A Research on SMEs in Turkey: Sustainable Product Design Practices and Its Effects on SMEs

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Article Info	Abstract
	Although it is known that 99.8% of the enterprises in Turkey are SMEs, it is seen in the past studies that, systematic sustainable product design practices were mostly handled by large companies. In this study, it is aimed to examine the awareness of sustainable product design in SMEs, the benefits of sustainable product design practices for SMEs and the problems and needs encountered in the process. In order to follow a systematical method to be conducted on the axis of Turkey, firstly companies were separated in two main classes in terms of consumer products and then categorized on a sectoral basis using the NACE classification system. Finally, cosmetics and cleaning industry, food industry and pharmaceutical industry were identified among fast-moving consumer goods category and electrics-electronics industry and furniture industry were identified among durable consumer goods category. Detailed interviews were conducted with 24 SMEs. Consequently, it was seen that companies consider sustainable design practices as long as they allow economic advantages. They implement sustainability practices mostly if they have a positive impact on the company's image and when the legislation creates a driving force on companies.

1. INTRODUCTION

Today where natural resources are rapidly depleted, the importance of sustainability is increasing and the need to industrial products make sustainable in order to reduce environmental impact arises. At this point, the idea of sustainable design, which is based on the approach of meeting human needs without harming the ecosystem or with the least possible damage, gains importance.

Today sustainable design is seen as a globally recognized method by which companies can work to increase as well as improve productivity, product quality and market opportunities [1, 2]. However, most current sustainable design guidelines were developed in Western Europe [3]. This situation requires a different sustainable design approach for developing economies compared to industry in the west. Because the needs may be different in developing economies and the characteristics of local companies may differ in terms of product innovation approaches, social, economic and industrial development aspects [3]. At this point, in order for the understanding of sustainability to spread in developing countries, it is necessary to examine what the current opportunities are, what is needed to realize these practices and what level of sustainability awareness is.

Findings from previous studies investigating sustainability practices in Turkey show that the awareness and knowledge required by companies has not yet developed, practices are limited and there is no integrative approach [4, 5, 6]. However, studies examining industrial design education indicate that sustainable design is a new approach for Turkey.

According to TUIK (Turkish Statistical Institute) data, SMEs (small and medium-sized enterprises) constitute 99.8% of the total number of enterprises in 2019 [7]. At the same time; 72.4% of employment, 51.8% of personnel costs, 50.4% of turnover, 44.1% of production value, 36.6% of exports, 21.5% of

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imports and SMEs account for 44% of the added value [7]. In the light of these data, it is seen that SMEs play an important role in the economy and social development in Turkey. However, in the past studies, sustainable product design practices are mostly handled through large companies. This study carried out within the scope of Turkey, focused on sustainable product design practices in SMEs. It is aimed to determine the current situation of awareness, attitudes and practices towards sustainability, determine the effects of sustainability practices on companies and make suggestions on how to solve them.

2. LITERATURE REVIEW

In the literature review, a conceptual framework was first introduced to define the concepts of sustainability and sustainable design. Then, previous studies on current sustainable product design practices are discussed in terms of businesses of different sizes.

2.1. Sustainability and Sustainable Design

The concept of sustainability, which first emerged in the 1960s; it is a participatory process that ensures the prudent use of all of the social, cultural, scientific, natural and human resources of the society and creates a social perspective on the basis of respect [8]. It is an interdisciplinary concept that focuses on what should be done for human beings to live in harmony with nature taking into account future generations. It is an interdisciplinary concept that focuses on what should be done for human beings to live in harmony with nature, taking into account future generations. The concept of sustainability is handled in three different dimensions. These can be conceptually defined as economic welfare, environmental quality and social justice [9]. Environmental sustainability aims to improve human welfare by protecting the sources of raw materials used for human needs and preventing the wastes from causing various harms [10]. Economic sustainability; It covers sustainability in terms of how profitability, operating expenses, income variability, financial performance of the company and other capital elements, human, production and natural capital are managed. [11]. The aim of the social sustainability approach is to maintain the dynamic stability of our social and cultural systems. This should be considered in view of goals such as equity, elimination of poverty, preservation of cultural diversity, human rights, people's safety, and the degree to which basic human needs are satisfied (quality of life) [12]. Many companies of European, Asian and American origin are required to publish their activities related to sustainable development in the form of a sustainability report periodically. Sustainability reports which are seen as an extension of financial reports, it refers to expanding the scope of corporate reports by explaining the environmental, social and economic performances of companies [13].

2.2. Sustainable Product Design Practices in Enterprises of Different Scales

The literature reveals that companies' sustainability practices differ according to company sizes. Large-scale companies try to be more sensitive to environmental and social issues than SMEs [14].

In Europe, most companies dealing with eco design have a structured product development system [3]. In a structured product design process, sustainability is included in the conceptual stage and is seen as a functional requirement of the product. SMEs, on the other hand, mostly lack a structured product development process, have low-educated personnel and operate in low-tech sectors such as food processing, metalworking, furniture [15].

Deutz who examines the design processes in order to understand how companies implement sustainability and how the environment is included in this process, in his study that he handled through UK-based companies; states that large companies tend to be more interested in sustainability practices than SMEs in a design process [16]. It turns out that large companies are more aware of environmental regulations and have easier access to reliable sources of information on environmental issues. The most important result of the study is the knowledge that designers do not consider the concept of sustainability as a functional requirement and tend to exclude the environment at the conceptual stage.

Yüksel conducted a study examining the approaches of large companies in Turkey to environmental management, environmental technologies and environmental performance. According to the results of the study, it is revealed that most of the large companies in Turkey consider environmental issues as a cost factor [17].

Küçüksayraç researched the best performing companies of Turkey in the field of sustainability, the obstacles they face, the benefits they obtain, their other needs for achieving sustainability and the scope of their practices [18]. According to the research results, it is revealed that sustainable design is mostly understood as a production issue rather than product development. In addition, the study shows that companies do not attach importance to criteria such as 'improving product quality' and 'new opportunities for value creation' in order to implement their sustainability practices; on the other hand, it shows that they have difficulty in finding certain tools with which they can cooperate and receive support.

Yangil investigated how many of the 100 large industrial enterprises determined by ISO (International Standards Organization) in Turkey in 2013 have sustainability reports and the scope of the explanations contained in these sustainability reports. According to the results of the research, 21 companies among the 100 large industrial enterprises in Turkey have sustainability reports [19]. Another result is that while companies are addressing energy and water use related to environmental sustainability, the diversity of species and the level of targeting to develop environmentally friendly products through alternative production methods are relatively few [19].

3. METHOD

The literature reveals that there are a limited number of domestic studies in Turkey that include sustainable product design practices within the scope of SMEs. The information that 99.8% of the enterprises in Turkey are SMEs shows that SMEs play an important role in the economy and social development. In line with these determinations, the following research questions were prepared with the aim of evaluating sustainable product design practices in Turkey within the scope of SMEs:

1. What are the awareness, attitudes and current practices of SMEs towards sustainable product design?
2. What are the incentive effects of sustainability practices on SMEs, obstacles that make it difficult to implement or the needs of companies to implement the practices?

The research universe consists of SMEs in Turkey, but it is not possible to reach all companies to conduct this examination. Therefore, the need to create a sub-population arose. With the aim of making the interviews with competent participants, the research area has been narrowed as SMEs that have an R&D or Design center registered by the T.R. Ministry of Industry and Technology. In order for the study to be carried out systematically, it was necessary to classify the companies on a sectoral basis. For this purpose, the sectors grouped according to consumer products are handled within the scope of the NACE classification system (Table 1) [20].

Table 1. *Sectors in consumer products grouped according to the NACE system*

CONSUMER GOODS		
Durable Consumer Goods		**Non-Durable Consumer Goods**
C26.4	Manufacture of consumer electronics;	C10.1 — Processing and preserving of meat and meat products;
C26.7	Manufacture of optical instruments and photographic equipment;	C10.2 — Processing and preserving of fish, crustaceans and molluscs;
C27.5	Manufacture of domestic appliances;	C10.3 — Processing and preserving of fruit and vegetables;
C30.9	Manufacture of transport equipment;	C10.4 — Manufacture of vegetable and animal oils and fats;
C31	Manufacture of furniture;	C10.5 — Manufacture of dairy products;
C32.1	Manufacture of jewellery, bijouterie and related articles;	C10.6 — Manufacture of bakery and farinaceous products;
C32.2	Manufacture of musical instruments.	C10.8 — Manufacture of other food products;
		C11 — Manufacture of beverages;
		C12 — Manufacture of tobacco products;
		C13.9 — Manufacture of other textiles;
		C14 — Manufacture of wearing apparel;
		C15 — Manufacture of leather and related products;
		C18 — Printing and reproduction of recorded media;
		C20.4 — Manufacture of soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations;
		C21 — Manufacture of basic pharmaceutical products and pharmaceutical preparations;
		C32.3 — Manufacture of sports goods;
		C32.4 — Manufacture of games and toys;
		C32.9 — Manufacturing, n.e.c..

The most appropriate titles were determined as electrical-electronics sector, furniture sector, food sector, cosmetics-cleaning sector and pharmaceutical sector by examining together with the sectors in the document of Companies with R&D or Design Centers published by the T. R. Ministry of Industry and Technology. The number of companies in these sectors is shown in Figure 1.
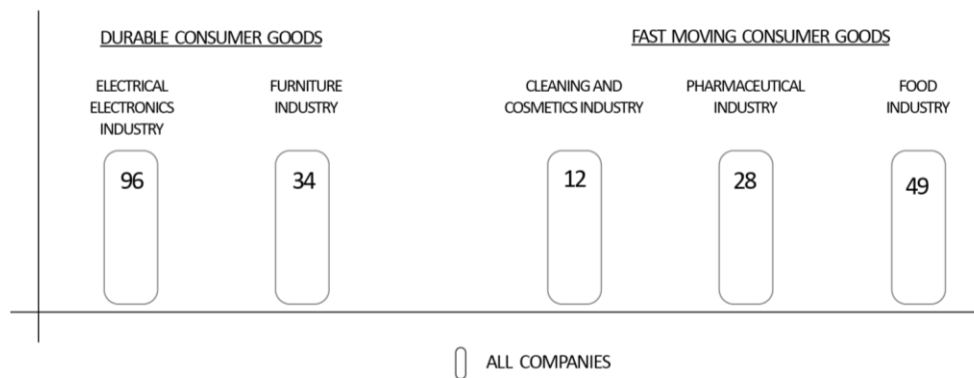
Figure 1. *Total number of companies that have R&D or design centers in the consumer goods sectors in Turkey*

According to the Regulation on the Definition, Qualifications and Classification of Small and Medium-Sized Enterprises published in the Presidential Legislation Information System, the criteria for being a medium-sized enterprise; employing less than 250 employees per year and annual net sales revenue or financial balance sheet not exceeding 125 million Turkish lira. Considering these criteria in the regulation; the distribution of large-scale companies and SMEs in the sectors covered in the study is shown in Figure 2.
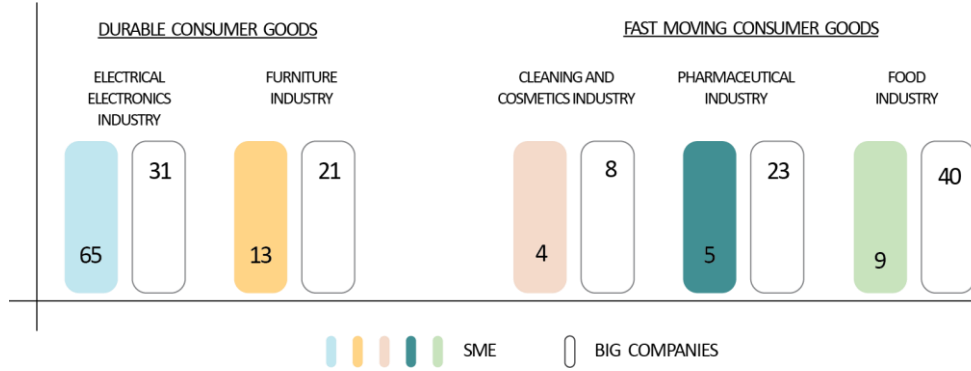
Figure 2. *Companies that have an R&D or design center in the consumer goods sectors in Turkey:*
Distribution of SMEs and large-scale companies

The data to be obtained in this study; companies producing end-consumer products among the 96 SMEs determined because it covers the process starting with the selection of raw materials and continuing with their use, production, packaging, transportation, distribution, assembly, maintenance and end of product life constitute the working sample group. Within the scope of the study, the number of companies producing end-consumer products to form the sample group is 33 and its distribution is shown in Figure 3.

Figure 3. *Distribution of SMEs that have R&D or design centers and produce end-user products in the consumer goods sectors in Turkey*

Among the 33 companies producing end-user products, 24 companies could be contacted and 9 companies could not be contacted. The sectoral distribution of the 24 companies constituting the sample group of the study is shown in Figure 4.

Figure 4. *Sample group of the study*

In the survey studies, the opinions of the participants were taken with open-ended and closed-ended questions. First, 33 sustainable design evaluation criteria suggested by Ryan were used to evaluate the sustainability approaches and practices of companies. While the 33 sustainable design evaluation criteria [21] were converted into survey questions, some criteria were removed by taking into account the workflow and production order in Turkey and some criteria were re-prepared in detail.

Secondly, in order to examine the effects of sustainability practices on business processes, 3 different question groups were formed about the reasons why companies prefer to implement sustainability practices, the disadvantages they face and what they need in this process. The questions in this evaluation section were prepared using the lists of "barriers to eco-design improvement options" and "motivation to perform or reject eco-design improvement options" proposed by Van Hemel and Cramer [14].

Thirdly, the current situation of the sectors in the sample group was investigated and the tools needed by the companies to realize their production practices were determined. These tools were asked by creating options.

Fourth, the legislations related to the sectors in the sample group included in the Legislation System of the Republic of Turkey were investigated. It was asked by creating options which legislations companies are subject to within the scope of sustainability.

4. FINDINGS AND DISCUSSION

As a result of all interviews, the data were analyzed descriptively. Durable consumer goods and FMCG categories were handled separately and then examined in terms of all consumer products.

4.1. Evaluation of Sustainability Practices in SMEs: Durable Consumer Goods

The results of the survey conducted with 15 participants in durable consumer goods regarding the evaluation of sustainable design practices are as follows (Figure 5):
- 81% sensitivity is shown in the use of materials and 60% environmentally sensitive material selection is given importance.
- 51% sensitivity is shown to sustainability practices in production and manufacturing and 54% care is given to the environmental impact in the use of the product and the environmental impact at the end of the product's life cycle.
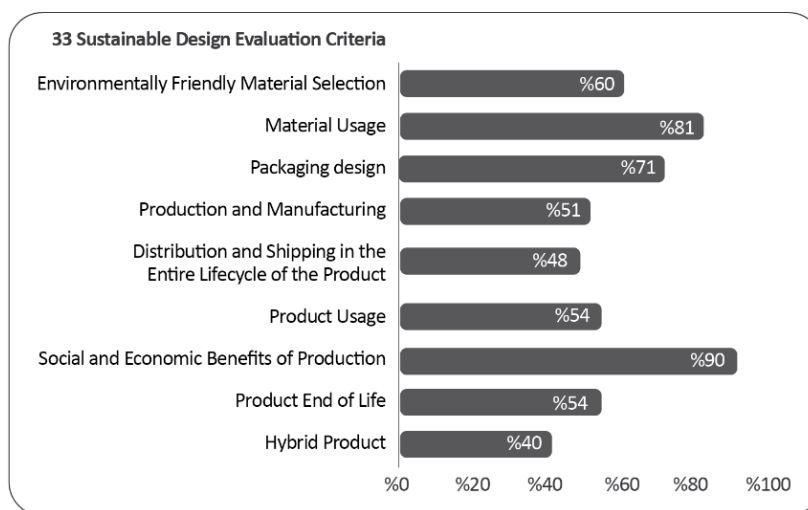
33 Sustainable Design Evaluation Criteria

Criteria	Value
Environmentally Friendly Material Selection	%60
Material Usage	%81
Packaging design	%71
Production and Manufacturing	%51
Distribution and Shipping in the Entire Lifecycle of the Product	%48
Product Usage	%54
Social and Economic Benefits of Production	%90
Product End of Life	%54
Hybrid Product	%40

***Figure 5.** Distribution of the answers given by companies in the durable consumer goods category to the questions on the evaluation of 33 sustainable design practices*

4.2. Evaluation of Sustainability Practices in SMEs: Fast Moving Consumer Goods

The results of the survey conducted with 9 participants in FMCG regarding the evaluation of sustainable design practices are as follows (Figure 6):

- 77% sensitivity is shown in the use of materials and 70% environment-friendly material selection is given importance.
- We pay attention to the sustainability practices in production and manufacturing at a rate of 60% and the environmental impact in the use of the product at a rate of 67% and the environmental impact at the end of the product life cycle at a rate of 19%.
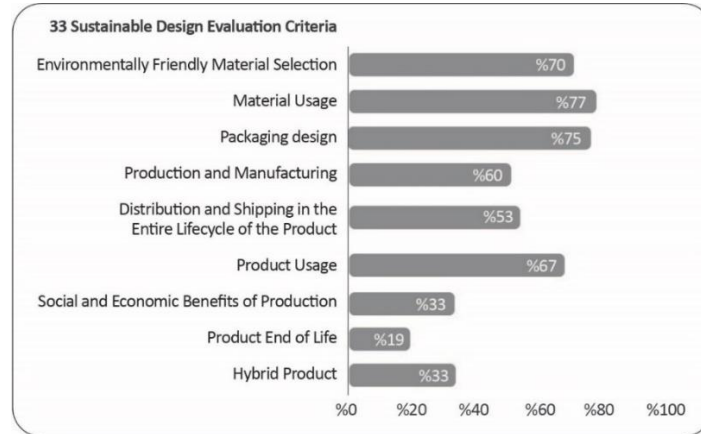

Figure 6. *Distribution of the answers given by companies in the FMCG category to the questions on the evaluation of 33 sustainable design practices*

4.3. Evaluation of Sustainability Practices in SMEs: Consumer Goods

The results of the survey conducted with 24 participants in consumer goods regarding the evaluation of sustainable design practices are as follows (Figure 7):

- 80% sensitivity is shown in the use of materials and 64% environment-friendly material selection is given importance.
- 55% sensitivity is given to sustainability practices in production and manufacturing, and environmental impact in product use is important at a rate of 59% and environmental impact at the end of product life at a rate of 41%.

Figure 7. *Distribution of the answers given by companies in the consumer goods category to the questions on the evaluation of 33 sustainable design practices*

4.4. Evaluation of the legislations to which SMEs are subject within the framework of sustainability

The results analyzed according to the answers given by a total of 24 participants, including 15 participants in the durable consumer goods category and 9 participants in the FMCG category, are shown in Table 2.

- Among the regulations presented, it is seen that the most applied regulation is the Packaging Waste Control Regulation with 83%.
- It is observed that 45% of the companies are subject to the control regulation of waste electrical and electronic equipment. All of the companies subject to this regulation are in the durable consumer goods sector.

Table 2. *Responses of SMEs to the legislations they are subject to*

Legislations Subject to Companiess	Durable Consumer Goods	Non-Durable Consumer Goods
Packaging Waste Control Regulation	12	9
Hazardous Waste Control Regulation	9	9
Regulation on Control of Waste Batteries and Accumulators	9	3
Waste Electrical and Electronic Equipment Control Regulation	11	-
Cosmetics Law	-	4
Regulation on Environmentally Responsible Design of Energy Related Products	3	2
Traditional Herbal Medicinal Products Regulation	-	2
Regulation on Health Declarations of Products Offered for Sale with Health Declaration	-	3

4.5. The effects of sustainability practices on SMEs: Reasons for preference

The results regarding the reasons for preferring sustainability practices in the survey conducted with the participants are as follows (Figure 8):

- It is seen that SMEs in the durable consumer goods category prefer sustainability practices "as per the legislation" with a rate of 67% and because they have a "commercial benefit such as efficiency in production, storage or distribution" with a rate of 27%.
- It is seen that SMEs in the FMCG category prefer sustainability practices because they provide "environmental benefits" with a rate of 89% and because they are a "long-term innovation opportunity" with a rate of 22%.
- It is seen that SMEs in the consumer goods category prefer sustainability practices because they provide "environmental benefits" with a rate of 75% and because they are a "long-term innovation opportunity" with a rate of 33%.
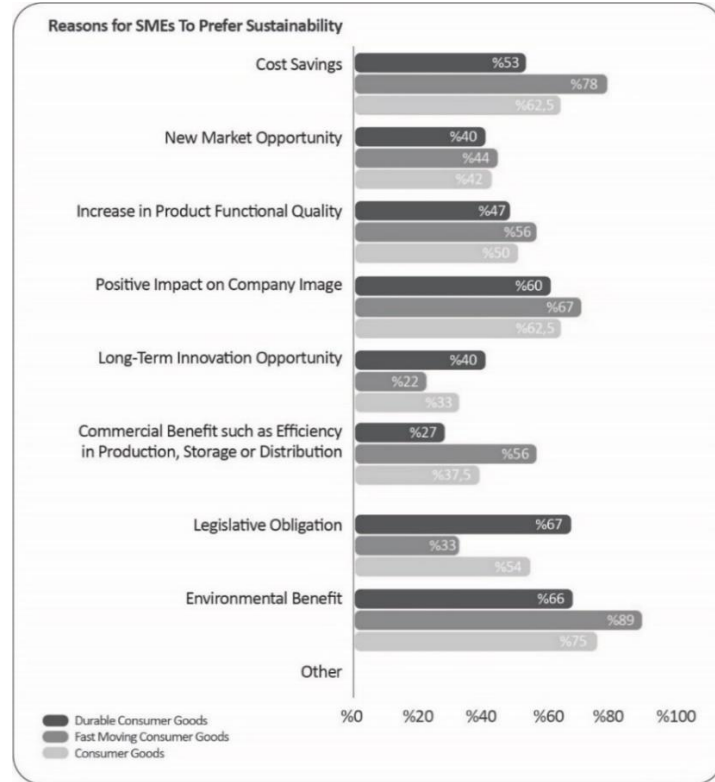
Figure 8. Distribution of answers given by SMEs in the section reasons for choosing sustainability practices

4.6. The effects of sustainability practices on SMEs: Disadvantages

The results regarding the disadvantages arising from sustainability practices in the survey conducted with the participants are as follows (Figure 9):

- For SMEs in the durable consumer goods category, the disadvantage arising from sustainability practices is seen as "increasing costs" with 80% and "conflicting with functional product requirements" with 7%.
- For SMEs in the FMCG category, the disadvantage arising from sustainability practices is seen as "increasing costs" by 44% and "conflicting with functional product requirements" by 11%.
- For SMEs in the consumer goods category, it is seen that the disadvantage arising from sustainability practices is "increased cost" with 67% and "conflict with functional product requirements" with 8%.

Figure 9. Distribution of answers given by SMEs in the section of disadvantages arising from sustainability practices

4.7. The effects of sustainability practices on SMEs: Needs

In the survey conducted with the participants, the results regarding the tools needed by the companies in order to implement sustainability practices are as follows (Figure 10):

- It is seen that SMEs in the durable consumer goods category need the most R&D support and the least market demand support in order to realize their sustainability practices.
- It is seen that it needs the most capital support and the least information services in order to realize the sustainability practices in the FMCG category.
- It is seen that it needs the most R&D support in order to realize the sustainability practices in the consumer products category.
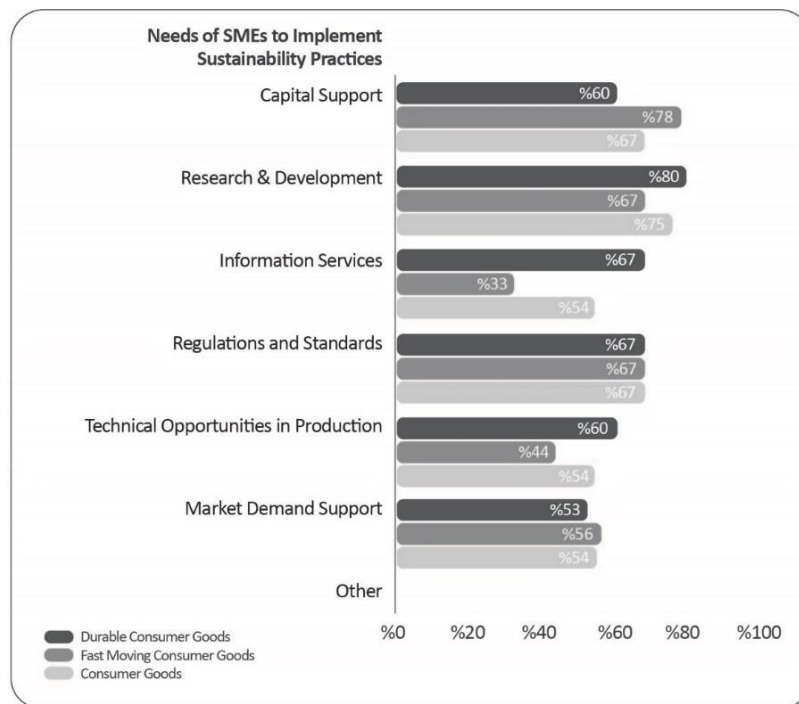

Figure 10. Distribution of answers given by SMEs in the section of tools they need to implement sustainability practices

4.8. Discussion

As a result of the study carried out in the Turkish universe, the following similarities and differences were found between the two categories of consumer goods for the answers given by the participating companies to the questions about their sustainable design practices:

- Among the evaluation criteria of all sustainability practices, it is seen that SMEs attach importance to the efficient use of materials with a rate of 80% and the selection of environmentally friendly materials at a rate of 64%. According to these results, although SMEs give importance to the selection of environmentally friendly materials, the efficient use of materials comes to the fore in this context with the effect of increasing costs in the production processes.
- SMEs, which mostly prefer to implement sustainability practices as per the legislation, are located in the Electric-Electronics sector. The fact that the legislations for the durable consumer goods sectors are meticulously applied to cover the end of product life shows that it has led SMEs in these sectors to think about the end of product life and has a positive effect on their implementation of sustainability practices.

- In the distribution and transportation of the product throughout its life cycle, SMEs in the durable consumer goods category show sensitivity at the rate of 48%, while SMEs in FMCG show sensitivity at the rate of 53%. This similarity reveals that companies have a common problem in distribution and transportation. Dependence on land transportation in terms of logistics, lack of alternative transportation and high transportation costs show that it is a challenge for them to implement sustainability practices.

- While 33% of the participating companies see sustainability practices as a long-term innovation opportunity, 62.5% of them implement these practices because they have a positive impact on the company's image. These results show that companies do not see sustainability practices as a long-term innovation opportunity, but rather implement these practices because they have a positive effect on the company's image.

- Looking at the findings of the legislation that the companies are subject to, it is seen that 87.5% of the participating companies are subject to the packaging waste control regulation. At the same time, it is seen that all companies in the FMCG category are subject to the packaging waste regulation, while 50% of the companies in the durable consumer goods category are subject to it. These results show that the companies in this category pay more attention to the packaging waste regulation, since the products in the FMCG category are short-lived and frequently consumed, and because they generate more packaging waste.

- While 80% of SMEs in the durable consumer goods category think that sustainability practices increase the cost, this rate is 44% in SMEs in the FMCG category. The fact that consumer durables are products that have been used for at least more than three years requires that these products be primarily durable, robust and reliable. Compared to FMCG products, the limited production volume of durable goods cannot tolerate the cost increase due to sustainability.

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