

RESEARCH ARTICLE

Competitive analysis of the Turkish composite industry by using the five forces model: A case study

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Abstract

The primary aim of this study is to investigate the competitive landscape and profitability prospects of the Turkish Composite Industry. To accomplish this objective, the research employs the Five Force Model framework developed by Michael E. Porter. A survey instrument was designed to collect data from companies operating within the Turkish Composite Industry. The results reveal that the industry exhibits a low susceptibility to substitution, a moderate level of buyer bargaining power, and a medium to high level of supplier bargaining power. With the presence of both large and small firms, competition among existing competitors is deemed high, while entry barriers are considered moderate to high.

1. Introduction

The primary objective of enterprises is to generate profits and enhance performance. The strategies we employ to accomplish these objectives hold significant importance. The theories that guide a company's pursuit of superior performance within its respective industries and markets are referred to as firm strategy [1]. Alternatively, strategy denotes "a cohesive, comprehensive, outwardly oriented concept outlining how the enterprise will attain its goals" [2]. In an increasingly competitive landscape, enterprises must articulate a sound strategic approach. A truly exemplary strategic approach encompasses a comprehensive assessment of the multitude of factors that influence overall industry performance.

During the process of strategy development, a meticulous examination of internal and external factors is imperative. Porter (1985) devised the industry analysis, commonly known as the five forces model of competition, to assess external factors (namely, the threat of potential entrants, the bargaining power of suppliers, the bargaining power of buyers, the threat of substitute products, and rivalry among current competitors). This model is rooted in the field of industrial organization (I/O), where a firm's market performance is contingent upon the characteristics of its surrounding environment.

The objective of this research is to ascertain the level of competitiveness within the composite industry in Türkiye and provide valuable insights for companies operating in this sector to develop their competitive strategies. By utilizing Porter's five forces model, this study aims to contribute to both the composite industry and the existing body of literature about industry competitiveness. With the primary focus on determining

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the competitive landscape of the composite industry, the following fundamental research question has been addressed: What are the prevailing conditions of competition in the Turkish Composite Industry?

Within this framework, the study commences with a comprehensive literature review encompassing Porter's Five Forces Model and the composite industry. The research methodology is elaborated upon in the third section, while the fourth section presents the findings and results. The implications of the research are discussed in the final section, accompanied by a set of recommendations tailored for industry practitioners and academics alike.

2. Porter's five forces and the Turkish composite industry

2.1. Porter's five forces model

The analytical framework known as the "Five Forces" model, initially developed by Michael E. Porter in 1980, has emerged as the most widely employed tool for assessing competitive forces within an industry and formulating organizational strategies based on the analysis outcomes [3,4]. The competitive landscape of an industry is contingent upon five distinct forces, the collective impact of which determines the industry's profitability [5].

Hence, for a firm to attain a favorable position within its industry, it is crucial to evaluate the five forces that shape its competitive environment, namely: (i) threats from potential competitors (entrants), (ii) the bargaining power of suppliers, (iii) the bargaining power of buyers, (iv) threats from substitute products, and (v) rivalry among current competitors, as depicted in Fig. 1 [3,5,6].

The underlying premise is that the attractiveness and overall profitability of a market primarily hinge upon its market structure. This analysis represents a straightforward yet influential model for discerning the level of competition within an industry. [7].

The initial environmental threat within the framework of the five forces is the threat of new entry. This threat imposes a limitation on the profit potential of the industry. When new entrants join an industry, they introduce additional capacity and aspire to acquire a portion of the market share. Consequently, this exerts pressure on prices, costs, and the investment choices required to remain competitive [3]. Generally, the success and substantial profits of established incumbents can serve as a motivating factor for new entrants [1].

To assess barriers to entry, it is essential to comprehend the nature and extent of these barriers. In simple terms, if a company encounters difficulties or competitive disadvantages when attempting to enter a new industry, we can conclude that barriers to entry exist and are high. Each industry possesses its unique structure, which can give rise to barriers that impede new entrants [7]. Additionally, there are several common factors identified by Porter that contribute to the creation of barriers to entry. These factors encompass (1) economies of scale, (2) product differentiation, (3) capital requirements, (4) access to distribution channels, (5) cost disadvantages independent of scale, (6) established brand loyalty, and (7) government policies [3].

Porter places significant emphasis on the analysis of buyer bargaining power as another factor in his examination of the five forces model. Suppliers, who provide various raw materials and components to companies, can exert a considerable influence on a company's profitability [8]. Powerful suppliers have the potential to disrupt the operations of businesses within an industry by raising prices or diminishing the quality of their offerings. Suppliers possess the power under the following circumstances: when the market is dominated by a few companies, when there are no substitutes for the supplier's products, when the supplier's products contribute to the quality of the customer's end product when customers face switching costs, when there is a threat of forward integration, and when firms are not significant customers for the suppliers [3], [9].

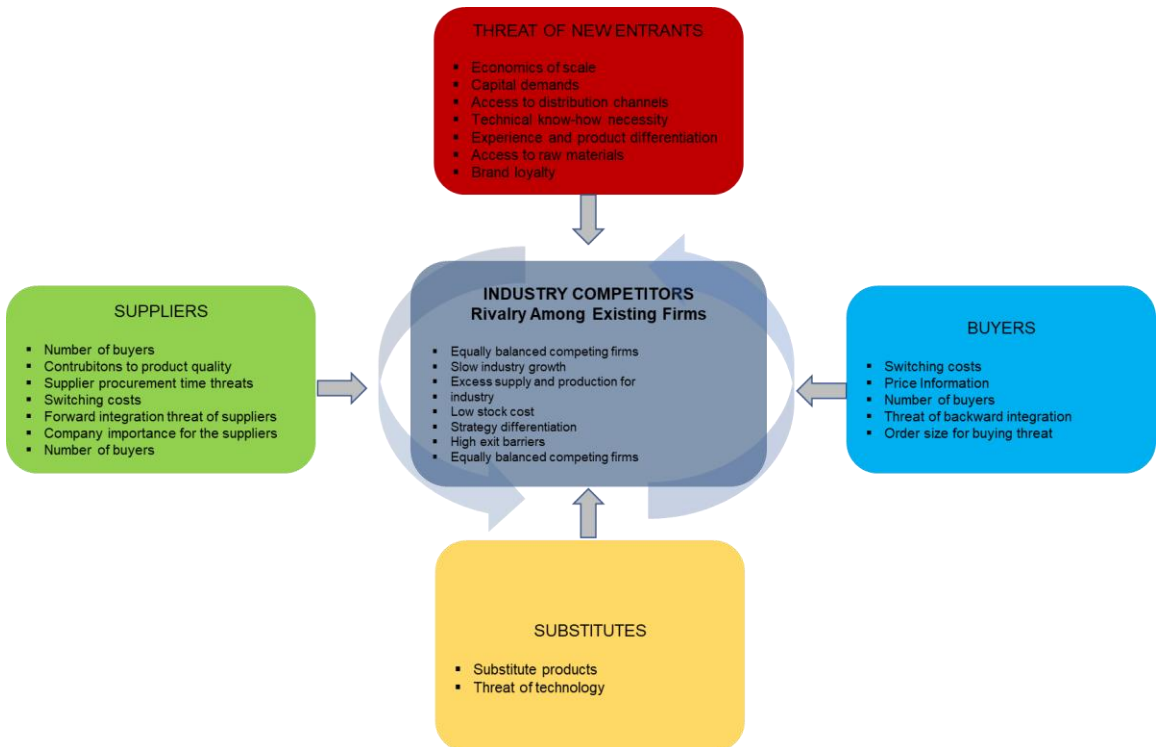


Fig. 1. Porter's Five Forces model of industry competition

A third environmental threat within the five forces framework is the bargaining power of buyers. Buyers, who purchase a firm's products or services, can exert significant influence. [1]. Powerful customers can extract greater value by exerting downward pressure on prices and negotiating for improved quality or additional services. Consequently, the actions of powerful buyers can diminish industry profitability [10]. Buyers wield substantial power when the number of buyers is small when products sold to buyers are standardized and yield low margins, when buyers face minimal switching costs, when buyers pose a threat of backward vertical integration, when buyers possess extensive product knowledge, and when products sold to buyers constitute a significant portion of their final costs.

The fourth threat within the five forces framework is the presence of substitute products. Substitute products are those that fulfill similar customer needs, albeit through different means. This threat encompasses the extent to which alternative products can be used in place of a company's products, including those offered by other industries. The threat posed by substitute products and services is influenced by two key indicators: (a) the switching costs associated with transitioning to substitute products or services, and (b) the level of buyer preference for substitute options [11]. When there is a wide array of substitute products available, accompanied by low switching costs and high demand from buyers for these substitutes, the threat of substitutes becomes significant. Such substitutes have the potential to curtail industry profitability by limiting the potential profits that can be attained.

The fifth and final threat is the threat of rivalry. This pertains to the intensity of competition among direct competitors within a firm's industry. In most industries, the level of rivalry among competitors serves as the primary determinant of overall industry competitiveness [12]. Intense rivalry emerges as a consequence of several interacting structural factors, including a large number of competitors or a balanced competitive landscape, slow industrial growth, high fixed or storage costs, lack of product differentiation, capacity

expansion occurring in significant increments, a diverse range of competitors, and low switching costs coupled with high exit barriers [3,13,14].

2.2. Composite industry in Türkiye

A composite product can be defined as a piece of wood, held together by a naturally occurring substance known as lignin, with cellulose at its core. Composite materials, resulting from the combination of two or more materials, similar to wood, exhibit various properties such as durability, permeability, and flexibility, thanks to the distinctive characteristics of their components. These components within the composite material remain distinct and do not dissolve or blend, thereby imparting unique properties to the composite. The utilization of composites can be traced back to ancient civilizations, such as the Egyptians and Mesopotamians, who employed a mixture of mud and straw to construct sturdier buildings and houses around 1500 BC. The composite industry witnessed significant advancements during World War II, owing to the lightweight and durable nature of composites, leading to increased production of fiber-reinforced composites (FRP). Today, the composite industry continues to transform, with a focus on areas such as renewable energy, heat, and chemical resistance, and the substitution of synthetic fibers with natural fibers. [15].

Composite materials exhibit various configurations, incorporating short fibers, particles, monofilaments, and long fibers. The matrix material, which constitutes the majority of the composite, can be polymeric, metallic, or ceramic. Reinforcement is typically provided through the use of ceramic, carbon, or glass fibers [16].

Composite materials have found applications in a wide range of industries and sectors, including space, appliances, architecture, automotive, transportation, construction and infrastructure, corrosive environments, electrical, energy, marine, sports, and recreation. This is attributed to their desirable properties such as corrosion resistance, lightweight nature, high strength, cost-effectiveness, enhanced productivity, design flexibility, and durability [16].

The global composites market is expected to expand from USD 88.0 billion in 2021 to USD 126.3 billion by 2026, with a compound annual growth rate (CAGR) of 7.5%. The growth of the composites market can be attributed to the increasing demand from industries such as wind energy, aerospace and defense, and automotive and transportation. However, the COVID-19 pandemic has adversely affected various industries, leading to a decline in composite demand [17].

In the year 2020, the production volume of European Glass Reinforced Plastics (GRP) is projected to decline by 12.7%. Consequently, the total volume of the European GRP market is estimated to be 996,000 tonnes. This marks the sharpest decline experienced by the market since the crisis of 2008/2009 [18].

As per the data provided by JEC Group, the European transportation industry is projected to account for the largest share of total growth (44%) in terms of volume size over the next four years. This will be followed by the construction industry (14%), pipe and tank industry (13%), and wind energy industry (10%) (Fig. 2). [19].

The value of the Turkish composite market has reached 1.35 billion Euros, and the product volume has increased to 250,000 tons, indicating a growing trend and a shift from substitute materials. This growth is in line with the higher growth rates observed in the composite market in Europe and worldwide. Considering global economic developments and the dynamics of the country, the field of composites in Türkiye is experiencing rapid and long-term development, similar to other industries [20].

In recent years, under the prevailing economic conditions, the composite industry in Türkiye has grown at a rate of 8% to 12%. In 2017, this growth rate was around 6%. However, in 2020, due to the impact of the COVID-19 pandemic, the Turkish trade association reported a 10% decline in production compared to the previous year, resulting in a total volume of 225,000 tonnes [18].

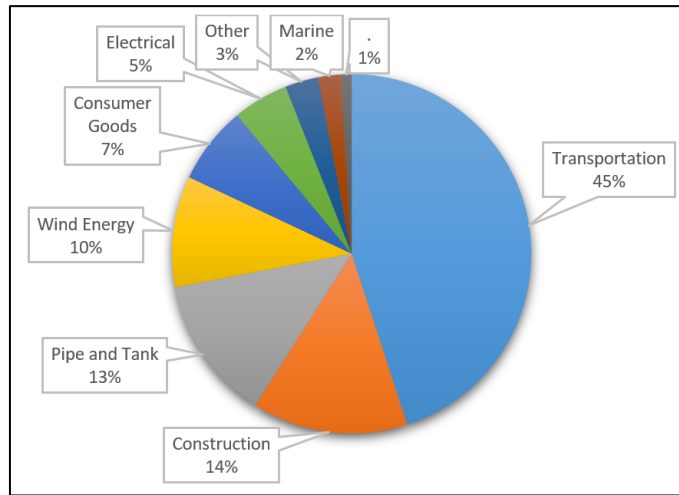


Fig. 2. European share growth by industry, 2018-2023 (by volume)

Composite consumption, which is considered a "Development Criterion" globally, is reflected in the per capita consumption of composites. This aspect has a positive effect on Türkiye's industrial composites sector. Although the global average per capita composite consumption ranges between 4-10 kg, in Türkiye, it stands at 3.5 kg as of 2019. The average unit price of composites is 6.9 Euro/kg worldwide and 5.5 Euro/kg in Türkiye, indicating various opportunities for the development of the composite industry in the country. In addition to per capita production and consumption, the average price provides an advantage for the country [20]. According to Table 1, Türkiye's composite industry has an export and import value of approximately 300 million dollars.

Glass and carbon fibers, which represent the predominant materials, can be manufactured within the borders of Türkiye. The industry exports polyester resin, GRP pipe, carbon fiber, glass fiber, and technical textiles while importing the necessary chemical raw materials such as glass, polyester resin, and other composite products [19].

The composite industry finds its largest market in the construction sector, which stands as one of the most prominent industries in Türkiye. Another significant market for the Turkish composite industry lies within the Turkish automotive sector. With its advantageous geographical position, relatively low costs, and a wealth of skilled labor, Türkiye boasts over 700 companies producing a diverse range of automotive parts, including those for European bus manufacturers.

Furthermore, considering Türkiye's geopolitical position, ship and boat-building businesses thrive in İstanbul, İzmir, and Antalya. Moreover, Türkiye's wind energy market, witnessing a growth in energy demand, exhibits strong potential. Anticipated developments include an acceleration in the production of advanced technology products such as wind energy and aviation, along with an increase in the utilization of composite materials in the electrical-electronics industry [20,21].

Approximately half of the production volume finds application in the construction industry (20%) and the manufacturing of pipes and tanks (35%). The automotive and transport sectors account for 25% of usage, while wind energy represents the third largest application area, comprising 12% [18,20].

The Composite Technologies Center of Excellence (KTMM), established in 2016, serves as a hub for composite technologies, fostering collaboration between industry and academia. It encompasses various realms, including basic research, applied research, technology and product development, sourcing, and production processes. These centers are anticipated to significantly contribute to the advancement of the Turkish composite industry.

Table 1. Composite industry trade values in Türkiye

Product	Import (m \$)	Export (m \$)
Polyester Resin	17	56
Glass Fiber	78	11
Carbon Fiber	-	28
Technical Textile	5	11
GRP Pipe	-	67
Chemical Raw Products	189	-
Other Composite Products	11	127
Total	300	300

3. Experimental Study

3.1. Material and method

The research employed a survey methodology as the data collection approach. The questionnaire utilized in this study consisted of two sections. The first section aimed to assess the participants' level of agreement or disagreement with statements concerning the structural analysis of the industry. This section comprised 27 statements. Each statement of industry forces was evaluated using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The survey instrument was developed and adapted from the works of Porter (2008) [3] Five Forces Model, Dess and Miller (1996) [22], Grant (2002) [23] Eren (2010) [24], Akçagün (2015) [13]. The second section of the questionnaire consisted of statements regarding the characteristics of the participating firm and manager.

The survey was distributed via email to 102 companies listed on the Turkish Composite Association website. However, some companies declined to participate in the survey. Ultimately, 22 surveys were considered valid as they were filled out and deemed crucial for determining the industry's level of competitiveness.

The survey data utilized in the study, which observes the development of the composite industry in Türkiye and contributes to the understanding of this process, was obtained from expert individuals. These experts are professionals who are employed by firms operating in the field and possess a comprehensive understanding of the industry's dynamics. Five survey responses were excluded from the analysis due to missing information in the required fields. Consequently, the evaluation of the survey was based on the responses of 22 companies. The limited number of participants can be attributed to the relatively small size of the industry.

The collected data from the survey were analyzed using the SPSS 21.0 software package. The managers' responses were utilized to unveil their perspectives on the competitive structure of the composite industry. During the program's data analysis, frequency analysis, mean calculations, and standard deviation results were considered. The survey's propositions of the competitiveness level of the composite industry in Türkiye were deemed sufficient for revealing the strategic capabilities of the participating companies.

To assess the scale's reliability, a reliability study was conducted using "Cronbach's Alpha" internal consistency coefficient. The scale, comprising a total of 27 items, demonstrated satisfactory internal consistency with a Cronbach's alpha value of $\alpha = 0.721$. This statistical measure indicates that the scale is consistent and reliable. The chosen research method aligns with the research's purpose, subject, and the questions being addressed, thereby being suitable for providing solutions and insights.

4. Results

4.1. Respondents' and Composite Firm's Characteristics

Table 2 presents an overview of the demographic characteristics of the survey participants. The findings indicate that the majority of respondents, accounting for 90.91% (20), hold managerial positions such as general manager, marketing manager, logistic manager, buying manager, and consultant. One participant, representing 4.55%, works in the R&D department, while another individual, also comprising 4.55%, is employed in logistics. Regarding educational qualifications, 63.64% (14) of the respondents hold a master's degree or higher, while 36.36% (8) have a bachelor's degree. The fact that all participants possess university degrees underscores the significance placed on education by institutions.

When examining the duration of current positions, it was found that 22.73% (5) of the respondents have been in their current roles for less than five years. Furthermore, 45.45% (10) have held their positions for 6-10 years, 18.18% (4) for 11-20 years, and 13.64% (3) for over 20 years. Additionally, the total work experience in the industry was analyzed. Results show that 45.45% (10) of the respondents have been working in the composite industry for 21-30 years, 18.18% (4) for 16-20 years, 27.27% (6) for 11-15 years, and 9.09% (2) for less than 10 years. Overall, the participants possess a wealth of experience and expertise in the composite industry.

Table 2 also describes the characteristics of composite firms. Out of the respondents, 13.64% (3) companies employ 301 or more workers, 18.18% (4) companies employ 201-300 workers, 31.82% (7) companies employ 101-200 workers, and 36.36% (8) companies employ 1-100 workers. Generally, firms in the composite industry have a relatively small number of employees.

Regarding the duration of operation in the composite industry, 68.18% (15) of the companies have been operating for more than 11 years, while 18.18% (4) have been working in the industry for 6-10 years, and 13.64% (3) for 2-5 years. Many of the companies participating in the survey have established a substantial presence within the composite industry.

It was found that 95.45% of the composite companies surveyed do not have foreign partners. These companies predominantly export to European and Asian countries, with twelve companies exporting to each region. Additionally, six companies export to America. The fact that all participating companies engage in exports to various regions reflects the promising potential and significance of the composite industry in Türkiye. It underscores the industry's role in the development and growth of the country.

4.2. Impact of Industry Forces

In the subsequent phase, all firms were requested to assess the strength of the five forces and their sub-forces, as presented in Table 2. The industry forces were evaluated using a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree). The responses were recorded and assigned the following values: 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree), and 5 (strongly agree).

4.2.1. The power of buyers

It can be observed from the responses provided by the participants, as presented in Table 2, that several factors influence the bargaining power of buyers in the composite industry. These factors include the number of buyers, their access to information about product prices, replacement costs, backward integration capabilities, and profit margins. In cases where the number of buyers is small, buyers possess extensive knowledge about product prices, generate low-profit margins, and have the ability to threaten backward integration, their bargaining power becomes significant.

Table 2. Respondents' and composite industry firms' characteristics

Characteristics	f	%	Characteristics	f	%
Current position			Number of workers		
R&D and Logistic staff	2	9.09	1-100	8	36.36
Manager (CEO, Marketing, etc.)	20	90.91	101-200	7	31.82
			201-300	4	18.18
Education			301 and more	3	13.64
Bachelor's degree	8	63.64	Total time in the industry of the firm		
Master's and higher	14	36.36	2-5 years	3	13.64
Total working time			6-10 years	4	18.18
1-10 years	2	9.09	11 years and more	15	68.18
11-15 years	6	27.27	The company's foreign partnership status		
16-20 years	4	18.18	Have	1	4.55
21-30 years	10	45.45	Don't have	21	95.45
Year of current position			Total	22	100
1-5 year	5	22.73	Regions your company exports its products		
6-10 year	10	45.45	Europe	17	
11-20 year	4	18.18	Asia	12	
21-30 year	3	13.64	US	6	
Total	22	100	Other	8	

When evaluating the participants' answers related to the statements regarding the bargaining power of buyers, it is evident that the number of buyers is relatively low ($\bar{x} = 3.41$, Std. Dev. = 1.05) and buyers have detailed information about market prices ($\bar{x} = 3.55$, Std. Dev. = 0.80). This factor can be considered influential in shaping the profitability of the composite industry. Furthermore, the buyers' capability to produce the products they purchase from firms demonstrates a moderate to low value ($\bar{x} = 2.91$, Std. Dev. = 1.23). This suggests that buyers opt to purchase rather than produce due to factors such as investment costs, lack of production expertise, and challenges in establishing a market presence.

Similarly, it is indicated by the participants' responses that buyers face difficulties in acquiring alternative products from other companies without incurring additional costs ($\bar{x} = 2.64$, Std. Dev. = 1.00). Moreover, the number of production orders is not a significant bargaining factor for companies ($\bar{x} = 2.96$, Std. Dev. = 1.00). Additionally, companies do not primarily offer standardized products, which can contribute to reducing the bargaining power of buyers ($\bar{x} = 1.77$, Std. Dev. = 0.81) (Table 3).

In a general assessment based on the participant's responses to the statements measuring the bargaining power of buyers, it can be concluded that the bargaining power of buyers is moderate. Buyers in these markets possess some influence in negotiating prices and supply terms. However, their power may be constrained by the specialized nature of composite materials and the limited number of suppliers. Moreover, high switching costs for producers and their lack of production know-how act as limiting factors on the bargaining power of buyers.

Table 3. Five forces and sub-forces result

Forces and Sub-Forces	n	Mean	Std. Dev.
Threat of new entry			
Economies of scale	22	2.50	1.06
Capital demands	22	3.01	1.25
Access to distribution channels	22	3.00	1.02
Technical know-how necessity	22	4.55	0.67
Experience and product differentiation	22	3.96	0.72
Access to raw materials	22	2.91	1.11
Brand loyalty	22	3.41	1.10
Bargaining Power of Buyers			
Switching costs	22	2.64	1.00
Price information	22	3.55	0.80
Number of buyers	22	3.41	1.05
The threat of backward integration	22	2.91	1.23
Standard products	22	1.77	0.81
Order size for buying threat	22	2.96	1.00
Bargaining Power of Suppliers			
Number of suppliers	22	3.86	0.83
Contribution to product quality	22	4.46	0.60
Supplier procurement time threats	22	4.18	0.80
Switching costs	22	2.64	0.95
Forward integration threat of suppliers	22	2.82	1.18
Company importance for the suppliers	22	4.00	0.76
Threat of Substitutes			
Substitute products	22	2.90	0.97
Threat of technology	22	2.68	0.95
Rivalry among Existing Companies			
Equally balanced competing firms	22	3.46	1.37
Slow industry growth	22	2.55	1.37
Excess supply and production for industry	22	2.64	1.05
Low stock cost	22	1.86	0.94
Strategy differentiation	22	3.82	0.96
High exit barriers	22	2.86	0.77

4.2.2. The power of suppliers

The examination of the responses to the questions regarding the measurement of the bargaining power of suppliers reveals several key findings, as presented in Table 3. It is evident that there are only a few companies from which firms can source their products ($\bar{x} = 3.86$, Std. Dev. = 0.83). The quality of the supplied products directly impacts the overall product quality of the company ($\bar{x} = 4.46$, Std. Dev. = 0.60). Moreover, product lead times directly affect the production workflow ($\bar{x} = 4.18$, Std. Dev. = 0.80), and companies rely heavily on their suppliers for a significant volume of raw materials ($\bar{x} = 4.00$, Std. Dev. = 0.76). Furthermore, the cost of switching suppliers is deemed to be challenging and costly ($\bar{x} = 2.64$, Std. Dev. = 0.95). However, it is noted that the suppliers' attempts at forward integration are relatively low ($\bar{x} = 2.82$, Std. Dev. = 1.18).

Considering all these factors, the bargaining power of suppliers can be described as moderate to high. This factor holds a significant influence on the profitability of companies in the composite industry. The industry relies on a limited number of suppliers for essential raw materials such as resins, fibers, and additives. These suppliers possess substantial power to negotiate prices and quality standards, and they may exert control over the supply in times of high demand.

4.2.3. Threat of new entry

Upon examining the responses to the questions regarding the threat of new entry into the composite industry, several key findings can be observed, as presented in Table 3. It is evident that a new company entering the industry does not necessarily need to commence with large-scale production ($\bar{x} = 2.50$, Std. Dev. = 1.06). The capital requirement for establishing a new firm in the industry is considered moderate ($\bar{x} = 3.01$, Std. Dev. = 1.25) and it is not overly challenging for a new company to gain access to distribution channels ($\bar{x} = 3.00$, Std. Dev. = 1.02). However, access to raw materials can be moderately difficult ($\bar{x} = 2.91$, Std. Dev. = 1.11). Additionally, customer loyalty toward existing companies and their products is notably high ($\bar{x} = 3.41$, Std. Dev. = 1.10) and a significant amount of technical knowledge and experience in the field is required ($\bar{x} = 4.55$, Std. Dev. = 0.67).

Upon a general evaluation, it can be concluded that the threat of new entry for companies involved in composite production and sales in Türkiye is low to moderate, based on the responses regarding the threat of new entry. Factors such as the ability to initiate production on a smaller scale and a moderate capital requirement for new company establishment can reduce the barriers to entry. However, the high requirement for technical knowledge, production expertise, and customer loyalty can increase the entry barrier for new companies.

4.2.4. Rivalry among existing firms

Upon analyzing the data obtained from the survey participants, it is evident that the composite industry comprises numerous large and small enterprises ($\bar{x} = 3.46$, Std. Dev. 1.37). This factor contributes to increased competition among existing firms. Additionally, respondents disagreed with the statement indicating a low growth rate for the industry ($\bar{x} = 2.55$, Std. Dev. 0.91), suggesting that the composite industry continues to experience growth. Moreover, participants stated that there is not yet an excessive supply in the industry ($\bar{x} = 2.64$, Std. Dev. = 1.05), and the exit barrier for companies leaving the industry is low ($\bar{x} = 2.86$, Std. Dev. = 0.77). Furthermore, respondents disagreed with the statement regarding high inventory costs and waiting times for products ($\bar{x} = 1.86$, Std. Dev. = 0.94).

Overall, when considering the responses to statements measuring the competition among existing competitors, it can be concluded that the rivalry between companies in the composite industry is moderate to high. The presence of numerous small and medium-sized companies competing with established large companies leads to competition in areas such as pricing, quality, and delivery times. While established

companies benefit from brand recognition and have greater bargaining power, the industry's composition with both large and small companies intensifies competition. Furthermore, the industry's high growth rate has a positive impact on industry firms, and the demand for innovative products and potential in the industry remains significant.

4.2.5. Substitute products

Based on the responses provided by the survey participants regarding the threat of substitute products, it can be concluded that the substitution threat for the products produced by companies in the composite industry is low. The participants expressed partial agreement with the statement regarding finding substitutes for the products they produce ($\bar{x} = 2.90$, Std. Dev. = 0.97). Furthermore, participants indicated that the development of new technologies like 3D printing and Industry 4.0 does not pose a direct threat in terms of creating substitute products for the industry ($\bar{x} = 2.68$, Std. Dev. = 0.94).

Composite materials possess unique properties such as durability, resistance to corrosion and impacts, and high strength. These characteristics cannot be easily replicated by other materials, giving composite materials a competitive advantage. Consequently, composite materials remain a preferred choice in various industries due to their distinctive properties and advantages.

5. Conclusion

This research focuses on analyzing the external factors that influence the profitability and competitiveness of the Turkish Composite Industry using Porter's Five Forces Framework. The industry consists of a relatively limited number of companies, with 102 companies currently operating in the sector, as reported by the Türkiye Composite Association. This indicates that the industry is still growing. The survey was distributed to the companies via email, and a total of 22 companies responded, representing approximately 25% of the surveyed companies. The obtained data were deemed sufficient to contribute to the industry and provide valuable insights.

Based on the findings, the Turkish composites industry can be characterized as highly competitive, with a low threat of substitution and moderate bargaining power of buyers. Suppliers hold a moderate to high level of bargaining power due to the specialized nature of the raw materials used in composite manufacturing. The presence of numerous large and small companies in the industry contributes to high competition among existing competitors, while barriers to entry are considered moderate to high.

Overall, this research provides valuable insights into the dynamics of the Turkish Composite Industry, offering a comprehensive understanding of the external factors shaping the industry's profitability and competitiveness.

Ethics Committee Permission

The study has been evaluated and approved by the Ethics Committee for Social and Humanities Research and Publications at Mimar Sinan Fine Arts University, under the reference letter E-60750483-050.01.03-4977.

Author Contributions

Engin Akçagün: Conceptualization, Methodology, Nuray Öz Ceviz: Data curation, Supervision, Abdurrahim Yılmaz: Writing- Writing-Original Draft Preparation, Reviewing and Editing.

Conflict of interests

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Data availability statement

No new data were created or analyzed in this study.

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