Article

Quantitative Evaluation of Sustainable Marketing Effectiveness: A Polish Case Study

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Abstract: This research investigates the sustainable marketing effectiveness of Poland's fruit and vegetable industry using a seminal approach to analyze the interconnected dynamics among all factors and highlight pivotal elements through a structural model. Methodologically, the research used a sample of 216 companies utilizing a comprehensive survey to gauge various dimensions of sustainable marketing, including the environmental and social aspects of production, pricing, distribution and promotional activities. The findings reveal a nuanced landscape of sustainability practices within the industry. While there is a commendable level of awareness and some positive strides in certain areas such as employee-focused social aspects, other domains lag significantly, particularly consumer-focused social aspects and sustainable promotional activities. The study highlights the need for a more concerted and integrated approach towards sustainability, emphasizing the necessity of balancing economic goals with environmental stewardship and social responsibility. These insights bear significant implications for both research and practice. Practically, the study offers industry stakeholders a detailed understanding of the current state of sustainable practices pinpointing areas of strength and opportunities for improvement. It underlines the originality and value of employing a sophisticated analytical approach in assessing and enhancing the sustainability of marketing practices in the industry.

Keywords: sustainable development; sustainable marketing; food sector; fruit and vegetable industry

1. Introduction

The food sector is one of the most important branches of Poland's economy. The main task of the food sector, which consists of food industry enterprises, is to produce and deliver an appropriate quantity and quality of food products to the consumer market. Furthermore, the food sector generates employment. In Poland, over 420,000 workers are employed in the food industry, and the employment in the food industry constitutes 13.2% of employment in the entire industry [1]. Hence, the food sector is one of the most important and fastest growing branches of the Polish economy. Poland is the sixth largest market in Europe, with the market's potential of 38.2 million customers [2]. The Polish food industry is characterized by high competitiveness both on the European and global markets. In 2014, this food industry was recognized as a priority for the Polish government, which implied that Polish food companies intending to develop their business or establish new production centers could count on government grants [3]. The food industry covers a very broad area of economic activity: companies involved in the processing of animal products (meat, fish and dairy industries), the processing of plant products (cereal, fruit and vegetable, potato, oil and sugar industries), secondary processing (bakery, feed, confectionery, pasta, food concentrates and soft drinks industries) and the production of stimulants (alcohols and tobacco products). The products of this sector can be low-processed (as in the case of animal slaughtering and meat cutting) or the result of advanced technological processes—as in the case of freeze-dried or functional foods [4].

One of the most important components of the food sector is fruit and vegetable enterprises classified under PKD code 1039Z, i.e., other processing and preserving of fruit and vegetables, Section C, Division 10, registered in the REGON database of the Central Statistical Office.

When considering the activities of fruit and vegetable processing enterprises from the point of view of environmental impact in such aspects as the demand for energy and fuels necessary for production, water and sewage management, production and packaging waste generation, as well as the emission of harmful chemical compounds, dust and nuisance odors into the atmosphere, it should be concluded that the production of fruit and vegetable preserves requires a change in approach towards a more sustainable production activity based on the principles of sustainable development, including the concept of the sustainable marketing of fruit and vegetable enterprises.

As a result of the recognition of the state of the art in sustainable marketing, it has to be concluded that this is a new and developing scientific area that requires further theoretical as well as empirical analysis. An analysis of the available literature on the subject indicates the existence of a theoretical and cognitive gap. A review of the literature reveals a modest body of theoretical studies on sustainable marketing, which will be commented on further in the Section 2. Furthermore, it is important to note the complete lack of scientific publications dedicated to sustainable marketing implemented in fruit and vegetable companies.

In addition to the identified theoretical and cognitive gap, the authors of this study additionally point to the existence of an empirical gap regarding the topic of sustainable marketing implemented in fruit and vegetable processing enterprises. Evidence indicating the existence of the aforementioned empirical gap is the lack of quantitative studies and the lack of presentation of the results of qualitative analyses so far, which undoubtedly constitute a valuable source of knowledge on sustainable marketing.

The qualitative and quantitative research carried out and presented in this paper contributes to some extent to filling identified gaps in knowledge on this important and, at the same time, difficult-to-recognize topic. At the same time, it should be noted that the recognition of the topic undertaken regarding the sustainable marketing of fruit and vegetable enterprises requires further exploration and intensification.

The subject of the study undertaken requires a definition of the objective. The purpose of this research study is to conduct a sophisticated quantitative evaluation of the sustainable marketing effectiveness of the fruit and vegetable industry in Poland with the application of the multivariate analysis approach, carefully depicted in further sections, i.e., the *development index*, and the *DEMATEL* technique, which is selected among other available methods, see, e.g., [5], as the most suitable method for scrutinizing the interconnected dynamics among the factors under study and pinpointing the pivotal elements via a graphical representation of the structural model.

Conducting a theoretical–empirical study of the topic undertaken is subject to the rigor of the logical ordering and structuring of the individual parts of the work. The study is theoretical–empirical in nature. The structure of the paper includes an abstract, key words, introduction and literature review. These components constitute the theoretical part of the paper. This is followed by a presentation of the research methodology, research results with a discussion, conclusions and a literature list.

The theoretical considerations presented in the paper and the analysis of the research results do not fully resolve the issue at hand. Thus, the search for new and creative solutions to reconcile the economic development of fruit and vegetable enterprises with ecological and social values remains an open issue. Sustainable marketing is in the development phase and requires further scientific exploration and work aimed at improving its procedures.

2. Literature Review

The 1980s saw a systematic deterioration of the environment. A widespread wave of concern about the ability of environmental resources to sustain human civilization triggered

many discussions. Therefore, people started to think about limiting the negative impact of civilization on the planet's ecosystem. In 1987, a report entitled *Our Common Future* was prepared which presented the essence and concept of sustainable development as follows: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [6]. There are many definitions of the concept in the literature. Some authors state that sustainable development is to focus on natural capital assets and suggest that they should not decline over time [7–9]. Sustainable development is development to meet the needs of the present generation while ensuring the ability of future generations to meet such needs also [10]. Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [11]. Sustainable development is an attempt to create a decent life for all people without the possibility of exposing people to the loss of a decent life in the future [12]. The concept of sustainable development is a message to managers who manage production enterprises. Managers, in addition to developing the enterprise and ensuring profits from their activities, also have a duty to provide development opportunities for future generations and to even increase these development opportunities [13]. The concept of sustainable development has also been presented by other authors [14–17].

The presented definitions and concepts of sustainable development indicate that the focus is on environmental and social aspects aimed at improving the quality of life of societies or guaranteeing development opportunities for future generations. However, complementing the presented concept of sustainable development is paying attention to economic aspects, so important for production companies, including the fruit and vegetable processing sector. Without the third pillar, which is the economic and financial aspect, the implementation of the sustainable development concept will not be fully possible from the point of view of enterprises. In addition to environmental protection and improving the quality of life of society, enterprise managers will consider, first of all, the economic aspects, i.e., increasing market share and profits in their enterprises. The reconciliation of interests focused on the environment, society and finance, i.e., the triad of objectives, leads to the *triple bottom line* (TBL) [18–21]. This is one of the most important approaches and means to realistically build environmental, social and economic capital based on the concept of sustainable development [22]. Figure 1 illustrates the concept of the *triple bottom line*.
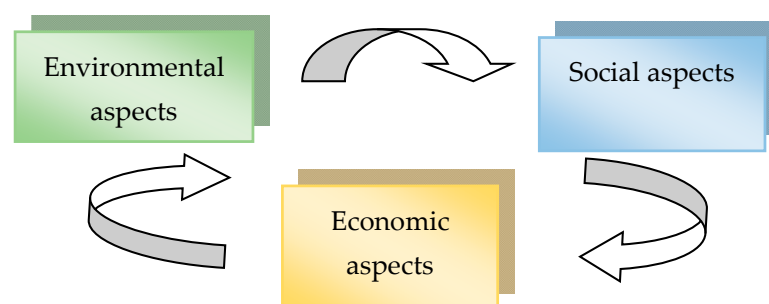

Figure 1. Triple bottom line.

The concept of sustainable development has inspired the creation of other concepts whose common point has become balancing activities to protect the environment, social aspects and profit making. A good example is the balancing of activities in the marketing mix which includes the product, price, distribution and promotion mix. Companies in the fruit and vegetable industry pursue their economic objectives using the marketing mix components. Hence, there is a need to balance these objectives for the sake of the environment and society.

A review of the literature in the area of sustainable marketing mix indicates a deficit of publications devoted to this concept. Therefore, there is a need to deepen the knowledge in this area by conducting qualitative and quantitative research. Sustainable marketing

mix is a new research trend that is not fully recognized and/or established. However, over the last ten years, one can notice the increased interest of scientists and researchers in the concept of sustainable marketing mix [23]. In the available publications [24–31], the authors have presented a fairly comprehensive knowledge of marketing and the individual instruments of the marketing mix in relation to the concept of sustainable development. In addition, in the cited publications, one can find content on, for example, sustainable market segmentation or sustainable marketing strategies. These publications are valuable resources that comprehensively present the essence and importance of sustainable marketing, including sustainable marketing mix. Apart from the previously indicated publications, books also [32–34] deserve attention. By subjecting the cited publications to theoretical analysis, one can conclude that they contain rather selective content devoted to sustainable marketing mix, focusing rather on a broad discussion of the concept of sustainable marketing. Conducting further analysis of the literature in the subject area, publications that focus on the instruments of sustainable marketing mix should be indicated [35–37]. The authors present the content in relation to each of the four instruments of the marketing mix—product, price, distribution and promotion mix. The included considerations concern the activities of enterprises oriented towards the concept of sustainable development.

The scientific output in the field of sustainable marketing mix is fairly small. It does not result from neglecting this concept by researchers. It is an important subject area due to the fact that the activities of production enterprises, including the fruit and vegetable sector, have a significant impact on the condition of the natural environment and society's state of life. Responsible management through the creation of sustainable fruit and vegetable products [38,39], sustainable pricing [40], sustainable distribution [41,42] and sustainable promotion [43] contributes to doing business in accordance with the principles of sustainable development. The indicated instruments of sustainable marketing mix contribute to the achievement of set financial goals by the fruit and vegetable industry enterprise. However, for an enterprise to be defined as a sustainable production organization, it should additionally focus its attention on environmental and social aspects. Production processes should be organized in such a way as to minimize or completely eliminate the negative impacts of production on the environment and society. The literature research carried out indicates that the experience of practitioners and the attitudes of scientists and experts on the subject matter prove that the overriding goal of manufacturing enterprises is attaining a financial result, thus neglecting the other two pillars of the triple bottom line, i.e., environmental and social considerations. The business model of most manufacturing companies, as well as service companies, are based on increasing profits and market share; this is the dominant model not only in the food market but also in other consumer markets [13,44–51].

The literature review and theoretical framework provided are the interrelated concepts, definitions and results of the research conducted that describe the phenomena or relationships occurring in the area under study. In addition, the research framework, presented later in this article, is used to guide the research process and helps to organize and define the key concepts that are explored.

3. Research Background

Poland is a leading producer of dairy products, poultry and pork meats, fruits (apples, raspberries, blackcurrants and blueberries), vegetables (cabbage, carrots, onions, beets, tomatoes and cucumbers) and mushrooms [4]. It was the production and cultivation of these raw materials that contributed to the emergence of a strong dairy, meat, fruit and vegetable industry. Figure 2 presents the main Polish companies involved in the production of dairy, meat, fruit and vegetable products.

Figure 2. Main Polish companies in the food sector. Source: https://images.app.goo.gl/Q9nBKJxh5 fkgU74y9 (accessed on 3 May 2024).

The food sector, which includes the production of various consumer goods, requires the provision and supply of energy, water, gases and fuels for production. The demand for fossil and energy resources entails interference with the environment and also contributes to the deterioration of the quality of life of societies [37].

The food industry is highly energy-intensive, and this in turn contributes to increased coal and lignite mining in order to provide power plants with fuel for the generation of electricity. It should also be pointed out that in addition to the food industry, other production enterprises that are part of, e.g., heavy industry require the provision and supply of a significant amount of electricity also. The relationship between agriculture and energy is very close. A good example is the production of fertilizers used in agriculture. Agricultural production requires the enrichment of the soil through the use of artificial fertilizers to guarantee the quality and efficiency of agricultural crops [52–54]. Natural gas, a fossil fuel, is used in the production of artificial fertilizers. Both electricity and gas are used in production processes. Production machinery and various types of equipment used for production are run by electricity. Gas, on the other hand, is an essential fuel for the industrial pasteurization of processed fruit or vegetable products, e.g., juices, jams or concentrates. Said thermal treatment is carried out at temperatures between 70 and 115 °C [55].

In addition to providing energy and gaseous fuels, fruit and vegetable processing consumes large volumes of water. Water is the primary raw material used in fruit and vegetable enterprises for washing fruit and vegetables for further processing. It is estimated that the largest amount of water is used in washing sugar beets and potatoes. In some plants, this consumption can account for up to 50% of the total water consumption [56]. Table 1 presents examples of water consumption for different types of fruit and vegetable products [57].

Table 1. Water consumption for different types of fruit and vegetable products.

Products	Water Consumption in m^3/ton
Jam	13–25
Canned beans	14
Frozen beans	12
Stewed fruits	9
Canned vegetables	10
Frozen fruit	7
Vegetable juices	16
Tomato juices	13
Concentrated fruit juices	40
Purées	6–12
Canned cucumbers	9

In this comparison, the most water is used in the production of concentrated fruit juices, with a consumption of 40 m^3 per ton of product. The production of jams requires a relatively high level of water consumption, ranging from 13 to even 25 m^3/ton. The smallest amount of water is needed for the production of frozen fruit—7 m^3/ton—and stewed fruits and pickles—9 m^3/ton—respectively. Producers of processed fruit and vegetables, taking into account the high water consumption in production processes, mostly use their own underground water sources. The use of water is connected with the production of industrial wastewater. They are generated at various stages of the production processes and pose a serious problem for many production companies. In the case of wastewater from fruit and vegetable processing plants, it can account for about 18% of the wastewater discharged from the food industry [58]. For this reason, companies decide to install internal, on-site waste water treatment plants.

Another aspect accompanying fruit and vegetable production negatively affecting the environment and society's quality of life is the generation of organic vegetable and packaging waste. Fruit and vegetable processing plants, next to sugar plants, generate significant amounts of organic waste. Vegetable waste is also a nuisance because of its unpleasant odor, which can spread over large areas reaching places inhabited by people. However, waste from the processing of fruit and vegetables can be properly managed. It can be used as animal feed or to produce dyes, flavors and fruit distillates. However, bigger problems are packaging and waste packaging, which are a serious threat to the environment [59,60]. It is estimated that about 60–70% of the packaging materials produced are used to package food products [61]. The responsibility for the introduction and recovery of packaging lies with the production companies that use packaging to sell their products [62].

Referring to the nuisance odors emitted into the atmosphere by enterprises of the fruit and vegetable industry, it is still necessary to mention of gas and dust emissions produced and emitted during production processes. The main sources of organized emissions are coal boilers, which discharge carbon monoxide, sulfur dioxide and dust into the atmosphere [58]. In Poland, there are still many enterprises with coal-fired boilers used in production processes or used for heating company premises (offices, warehouses and production halls). The amount and type of emission depends on the specifics of production in individual industries, e.g., confectionery companies use gas or electric ovens, in which cakes are baked. Regardless of the type of fuel used, there is no doubt that fruit and vegetable processing companies contribute to the emission of harmful substances into the atmosphere.

4. Research Methodology

In alignment with the primary aim of this investigation, 216 randomly chosen companies from the fruit and vegetable sector in Poland were selected to participate in a survey. The research was conducted in the second quarter of 2023 and was cleared by the authorities of the Opole University of Technology under Gamma Project no. 152/22. The template for the questionnaire together with other supplementary research data is integrated with

this research paper as the source file: Supplementary S1. The questionnaire comprised of 40 questions spread within 8 sections. Questions were established on the basis of formerly published surveys with questions successfully applied to similar research studies, see, e.g., [35,37]. The focus of the questions was on eight fundamental aspects of the sustainable marketing mix concept: the awareness among participants related to the sustainable development concept, the productional activity of the surveyed enterprises in relation to the environment, the production activity of the examined companies in relation to social concerns from the perspective of consumers, the production activity of the studied firms in relation to social concerns from the perspective of employees, the incorporation of social and environmental costs within the sustainable pricing of fruit and vegetable products, the evaluation of the sustainable distribution activity of the examined enterprises, the examination of the promotional activity of the surveyed firms in relation to the sustainable development concept and the examination of the development perspectives of sustainable marketing mix for fruit and vegetable products. These questions were elaborated following a brainstorming session with seven specialists. The selection of the seven experts was carried out purposefully. The purposefulness consisted in reaching specialists with knowledge of both sustainable development, including sustainable marketing, and practical knowledge gained from many years of professional experience acquired while working in food industry companies. The grouping of seven experts enabled a smooth discussion of the research concept, including the identification and formulation of the research questions. The selection of the number of seven experts was also carried out deliberately to prevent chaos and distraction, avoiding side threads during the discussion. Their characteristics are presented in Table 2.

Table 2. Experts' characteristics.

No.	Legal Form of the Business	Firm's Size Class	Years of Work	Expert's Status
1	Limited Partnership	Medium	16	Entrepreneur/Proprietor
2	Sole Proprietorship	Medium	20	Entrepreneur/Proprietor
3	Public Limited Company	Large	21	Business Manager
4	Civil Law Partnership	Small	19	Entrepreneur/Proprietor
5	Limited Liability Company	Large	19	Business Manager
6	Public Limited Company	Large	23	Business Manager
7	Limited Liability Company	Large	17	Business Manager

A preliminary examination was conducted to assess the questionnaire's relevance and comprehensiveness in terms of both structure and content. This preliminary assessment, a crucial step before the main survey, is widely recommended for the optimal choice of research methods and tools [63,64]. The objective of this pre-test was to ascertain the intelligibility and significance of the questions, ensure the alignment of respondent answers with the researcher's intentions and evaluate the questionnaire's consistency (stability) and uniformity (internal coherence) [64–66]. This process led to refinements in several questions, response choices and instructions for completing the questionnaire. Subsequent modifications and amendments gave the questionnaire its definitive shape. The correlation coefficient was found to be stable at $R \geq 0.7$. Additionally, Cronbach's alpha coefficient $C(\alpha)$, commonly employed in constructing scales with multiple-choice items, was also noted as $C(\alpha) = 0.935964 \geq 0.7$, indicating a high level of questionnaire reliability [63,64,67].

With the survey's goal in mind, namely to probe the perceptions of the respondents concerning specific facets of sustainable marketing mix evolution, particularly its intensity of development in the studied areas, the *development index—dE_i*—was selected as a measure. This selection was based on deviations from a standard value, specifically using the gradient method [68–71]. As this measure, under its various names, was already thoroughly explained and successfully applied in many similar research papers, see, e.g., [35,37,72], for

the brevity of this article, its detailed discussion will be omitted. However, its construction is defined here by Formula (1), and the formulation of the ratio is outlined as follows:

It is postulated that the subject of evaluation P_i is symbolized by the vector denoted as $P_i = (p_{i1}, p_{i2}, p_{i3}, \ldots, p_{in})$, where each component is $p, i, n \in N$. The model, or the entity depicted by anticipated variables, is portrayed by vector $\hat{P}_i = (\hat{p}_{i1}, \hat{p}_{i2}, \hat{p}_{i3}, \ldots, \hat{p}_{in})$, with each constituent being $\hat{p}, i, n \in N$. In contrast, the counter-model, or the entity signified by variables considered non-preferred, is represented by vector $\widetilde{P}_i = \left(\widetilde{p}_{i1}, \widetilde{p}_{i2}, \widetilde{p}_{i3}, \ldots, \widetilde{p}_{in} \right)$, each element of which is $\widetilde{p}, i, n \in N$.

$$dE_{ik} = 1 - (\hat{p}_{ik} - p_{ik})/\left(\hat{p}_{ik} - \widetilde{p}_{ik} \right) \tag{1}$$

where $k \in \{1, 2, 3, \ldots, n\}$ and the numerator $\hat{p}_{ik} - p_{ik}$ quantifies the Euclidean distance between a component of the object being analyzed and its ideal counterpart, while the denominator $\hat{p}_{ik} - \widetilde{p}_{ik}$ indicates the Euclidean distance between the anticipated value of a component and its non-preferred counterpart. In this research, $p_{ik} \in \{1, 2, 3, 4, 5, 6, 7\}$, while $\hat{p}_{ik} = 7$, and $\widetilde{p}_{ik} = 1$. Noticeably, $dE_{ik} \in [0, 1]$, and when it becomes closer to the unit value, the development status becomes higher than the element being evaluated. In this research, median values were taken as results for further examination of all questions asked in the survey. Then, mean development indices were applicated for the further examination process which had already proceeded with the application of the DEMATEL methodology, meticulously discussed, e.g., in [73–80].

The following sections provide a detailed analysis of the ratio results and their further examination from the outlined perspective. This metric reflects the sustainability level of the marketing mix in the evaluated domains, determined via an interview technique with each query rated on a seven-point Likert scale [81]. This scale is a widely recognized method for gauging social attitudes in research [67,82,83]. The rationale behind opting for a seven-point scale over a five- or eleven-point alternative is subject to debate, with various perspectives on this matter [84]. Nonetheless, considering the aim of the study and the finite processing capacity of humans [85–87], a seven-point Likert scale was deemed the most suitable choice for this survey. Baseline ratios were computed for all of the evaluated domains covered by the sustainable marketing mix questions, based on participant responses. Subsequently, the significance of the questions was considered equal within each domain. However, all domains were further examined with the application of the DEMATEL [73,79,80,88] method from the perspective of their total influence on the final outcome. This method was considered as the most appropriate in discovering not only the importance of each domain but also its influence on the remaining domains.

The focal entities for the researchers were active businesses within the fruit and vegetable sector of Poland's market. These were categorized under the Polish Classification of Economic Activities (PKD) code 10.39.Z (other processing and preserving of fruit and vegetables), Section C, Division 10, as recorded in the REGON database of the Central Statistical Office in Poland.

Owing to constrained financial resources allocated for the survey, it was resolved to poll merely a segment of the intended demographic. Employing dependent sampling, and once the significance level and accuracy of outcomes were established, the minimal sample size necessary could be computed utilizing Formula (2) [35,37], delineated as follows:

$$n \geq \frac{N}{\frac{4(N-1)d^2}{\mu_{\alpha/2}^2} + 1} \tag{2}$$

Therefore, with an assumed standard confidence level $\alpha = 0.95$ indicating $\mu_{\alpha/2} = 1.96$ and an anticipated precision level $d \leq 0.05$ ensuring a decent error margin of $\pm 5\%$, i.e., a relatively trustworthy estimate threshold, given a target population size of $N = 490$, the calculation yields $n \geq 216$. Consequently, this study investigates a randomly selected

sample of $n = 216$ from 490 enterprises active in the fruits and vegetable sector in Poland, as detailed in the source file: Supplementary S2.

The general characteristics of the surveyed sample (Table 3 and Figures 3–6), in particular featuring the companies' respondents' professional experience (Figure 3), are detailed below.

Table 3. The sample's spread of companies' representative's positions.

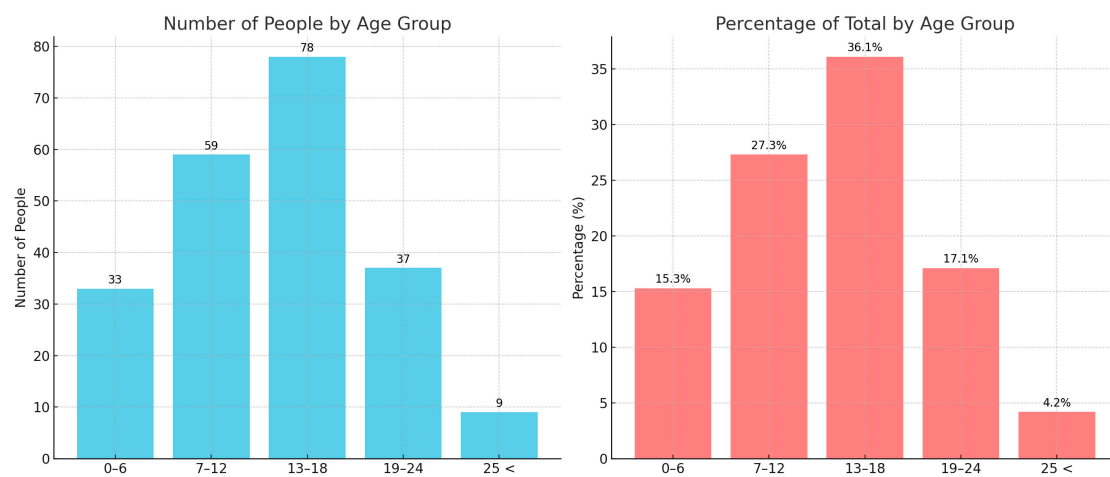| Representative's Position	Business Manager	Entrepreneur/Proprietor
No.	121	95
Percent	56.02%	43.98%

Figure 3. The companies' representatives' professional experience in years.
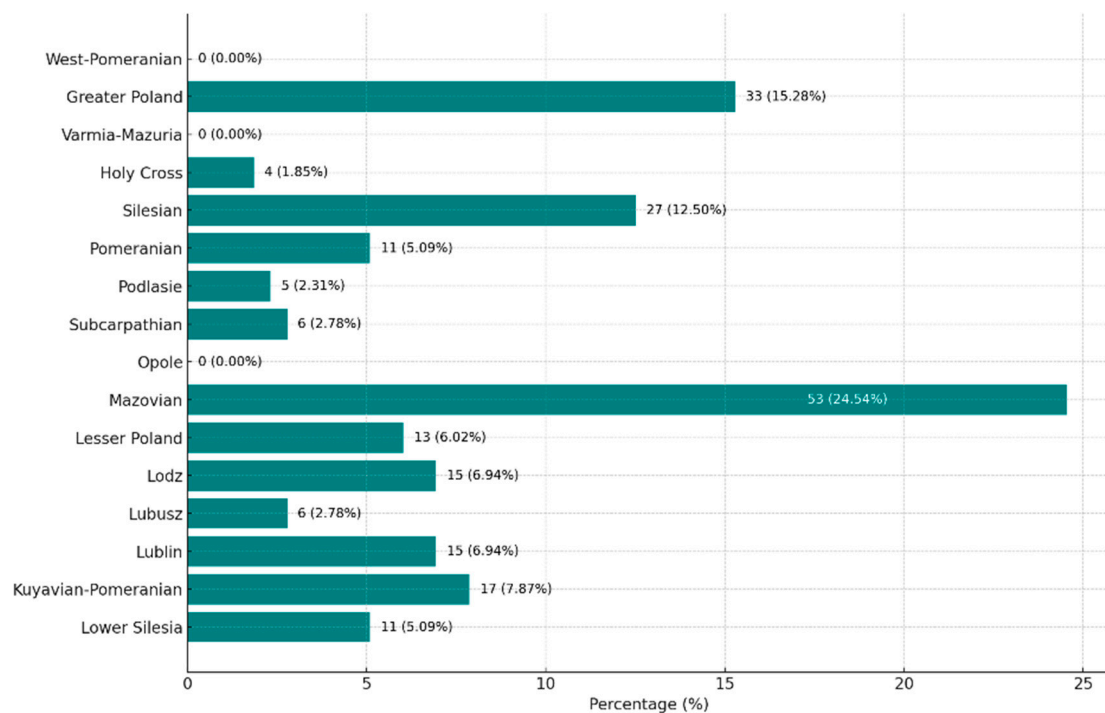
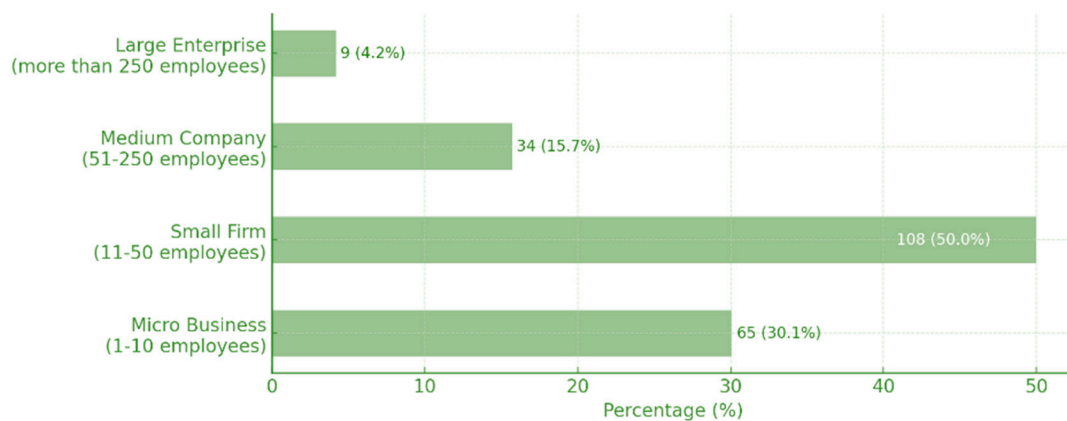**Figure 4.** Number and percentage of total by provinces where the businesses operate.

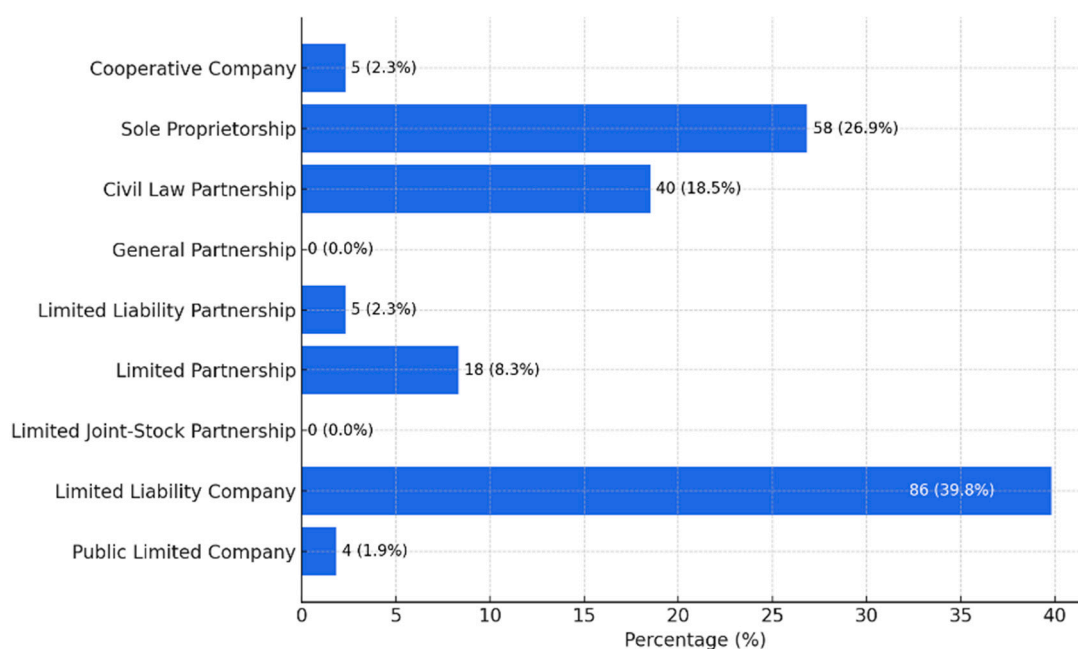**Figure 5.** Numbers and percentages of companies by size.

Figure 6. Number and percentage of companies by legal form.

The complete databases of raw answers for the survey questions and ones computed for each survey question, their *development indices*, are also integrated with this research paper. See, respectively, the following:

— source file: Supplementary S3;
— source file: Supplementary S4.

5. Research Results with Discussion

Decision-Making Trial and Evaluation Laboratory is a technique for decision making that relies on a comparative analysis between pairs. Similar heuristics proved themselves as reliable methods, e.g., [35,37]. As proposed for this research, the DEMATEL approach facilitates the delineation of a causal framework among variables illustrating directional relationships and the extent of impacts exerted by the studied factors. A significant merit of this technique lies in its ability to enable specialists to articulate their insights more effectively regarding the nature and magnitude of the influences among the elements. The results of the seven analyzed domains of sustainable marketing mix with the application of this technique are presented below.

To identify the model of the relations among the $n = 7$ domains (criteria), an $n \times n$ matrix denoted as X had to be generated first—Formula (3).

$$X = \begin{bmatrix} 0 & \cdots & x_{1n} \\ \vdots & \ddots & \vdots \\ x_{n1} & \cdots & 0 \end{bmatrix} \tag{3}$$

The influence of the element in each row on the element of each column of this matrix was denoted by the seven experts mentioned and described earlier. As multiple experts' judgments were used, all experts firstly completed their own matrix, then the arithmetic mean of all of the experts' judgments was calculated and then a direct relation matrix was generated with judgments rounded to integers from 0 to 4 (when: 0 = no impact, 1 = weak impact, 2 = medium impact, 3 = strong impact and 4 = very strong impact). Figure 7 below shows the direct relation matrix X which reflects the judgments of the experts.
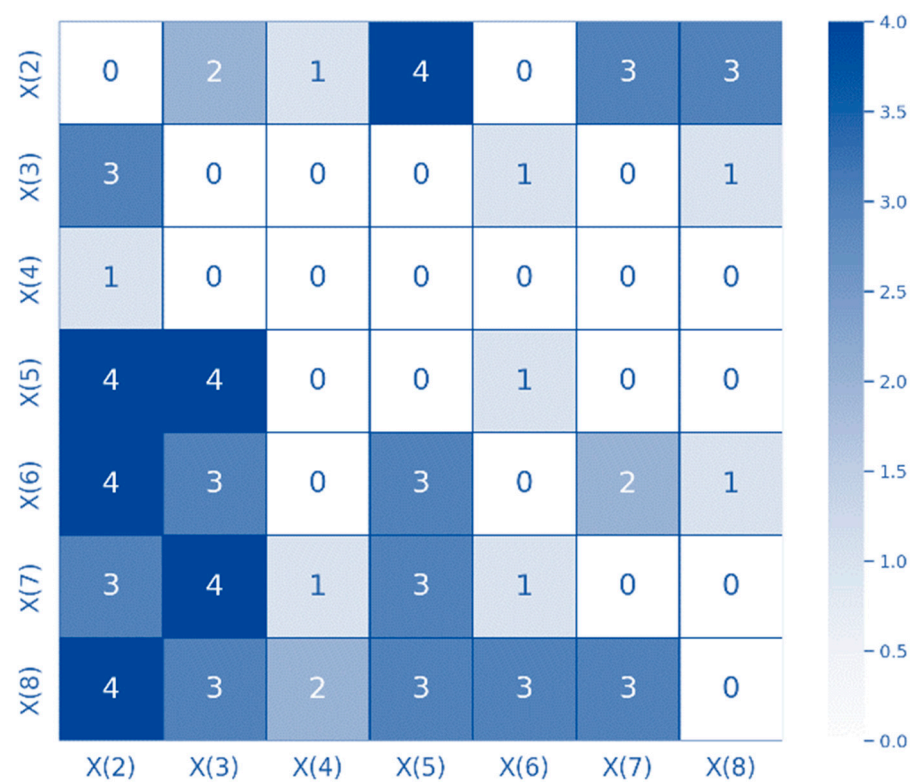

Figure 7. The heatmap of the direct relation matrix.

On the basis of X, the normalized direct relation matrix (DRM) and the resulting total relation matrix (TRM) are created (Tables 4 and 5).

Table 4. The normalized DRM.

	X(2)	X(3)	X(4)	X(5)	X(6)	X(7)	X(8)
X(2)	0	0.111	0.056	0.222	0	0.167	0.167
X(3)	0.167	0	0	0	0.056	0	0.056
X(4)	0.056	0	0	0	0	0	0
X(5)	0.222	0.222	0	0	0.056	0	0
X(6)	0.222	0.167	0	0.167	0	0.111	0.056
X(7)	0.167	0.222	0.056	0.167	0.056	0	0
X(8)	0.222	0.167	0.111	0.167	0.167	0.167	0

Table 5. The resulted TRM.

	X(2)	X(3)	X(4)	X(5)	X(6)	X(7)	X(8)
X(2)	0.262	0.337	0.111	0.378	0.093	0.26	0.234
X(3)	0.265	0.102	0.031	0.104	0.089	0.073	0.11
X(4)	0.07	0.019	0.006	0.021	0.005	0.014	0.013
X(5)	0.365	0.341	0.035	0.126	0.101	0.086	0.085
X(6)	0.455	0.382	0.055	0.344	0.079	0.222	0.157
X(7)	0.359	0.38	0.09	0.294	0.112	0.087	0.087
X(8)	0.529	0.444	0.171	0.398	0.251	0.304	0.127

To calculate the internal relations matrix, it was necessary to first determine a threshold value. This threshold enabled the omission of partial relations, leading to the creation of a network relationship map (NRM), where only interactions with values in the total relations matrix (TRM) exceeding the threshold were shown. The calculation of this threshold involved averaging the values within the TRM. Once the threshold intensity was established, all TRM values below this threshold were effectively nullified, meaning these causal relations were no longer considered relevant. For this study, the threshold was set at 0.185; thus, all TRM values below 0.185 were set to zero. The significant relationships model is depicted in Table 6.

Table 6. The resulting TRM$_{TV}$ calculated by considering the threshold value.

	X(2)	X(3)	X(4)	X(5)	X(6)	X(7)	X(8)
X(2)	0.262	0.337	0	0.378	0	0.26	0.234
X(3)	0.265	0	0	0	0	0	0
X(4)	0	0	0	0	0	0	0
X(5)	0.365	0.341	0	0	0	0	0
X(6)	0.455	0.382	0	0.344	0	0.222	0
X(7)	0.359	0.38	0	0.294	0	0	0
X(8)	0.529	0.444	0	0.398	0.251	0.304	0

The subsequent phase involved calculating the sum of each row and each column in TRMTV (Table 6). From these sums, the values of D + R and D − R were derived. Here, D + R denotes the overall significance of each factor within the system, while D − R indicates the net effect that each factor imparts to the system. Figure 8 below displays the results of these computations.

Figure 9 illustrates the model depicting the crucial relationships of the case. This model is visualized as a diagram where D + R values are aligned along the horizontal axis and D − R values along the vertical axis. Consequently, the position and interplay of each factor within the model are defined by their coordinates in this system.

Referencing the illustrations in Figures 8 and 9, each factor is evaluated based on specific criteria:

- Horizontal vector D + R indicates the overall significance of each factor within the system. This vector reflects both the impact of a particular factor on the entire system and the influence of other system elements on this factor. Consequently, in terms of importance, domain X(2) occupies the highest priority, followed sequentially by domains X(8), X(5), X(3), X(7), X(6) and X(4).

- Vertical vector D − R gauges the extent of a factor's influence within the system. Typically, a positive D − R value signifies a causal variable, while a negative D − R value denotes an explained variable which represents a resultant condition. In this research study, domains X(6), X(7) and X(8) are considered to be causal variables, and domains X(2), X(3), X(4) and X(5) are regarded as their implications. Noticeably, the production activity of enterprises in the environmental area, and in the social area from both perspectives, i.e., consumers and employees, as well as environmental and

social cost policies in relation to the prices of sustainable products, are impacted by prospects for the development of a sustainable marketing mix of a particular industry—herein, the fruit and vegetable products sector and enterprises' sustainable distribution activities and their activity in the area of the promotional messages content.
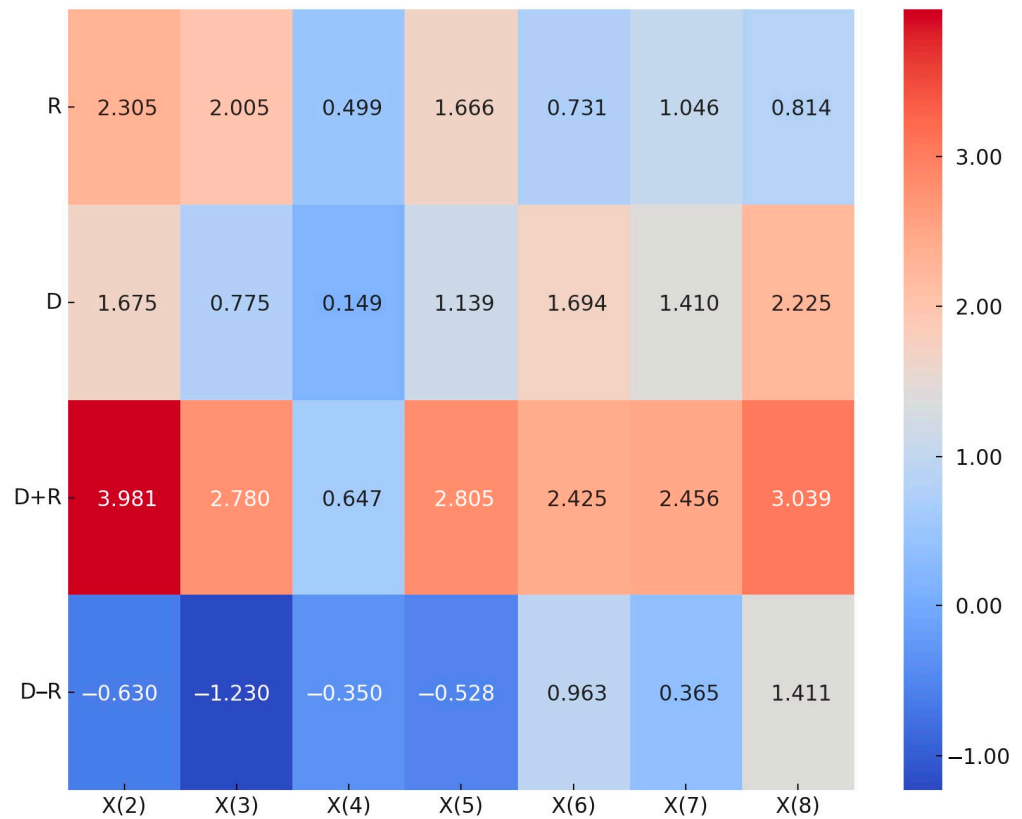

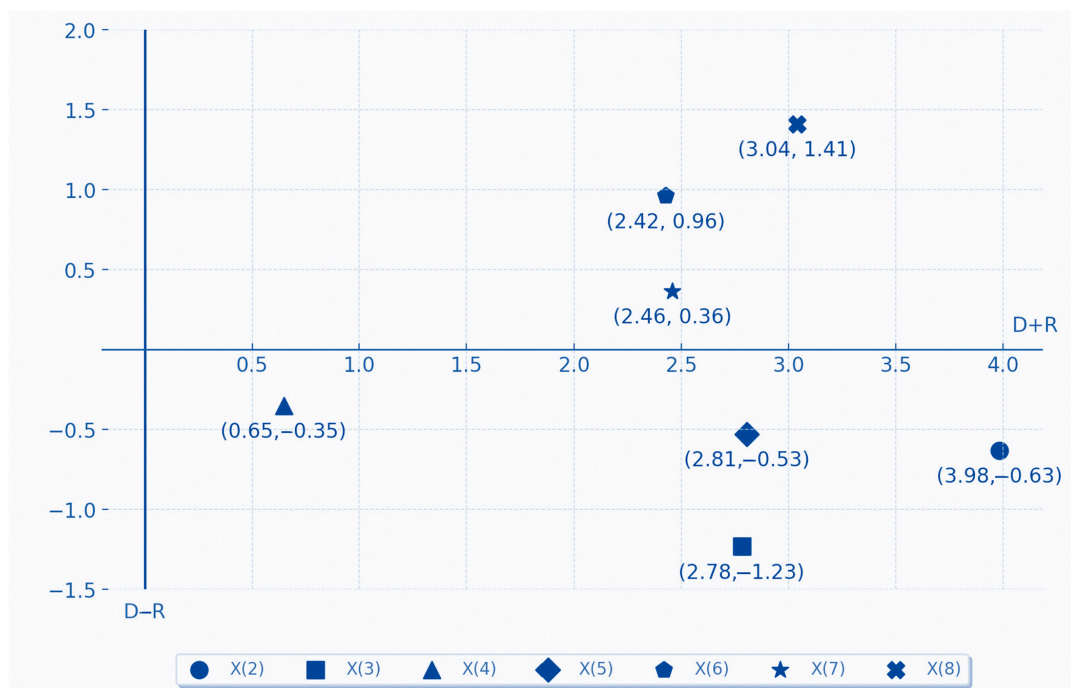**Figure 8.** The DEMATEL final output.

Figure 9. The DEMATEL interactions system.

However, the final research paper's output is much broader and is presented as the research's outcome summary in the form of Table 7. This table comprises the outputs of all median values of the *development indices* for particular questions—denoted as $Me(dE_{Q_n})$— the mean values of $Me(dE_{Q_n})$ for the studied particular domains—denoted as $Mn^{SimF}_{Me(dE_{Q_n})}$ for simple fractions and $Mn^{DecF}_{Me(dE_{Q_n})}$ for decimal fractions—the *importance indices* derived during the DEMATEL analysis for the studied domains—denoted as IMP_{Dtl}—the normalized *importance indices* utilized as weights in the research process—denoted as W_{Dtl}—and weighted mean *development indices* for all domains of sustainable marketing mix—denoted as MnW_{Dtl}.

Table 7. The research's outcome summary.

$X(n)$	Q_n	$Me(dE_{Q_n})$	$Mn^{SimF}_{Me(dE_{Q_n})}$	$Mn^{DecF}_{Me(dE_{Q_n})}$	IMP_{Dtl}	W_{Dtl}	MnW_{Dtl}
(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(4) × (7)**
X(1)	Q_1	5/6	13/18	0.722	$\equiv$	$\equiv$	$\equiv$
	Q_2	2/3					
	Q_3	2/3					
X(2)	Q_1	2/3	4/7	0.571	3.981	0.220	0.125
	Q_2	5/6					
	Q_3	5/6					
	Q_4	2/3					
	Q_5	1/6					
	Q_6	2/3					
	Q_7	1/6					
X(3)	Q_1	1/6	1/6	0.167	2.780	0.153	0.026
	Q_2	1/6					
X(4)	Q_1	5/6	7/9	0.778	0.647	0.036	0.028
	Q_2	5/6					
	Q_3	2/3					
X(5)	Q_1	1	17/36	0.472	2.805	0.155	0.073
	Q_2	5/6					
	Q_3	2/3					
	Q_4	1/6					
	Q_5	1/6					
	Q_6	0					
X(6)	Q_1	1/6	61/120	0.508	2.425	0.134	0.068
	Q_2	1/3					
	Q_3	1/3					
	Q_4	5/6					
	Q_5	5/6					
	Q_6	5/6					
	Q_7	2/3					
	Q_8	2/3					
	Q_9	2/5					
	Q_{10}	0					

Table 7. *Cont.*

X(n)	Q_n	$Me(dE_{Q_n})$	$Mn^{SimF}_{Me(dE_{Q_n})}$	$Mn^{DecF}_{Me(dE_{Q_n})}$	IMP_{Dtl}	W_{Dtl}	MnW_{Dtl}
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(4) × (7)
X(7)	Q_1	2/3	4/15	0.267	2.456	0.135	0.036
	Q_2	1/6					
	Q_3	1/6					
	Q_4	1/6					
	Q_5	1/6					
X(8)	Q_1	2/3	1/3	0.333	3.039	0.168	0.056
	Q_2	1/6					
	Q_3	1/6					
	Q_4	1/3					
		——			$\sum$ 18.133	$\sum$ 1.0	$\sum$ 0.412

For a better perception, Figure 10 below presents the *development indices* for particular domains with their percentage shares in the *combined development index* that, from the perspective of all examined domains of sustainable marketing mix, equals only 0.412.
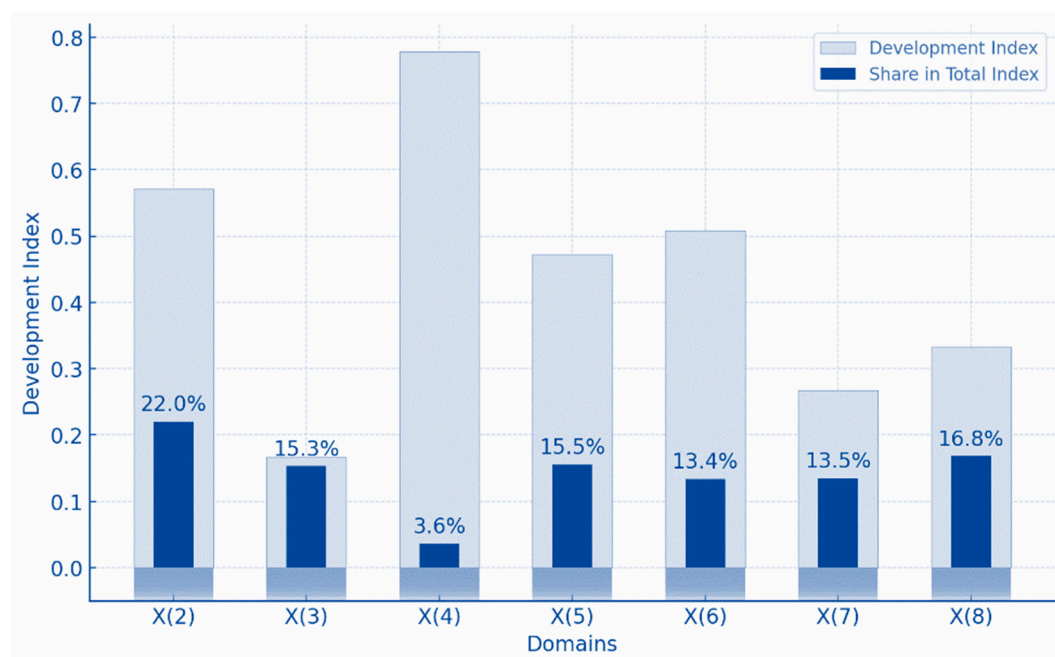
Figure 10. *Development indices* of all analyzed domains with their percentage shares in *combined development index*.

The fast-paced economic development of the modern world entails the degradation of the natural environment, which in turn has a negative impact on people's quality of life. The production industry's demand for various raw materials is often linked to the uncontrolled and unrestrained exploitation of the planet's natural resources. Not only heavy industry but also food companies, including producers of fruit and vegetable products, are involved in this.

On the one hand, food producers try to satisfy the food needs of societies, which is perfectly legitimate, and on the other hand, they contribute to weakening the Earth's ecosystem. Reconciling the existing contradictions requires balancing the actions taken

both in the sphere of production and consumption. A helpful solution to this problem is to take action in accordance with the concept of sustainable development, which can be an inspiration for fruit and vegetable companies to create a sustainable marketing mix.

The functioning of an enterprise on the market is conditioned by the sale of products or services in the case of service enterprises. It is the manufactured product, and more precisely, its sale that constitutes the foundation of the company's existence on the market. In the hierarchy of marketing mix instruments, the product occupies a prominent place as the instrument which gives rise to other marketing instruments, i.e., the price, distribution and promotion mix. Thus, the task of managers responsible for production processes is to create and develop sustainable products already at the planning stage [89–93].

The results of the conducted research on the creation of sustainable products in enterprises of the fruit and vegetable industry indicate that the activities of enterprises require a significant reorientation of their production activities to a more sustainable one with an emphasis on environmental protection. The achieved *development index* for this domain, $dE_{X(2)} = 0.571$, shows that there is a need for betterment within environmental aspects when creating fruit and vegetable products. On the other hand, the index describing the companies' activities in the social area from the employees' perspective is at a quite satisfactory level. The value of the index at $dE_{X(4)} = 0.778$ proves that social issues from the employees' perspective are an important aspect of the companies' activities. However, the index describing the companies' activities in the social area from the consumers' perspective is entirely at the unsatisfactory level, $dE_{X(3)} = 0.167$, and needs urgent attention.

In further discussing the use of sustainable marketing mix instruments by companies in the fruit and vegetable industry, sustainable product pricing should be discussed. The sustainable pricing of a product offer is not an easy task. In addition to the financial outlays that the company incurs for the purchase of various types of raw materials and production materials, employee wages, taxes or costs related to the payment of utilities and other obligations, it is also necessary to take into account the environmental and social costs that accompany the production, distribution, sale and disposal of packaging after the use, damage or expiration of said products. Sustainable pricing is hampered by the prevailing public perception that sustainable products are more expensive because environmental and social costs are added to the actual costs of producing the product [94]. In addition, customer opposition to sustainable prices is further raised by the issue of intangibility and immediate effect [95]. Improving the condition of the environment or improving the life quality of societies takes time [96]. These values do not occur immediately at the time of product purchases, which consequently makes consumers unwilling to pay for something they do not receive immediately at the time of product purchases.

The results of the research prove that in the analyzed companies, the process of forming sustainable prices including environmental and social costs is not at a satisfactory level. The index value of $dE_{X(5)} = 0.472$ is rather low and requires necessary attention. In the prices of their products, enterprises include expenditures incurred on the purchase of raw materials for production, completely ignoring the costs incurred by the environment and society as a result of the enterprises' economic activity.

Taking into account the concept of sustainable development in creating sustainable marketing mix instruments in enterprises of the fruit and vegetable industry, attention should be paid to another instrument, i.e., distribution. The distribution of products, apart from fulfilling its function, which consists in delivering products at the right time and to the right place while ensuring product integrity, plays an important role in influencing the environment and society. Sustainable distribution includes not only physical resources, which can include the means of transport using environmentally friendly fuels, but also focuses on transport routes (shorter, faster routes), which results in shorter delivery times and the way in which products are arranged to maximize the use of transport space. An important factor in creating sustainable distribution is also the shortening of distribution channels by reducing the intermediaries involved in distribution processes.

Analyzing the results of the research concerning the activities of enterprises aimed at creating sustainable distribution, it should be stated that the achieved index is at a rather low level of $dE_{X(6)} = 0.508$. Hence, it can be concluded that enterprises do not act in accordance with the concept of sustainable development. This state of affairs proves that modern means of transport are not used by enterprises, and distribution channels need to be shortened and reoriented towards balancing economic goals with environmental and social goals.

Concluding the discussion on the concept of sustainable marketing mix in enterprises of the fruit and vegetable industry, we should refer to the fourth instrument, i.e., the promotion mix. Promotion is a form of communication between an enterprise and its environment. An enterprise communicating with market participants has an opportunity to convey information about its pro-ecological and pro-social activities. The means and forms of communication and the content of promotional messages persuade consumers to purchase pro-ecological and pro-social products. A sustainable promotion mix gives companies a wider opportunity to show market participants the actions taken by said companies which are implemented to protect the environment and contribute to improving the quality of life.

However, the study shows that companies do not fully exploit the opportunities offered by a sustainable promotion mix in communicating with the environment. The index of $dE_{X(7)} = 0.267$ is entirely not at a satisfactory level. This shows that the organizations in question do not show involvement and creativity in the use of the means, forms and content of promotional messages addressed to market participants.

Finally, prospects for Poland's fruit and vegetable industry development from the perspective of sustainable marketing mix are low; the index of $dE_{X(8)} = 0.333$ clearly is not at a satisfactory level. However, the respondents' awareness in the area of sustainable development is rather high ($dE_{X(1)} = 0.722$). Hence, there is hope that enterprises of the fruit and vegetable industry undertaking action towards balancing the business, based on achieving financial benefits from the conducted activity, with activities aimed at improving the condition of the natural environment and the societies' quality of life, may contribute to strengthening the company's position in the difficult and competitive food market. Moreover, the perception of the enterprise by market participants as a sustainable organization may induce other competitive organizations to change their behavioral strategies in the area of production, price policy, distribution and promotion into more pro-environmental and pro-social enterprises, which will result in the improvement of the condition of the environment and living standards of people for the sake of future generations.

6. Conclusions

The study conducted an in-depth investigation into the sustainable marketing mix of Poland's fruit and vegetable industry, focusing on the environmental and social aspects of production, pricing, distribution and promotional activities. Utilizing the DEMATEL approach, the research provided a structural model of the interconnected dynamics among the various factors of sustainable marketing mix and its development prospects. It revealed a nuanced understanding of sustainability practices within the industry. Notably, while there was a commendable level of awareness and some positive strides in areas such as employee-focused social aspects, significant deficits were observed in consumer-focused social aspects and sustainable promotional activities. This indicates a pressing need for a more integrated approach to sustainability, i.e., balancing economic goals with environmental and social responsibilities. The study's implications extend both to academia, by enriching the discourse on sustainable marketing, and to industry stakeholders, by providing a detailed understanding of the current practices and areas needing improvement.

While the study offers substantial insights, it also opens avenues for further research. Longitudinal studies could monitor the progress and impact of implemented sustainability strategies over time. Investigating consumer perceptions and behaviors toward companies'

sustainable practices could also provide a more holistic view of market dynamics and further guide industry practices.

The research, while thorough, is not without limitations. The study focused on a specific sector within Poland's economy, which may limit the generalizability of its findings to other industries or countries. The sample size, although adequate for the scope of this study, represents a fraction of the industry, and larger studies might yield more generalized results. Furthermore, the reliance on the DEMATEL method, while effective, means that the findings are contingent on the specificities of this approach, and employing different methodologies might provide alternative perspectives.

Conducting a research study on the undertaken topic made it possible to achieve the purpose of the study, which was to quantify the effectiveness of sustainable marketing implemented in companies operating in Poland's market of the fruit and vegetable industry.

In conclusion, this research provides valuable insights into sustainable marketing practices within Poland's fruit and vegetable industry, highlighting areas of strength and opportunities for improvement. It contributes to the theoretical understanding of sustainable marketing while offering practical implications for industry stakeholders. This study may be of interest to practitioners and theoreticians dealing with sustainable marketing issues. The article can also be a helpful tool for managers of food companies, including those in the fruit and vegetable industry, in their efforts to achieve their economic, environmental and social goals in accordance with the concept of sustainable development. Future research in this area is vital to continue advancing our understanding and implementation of sustainability in marketing practices across various sectors and regions.

Nomenclature

Variables and functions

N	population size
n	sample size
d	level of accuracy
$\mu_{\alpha/2}$	quantile of order $\alpha/2$
α	significance level
dE_{Q_n}	the *development index* for a question, Q_n
X(1)	respondents' awareness in relation to sustainable development concept
X(2)	production activity of enterprises in the environmental area
X(3)	production activity of businesses in the social area (the consumer perspective)
X(4)	production activity of firms in the social area (the perspective of employees)
X(5)	environmental and social cost policies in relation to the prices of sustainable fruit and vegetable products
X(6)	sustainable distribution activities for fruit and vegetable products
X(7)	activity in the area of the promotional messages content
X(8)	prospects for the development of sustainable marketing mix of fruit and vegetable products

Abbreviations

DEMATEL	Decision-Making Trial and Evaluation Laboratory

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