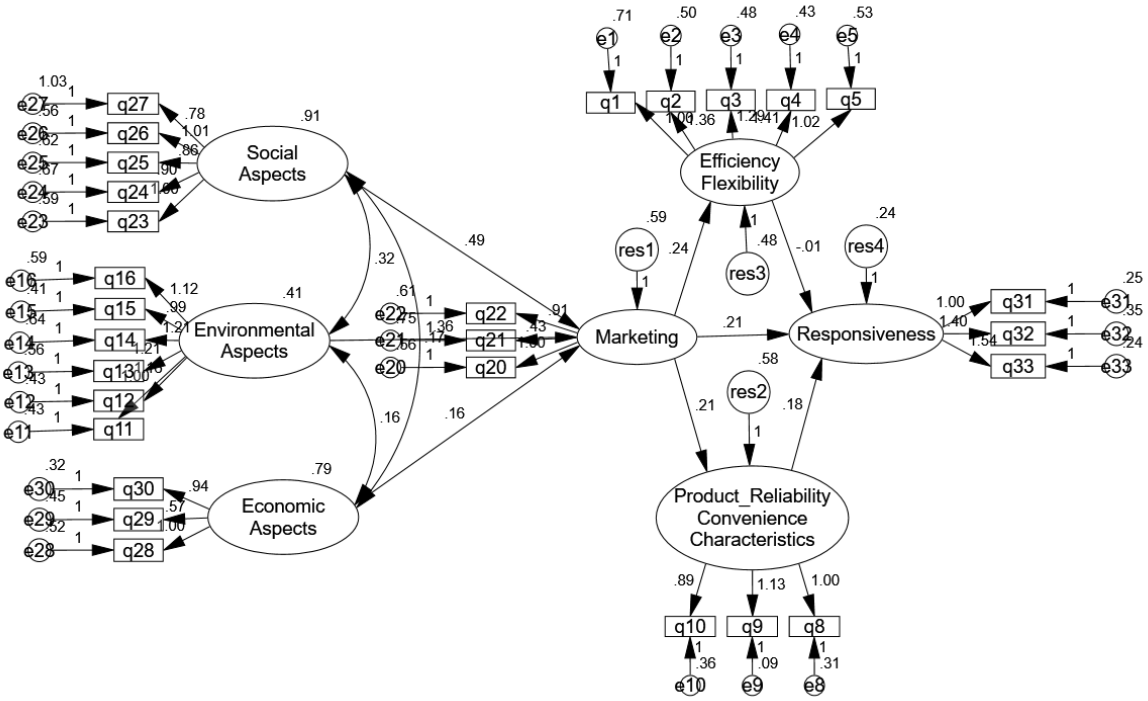

Figure 6.13: Structural model of mediation analysis with the presence of mediator variable in non-standard estimation mode

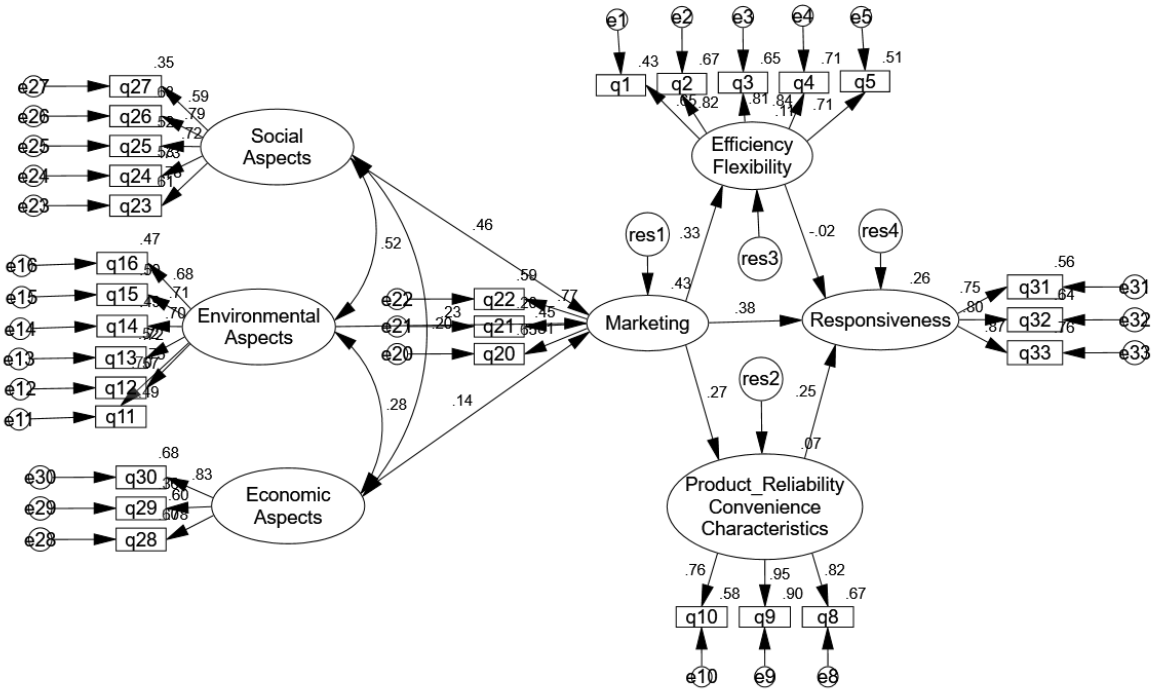

Figure 6.14: Structural model of mediation analysis with the presence of mediator variable in standard estimation mode

Mediation analysis	C	C' direct	a	B	Ab indirect	total path
first triangle	0.432	0.384	0.328	-0.015	-0.0049	0.379
second triangle	0.432	0.384	0.274	0.247	0.067	0.451

Table 6.21: Direct, indirect, and total path

As additional information, we ran the model once without the presence of the mediator and once again with the presence of the mediator and then reported the information of the direct path, the indirect path and the total path in Table 6.21. However, the mediation analysis with Baron and Kenny's method is not directly related to the values of the coefficients of the path but based on the significance of these coefficients within the target population of the research.

	Path c	**Path a**	**Path b**	**path c'**	**result**
Category 1	Meaningful	Meaningful	Meaningful	Meaningful	partial mediator
Category 2	Meaningful	Meaningful	Meaningful	meaningless	perfect mediator
Category 3	Meaningful	meaningless	Does not matter	Meaningful	no mediator
Category 4	Meaningful	Does not matter	meaningless	Meaningful	no mediator
Category 5	meaningless	Meaningful	Meaningful	meaningless	no mediator Indirect) (impact
Category 6	meaningless	Meaningful	meaningless	meaningless	no mediator (no effect)
Category 7	meaningless	meaningless	Meaningful	meaningless	no mediator (no effect)

Table 6.22: Mediating variable analysis

Analysis of the variable role of efficiency and flexibility:
Examining the hypothesis:
H9: efficiency and flexibility mediate the effects of marketing on responsiveness.

In the analysis of the first triangle, path c (the path between the marketing variable and responsiveness without mediating variables) is significant and c' (the path between the marketing variable and responsiveness with mediating variables) is significant, path a (the path between the marketing variable and efficiency and flexibility) significant and path b (the path between efficiency variable and flexibility and responsiveness) is non-significant. As a result, it is placed in the fourth category, and efficiency and flexibility variables do not have a mediating role between marketing variables and responsiveness.

Analysis of the variable role of reliability, convenience, and product features:
Examining the hypothesis:
H10: product reliability, convenience, and characteristics, mediates the effects of, marketing on responsiveness.
In the analysis of the second triangle, path c (path between marketing variable and responsiveness without mediating variables) is significant and c' (path between marketing variable and responsiveness with mediating variables) is significant, path a (path between marketing variable and reliability, convenience, and product features) is significant and the path b (the path between the variable reliability, convenience and product features and responsiveness) is also significant. As a result, it is placed in the first category and the variable of reliability, comfort and product features has a partial mediating role between the variables of marketing and responsiveness.

6.7 Conclusion

In this chapter, descriptive statistics were first examined. Descriptive statistics were performed for both questionnaire questions and research variables, and the obtained results have shown the correctness of the results. In the continuation of the sufficiency test, the normality of the data and also the correlation between the variables were examined. The results indicate that the values obtained from the conducted tests achieved the set quorum and this shows the approval of the conducted test. In the following, the measurement model was drawn in the Amos software and the items of the questionnaire were checked in terms of significance coefficient and factor loading, and the results showed that all indicators, except for questions 6, 7, 17, 18, 19, had a factor loading above 0.4. data and model are sufficient. In the continuation of the model, the initial conditions of the structural model and the fitness indices of the model were examined. The validity and reliability of the constructs were measured, and the results indicated that all conditions of the fitting model were met. Next, the structural model of the research was drawn and tested. The research hypotheses were tested and analysed. At the end, the mediating variables considered were tested by Baron and Kenny's model method. Now, in the next chapter, summarizing and presenting suggestions will be discussed considering the results of the current research.

Chapter 7

Conclusion

7.1 Introduction

This thesis aims to identify different factors to achieve sustainability in the supply chain of Italian agricultural products. To achieve this goal, in the first chapter, an introduction to the research was stated and the research questions were determined. In the second chapter, more concepts of the main issues of the thesis were presented and a comprehensive review of the research conducted around the research topic was presented. In the third chapter, the research method was explained along with the statistical population, as well as the methods and tools of data analysis. In the fourth chapter, the research hypotheses were formulated according to the identified variables and each of the hypotheses was examined in detail. In the fifth chapter, the desired model of the research was presented and the methods of analyzing the results and checking the questionnaire data were evaluated. In the sixth chapter, using the data obtained from the questionnaire, the initial conditions of the structural model were examined and then the model was drawn and analyzed in the Amos software. Now, in this chapter, we are going to summarize the results obtained in the previous chapters and answer the questions posed in the first chapter.

7.2 Answers to research questions

In this section, the research questions have been examined. Due to the comprehensiveness of the questions, by answering the questions raised in the first chapter, all the steps have been completed and all the results will be fully examined.
RQ1: What are the different factors to achieve sustainability in the supply chain of Italian agricultural products?
To answer this question, first the desired factors were identified from the existing literature, and then the final indicators were selected through consultation with experts to understand the existing factors affecting sustainability in the supply chain of agricultural products in

Italy. Finally, the final indicators were categorized and presented. These indicators are as follows:

- Efficiency and flexibility
- Product reliability, convenience, and characteristics
- Environmental aspects
- Marketing
- Social aspects
- Economic aspects
- Responsiveness

RQ2: How are the factors related to each other to achieve sustainability dimensions in the supply chains of Italian agricultural products?
RO1: Determining the sample size for primary data collection.
In this research, in order to determine the sample size, the number of farmers and also people involved in the field of agriculture in Italy was examined. Finally, 200 samples of people who had the necessary knowledge and experience in the field of agriculture and agricultural products in Italy, as well as the problems and characteristics of working in farms and growing agricultural products, were selected.

RO 2: Adopt a quantitative methodological stance to understand causal relationships between factors
In order to check the relationships between indicators, various tests and software were used. The validity of the data obtained from the questionnaire was tested using SPSS software. Examination of descriptive statistics, test of sample size adequacy, correlation between indicators and normality of data distribution were examples of these tests. Next, due to structural equations, Imus software was used. The initial conditions of structural equations, factor loadings of questions and causal relationships between indicators were examined and the results were presented in different tables.

RO3: Designing a survey questionnaire and a set of interview questions to collect primary data
In the questionnaire section, a statistical sample survey was conducted using a 5-point Likert scale, and a certain number of items were considered for each index. These items were arranged as described in the table below.

Indicators	items

Efficiency and flexibility	1-7
Product reliability, convenience, and characteristics	8-10
Environmental aspects	11-19
Marketing	20-22
Social aspects	23-27
Economic aspects	28-30
Responsiveness	31-33

Table 7.1: Questionnaire items

RO 4: Develop a structural equation model considering factors

After identifying the indicators, the relationships between them were determined in a structural diagram. Determining these relationships is based on the effectiveness of each index relative to the other. This was done in consultation with the supervisor and advisor, as well as checking the relationship between abstracts in related articles. Finally, the structural model was designed and compiled as follows.

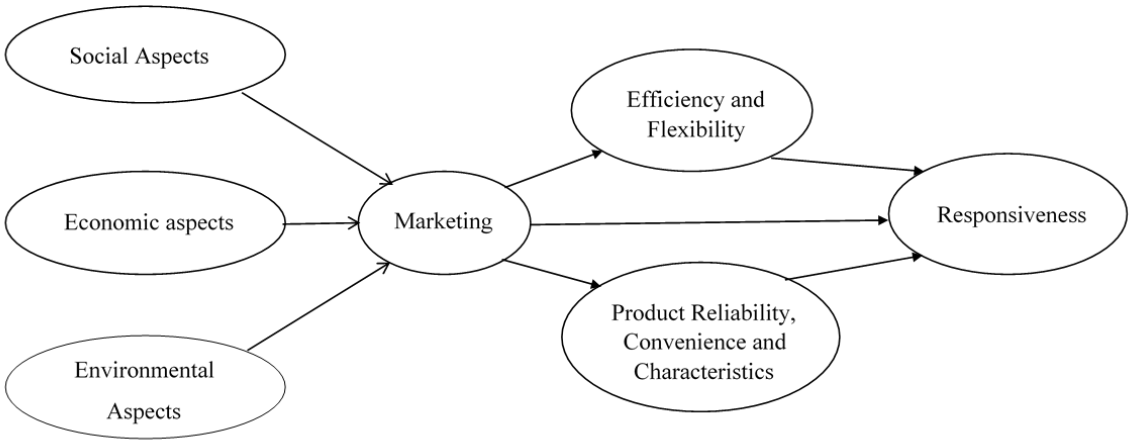

Figure 7.1: model development

RO5: Designing the data analysis process in statistical software

In order to analyze data, SPSS and Amos software were used, and the process of data analysis in this two software is as follows.
SPSS software:
- Descriptive Statistics
- Sample size adequacy test and Barnett
- Checking the normality with the Kolmogorov-Smirnov test
- Linear relationships of variables

Amos software
- Measurement model fit
- Examining the conditions of measurement equations
- Checking the validity and reliability of the structure
- Structural model fit
- Mediating variable analysis

RQ3. What recommendations can be made to improve sustainability in the supply chain of agricultural and food products in Italy?

RO1: Investigating the type of relationship between the factors of achieving sustainability dimensions in the supply of agricultural and food products.

In order to check the type of relationship between variables, hypothesis testing and path analysis between variables were used. The results were as follows:

variables	Hypothesis	variables	β	Hypothesis status
Marketing	<---	Social Aspects	.458	confirmed
Marketing	<---	Economic Aspects	.140	rejected
Marketing	<---	Environmental Aspects	.230	confirmed
Efficiency Flexibility	<---	Marketing	.328	confirmed
Product Reliability Convenience Characteristics	<---	Marketing	.274	confirmed
Responsiveness	<---	Efficiency Flexibility	-.015	rejected
Responsiveness	<---	Product Reliability Convenience Characteristics	.247	confirmed
Responsiveness	<---	Marketing	.384	confirmed

Table 7.2: Standard path coefficients of research hypotheses

Table 31.

Also, the results of examining the mediating variables with Baron and Kenny's model are as follows:

• Because the path between the marketing variable and responsiveness is significant without intermediate variables and the path between the marketing variable and responsiveness is significant with the presence of intermediate variables, the path between the marketing variable and efficiency and flexibility is significant and the path between the efficiency variable and flexibility and responsiveness is non-significant Is. As a result, efficiency and flexibility variables do not have a mediating role between marketing variables and responsiveness.

• The path between marketing variable and responsiveness is significant without mediating variables and the path between marketing variable and responsiveness is significant with the presence of mediating variables, the path between marketing variable and reliability, convenience and product features is significant and the path between reliability, convenience and Product features and responsiveness are also significant. As a result, the variable of reliability, convenience and product features has a partial mediating role between marketing variables and responsiveness.

RO2: Providing solutions to improve sustainability in agricultural and food products by considering the intensity of the relationship between factors

Positive relationship between social aspects and marketing

Due to the positive and significant relationship between the variables of social aspects and marketing, the following suggestions are presented. It should be mentioned due to the importance of indicators q23, q24 and q26 (availability of necessary agricultural inputs and equipment, preservation and protection of people's health and integrated pest management technologies) considering R^2 values according to Table 10-6 The previous chapter offers the following suggestions for the index of social aspects.

- It is suggested that the needs of farmers for up-to-date agricultural equipment, such as integrated pest management technologies, should be investigated by the management department of each district in Italy, and financial resources should be provided so that farmers are forced to do Substitute and non-standard measures should not be used in different stages of agriculture to produce agricultural products with lower quality than the standard level.

- It is suggested that before the marketing process of the products, all the products should be checked in terms of quality and health in the laboratories as well as the cold storages, so that the high-quality product is available to the customers. Considering product quality approval labels on products approved by relevant authorities and knowing the type of standardization labels for people and manufacturers can largely prevent poor quality products from being presented to people.

Positive relationship between environmental aspects and marketing

In environmental aspects, the most important indicators by examining the R^2 criterion are the reduction of greenhouse gas emissions in the production of any agricultural product, recycling/reuse and sustainable use of soil resources.

- Recent research shows that agriculture and the creation of mass production systems cause severe changes in the physical and chemical structure of the soil and disrupt the relationships between microorganisms and plants. Soil erosion due to the increase in crop production is one of the main problems of the agricultural sector. Also, the use of industrial machinery in mass production of agricultural products can increase air pollution and bring air pollution in addition to soil pollution problems.

- Another common agricultural problem is the excessive use of chemicals such as fertilizers and chemical pesticides, which has caused many problems in the economic, agricultural and environmental fields. The use of pesticides and chemical fertilizers is increasing in developing countries. Pollution of surface and underground water by water-soluble fertilizers and pesticides creates major problems for humans and the environment, and unfortunately, the government does not adopt the necessary policies to combat these problems and create a plan to solve the problems. have not been.

The only way to deal with such problems is to promote organic agriculture using agricultural equipment based on organic agriculture. Organic agriculture can help to solve the created problems to a great extent by producing products in line with the protection of the environment. The use of appropriate agricultural systems leads to the production of quality products and increased production efficiency. Pest management, genetic resistance to pests and environmental stresses and increasing biological activities of nitrogen and phosphorus fixation are among the conflict resolution methods.

Organic agriculture creates sustainable agricultural development and uses fertilizers and pesticides to produce healthy products in line with the environment.

In organic farming, water is not polluted with chemicals such as artificial fertilizers.

Farmers are exposed to less toxins and pollutants.

In organic agriculture, ecosystem balance and soil fertility are maintained. Soil erosion is also reduced by 50% and finally biodiversity is preserved as much as possible. Also, the organic nature of the products has created trust in the customers and facilitates the marketing of agricultural products to a great extent. This is a big step in achieving a sustainable supply chain.

• Positive relationship between marketing and responsiveness

More effective indicators for the marketing variable have been determined by examining the R^2 index, reverse logistics and handling complaints. Since the marketing of agricultural products has made a positive impact in responding to the needs of customers, as a result, answering the questions and complaints of customers should also be included in the program of farmers and officials. Due to the perishable nature of agricultural products and the specific lifespan of some products, different distribution and marketing policies should be considered for products with a longer lifespan. In case of possible spoilage of products, return policies such as transferring products to paste, compote, canned fruit juice production factories, etc. should be taken into account so as not to cause loss to farmers and fresh products are always available to customers. By forming a returnable supply chain and determining the useful life for products in product standardization labels, it is possible to manage the flow cycle of products in this sustainable supply chain and respond to people's needs in the best way.

• Partial mediating relationship of reliability, convenience and product attributes between marketing indicators and responsiveness

Influential indicators for reliability, comfort and product features variables have been determined by considering the R^2 index of product and packaging safety and health variables. One of the most important factors in marketing is advertising. And recently, packaging has also become one of the powerful elements of marketing and sales. Some say that the role of packaging in marketing and sales is more prominent than the role of advertising, because it has a significant impact on attracting customer attention. Some also say that the goal of marketing is much higher and they consider only advertising as important. Packaging not only affects customer attraction, but also has other benefits. In fact, it can be said that packaging is effective in the following cases:

- Packaging affects product protection. Because all the contents are placed inside the package and damage to it is prevented. Since agricultural products are sensitive to pressure and impact, as a result, a suitable packaging can be more responsive to customer needs and bring a sense of trust in customers regarding the health of the product purchased by them. This will create stability in the sales department and provide products to customers.
- The presence of suitable packages makes it easy for customers to carry the product and prevent damage to the contents during transportation. Because a large part of the customers enter the stores on foot and without vehicles, and during the way back home, they certainly use public transportation, as a result of using a standard packaging that conforms to the health factors of the product. It can bring customer satisfaction and sustainable distribution system in the created chain.
- Apart from the above, you can communicate with customers through packaging.

7.3 research limitations

According to the objectives and nature of the present research, the research results cannot be generalized to other researches.

The limitation of distributing the questionnaire in a certain place among people and the problems in identifying people and delivering the questionnaire to the desired community.

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Appendix:

Appendix N1. Questionnaire

1.What is your age?

☐ Less than 40
☐ Between 40 – 60
☐ Older than 60

2.What is the total area of your agriculture land? (per hectares)

☐ Less than a hectare
☐ Between 2- 5 hectares
☐ Between 5-10 hectares
☐ More than 10 hectars

3.How many farmers work on your agricultural land at the same time ?

☐ Less that 5 person
☐ Between 6-10 person
☐ More than 10 person

4.How many years have you been continuously planting crops in this agricultural land?

☐ Less than 5 years
☐ Between 6 to 10 years
☐ More than 10 years
☐ Type option 4

5.How would you rate your production cost?

Poor	Fair	Neutral	Good	Exceptional
○	○	○	○	○

6.How would you rate your transaction cost?

Poor	Fair	Neutral	Good	Exceptional
○	○	○	○	○

7.How would you rate your distribution cost?

Poor	Fair	Neutral	Good	Exceptional
○	○	○	○	○

8.How would you rate your return on investment?

Poor	Fair	Neutral	Good	Exceptional
○	○	○	○	○

9.How would you rate your inventory management?

Poor	Fair	Neutral	Good	Exceptional
○	○	○	○	○

10.How would you rate your disposal cost?

Poor Fair Neutral Good Exceptional

11.How would you rate your recycling cost?

Poor Fair Neutral Good Exceptional

12.How important is product quality for you?

Not important Somewhat important Neutral Important Very important

13.Which type of packaging are you using for your products?

Jute or calico sacks Plastic or polythene bags Cardboard boxes and trays Biodegradable packaging

14.How would you rate your delivery and transport system?

Poor Fair Neutral Good Exceptional

15.How would you rate your irrigation management?

Poor Fair Neutral Good Exceptional

16.How would you rate the amount of greenhouse gas emissions regarding your production process?

Poor Fair Neutral Good Exceptional

17.How important is recycling for you?

Not important Somewhat important Neutral Important Very important

18.How often do you use chemical fertilizers?

Never Rarely Sometimes Always Often

19.Which type of cultivation pattern are you using?

Shifting cultivation | Terrace farming | Horticulture | Commercial farming | Mixed farming

20. How important is the sustainable use of soil resources for you?

Not important | Somewhat important | Neutral | Important | Very important

21. How important is the amount of water used (per hectare) for you?

Not important | Somewhat important | Neutral | Important | Very important

22. How would you rate your energy consumption during production?

Very low | Low | Moderate | High | Extremely high

23. How often did you use pesticides?

Never | Rarely | Sometimes | Always | Often

24. How would you rate your interaction with customers and their expectation and needs?

Poor | Fair | Neutral | Good | Exceptional

25. How would you rate your reverse logistics?

Poor | Fair | Neutral | Good | Exceptional

26. How would you rate your complaint redressal?

Poor | Fair | Neutral | Good | Exceptional

27. How would you rate the availability of necessary input and equipment for your production?

Poor | Fair | Neutral | Good | Exceptional

28. How would you agree or disagree with the following statement: "we consider people's health in our product" .

Completely disagree	Disagree	Neutral	Agree	Strongly agree
○	○	○	○	○

29. How important is it to have expert workers in your production?

Not important	Somewhat important	Neutral	Important	Extremely important
○	○	○	○	○

30. Which type of pest management system are you using for your production?

Trap crops	Water sprays and irrigation	Frightening devices (human or predator effigies)	Heat treatment	Pruning and raking
○	○	○	○	○

31. How important is average transportation distance for the key resources for you?

Not important	Somewhat important	Neutral	Important	Very important
○	○	○	○	○

32. How would you rate your income from production?

Poor	Fair	Neutral	Good	Exceptional
○	○	○	○	○

33. How would you rate your product yield level (per hectare)?

Poor	Fair	Neutral	Good	Exceptional
○	○	○	○	○

34. How often did you use renewable energy sources?

Never	Rarely	Sometimes	Always	Often
○	○	○	○	○

35. How would you rate your customer response time ?

Poor	Fair	Neutral	Good	Exceptional
○	○	○	○	○

36. How would you rate your delivery flexibility ?

	Poor	Fair	Neutral	Good	Exceptional
Responsiveness	○	○	○	○	○

Appendix N2. Semi-structured interview

1. What is your impression about Italy's domestic and global agri-food supply chains? How are those doing in recent years, i.e., pre-Covid and post-Covid situations?

2. Italy's agri-food supply chains should have certain key drivers and barriers. What are those and how do you see those?

3. What is your view about Italy's agri-food supply chain networks' sustainability standards? Do Italy's agri-food supply chain networks comply the domestic and global sustainability standards? (Here, "sustainability" refers to environmental, social, and economic standards of agri-food production.)

4. Italy's sustainable agri-food supply chain networks are driven by certain factors. What are the factors that help drive the supply chain networks? How do you see these factors?

5. Do you think that Italy's agri-food supply chains can become more robust for achieving sustainability? What are your recommendations for future growth?