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A SUSTAINABLE PRODUCT IN VIEW OF TECHNICAL PARTS AND COMPONENTS OF A MEANS OF AGRICULTURAL TRANSPORT

Summary. This study includes research whose main goal was to answer the question of the mandatory features of a sustainable product and the level of their fulfilment in view of the manufacturing process of parts and technical subassemblies of a means of agricultural transport. With reference to the objective formulated in this way, preliminary criteria were established that were then subjected to a comprehensive analysis and breakdown (determining the significance from the research perspective). In the next stage, within the theoretical and design layer – following literature review and expert research – a research tool in the form of an evaluation sheet was created. At the empirical level, a thorough evaluation of the implementation of deliberately selected propositions serving as the global foundation of the concept of the sustainable product manufacturing process was performed (the holistic approach). The investigation was conducted among selected manufacturers of parts and technical subassemblies of means of agricultural transport (agricultural machinery sector). At the onset of the research work, the conceptual model of the thesis was constructed, according to which the surveyed enterprises are focused on individuals (working environment), natural

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environment and economics (including minimizing waste throughout the product life cycle), which is a prerequisite as far as a sustainable product is concerned.

Keywords: sustainable product, product life cycle, sustainable development, sustainable production, parts and components of a means of agricultural transport

1. INTRODUCTION

Company's efficiency depends on the ability to meet the growing expectations of customers [1]. Therefore, to improve the competitiveness of manufactured products, a company must adjust all its activities to the needs of customers by giving its products the features desired and preferred by buyers [2]. In order to keep up with the competition, all the potential opportunities of the organization should be exploited by optimally utilising its own resources. It is about providing the market with what is needed and at the same time with what can be produced by the company. Therefore, modification of existing products or development of new products are of great importance for the company. They determine the level and pace of revenue growth, market share, market position or quality and cost leadership [3].

The starting point before the manufacturing process should therefore be the recognition of customer needs, enhanced with market research. Based on the knowledge of customer needs, competition activities, consumer sensitivity to the social environment and environmental activities, the company develops its action plans. The suggested price, the properties of the offer, the added value it provides all affect the purchase decision made by the customer. Their analysis is to assist the manufacturer in predicting future market behaviour. Although the process of consumer behaviour on the market because of multi-faceted conditions, is very complex, getting to know it is the best way to adjust the offer to the needs and preferences of customers [4].

The objectives of modern enterprises focus on increasing the value of the product [5-7] in view of their interests (manufacturing economics) on the one hand, and they must consider a number of factors resulting from the needs of the environment [8] on the other. Considerable attention is paid to environmental criteria [9], which should be included at the stage of selecting raw materials and materials utilised in production, as well as at the manufacturing processes themselves. Products should be designed to be recyclable or reusable, facilitating waste management and making it less costly. In such a way, enterprises can improve their own processes, influence suppliers and other market entities with whom they cooperate at various stages of the life cycle of products. While they take care of the impact on the environment and monitor it, they implement the idea of thinking with the product life cycle in mind. Hence, the rational minimization of the negative environmental impact of manufacturing processes, involving employees, the natural environment and the minimization of post-production waste, is therefore an inherent feature of a sustainable product [10].

In connection with the above, the key and inseparable element of production activity is the ability to manage it. To understand it, companies need to adapt and influence specific aspects of their economic, social and natural environment [11].

Ensuring the final product's quality and durability through a number of factors occurring during the entire cycle leading from its production, processing, transport, storage to its acquisition by the consumer and end-of-life treatment should ensure the long-term development capacity of the company while maintaining good economic, social and environmental results [12].

In the search for a market advantage, one of the most important steps is to analyse the value of the manufactured product from the consumer's perspective [13]. It is essential to identify the benefits expected by consumers within a given market segment and how they perceive the added value of the product portfolio.

In view of the above, the main goal of the research was to address the issue of the mandatory features of a sustainable product and to estimate the level of their fulfilment in view of the production process of parts and technical subassemblies of agricultural means of transport.

This theoretical and empirical scope of the publication dictates the research methods applied. As for the theoretical aspects, the method of analysing and interpreting the literature related to the theory of sustainable management was used, and regarding the design layer, a research procedure based on a creative discussion conducted among carefully selected experts – representatives of agricultural machinery companies manufacturing parts and subassemblies of technical means of agricultural transport (tractors, trailers, self-propelled agricultural machines) was initiated.

The intention of the authors was to present product evaluation in the broader context of striving for the optimal value for the customer, including the highest quality, the lowest (or acceptable) cost, the shortest delivery time obtained simultaneously as a result of avoiding and constantly eliminating all kinds of waste and negative impact on the environment [14] while providing customers with what they want and need (sustainable product philosophy). It is intended to provide practical guidance in this regard.

2. SUSTAINABLE PRODUCT – SOME REFLECTIONS

The market leading position of a product requires numerous elements that are of a specific value for the customer. From the consumer's perspective: the greater this value is, the better chance there is for a manufacturer to gain loyal customers [15], which ultimately ensures its functioning and development. The decisive condition for achieving market success is therefore the product's ability to satisfy specific needs of the consumer. This means that when buying the product, the customer acquires not only its physical features, but also certain benefits: utility values and expectations related to a given product [16]. The product is therefore a combination of interconnected physical features, utilities, benefits, and values.

One of the essential conditions for the company's success on the market is to identify the most effective product position on the market. Therefore, it is necessary to decide what image of the product and the company to create in the minds of consumers [17]. This process is known as product positioning on the market [18]. The starting point for positioning is the product [19]. Yet positioning does not just mean what is done with the product itself. It also refers to product perception by potential buyer. In other words, the product is positioned in the buyer's mind [20]. The aim of this activity is to obtain the desired position of the product and the company in the future awareness of buyers [21].

Currently, more and more consumers are aware of their impact on the environment – both in the context of the impact exerted by the manufacturers and the products they manufacture. Several practical examples show the economic and social benefits resulting from caring for ecological issues, as well as the environmental policy adopted [22].

Environmental aspects should therefore be analysed and incorporated into product design and development. Which means that the product should be designed in a way that reduces the consumption of natural resources and reduces the negative impact on the environment without compromising quality (ecodesign). It aims at reducing the negative environmental impact at

every stage of the life cycle [23-25]. Starting from the acquisition of materials and raw materials, through production, transport, use, up to the final management and final disposal of the generated waste or its reuse. [26-27].

Unfortunately, the current economic model is still based on the "take-make-dispose" principle. It depletes available resources, pollutes the environment and destroys biodiversity and climate [28]. This also makes European countries dependent on resources from other sources. To solve these problems, it is necessary to move to a circular economy model [29-30] based on sustainable products [31]. It involves addressing the environmental impact of products at every stage of their life cycle and extending their functionality. Businesses must thus focus on manufacturing more sustainable, circular and more resource-efficient products. More sustainable products contribute to increasing the competitiveness of companies.

However, at the level of the European Commission (EC), certain activities have been undertaken to introduce uniform, EU-wide methods for measuring the environmental performance of products and organizations (as initiated by the Communication to the European Parliament and the Council issued by the European Commission in 2013 on the need to build a common market of green products and assessment of their environmental performance), but there is still a lot to do in this area. That is why on 30 March 2022 a set of measures was adopted by the EC whose aim is to make sustainable products the norm in the EU. The activities suggested are crucial to achieve the goals of the European Green Deal, the European growth strategy to transform the EU into a fairer and more prosperous society, and to implement the key objectives of the Circular Economy Action Plan. They will help to achieve EU environmental and climate goals by doubling the circular material consumption rate and achieving energy efficiency targets by 2030 [32].

In view of the above, the following questions must always be asked:

- Where was the product manufactured (by whom and under what conditions)?
- What materials is it made from?
- Will it recyclable or reusable at the end of its life?
- How efficient is the product?

With the deterioration of the natural environment in mind, these issues become crucial. The basis of a sustainable business model should, therefore focus on safe, economical and durable products that are created during the clean production process. Manufacturing goods in a clean production process requires the elimination of harmful emissions of gases, liquids, solid substances and radiation from technological processes, limiting the waste of energy, heat, water, raw materials and other aspects of production. The same should also be implemented by manufacturers of materials, parts, and components.

A sustainable company manufactures safe, durable products [33]. Environmental criteria should be considered both at the level of selecting raw materials and materials used for production, as well as the production processes themselves (sustainable production). Products should be designed in such a way as to be recyclable [34-35], or reusable, resulting in waste management that is more efficient and less costly [36-37]. In order to create such products, the analysis of their entire life cycle must be carried out, including the production, marketing and use phases, as well as the social and ecological aspects of their disposal. Disposing of goods is one of the greatest challenges for manufacturers [38].

3. SCOPE OF RESEARCH

3.1. Defining the research problem

In the market of manufacturers of parts and components of agricultural machinery (technical means of agricultural transport), the basic competition tool (to an even greater extent) is the product. Product orientation will determine other marketing instruments – this is proven by the analysis of the development strategy and competition of participants in this sector conducted by the authors of the study. It asserts the dominant position of the product strategy in the marketing mix. The effectiveness of marketing instruments and activities understood as an integrated whole, i.e. a certain sustainable marketing system, will be decisive for the success of the company. It is why formulating the company's marketing strategy should not be based exclusively on striving to maximize individual elements of this strategy, but all its elements combined.

Factors that destabilize the environment, causing its increasing turbulence, include many social changes. Farmers are increasingly ambitious entrepreneurs, spontaneously looking for new solutions, striving for innovative methods of cultivation and breeding. A modern agricultural entrepreneur strives to increase the profitability of its company and to implement as many rational solutions as possible with the lowest possible costs and environmental risk. It should be remembered that social and technological development will focus its special attention on maintaining ethical, moral and religious principles, so that the centre of attention is always the man and the environment, not only the machine and profit.

The changes that have already taken place in the 21st century have resulted in a radical revision of the philosophy of management. An important feature of the new approach to doing business is environmental protection. From this perspective, the company should be more aware of ecological issues and, by addressing them indirectly, ease the burden on the natural environment. The implementation of such an approach requires a change in the attitude to ecology from the end stage of the production process to its very onset (process design).

Nowadays, attention to natural environmental resources is becoming an increasingly significant element of the functioning of enterprises on the global market. When choosing a specific product, consumers are increasingly guided by information about the company's influence on the environment. The increasingly stronger ecological lobby active in highly developed countries is accelerating the process of making production companies operating within the agricultural machinery sector more eco-friendly. Today, the basic goal of an enterprise is not only to generate profit, survive and develop, but also to respect the environment and ensure the sustainable use of natural resources. An efficiently implemented and functioning green process within the enterprise is a guarantee of sustainable economic development. In view of the above, production companies will be forced to incur considerable expenses to maintain extensive environmental systems. Of course, alternative ways of achieving the assumed goals by implementing other (cheaper) solutions in this area may be considered but linking new production methods with environmental protection should be preferred.

The key is to adapt products to the demands of a climate-neutral and resource-efficient circular economy and reduce the amount of waste. This initiative should also cover the issue of the presence of harmful chemicals in products, e.g. in cast iron (a key raw material in the production of parts, components and agricultural machines, including agricultural means of transport), as well as strengthening the position of consumers. Therefore, the action plan for sustainable production and its individual elements should be supported. The concept of product life cycle analysis, and in particular the concept of efficient management of resources and raw

materials, should be effectively strengthened. Therefore, sustainable, safe and non-toxic circular products and materials should be the norm (not the exception) for manufacturers and should be considered a mandatory option that is attractive, affordable, and accessible to all consumers.

The complexity of the description of actions and proposals regarding sustainable consumption and production as well as sustainable industrial policy, aimed at increasing the environmental performance of products throughout their life cycle, increasing consumer awareness and demand for sustainable products (components and parts) and production technologies, make this issue important, both theoretically and practically to management staff as well as business owners. In view of the above, it was the authors' intention to conduct a series of pilot studies (initial research) in an attempt to answer the question concerning the mandatory features of a sustainable product on the agricultural machinery market. Additionally, the lack of studies was noticed in which research work is undertaken to determine the level of their fulfilment in terms of the production process of parts and technical components of agricultural transport means. In view of the above, filling this knowledge gap was considered justified.

3.2. Purpose, questions, and presumption

The study undertook research with the main goal of trying to address the question of the obligatory features of a sustainable product. It was also considered crucial to specify the level of their achievement in terms of the production process of parts and technical components of agricultural transport means.

To achieve the main goal, the formulation, and implementation of theoretical (cognitive), methodological and practical partial goals was required. The cognitive goals involved literature review on the concept of a sustainable product, which gave rise to further research reflected in the process of collective search, creation, and evaluation of ideas (features significantly emphasized in the literature on the subject). The methodological goals included specifying the procedure for forming key – from the research point of view – proposals and the mechanism for determining the hierarchy of articulated features of a sustainable product. The practical goal was to specify the level of compliance with these features from the perspective of parts and components required for technical means of agricultural transport (verification among manufacturers operating in the agricultural machinery sector). The authors' intention was to make a list of practical conclusions and recommendations. From the perspective of the discussed topic, a number of important research questions were formulated:

- What features of a sustainable product, emphasized in literature, are important for the evaluation of parts and technical components of a means of agricultural transport?
- What features that constitute a sustainable product – in the opinion of experts and manufacturers of technical parts and components for means of agricultural transport – are the key features?
- Do parts and components of technical means of agricultural transport as manufactured by the surveyed companies qualify as a sustainable product?

The belief that there exists an economic demand for results of an applied nature served as the main inspiration to undertake research, and it became the starting point for formulating the thesis (presumption). On the other hand, an increasing number of manufacturers of parts and technical components for agricultural transport organise a business model which revolves around the concept of a sustainable product and the values that define it. Thus, the surveyed

companies are oriented towards people (work environment), natural environment and economy (including minimization of waste throughout the entire product life cycle), which, from this perspective, is a necessary condition.

3.3. The concept of study procedure

In this study, a four-stage research procedure was applied, the diagram of which is shown in Figure 1.

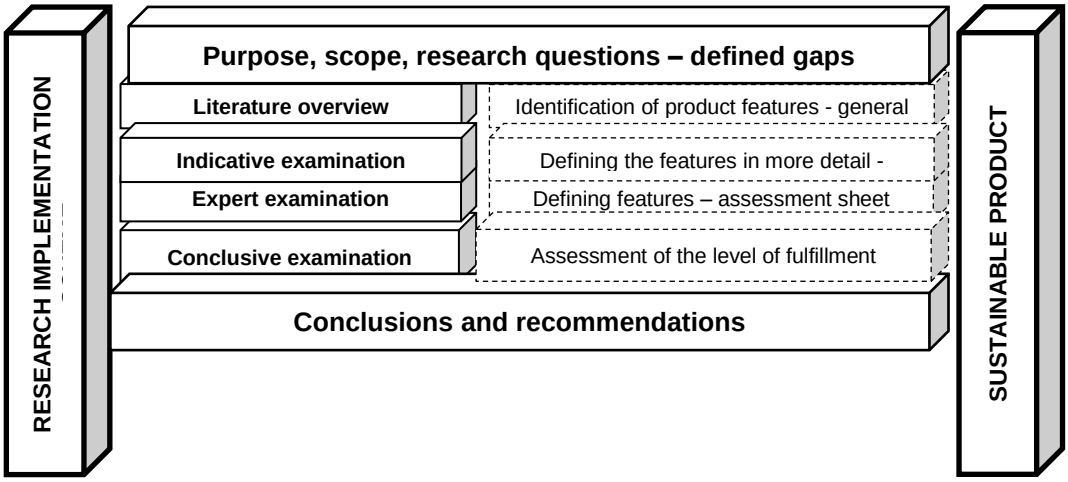

Fig. 1. Concept of research procedure (own study)

The first stage of the research, stemming from the literature overview, includes features characteristic of a sustainable product (values), which are assessed later on in the work. Still – at the stage of formulating the general list – it was assumed that none of the features was more important than others, the main goal of further research was to try to estimate the level of their essence and accomplishment. In this context, their ranking was justified. Theoretical research – in the further part – constituted the basis for defining key values.

In the second stage, an expert team was appointed to define a catalogue of sustainable product features and discuss them in relation to the examined sector and the results of literature overview. As developing characteristics poses difficulties (individual researchers create their own categories of research objects, without assigning them ranks, naming and interpreting them differently), such action was considered desirable. In the end, a catalogue of features defining a sustainable product was assembled, which is the basis of the assessment sheet. The main survey was carried out among manufacturers of parts and technical components of agricultural transport means. From their perspective, the degree of implementation of the features defining a sustainable product throughout its life cycle was measured.

4. METHODOLOGY

4.1. Literature query

The literature review was carried out based on the two largest indexing databases (Web of Science and SCOPUS). Still, the decision was also made to include scientific texts written in

Polish and possibly those of non-scientific type as well. Therefore, with authors' perceptual and time capabilities in mind, as well as the practical limitations imposed, the decision was made to include publications catalogued in EBSCO and BazEkon in the final database as well. The choice of the databases was informed by the availability of publications concerned with the research subject and their quality.

A preliminary analysis of the literature indicated that the topic of sustainable products is covered under different headings and in various combinations. Therefore, the following terms were searched for in electronic databases: "Sustainable Parts and Components", "Product Life Cycle", "Sustainable Product", "Sustainable Management", "Sustainable Development". The reconstruction and interpretation of the subject literature method was supported by two competent reviewers, which enabled the selection of publications that most significantly reflected the research problem. The literature review included works mainly from the area of engineering, technical and social sciences.

As a result, the catalogue of features characteristic of a sustainable product has been compiled. The literature query made it possible to confront the authors' thoughts and experiences with the findings of other researchers. Moreover, it was an inspiration to undertake further research. The analysis took place in three phases. First, key features defining a sustainable product were extracted from the available texts. Secondly, repeated features were isolated through logical analysis. Then, content defining was assigned to each feature. On this basis, conclusions were drawn and presented during the organized creative session.

4.2. Exchange of ideas – expert method

The concern of the next stage of research was to attempt identification of features characteristic of a sustainable product (the proposals) by deliberately selected field experts. It was assumed that a debate held within a group of experts may lead to formulating new proposals, on the one hand, as well as enable the verification of the accuracy of the selection of proposals developed on the basis of previous literature research, on the other. To ensure the adequacy of their assessments, a representative panel of experts was selected: 12 participants were invited to participate in the study. The surveyed experts included a group aged between 31 and 40 (8.33%). The age of 58.33% of the respondents was between 41 and 50 years, 8.33% was between 51 and 60 years, and 25.00% were over 60 years. Among the respondents, the majority had higher education (75.00%); 16.67% had secondary education, 8.33% – had vocational education.

In order to select the best group of ideas – each invited user could formulate proposals (the brainstorming), and the other members could debate them (the selection of ideas). After completing the research, the authors wrote down all the proposals suggested, compared them with the proposals of selected researchers (literature research), grouped similar ideas, which in the long run resulted in compiling a list of 39 essential characteristics as regards the concept of a sustainable product.

It is assumed that the factors mentioned here are by no means exhaustive. Their list is not and cannot be finite. In the opinion of the authors, sometimes an entirely new or underestimated factor (feature) appears, which suddenly changes the image of the prevailing reality radically. Moreover, there is a probability of mutual interactions of individual factors, the possibility of their accumulation, which leads to further adjustments and breakthroughs in the organization.

Regardless of the above, in order to be able to discuss the key proposals (constituting the strongest accents from the perspective of the concept of a sustainable product), it was necessary to reduce the list by means of expert organization method, as the introduction of such a large

number of variables would prevent the formulation of significant conclusions. To achieve specifically this goal, the decision was made to conduct an additional reduction study. For this purpose, a team of competent judges was appointed, consisting of 3 selected specialists.

4.3. Verification test

4.3.1. Description of the research sample

47 companies manufacturing parts and components of technical means of agricultural transport took part in the survey, the main aim of which was to assess the importance and level of fulfilment of selected features of a sustainable product. The surveyed enterprises included manufacturers of products classified within the groups of (1) agricultural tractors, (2) manure spreaders and trailers, (3) self-propelled machines. The majority of the surveyed entities were natural individuals running a business (53.19%). The share of enterprises operating in the form of a limited liability company was also relatively high (34.04%), it was also true for private partnerships (8.51%). The share of joint-stock companies and general partnerships was insignificant (4.26%). Most of the companies taking part in the survey were enterprises consisting of 10–50 employees. Their share in the research sample was 42.55%. There was also a large percentage of companies employing 51–250 employees (38.30%). The share of small companies (up to 9 employees) was 10.64%, and large companies (over 250 employees) accounted for only 8.51%. The vast majority of enterprises hold an established position on the market and have been operating on it for many years. Note that 70.21% of the companies have been operating on the market for at least 11 years. The percentage of companies that have been operating on the market for 6–10 years is also rather large (25.53%). However, companies that have been operating on the market for no more than 5 years accounted for the total of 4.26% in the survey. Most of the analysed companies conduct their business activities mostly on the domestic market (31.91%) and the European market (38.30%). The share of enterprises in the agricultural machinery sector (technical means of agricultural transport) operating primarily on a global scale was 29.79%. The products manufactured by the company are 23.40% original parts, which are mainly used for the so-called first assembly (OE — Original Equipment). In the case of 17.02% of enterprises, products are manufactured on the same production line as spare parts; they are not marked with the logo of the manufacturer of the agricultural means of transport, but with the logo of the parts' manufacturer (OEM — Original Equipment Manufacturer). As many as 38.30% are companies whose parts have appropriate certificates issued but are not delivered for the first assembly (OEQ). For 21.28% of companies, substitutes that do not have certificates are crucial.

The vast majority of the survey was completed by respondents holding positions at the highest management level of the company. Most often, they were owners (46.81%) or respondents from the company's management board (27.66%). The percentage of respondents belonging to the company's management staff (19.15%) and respondents holding lower positions in the company (6.38%) was much smaller. The vast majority of respondents (70.21%) who represented companies in the process of completing the survey questionnaire had higher education (bachelor's, engineering or master's degrees). There were only 29.79% of respondents who had less than higher education (vocational and secondary education, and this group was dominated by respondents with secondary education). The majority of respondents completing the survey questionnaire were respondents aged 45-54 (31.91%). There was also a significant share of respondents aged 36-44 (19.15%) and 55-65 (29.79%). Younger

respondents, i.e. under 35 years of age, constituted only 2.13% of all respondents, and those aged 65+ – as much as 17.02%.

4.3.2. Results

A survey questionnaire was developed to collect statistical material in order to perform the data collection process using this tool. The empirical material obtained from the above sources enabled the researchers to create collective tables showing the impact of specific factors on a sustainable product. A point assessment of the attractiveness of the sector was used for the analysis. It involved constructing a list of features characteristic of a sustainable product. Then, this list was assessed during survey interviews. Participants in the study were asked to determine the weights of the respective features affecting a sustainable product (importance assessment). When determining the weights, they were given a scale from 1 to 5, where 1 meant the lowest weight and 5 – the highest one. In addition, respondents were asked to evaluate specific features, in accordance with the current situation in the company in which they operated. The assessment of individual factors was also made on a scale from 1 to 5, where 1 meant the lowest assessment and 5 – the highest one. The research results are presented in Table 1.

Tab. 1

Importance of sustainable product features (own research results)

No.	Sustainable product feature	1	2	3	4	5	Mean	
		% of indications (study I / II)					(I)	(II)
1.	Product compliance with EU directives	- -	- 4.3	- 10.6	38.3 42.6	61.7 42.6	4.62	4.23
2.	High-quality product	- -	- 2.1	- 6.4	40.4 48.9	59.6 42.6	4.60	4.32
3.	High degree of compliance with requirements throughout the product life cycle	- -	- -	- 12.8	42.6 44.7	57.4 42.6	4.57	4.30
4.	A “relationship-based” product	- 4.3	- 2.1	- 10.6	44.7 44.7	55.3 38.3	4.55	4.11
5.	Efficient and modern production technologies that are environmentally friendly	- -	- 4.3	6.4 8.5	36.2 42.6	57.4 44.7	4.51	4.28
6.	Reputation and opinion prevailing in the market	- -	- 4.3	6.4 8.5	40.4 44.7	53.2 42.6	4.47	4.26
7.	A product focused on ecology in the process of use	- 2.1	- 6.4	6.4 21.3	42.6 36.2	51.1 34.0	4.45	3.94
8.	Ecodesign	- -	- 4.3	10.6 10.6	36.2 38.3	53.2 46.8	4.43	4.28
9.	Supply of spare parts	- -	- 2.1	8.5 12.8	40.4 36.2	51.1 48.9	4.43	4.32
10.	Types and quantities of packaging materials	- 2.1	- 6.4	10.6 17.0	38.3 38.3	51.1 36.2	4.40	4.00

11.	The product is designed in such a way as to make it recyclable	- 4.3	2.1 14.9	8.5 29.8	40.4 25.5	48.9 25.5	4.36	3.53
12.	Technological options for harmless disposal	- 2.1	- 6.4	14.9 21.3	34.0 27.7	51.1 42.6	4.36	4.02
13.	Resistance to changing working conditions	- -	- 4.3	8.5 12.8	48.9 36.2	42.6 44.7	4.34	4.15
14.	Elimination of activities not adding value to the product	- 4.3	2.1 4.3	10.6 14.9	40.4 36.2	46.8 40.4	4.32	4.04
15.	Designing work systems with the recommendations of conceptual ergonomics in mind	- 2.1	- 6.4	14.9 17.0	42.6 27.7	42.6 46.8	4.28	4.11
16.	An “ethical” product that incorporates the theme of social justice	2.1 -	2.1 2.1	14.9 17.0	31.9 29.8	48.9 51.1	4.23	4.30
17.	Maximizing usability while minimizing operating costs	2.1	4.3 6.4	10.6 14.9	36.2 38.3	46.8 40.4	4.21	4.02
18.	Supervision of product functioning and assessment of safety of use	2.1 4.3	2.1 6.4	14.9 31.9	36.2 23.4	44.7 34.0	4.19	3.77
19.	Highly competitive product (cost-profit ratio combined with environmental benefits)	2.1 -	- 4.3	14.9 14.9	42.6 36.2	40.4 44.7	4.19	4.21
20.	Possibility to transfer the used product to the supplier	- 4.3	6.4 6.4	12.8 27.7	38.3 31.9	42.6 29.8	4.17	3.77
21.	Compliance with specifications	- -	4.3 2.1	12.8 8.5	51.1 53.2	31.9 36.2	4.11	4.23
22.	Replacing energy sources in production processes - introducing the so-called green energy	2.1 6.4	4.3 14.9	21.3 34.0	34.0 25.5	38.3 19.1	4.02	3.36
23.	Improvements in tool and material management are introduced in production	2.1 -	6.4 4.3	17.0 17.0	38.3 42.6	36.2 38.3	4.00	4.21
24.	Instruction manual ensuring safe use	2.1 -	6.4 -	14.9 8.5	42.6 44.7	34.0 46.8	4.00	4.38
25.	The product has a warranty	4.3 2.1	2.1 -	21.3 10.6	40.4 38.3	31.9 48.9	3.94	4.32

In the context of a sustainable product, its compliance with EU directives, including a hazard analysis and risk assessment for the purposes of issuing an EC declaration of conformity, was considered. In the case of manufacturers of components and parts of agricultural trailers, the compliance with the regulations on technical conditions and vehicle equipment (traffic on public roads) is crucial, including measurements of masses and wheel and axle loads of road vehicles (4.62), the requirement generally implemented by the examined enterprises (4.23). This partly influences the high quality of components and parts (performance, reliability, compatibility, durability, aesthetics) ensuring their long-term use (4.32). It is important as ensuring the quality and durability of the final product (through a number of factors present during the entire cycle leading from its production, processing, transport, storage to purchase by the consumer and recycling) is – in the opinion of the surveyed enterprises – a premise that significantly determines a sustainable product (4.60). A relatively high degree of meeting the requirements resulting from market needs is implied, taking into account the latest

achievements and experience in the processes of design, construction, production, and operation (4.30). It thus influences the level of modernity throughout the product's life cycle, which is important as far as a sustainable product is concerned (4.57).

A sustainable product is a "relationship-based" product where the consumer is simultaneously involved in the process of creating and promoting the product (4.55). In the course of the research, it was established that it is the customer who co-creates the value of the product (its components and parts) of which they are the recipient (4.11). In this sense, the customer's actions consist in the broadly understood individualization of the value composition (customization), i.e. taking actions aimed at obtaining values tailored to their needs and expectations. That is why increasingly more efficient and modern production technologies that are neutral (and not harmful) to the environment are so essential in the production process of parts and components (4.51). New methods of organizing production (aimed primarily at eliminating any losses resulting from production processes) characterize the surveyed enterprises significantly (4.28). The above activities constitute objective opinions, views and judgments, which are important when it comes to a sustainable product (4.47). The image of parts and components – created as a result of monitoring customer activities and behaviour – is the sum of how companies reacted towards the environment (4.26). A derivative of this considers account ecological limitations in the process of their use (3.94), since a sustainable product is a product focused on ecology (4.45). Therefore, striving to meet customer needs while avoiding deteriorating the condition of ecosystems and their ability to continue further use (minimizing the impact of the product on the natural environment and humans during use) is already a standard today. Particular attention is paid to the environmental criteria of the product, which are included at the stage of selecting raw materials and materials used for its production (4.28). This is important since a sustainable product is characterized by a production process that takes into account the efficiency of raw material management throughout the product's life cycle (4.43) and is designed according to ecodesign principles (4.43). Therefore, by taking care of its impact on the environment and monitoring it, the company implements the idea of life cycle thinking into its strategy and decision-making process.

Securing product reliability is of paramount importance in customer service. Moreover, it builds a competitive advantage and creates the image of the company as a solid, trustworthy partner. The increase in the complexity of modern tractors, trailers and agricultural machines means that ensuring technical readiness requires appropriate design solutions and an appropriate spare parts supply strategy. The flow of spare parts related to the introduction of specific products into use has characteristic features that influence the requirements and structure of a sustainable product (4.43). To ensure the efficient operation of the service department, it is necessary to take into account aspects related to the logistic chain of manufactured components and spare parts. The operation of the spare parts supply and acquisition system significantly determines the possibilities of planning and implementing accepted orders. It should be emphasized that the surveyed companies, due to the increasing complexity of design solutions, as well as a significant increase in the efficiency of tractors, trailers and self-propelled agricultural machines, ensure quick and reliable maintenance in order to minimize the costs associated with downtime. It is characterized by quick response, cost analysis and effective repair or replacement (4.32).

The packaging material is important from the perspective of a sustainable product, which on the one hand has a very low impact on the natural environment, reveals excellent shock-absorbing properties and individual design and is recyclable, and is economically beneficial on the other (4.40). The limited impact of parts and technical components of agricultural transport

means on the environment in terms of such attributes as the types and amount of packaging used, although important, is implemented at an average level (4.00).

Research conducted by the authors clearly shows that customers of the agricultural machinery sector are becoming more proactive in striving to adopt a more sustainable lifestyle by choosing parts and components from manufacturers that use ethical or sustainable production. They share and adhere to values that sustainable products should be environmentally friendly, recyclable, reusable, or made from recycled materials (4.36). Some types of products have mandatory recovery levels as set by the directive. However, this does not include technical parts and components of agricultural transport means, which is reflected in the low level of implementation of the mentioned feature (3.53). Perhaps the introduction of such limits is necessary. If it is known in advance that a certain amount of secondary raw materials must be collected and processed, such market predictability will certainly encourage investment in sorting and recycling. Particular attention is also paid to taking into account technological options in the product development process that allow for the harmless disposal of materials that are not subject to reuse (4.36), which from the perspective of the surveyed enterprises requires improvement (4.02).

A sustainable product is made of material and shaped in such a way so that it can exercise its utility functions, i.e. it is not destroyed as a result of loads, or by loss of material cohesion, or by changes in shape that make it impossible to use (4.34). In the context of the surveyed enterprises, attention is paid to the resistance to changing operating conditions and the functioning of a part or subassembly in conditions resulting from disturbances that violate normal operating conditions (4.15).

During expert conversations, attention was paid to the ability of enterprises to eliminate activities that do not add value to the product, which from the customer's point of view do not increase its value, but increase its cost as well as the time and effort of its production (4.04). The above seems to be important from the perspective of producing a sustainable product (4.32). Attention was drawn to the need to design all work systems related to the creation of a sustainable product in such a way that production takes place in accordance with the recommendations of conceptual ergonomics (4.28). It was further indicated that during the production of parts and technical components of agricultural means of transport, safety is ensured and the burdensome and unfavourable effects of elements of the working space are counteracted, thus ensuring optimal working conditions (4.11).

A sustainable product – throughout its entire life cycle – should meet the proposal of social justice and equality (4.23). In the context of the above, a fair price adequate to production costs, fair wages and appropriate social conditions, as well as transparency, honesty, and respect in commercial relations are postulated (4.30).

A sustainable product guarantees a high ratio of the number of value-adding activities to all activities performed by a given product (4.21). In the course of the research, it was found that manufacturers of parts and components operating in the agricultural machinery sector strive to maximize utility while minimizing operating expenses (4.02). Achieving the highest possible quality of products, extending the economic period of use and creating safe conditions for the operation of production equipment is a manifestation of such conduct. This includes, among others: a derivative of the use of modern, non-invasive methods allowing continuous supervision of the product's functioning and assessment of the safety of its use (3.77), which is important from the perspective of a sustainable product (4.19).

A sustainable product should be highly competitive in terms of both technical feasibility and economic competitiveness (4.19). That is why the appropriate relationships between the costs of production activities and profit combined with environmental benefits (4.21), expressed,

among others, through the possibility of transferring a used product to the supplier and thus covering part of the delivery value with used and damaged products are so important for the surveyed enterprises (4.17). However, in the case of the surveyed enterprises, the possibility of compensating the difference between the value of the delivery and used parts or components is limited (3.77).

The operating system, due to the increasing complexity of design solutions, as well as a significant increase in the efficiency of tractors, trailers, spreaders and self-propelled agricultural machines, should ensure quick and reliable maintenance. Although in order to minimize the repair time, it is necessary to have appropriate service facilities and to match the parts or components to a given machine (4.11), in the case of the surveyed companies, compliance with the specification is declared (4.23). Therefore, the parts and components they offer optimize cultivation technology, reduce costs, shorten process time and increase the quality of work.

The European Union's energy policy prioritizes the development of renewable energy sources in connection with the fight against ongoing climate change and environmental degradation. The above also translates into striving to replace energy sources in production processes, which is also important from the perspective of assessing a sustainable product (4.02). One of the ways to obtain electricity is solar energy. Although this is by far the most common and well-known form of obtaining electrical power among Polish manufacturers of parts and technical components for agricultural transport, it requires further development (3.36). The arguments that renewable energy sources are definitely a suitable solution are that they are available all over the world and their use is practically unlimited. Access to renewable energy sources contributes to the increase in the energy security of companies, as they become independent of energy supplies from other sources. The next reason why it is worth implementing the so-called green energy is economics. By producing electricity from renewable energy sources, companies can save a lot.

Tool management directly affects the costs of product development and the entire production system. Well-organized tool management noticeably reduces product development costs. By implementing a tool management system, many enterprises reduce expenses related to the production process. Double purchases and machine downtime are only a small part of the problems resulting from ineffective tool management. More and more enterprises in the examined sector are beginning to notice issues in this area and have actively implemented solutions that help systematize the operation of tool shops, seeing this as an opportunity for genuine savings and an increase in production efficiency (4.21). As analyses show, the implementation of a tool management system can reduce costs related to the purchase, storage, repair and scrapping of equipment by up to 30-40%. Therefore, improvements in tool management that result in measurable savings indirectly define a sustainable product (4.00). In the context of the research carried out, attention was paid to the instruction manual ensuring safe use, maintenance, adjustment, assembly, transport, as well as any other information regarding the safe use of the part or component (4.38), which significantly characterizes a sustainable product (4.00). Similarly, warranties (based on their uniqueness, among others, on a long period, a wide scope of protection, offering a particularly simple and convenient complaint procedure for the customer or the right to return) are a feature identifying a sustainable product (3.94), are an obvious-added value offered by surveyed enterprises (4.32).

5. DISCUSSION AND RECOMMENDATIONS

The features expressed in the results of the literature search and expert research are important from the perspective of a sustainable product (parts and technical components of agricultural transport means). The average of the indications relating to the level of their significance oscillates between 3.94 and 4.62, and takes into account the proposals that define them and the level of their fulfilment, 3.36-4.38. It can be noted that in the case of as many as twenty-four proposals, the average rating of the respondents regarding their level of importance is at least 4 (significantly defining a sustainable product). Only one feature was rated by the respondents as having a value close to 4.00 (the average was 3.94). For the level of implementation, eighteen features were rated 4.00 or higher. The analysis of the distribution of means provided the observation that the concept of a sustainable product from the perspective of its defining features is relatively little differentiated in terms of significance. When analysing the determined means, it can be noticed that the legal form, age of the respondent, and length of service in the industry do not significantly differentiate the assessment of the importance of individual features. In fact, in most of the components analysed and relating to subsequent features, differences between the means did not occur or were at a very low level. Therefore, the vast majority of proposals in this approach were important. No major differences were observed in the perception of these elements as regards the legal form, age of the respondent, experience in the industry or their experience in the current company. However, some differences in the perception of the importance of features were noticed in terms of the nature of production organization and the size of the enterprise. Enterprises producing original parts that are used mainly for the so-called first assembly (OE — Original Equipment) rate features directly related to the environmental dimension higher. In the case of enterprises whose products are manufactured on the same production line as spare parts, a slightly lower level of significance was noted. A high rating characterizes companies whose parts have appropriate certificates but are not delivered for the first assembly. What is noteworthy is the lower rating from the perspective of manufacturers, for whom uncertified substitutes are the basis for their operation. It can therefore be assumed that EU formal requirements, determined by relevant regulations, influence the level of perception of the features of a sustainable product. Moreover, with regard to the size of employment, it should be noted that as the size of the enterprise increases, so does the level of significance of features defined from the environmental perspective.

The analysis of the evaluation of the characteristics of a sustainable product in the agricultural machinery sector (parts and components of technical means of agricultural transport) from the point of view of comparing the average value did not offer clear indications regarding the level of their implementation. For this reason – and in order to be more specific – it should be attempted to isolate and assess the importance of the most important factors determining a sustainable product using factor analysis. Determining these factors will result in the creation of a group of recommended features, which will allow for a more detailed definition of a sustainable product, i.e. parts and technical components of agricultural transport means.

6. CONCLUSIONS

The developed proprietary profile of sustainable product's features serves as a starting point for improving the assortment database management processes. In view of the research subject, the developed assessment model can be used when improving the product portfolio of

enterprises in the agricultural machinery sector. Additionally, the model can be used to develop criteria for evaluating products from other sectors. Knowledge of the differences between the benchmark and the current level of implementation of a given criterion can be used when planning needs for improving the assortment offer and the products that constitute it. People responsible for their development have specific expectations regarding the desired product features, which is undoubtedly necessary when creating development programs. This study describes the procedures and tools enabling the identification of key features and the method of defining them in relation to technical parts and components of agricultural transport means. The above, according to the authors, contributes to partially filling the lack of knowledge in this area.

The authors recognize the need for further, even more in-depth research in the selected area. The problems discussed in the study should constitute the subject of subsequent investigations. In the authors' opinion, there is a need to conduct further research on the determinants of a sustainable product, especially since, as research shows, in the long term, sustainability and durability may be dictated by completely different factors.

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