Environmental Uncertainties and Competitive Advantage: A Sequential Mediation Model of Supply Chain Integration and Supply Chain Agility

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Abstract: In this study, the direct effect of environmental uncertainty on competitive advantage and its indirect effect through the sequential mediator variables of supply chain integration and supply chain agility were investigated. The sample of the study consists of company managers operating in the manufacturing sector in Turkey. An online survey was sent to company managers through connections established on LinkedIn and an analysis was carried out with the data collected from 414 participants. As a result of the analysis, it has been determined that environmental uncertainty has a direct, significant and positive effect on competitive advantage. In addition, the results of the research show that supply chain integration and supply chain agility have a partial mediating role in the relationship between environmental uncertainty and competitive advantage. According to the results of this study, in conditions of high environmental uncertainty, companies can increase their supply chain agility capabilities by establishing a more integrated structure with their supply chain partners, and thus gain a unique competitive advantage over their competitors. It has been observed that the relationships between the concepts, which are the subject of the study, have been investigated separately in different studies in the literature. This study will contribute to the literature by investigating the relationships between concepts in a holistic way.

Keywords: environmental uncertainties; supply chain integration; supply chain agility; competitive advantage; sequential mediation

1. Introduction

The change and development experienced in the last few decades closely affect the business world [1]. With the widespread use of information and communication technologies, the demands of customers, who have become less loyal and more sophisticated, are increasing and thus, product life cycles are shortening [2–4]. With the use of different transportation vehicles, product distribution costs decrease and competition becomes more challenging. Today, in an environment characterized by the concepts of volatility, uncertainty, complexity and ambiguity (VUCA), companies experience that their competitiveness is only possible by applying different and innovative strategies [5,6]. Although concepts such as volatility and complexity are accepted within the definition of the VUCA environment, they are causes of uncertainty with different factors according to transaction cost theory [7]. Competition has now moved from the level of companies to the level of supply chains. The need for internationalization in the production and marketing of the product also increases the complexity of supply chains. The global crisis of COVID-19, which has occupied the world agenda since December 2019, has once again revealed the importance of supply chains and forced companies to be careful and ready for environmental uncertainties. Considering that companies act within supply chains rather than...
being autonomous organizations [8], effectively-managed supply chains are considered an important source of competitive advantage ensuring the survival of companies [9,10].

With the supply chain management approach, companies have started to see their customers and suppliers as their partners by getting rid of the traditional perspective [11]. Due to the collaborative network structure of the supply chain approach, where the mutual benefits of the members are tried to be maximized, suppliers, manufacturers and customers tend to integrate interconnected businesses [12]. In a business environment where uncertainty, environmental complexity and dynamics are constantly changing [13], companies increase the level of integration with their supply chain partners to minimize risks [14]. The problem of information sharing, which is considered one of the reasons for environmental uncertainty, can be eliminated with the integration to be established between supply chain members, and companies can have more realistic information regarding market conditions, technological developments and resource availability [15]. The resource-based view argues that companies can gain a competitive advantage if they have rare, valuable, inimitable and nonsubstitutable resources [16]. These resources can be tangible or intangible. In addition, these resources can be found within the company as well as in the supply chains of the companies [17]. The relational view emphasizes that supply chain integration is a strategic intangible resource [18]. According to the relational view, agility is also seen as an important resource for companies and is evaluated within supply chain management [19]. Agility is the most suitable supply chain paradigm for market conditions where demand and supply uncertainty are high [20]. However, agile supply chains are only possible with strong cooperation and communication between supply chain members. In this respect, it can be stated that supply chain integration contributes to the creation of agile supply chains with its tools. Thus, it is assumed that in situations where environmental uncertainty is high, companies can gain a competitive advantage by reaching supply chain agility through supply chain integration.

Although there are studies in the literature in which environmental uncertainty [3,14,21,22], supply chain integration [23–26] and supply chain agility [1,5,27–29] are discussed separately or in pairs, no study has been found in which all of them are discussed together. This study will contribute to the literature by considering the relationship between environmental uncertainty, supply chain integration, supply chain agility and competitive advantage from a holistic perspective. This paper consists of five sections including the introduction. In Section 2, the concepts are introduced and the hypotheses of the research are explained. In Section 3, the methodology of the research is described, and data analyses are provided. In Section 4, the findings are evaluated and the theoretical and managerial implications of the study are discussed. Finally, in Section 5, the study is concluded with limitations and possible directions for future research.

2. Theories and Hypotheses

2.1. Environmental Uncertainties

There are two different approaches to environmental factors. The first is the company’s dependence on environmental factors in order to continue its activities and, more importantly, to remain competitive [30]. The second is the effect of environmental uncertainty on decision-making mechanisms [31]. Uncertainty is defined as the perceived inability to predict something to be predicted [32]. Williamson [33,34] divides uncertainty into three classes: (1) environmental/external uncertainty, (2) organizational/internal uncertainty and (3) strategic uncertainty. Internal uncertainty is defined as the lack of communication between decision makers and strategic uncertainty is the uncertainty in relations with suppliers and customers due to information hiding or distorting [34]. Environmental uncertainty, on the other hand, is the inability to predict the success or failure of decision-making units due to environmental factors [35]. External causes where the firm cannot intervene directly are considered environmental factors within the scope of contingency theory [14]. Internal and external (environmental) causes play a role in the formation of uncertainty. Duncan [13] focuses on the environmental causes of uncertainty and points
out customers, suppliers, competitors, socio-political factors and technology as external sources of uncertainty. The environmental uncertainty elements that directly interact with and affect the ability [15] of companies to achieve their goals are seen as demand, supply and technology [5,36]. Contrary to the closed system approach where uncertainty is rejected, the open system approach states that uncertainty exists and companies cannot overcome uncertainty only by following internally-applied rational steps [37]. In highly volatile markets, companies should develop closer relationships with supply chain members [38]. Wong [39] states in their study on the Thai automotive sector that companies tend to have high integration when faced with high environmental uncertainty (supply, demand and technology). Xu et al. [40] examine the relationship between environmental uncertainty factors (demand, supply and technology) and the three components of supply chain integration (supplier, customer and internal) and reveal that environmental uncertainty factors have significant but different effects on the components of supply chain integration. Paulraj [41] while examining environmental uncertainty within the context of a resource-based approach, points out that the increased level of uncertainty will lead to greater interdependence among supply chain partners. Based on the studies mentioned above, the following hypothesis is proposed.

**Hypothesis 1 (H1).** Environmental uncertainty is positively related to supply chain integration.

In environments where uncertainty prevails and constantly changes, businesses need to be able to respond quickly to changes, and the ability to respond to these changes within expected timeframes is called agility [42]. In this context, environmental uncertainty necessitates agility. Because the higher the degree of turbulence in the business environment, the higher the agility that is required, environmental uncertainty has been evaluated as a driver of the need to develop agile manufacturing capabilities [43–45]. Gligor [46] argues that as the level of environmental uncertainty increases, it will become increasingly difficult to match supply and demand, and the negative effects of high uncertainty can only be reduced by supply chain agility. Prater et al. [42] characterize speed and flexibility as two concepts inherent in agility. They also argue that flexibility is a typical response to uncertainty [42]. Inman and Green [22] find that there is a significant positive relationship between environmental uncertainty and agile production in their study with production managers from 136 manufacturing enterprises in the USA. Güner et al. [47] also conclude in their study that technological uncertainty positively affects supply chain agility. In addition to these studies, Rasi et al. [35] do not detect a direct effect of environmental uncertainty on supply chain agility, but they reveal that there is an indirect effect through supply chain orientation and market orientation. Based on the studies mentioned above, the following hypothesis is proposed.

**Hypothesis 2 (H2).** Environmental uncertainty is positively related to supply chain agility.

Environmental uncertainty presents opportunities as well as threats to companies that must neutralize threats and take advantage of opportunities in order to maintain their competitive position [48]. While the prevailing view is on the created risks posed by uncertainty, López-Gamero et al. [49] state that it can offer advantages to companies, such as identifying competitive opportunities, making new investments and benefiting from innovative approaches. Although there are not many studies in the literature on the effect of environmental uncertainty on competitive advantage, various indirect or direct relationships have been identified between these two variables. Qi et al. [44] find that environmental uncertainty has a moderating role in the relationship between supply chain strategies and competitive strategies. Although Karagozoglu [50] cannot detect a direct and significant relationship between environmental uncertainty and competitive advantage, it has been determined that environmental uncertainty, together with the mediating role of technology-strategic planning integration, affect the competitive advantage of the companies both directly and indirectly. Zhang et al. [51] conceptually reveal the mediating role of
value chain flexibility in the relationship between environmental uncertainty and competitive advantage on the basis of competence and capability theories. O’Sullivanassy [52] states that perceived environmental uncertainty can act as a catalyst to help the company gain a competitive advantage. Finally, Liao and Hu [53] assume that environmental uncertainty would have a negative effect on competitive advantage, but they could not reach a conclusion supporting this negative effect. Lee et al. [54] examine competitive advantage in terms of differentiation and cost advantages, as often expressed in the literature, and hypothesize that environmental uncertainty has an effect on differentiation and cost advantages. Based on the studies mentioned above, the following hypothesis is proposed.

**Hypothesis 3 (H3).** Environmental uncertainty is positively related to competitive advantage.

### 2.2. Supply Chain Integration

The importance of supply chain integration has been unquestionably accepted in the literature over the last decade [55]. Supply chain integration has been discussed in various studies as the integration of cross-functional processes [56,57], suppliers [58–61], customers [62–64] and all supply chain partners forward and backward [5,26,65]. The Association for Supply Chain Management states that supply chain integration will occur “when there is interaction between supply chain partners at all levels to maximize mutual benefit.” [66]. Stevens and Johnson [67] also define supply chain integration as the cooperation of all partners in the supply chain on material, information, money and strategy flow in order to meet customer needs. Although some of the studies have focused on one or more of the supply chain partners, it is generally accepted that the inclusion of all supply chain partners in the integration increases the supply chain performance. Therefore, in this study, all partners of the supply chain, from suppliers to customers, are included in the scope of supply chain integration. The ability to establish win-win relationships with supply chain partners in VUCA environmental conditions is recognized as an important component of supply chain agility [5,68]. It has been stated by Shukor et al. [5] that supply chain integration has a positive effect on supply chain agility, especially under environmental uncertainty conditions. In his review to identify the factors affecting supply chain agility, Gligor [69] states that demand and supply integration play an important role in achieving supply chain agility. Likewise, Abdelilah et al. [19] also confirm that external integration leads to higher agility. According to this study, supplier and customer relations increase the reconfigurability of the chain in terms of flexibility and responsiveness by facilitating communication and cooperation between the elements of the supply chain. Ngai et al. [70], in their research using the case study method, reveal that there is a strong relationship between supply chain integration and supply chain agility in large-scale companies. In a study in which a food company operating in China was selected as the case, Deng Xu and Long [71] show supply chain agility as one of the internal drivers of supply chain integration. Fayezi and Zomorrodi [72] state that relationship integration (both supplier and customer) is one of the important factors affecting supply chain agility in their study based on qualitative data analysis with semi-structured interviews in the Australian manufacturing sector. Based on the above evaluations and related studies, the following hypothesis is proposed.

**Hypothesis 4 (H4).** Supply chain integration is positively related to supply chain agility.

Supply chain partners have to be more integrated with tough competitive conditions where customer demands are changing day by day. Because integrated supply chains have a more advanced process and distribution efficiency than those that cannot effectively integrate their supply chain partners, they also have a cost advantage [73,74]. Morash and Clinton [75] state that a strategy focused on cost advantage requires an operationally perfect supply chain, and a differentiation strategy requires closer collaboration with customers and supply chain partners. Apart from the functional benefits of supply chain
integration, it is expected to be an application that provides a competitive advantage for businesses due to its nature which is difficult to imitate [76]. As a matter of fact, Sukati et al. [77] find that there is a significant relationship between each of the three sub-dimensions of supply chain integration—internal integration, customer and supplier integrations—and competitive advantage. Likewise, Du [78] states in his case study that supply chain integration plays an important role in achieving competitive advantage. Hosseini and Sheikhi [79] examine competitive advantage with two factors—cost leadership and differentiation—in their empirical study on the Iranian food industry and concluded that supply chain integration has a significant and positive effect on cost leadership and differentiation. Finally, Sinaga et al. [80] find that supply chain integration positively affects competitive advantage in their empirical study of the Indonesian manufacturing sector. Based on the above evaluations and related studies, the following hypothesis is proposed.

**Hypothesis 5 (H5). Supply chain integration is positively related to competitive advantage.**

### 2.3. Supply Chain Agility

There is an increasing interest in the literature on supply chain agility, which leads to a clearer understanding of the importance of the subject [81]. Agility is an umbrella term covering a set of approaches and practices that companies must adopt in order to gain a competitive advantage in global markets [82]. Koç [83], in his study examining different approaches to agility, states that agility is not an activity that departments within the company can perform separately. Power et al. [84] suggest a more holistic approach, stating that all departments, even the company’s supply chain partners, should contribute to agility. For this reason, companies will be able to reach a level of agility that the company could not achieve with their limited resources, in harmony and coordination with all supply chain partners, from suppliers to customers [85,86]. Supply chain agility is a key success factor to cope with market instability and competitive pressures in the ever-changing business environment [87,88]. Almahamid et al. [89] conclude that agile capabilities have a significant impact on competitive advantage, as a result of the analysis they conducted with the data they collected from 112 senior managers in the Jordanian manufacturing industry. Zhang and Sharifi [45] evaluate agility as a production paradigm, as a strategy to ensure that today’s manufacturing enterprises maintain their competitive advantages. In the research on the electronics industry in Taiwan, Wu et al. [90] find that competitive advantage in rapidly changing competitive markets is related to supply chain agility. Alfalla-Luque et al. [91] examine competitive advantage in five dimensions (cost, quality, delivery, flexibility and finance) and find a significant relationship between supply chain agility and its two sub-dimensions, including flexibility and finance. Again, Chen [28], in his study on manufacturing enterprises in Taiwan, finds that one of the important sources of competitive advantage is supply chain agility. Based on the above evaluations and related studies, the following hypothesis is proposed.

**Hypothesis 6 (H6). Supply chain agility is positively related to competitive advantage.**

### 2.4. Sequential Mediation

It is considered necessary to scan and evaluate the environment in which organizations operate, adapt organizational strategies according to constantly evolving conditions and make appropriate decisions [92]. As the struggle against the uncertainties in the business environment is accepted as one of the main problems of organizations [37] and the determination of these uncertainties is only possible with these scanning and evaluation activities, the elements of the environment in which the activities are carried out and the sources of environmental uncertainty have a large place in the literature. Environmental uncertainty has been formulated by Duncan [13] as the lack of information regarding environmental factors in decision processes, the inability to predict the size of the cost that will be incurred if the result of the decision is wrong and the inability to reveal probabilities with any degree
of confidence regarding how environmental factors will affect the success or failure of the decision unit.

In such uncertain environments, decisions that are in the light of the managers’ environmental perceptions and available information play an important role in the success or failure of organizations [14]. Although the success of businesses can be evaluated depending on many different factors, the main goal that businesses want to achieve is to gain a competitive advantage [80,93], as competitive advantage is a prerequisite for achieving long-term results, such as relatively better financial results and market share for the company and more value for consumers and stakeholders [94]. Barney [16] argues that businesses will gain a competitive advantage when they can implement a value-creating strategy that their current or potential competitors cannot implement simultaneously with the business. The unique competencies of a business give that business an advantage that its competitors cannot achieve, and when these competencies overlap with critical success factors in competition, a competitive advantage emerges [95]. Competitive advantage can be achieved through various factors such as high quality, advanced technology, rapid response to changes and needs in the market and product and service differentiation; however, the sustainability of this advantage is only possible when it is achieved through competencies that are difficult to imitate [28].

The relational view, which is an extension of the resource-based approach, assumes that businesses can obtain valuable resources that they do not own or whose cost of ownership is higher than the benefit they will obtain, by utilizing inter-organizational integration and strategic partnerships [96]. Inter-business integration is also generally considered as a structure in which the total supply chain benefits increase and all members of the supply chain gain due to the use of proprietary assets, skills and information that are hard to imitate [18,96]. In addition, it is stated in many studies that many production-related problems arise from the lack of effective internal and external supply chain integration [39,97–99]. Integration efforts to overcome such problems result in increased interactions between companies in the supply chain, requiring closer relationships to ensure that product, information and payment flow work efficiently [73,100].

Another important phenomenon in today’s business world is the constant change in the markets and the resulting unpredictability. Businesses that are successful in environments where such rapid changes and unpredictable situations are experienced are those that can keep up with the changing market conditions and remain competitive [101]. At this point, it has been determined that businesses with supply chain agility can also achieve higher levels of organizational agility. It is argued that companies with supply chain agility and higher organizational agility respond more quickly and more effectively to market fluctuations and other uncertainties, which contributes significantly to the a company’s superior competitive position [102]. Prater et al. [42] define supply chain agility as the combination of the individual speed and flexibility of the three components of the supply chain: sourcing, production and delivery. Accordingly, it has been stated that as the speed and flexibility of sourcing, production and delivery components increase, the supply chain agility of the companies also increases.

Hypothesis 7 (H7). Supply chain integration mediates the relation between environmental uncertainties and competitive advantage.

Hypothesis 8 (H8). Supply chain agility mediates the relation between environmental uncertainties and competitive advantage.

Hypothesis 9 (H9). There will be sequential mediation from environmental uncertainties to competitive advantage through supply chain integration and supply chain agility.
3. Methodology

3.1. Research Design

3.1.1. Measurement Items

In the study, the relationships between environmental uncertainty, supply chain integration, supply chain agility and competitive advantage were examined. The relationships between the research constructs are shown in Figure 1. The items used to measure environmental uncertainty were obtained from the study of Sreedevi and Saranga [103]. The items for supply chain integration, another construct used in the study, were adapted from Ramirez et al. [104]. The items for supply chain agility and competitive advantage constructs were derived from Chen [28]. The answers given to all the items related to the structures were asked from 1 strongly disagree to 5 strongly agree and were measured on a 5-point Likert scale. The adapted items were first translated into Turkish by three academics working in the field of supply chains, including the author. Subsequently, the items translated into Turkish were translated into the original language by two academics, one of whom was an expert in English language literature. After the reverse (back) translation, the controls were carried out and the necessary adjustments were made.

![Figure 1. Conceptual model of the sequential mediation.](image)

3.1.2. Data Collection

Businesses operating in the manufacturing sector in Turkey constituted the population of this study. In the study, the survey method, one of the quantitative research methods, was preferred, and online questionnaires were sent to the participants, taking into account the COVID-19 pandemic conditions. Potential participants with a position in the target group of the study were randomly determined from the search tab of LinkedIn, an online platform where professionals are members, thus ensuring that the online survey was sent only to people related to the field of study. By establishing 1429 new contacts, a piece of short descriptive information regarding the study with these people and an online survey link was shared. After the data collection process was carried out between November 2021 and February 2022, responses were received from 414 participants. Since each question was defined as mandatory, there was no missing value. Considering the number of answered questionnaires, it was understood that the response rate was 28%.

3.1.3. Common Method Bias and Non-Response Bias

In order to avoid the common method bias problem, potential participants were briefed about the study. In this information, it was stated that there was no right or wrong answer to the questions given to the participants in order to ensure anonymity. Common method bias is problematic if most of the explained variance is explained by a single factor (construct) [105]. In the study, Harman’s one-factor test was used to determine the common method bias [106]. In this method, all the variables used in the study were loaded under a single non-rotated factor and the explained variance of this factor was taken into
consideration. Since the variance explained by a single factor was 37% and lower than 50%, which is defined as the threshold value, there is no common method bias problem in the study. In non-response bias, those who responded before the reminder was sent and those who responded after the reminder was sent were compared. Respondents after the reminder was sent were considered late responders [107] and were considered similar to non-responders [108]. The t-test was used to determine whether there was a significant difference between early responders and late responders. The results revealed that there was no significant difference between the two groups.

3.2. Data Analysis

3.2.1. Demographic Data

In the study, business scaling based on the Small and Medium Enterprises Development Organization for Turkey was used and all micro, small, medium and large enterprises were included in the scope of the study. The number of micro enterprises participating in the study was 54 (13%), the number of small-scale enterprises was 96 (23.2%), the number of medium-sized enterprises was 126 (30.4%) and the number of large-scale enterprises was 138 (33.3). Turkey has seven geographical regions and 202 (48.8%) companies participated in the research from the Marmara Region, where the manufacturing sector is the most concentrated. According to the Textile, Ready-to-Wear Clothing and Leather Products Sectors Report of the Republic of Turkey Ministry of Industry and Technology [109], the added value created by textile, ready-made clothing and leather products corresponded to 16.4% of the added value of the manufacturing industry and 5.4% of the total value added produced in the country. Among these three sub-sectors that create the most added value in Turkey, 139 (33.6) companies participated in the research. Other demographic data used in the study are presented in detail in Table 1.

Table 1. Demographic data.

<table>
<thead>
<tr>
<th>Employee Position</th>
<th>N</th>
<th>%</th>
<th>Position</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–9</td>
<td>54</td>
<td>13</td>
<td>Manufacturing Manager</td>
<td>215</td>
<td>51.9</td>
</tr>
<tr>
<td>10–49</td>
<td>96</td>
<td>23.2</td>
<td>Quality Control Manager</td>
<td>26</td>
<td>6.3</td>
</tr>
<tr>
<td>50–249</td>
<td>126</td>
<td>30.4</td>
<td>Chief Operating Officer</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>250 and above</td>
<td>138</td>
<td>33.3</td>
<td>Product Development Manager</td>
<td>19</td>
<td>4.6</td>
</tr>
<tr>
<td>Sector</td>
<td></td>
<td></td>
<td>Purchasing Manager</td>
<td>17</td>
<td>4.1</td>
</tr>
<tr>
<td>Food products</td>
<td>62</td>
<td>15</td>
<td>Supply Chain Manager</td>
<td>89</td>
<td>21.5</td>
</tr>
<tr>
<td>Beverages</td>
<td>5</td>
<td>1.2</td>
<td>Production Planning Manager</td>
<td>22</td>
<td>5.3</td>
</tr>
<tr>
<td>Tobacco products</td>
<td>2</td>
<td>0.5</td>
<td>Assistant General Manager</td>
<td>12</td>
<td>2.9</td>
</tr>
<tr>
<td>Textiles</td>
<td>116</td>
<td>28</td>
<td>General Manager</td>
<td>10</td>
<td>2.4</td>
</tr>
<tr>
<td>Wearing apparel</td>
<td>21</td>
<td>5.1</td>
<td>Mediterranean</td>
<td>23</td>
<td>5.6</td>
</tr>
<tr>
<td>Leather and related products</td>
<td>2</td>
<td>0.5</td>
<td>Aegean</td>
<td>42</td>
<td>10.1</td>
</tr>
<tr>
<td>Paper and paper products</td>
<td>9</td>
<td>2.2</td>
<td>Marmara</td>
<td>202</td>
<td>48.8</td>
</tr>
<tr>
<td>Chemicals and chemical products</td>
<td>22</td>
<td>5.3</td>
<td>Central Anatolia</td>
<td>65</td>
<td>15.7</td>
</tr>
<tr>
<td>Basic pharmaceutical products</td>
<td>14</td>
<td>3.4</td>
<td>Black Sea</td>
<td>11</td>
<td>2.7</td>
</tr>
<tr>
<td>Rubber and plastic products</td>
<td>12</td>
<td>2.9</td>
<td>East Anatolia</td>
<td>40</td>
<td>9.7</td>
</tr>
<tr>
<td>Other non-metallic mineral products</td>
<td>3</td>
<td>0.7</td>
<td>Southeastern Anatolia</td>
<td>31</td>
<td>7.5</td>
</tr>
<tr>
<td>Manufacture of basic metals</td>
<td>18</td>
<td>4.3</td>
<td>Source of raw material</td>
<td>93</td>
<td>22.5</td>
</tr>
<tr>
<td>Fabricated metal products</td>
<td>13</td>
<td>3.1</td>
<td>Domestic</td>
<td>85</td>
<td>20.5</td>
</tr>
<tr>
<td>Comp., electronic and optical products</td>
<td>2</td>
<td>0.5</td>
<td>Abroad</td>
<td>54</td>
<td>13</td>
</tr>
<tr>
<td>Electrical equipment</td>
<td>1</td>
<td>0.2</td>
<td>Both of them</td>
<td>275</td>
<td>66.4</td>
</tr>
<tr>
<td>Machinery and equipment</td>
<td>31</td>
<td>7.5</td>
<td>Both of them</td>
<td>294</td>
<td>71</td>
</tr>
<tr>
<td>Motor veh., trailers and semi-trailers</td>
<td>5</td>
<td>1.2</td>
<td>Market</td>
<td>85</td>
<td>20.5</td>
</tr>
<tr>
<td>Other transport equipment</td>
<td>2</td>
<td>0.5</td>
<td>Domestic</td>
<td>7</td>
<td>1.7</td>
</tr>
<tr>
<td>Furniture</td>
<td>7</td>
<td>1.7</td>
<td>Abroad</td>
<td>54</td>
<td>13</td>
</tr>
<tr>
<td>Other manufacturing</td>
<td>67</td>
<td>16.2</td>
<td>Both of them</td>
<td>275</td>
<td>66.4</td>
</tr>
</tbody>
</table>
3.2.2. Measurement Model Results

For the reliability of the structures, Cronbach alpha and composite reliability values were examined. Table 2 shows that the Cronbach alpha values of the structures are between 0.826 and 0.894, and the composite reliability values are between 0.84 and 0.89. When the obtained values are examined, it can be said that the structures are reliable [110]. In the next step, convergent and discriminant validity analyses of the constructs were performed. The AVE values of the constructs were examined for convergent validity. It can be said that the constructs have convergent validity since they have AVE values ranging from 0.51–0.63 and are above the reference value of 0.5 [111]. Instead of the Fornell–Larcker criterion or the cross-loading approach, a newer method, the heterotrait–monotrait ratio of correlations, was used to test the discriminant validity [112]. Since the HTMT values presented in Table 3 are smaller than the generally accepted value of 0.85, the structures have discriminant validity [113].

Table 2. Assessment results of the measurement model.

<table>
<thead>
<tr>
<th>Construct</th>
<th>Loadings</th>
<th>t Value</th>
<th>AVE</th>
<th>CR</th>
<th>CA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Environmental Uncertainties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Demand fluctuates drastically from week to week</td>
<td>0.76</td>
<td>17.68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total manufacturing volume fluctuates drastically from week to week</td>
<td>0.86</td>
<td>21.21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mix of products you produce changes drastically from week to week</td>
<td>0.87</td>
<td>21.60</td>
<td>0.59</td>
<td>0.89</td>
<td>0.894</td>
</tr>
<tr>
<td>Supply requirements (volume and mix) vary drastically from week to week</td>
<td>0.86</td>
<td>21.42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Products are characterized by a lot of technical modifications</td>
<td>0.49</td>
<td>10.16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suppliers frequently need to carry out modifications to the parts/components they deliver to your plant</td>
<td>0.70</td>
<td>15.86</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Supply Chain Integration</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The partners’ information is shared along the supply chain</td>
<td>0.60</td>
<td>12.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The problems or difficulties of the partners are promptly addressed through the exchange of information</td>
<td>0.76</td>
<td>17.36</td>
<td>0.57</td>
<td>0.84</td>
<td>0.826</td>
</tr>
<tr>
<td>The supply chain partners rely on communication plans</td>
<td>0.84</td>
<td>19.99</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The supply chain partners collaborate on the initiatives of new projects</td>
<td>0.81</td>
<td>18.68</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Supply Chain Agility</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed in reducing manufacturing lead time</td>
<td>0.71</td>
<td>16.95</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed in reducing product development cycle time</td>
<td>0.78</td>
<td>18.03</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed in increasing frequency of new product introductions</td>
<td>0.74</td>
<td>16.79</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed in increasing levels of product customization</td>
<td>0.63</td>
<td>13.44</td>
<td>0.51</td>
<td>0.86</td>
<td>0.856</td>
</tr>
<tr>
<td>Speed in adjusting delivery capability</td>
<td>0.70</td>
<td>15.62</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speed in improving responsiveness to changing market needs</td>
<td>0.72</td>
<td>16.16</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Competitive Advantage</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compared with our competitors, we offer unique benefits and novel features to our customers</td>
<td>0.73</td>
<td>16.69</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compared with our competitors, we offer high-quality products to our customers</td>
<td>0.77</td>
<td>18.06</td>
<td>0.63</td>
<td>0.89</td>
<td>0.893</td>
</tr>
<tr>
<td>Compared with our competitors, we provide dependable delivery</td>
<td>0.80</td>
<td>19.19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compared with our competitors, we provide customized products</td>
<td>0.87</td>
<td>21.73</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Compared with our competitors, we deliver products to the market quickly</td>
<td>0.81</td>
<td>19.26</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. HTMT results.

<table>
<thead>
<tr>
<th>Construct</th>
<th>CA</th>
<th>EU</th>
<th>SCA</th>
<th>SCI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Competitive Advantage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental Uncertainties</td>
<td>0.316</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Chain Agility</td>
<td>0.734</td>
<td>0.373</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supply Chain Integration</td>
<td>0.532</td>
<td>0.477</td>
<td>0.583</td>
<td></td>
</tr>
</tbody>
</table>
As a result of the confirmatory factor analysis of the measurement model, item loads and t values are shown in Table 2. In confirmatory factor analysis, item loads are required to be above 0.5 [110]. It is seen that only the EU5 item has a 0.49 item load in the measurement model, but when the t value of the related item was examined, it was found to be significant at the \( p < 0.01 \) level, so the item was not removed from the measurement model. In the next step, the fit indices of the model were examined. Within the scope of fit indices, goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), normed fit index (NFI), comparative fit index (CFI), root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR) values were examined. GFI, AGFI, NFI and CFI indices take values between 0 and 1, and values close to 1 are considered to be a good fit [114]. However, the RMSEA value should not exceed 0.1. The generally accepted approach is that models with RMSEA and SRMR values below 0.08 have an acceptable estimation error [115]. When the fit indices of the model are examined, it can be said that the model has a sufficient fit with the values of RMSEA: 0.067, SRMR: 0.073, NFI: 0.96, CFI: 0.97, AGFI: 0.86 and Chi-square/df: 2.84.

3.2.3. Structural Model Analysis

According to Baron and Kenny [116], some prerequisites must be met in order to test the mediation effect. The independent variable should have a significant effect on the dependent variable and the mediating variable, and the mediating variable should have a significant effect on the dependent variable. In this context, research hypotheses were formed and tested. Each research hypothesis was evaluated by examining the path coefficients and t values between the structures. In the study, there were two mediating variables sequentially. As presented in Table 4, six hypotheses created within the scope of the study test the direct relationship between the structures. As a result of the study, it was found that environmental uncertainty has a significant effect on supply chain integration (0.490, \( p < 0.01 \)), supply chain agility (0.144, \( p < 0.05 \)) and competitive advantage (0.351, \( p < 0.01 \)); supply chain integration has a significant effect on supply chain agility (0.516, \( p < 0.01 \)) and competitive advantage (0.151, \( p < 0.05 \)); supply chain agility has a significant effect on competitive advantage (0.643, \( p < 0.01 \)). The path coefficients, t and p values, obtained were examined and the hypotheses H1, H2, H3, H4, H5 and H6, which tested the direct relationships between the structures, were supported. The mediating role of supply chain integration in the impact of environmental uncertainty on competitive advantage is tested with the H7 hypothesis. When the results obtained were examined (0.074, \( p < 0.05 \)), it had been determined that supply chain integration has a partial mediating effect on the relationship between environmental uncertainty and competitive advantage. The mediating role of supply chain agility in the impact of environmental uncertainty on competitive advantage was tested with the H8 hypothesis. When the results were analyzed (0.092, \( p < 0.05 \)), it had been determined that supply chain agility has a partial mediating effect on the relationship between environmental uncertainty and competitive advantage. The mediating role of supply chain integration and supply chain agility in the impact of environmental uncertainty on competitive advantage had been tested with the H9 hypothesis. When the results were analyzed (0.162, \( p < 0.01 \)), it had been determined that supply chain integration and supply chain agility have a partial mediating effect on the relationship between environmental uncertainty and competitive advantage. In addition, environmental uncertainty, supply chain integration and supply chain agility account for 0.557 R square in competitive advantage. This reveals that 55.7% of the change in competitive advantage is the result of environmental uncertainty, supply chain integration and supply chain agility. The structural model has RMSEA: 0.067 and SRMR: 0.073 and has a good enough fit.
Table 4. Results of hypothesized relationships.

<table>
<thead>
<tr>
<th>Hs</th>
<th>Hypothesized Path</th>
<th>Beta</th>
<th>t Value</th>
<th>p Value</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>Environmental Uncertainties → Supply Chain Integration</td>
<td>0.490</td>
<td>9.756</td>
<td>0.000</td>
<td>Supported</td>
</tr>
<tr>
<td>H2</td>
<td>Environmental Uncertainties → Supply Chain Agility</td>
<td>0.144</td>
<td>2.453</td>
<td>0.014</td>
<td>Supported</td>
</tr>
<tr>
<td>H3</td>
<td>Environmental Uncertainties → Competitive Advantage</td>
<td>0.351</td>
<td>7.865</td>
<td>0.000</td>
<td>Supported</td>
</tr>
<tr>
<td>H4</td>
<td>Supply Chain Integration → Supply Chain Agility</td>
<td>0.516</td>
<td>8.739</td>
<td>0.000</td>
<td>Supported</td>
</tr>
<tr>
<td>H5</td>
<td>Supply Chain Integration → Competitive Advantage</td>
<td>0.151</td>
<td>2.242</td>
<td>0.025</td>
<td>Supported</td>
</tr>
<tr>
<td>H6</td>
<td>Supply Chain Agility → Competitive Advantage</td>
<td>0.643</td>
<td>11.363</td>
<td>0.000</td>
<td>Supported</td>
</tr>
<tr>
<td>H7</td>
<td>Environmental Uncertainties → Supply Chain Integration</td>
<td>0.074</td>
<td>2.119</td>
<td>0.034</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>+ Competitive Advantage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H8</td>
<td>Environmental Uncertainties → Supply Chain Agility</td>
<td>0.092</td>
<td>2.305</td>
<td>0.021</td>
<td>Supported</td>
</tr>
<tr>
<td>H9</td>
<td>Environmental Uncertainties → Supply Chain Integration</td>
<td>0.162</td>
<td>5.589</td>
<td>0.000</td>
<td>Supported</td>
</tr>
<tr>
<td></td>
<td>+ Supply Chain Agility + Competitive Advantage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p < 0.01, ** p < 0.05.

4. Discussion
4.1. Theoretical Implications

In this study, it is empirically investigated how environmental uncertainty affects competitive advantage through supply chain integration and supply chain agility. The results show that the environmental uncertainty levels of the responding companies are moderate (mean = 3.30). The supply chain integration (mean = 4.01) and supply chain agility (mean = 4.25) levels are above medium. When the competitive advantage levels were examined (mean = 4.37), it was found to be high. In the literature, the effects of environmental uncertainty, supply chain integration and supply chain agility on competitive advantage have been examined separately. In this study, it is tried to contribute to the literature by testing a more holistic structure, taking into account the existence of relations between the structures.

As a result of the study, a significant and positive effect was found between environmental uncertainty and supply chain integration. This result is in line with the study of Wong et al. [14]. As assumed, high demand and supply uncertainties increase integration between supply chain partners. Environmental uncertainty, in addition to its contribution to the creation of coordination between supply chain partners, also prompts companies to act agile. In this context, the effect of environmental uncertainty on supply chain agility was examined within the scope of the study, and a significant and positive relationship was determined between the two variables. Tran [117] and Inman and Green [22] reached similar results with their studies. Dreyer [48] states that it is possible to gain a sustainable competitive advantage in environments where uncertainty is high. From an internal perspective, environmental uncertainty also changes the way managers think and enables them to evaluate environmental opportunities [49]. In the study, the effect of environmental uncertainty on creating competitive advantage was examined with another hypothesis and a significant and positive effect was found between the two concepts.

Abdelilah et al. [19] stated that the integration of companies with suppliers and customers increases operational visibility by minimizing external instability, and this has a positive effect on agility. Fayezi and Zomorrodi [72] stated that the integration of relationships with suppliers and customers is one of the important factors affecting supply chain agility. Similarly, the results of this study show that supply chain integration has a significant and positive effect on supply chain agility. By using demand, production time and stock information shared with suppliers, companies can make production plans on time [24] and match resource allocations with customer demands [118]. Thanks to customer integration, companies can benefit from embedded intelligence in collaborative processes to reduce costs, notice demand changes earlier and create more value [100]. Integration with supply chain partners is the result of long-term and personal relationships [119]. Therefore, they are difficult resources to be copied or obtained by other companies. With the
hypothesis created in this context, it has been concluded that supply chain integration has a significant and positive effect on competitive advantage. The result obtained is consistent with the studies in the literature [80,119,120]. Another variable that is assumed to have a direct impact on competitive advantage in the study is supply chain agility. Wu et al. [90] stated that companies can gain a competitive advantage only by improving supply chain agility to cope with intense competition and rapid change. Chen [28] stated that the supply chain agility created by each of the supply chain members will increase the competitive advantage of the company. When the results obtained are examined, it is understood that supply chain agility has a significant and positive effect on competitive advantage and this result is compatible with studies with similar hypotheses in the literature.

Environmental uncertainty is examined under three subheadings, namely supply, demand and technology uncertainty in studies on the subject. Environmental uncertainty leads to supply uncertainty as it causes the quantity, quality and timing of supply to be unpredictable [41]. Increasing environmental uncertainty also leads to demand uncertainty and directs companies to personalized products and diversity [121]. According to the resource dependency theory, the problems caused by environmental uncertainty can be solved by using the strong relationships that firms have [40]. The impact of environmental uncertainty on companies cannot be reduced to zero; however, in order to reduce this impact, companies can integrate with their supply chain partners and this may allow the creation or continuation of a sustainable competitive advantage. In this context, the mediating role of supply chain integration in the effect of environmental uncertainty on competitive advantage was examined and the hypothesis (H7) was supported.

Firms focus on improving supply chain agility to overcome high levels of turbulence and environmental uncertainty [1,122,123]. They need to act faster in order to meet customer demands in an environment of high uncertainty [122], which is associated with agility. Prater [42] also related that companies are considered reliable in an uncertain environment with their ability to respond quickly to changes, that is, to be agile. Agility is one of the key elements for companies to survive and gain a competitive advantage in today’s intensely competitive environment. Alfalla-Luque et al. [91] concluded in their study that supply chain agility has a positive effect on two (flexibility and financial) of the five (cost, quality, delivery, flexibility and financial) components of competitive advantage. Similarly, Wu et al. [90] also concluded in their study that supply chain agility has an impact on competitive advantage in cases of environmental uncertainty. Within the scope of the study, the mediating role of supply chain agility in the relationship between environmental uncertainty and competitive advantage was examined and the relevant hypothesis (H8) was also supported.

In order to benefit from supply chain agility in situations of environmental uncertainty, it is necessary to establish strategic alliances, collaborations and integration between companies and supply chain partners [124]. Flynn et al. [100] also suggested that companies should focus on internal and external integration in order to understand environmental uncertainty and changes affecting agility. By forming strategic alliances with their suppliers, customers and stakeholders, companies can respond to environmental variability and uncertainties faster than their competitors, thereby gaining a competitive advantage [5]. Tran [117], who examined these structures empirically, also concluded that supply chain integration has a mediating role in the relationship between environmental uncertainty and agility. The sequential mediation hypothesis of the study was formed by considering the relationship between environmental uncertainty and competitive advantage and the intermediary role of supply chain agility. In this context, the sequential mediating role of supply chain integration and supply chain agility in the effect of environmental uncertainty on competitive advantage was tested with the last hypothesis of the study. Studies on the subject were examined in the literature and no study examining this relationship was found. According to the results obtained, supply chain integration and supply chain agility have a sequential mediating role in the relationship between environmental uncertainty and competitive advantage.
4.2. Managerial Implications

Global crises increase the environmental uncertainties faced by companies. The recent COVID-19 pandemic or the financial crises experienced in the last decade have increased the awareness of company managers against environmental uncertainty. Decision makers develop different practices or strategies to reduce the negative impact of environmental uncertainty on company performance and gain sustainable competitive advantage and even transform environmental uncertainty into a positive effect. Developing effective supply chain strategies or revising existing supply chain strategies in order to gain a competitive advantage is one of the most frequently used decision points by managers.

Today, the competition is between the supply chains rather than the companies; therefore, developing effective supply chain strategies is crucial to remain competitive. Although it can diversify and change according to the product and company strategies, the ultimate aim of the supply chains is to meet the demands of the customers at the least cost, wherever and whenever they want. High uncertainty leads companies to react to customer demands faster. This can only be achieved with the agility of supply chains [125]. In order to achieve an agile supply chain, decision makers must be able to overcome obstacles and explore best practices [126]. Integration between supply chain partners is seen as one of the enablers of supply chain agility [127]. Company managers can create agile supply chains that can respond to customer requests faster with their integrated business manners with their supply chain partners. The results obtained with the study also support that company managers tend to supply chain integration in cases of environmental uncertainty and those integrated activities have a positive effect on the creation of an agile supply chain. The results show that companies’ supply chain integration and supply chain agility practices have a positive effect on gaining a competitive advantage as an intangible element. The resource-based view states that intangibles are vital for companies to gain a competitive advantage [16]. The results obtained can be supported in this direction with a resource-based view.

5. Conclusions

Companies should investigate the factors and resources that will give them a sustainable competitive advantage over their competitors. These factors should be unique and aligned with the resource-based view, to be rare, valuable, inimitable and non-substitutable to allow companies to transform their business practices to competitive advantage. Supply chain integration and supply chain agility reveal themselves among those resources. Especially in cases where there is uncertainty, companies should pay attention to which factors they should focus on at which decision points. Although the relationship between environmental uncertainty and competitive advantage is very limited, studies that examine supply chains in this relationship need to be developed. Environmental uncertainty is one of the important factors affecting companies and supply chains, considering that competition is experienced at the level of supply chains today. Although environmental uncertainty is often considered a threat to companies and supply chains in the literature, some studies claim that environmental uncertainty creates opportunities for companies. Firms can directly benefit from the opportunities created by environmental uncertainty, or they can benefit from using different intermediary factors. Supply chain partners, acting in environmental uncertainty, seek solutions together to the threats they encounter by developing collaborative processes and try to respond more quickly to the opportunities and threats in the market. Integration developed between supply chain partners enables companies to adapt to changing market conditions, enabling them to act more agile. Although the positive effect of supply chain agility on company and supply chain performance is seen in the literature, the impact of agile supply chains on competitive advantage is yet to be explored further in different supply chains. As supported in our study, companies with agile supply chains can gain a competitive advantage over their competitors. This result is also consistent with the practice we have encountered in the last few years due to the COVID-19 pandemic.
When evaluated from a holistic point of view, all of our hypotheses are supported and we concluded that environmental uncertainty leads companies to increase their level of integration by developing collaborative processes with their supply chain partners that increase the level of supply chain agility. Since the high level of integration between supply chain partners affects supply chain agility, it has been accepted as an important strategy to be implemented by managers. Collaboration between supply chain partners can also be seen as a rare resource that competitors cannot copy. Developments in communication and transportation technology, and global crises such as the sudden emergence of COVID-19 forced companies and supply chains to be more agile. The ability of companies to respond to threats or opportunities that they may encounter depends on the agility of their supply chains. The conclusion that supply chain integration and supply chain agility play a sequential role in the effect of environmental uncertainty reached by this study on competitive advantage has not been found in previous studies in the literature.

This study has several limitations. First of all, a comprehensive literature review on structures has been tried, but some information may not have been covered in the study. In the study, the relationship between environmental uncertainty, supply chain integration, supply chain agility and competitive advantage is shown through companies in the manufacturing sector operating in Turkey. Conducting the study in different countries will allow the results to be generalized on a global scale. More complex structures in which the factors affecting environmental uncertainty are included in the research can be the subject of future studies. Environmental uncertainty has been evaluated as a holistic structure within the scope of the study. The relationships between supply, demand and technological uncertainty, which are the sub-components of environmental uncertainty, with other structures have not been investigated. Similarly, the relationship between suppliers, customers and internal integration, which are the components of supply chain integration, with other structures was not included in the research. Relationships between sub-components can be examined in future studies. In addition, structures that affect supply chain integration and supply chain agility or moderate the relations between these structures can be investigated in future studies.

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