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## **MARKET THREATS AND OPPORTUNITIES IN THE IMPLEMENTATION OF SUSTAINABLE PRODUCTS – RESULTS FROM EMPIRICAL STUDY OF FURNITURE INDUSTRY**

*The primary goal of the research was to define the market threats and opportunities which the furniture industry is faced with on introducing the asymmetrical veneering of wood-based panels. The empirical research was conducted in two stages. The first comprised a survey carried out in 80 medium-sized and large furniture enterprises. In the second phase of the research, individual in-depth interviews were conducted among representatives of the furniture industry and experts representing research and development units. Being able to meet consumers' new needs and expectations is one of the more significant benefits derived from the choice of the asymmetrical method for veneering wood-based panels. Moreover, emphasis was laid on the chance of an increase in production profitability resulting from the possibility of partially substituting more expensive materials for less expensive ones. Additionally, the chances of a new design were also stressed, with the use of veneer made from different types of wood. Apart from the expected benefits, the study also dealt with threats resulting from the introduction of new technology. From the conducted research, it was found that a number of the respondents feared an increase in production costs and the emergence of new technological problems resulting from the introduction of this specific technology.*

**Keywords:** furniture industry, asymmetrical veneering, wood-based panels, opportunity, threat, empirical research

### **Introduction**

Poland is now one of the world's top furniture manufacturers. Official statistical data gathered from a number of countries indicates that, in recent years, the Polish furniture industry has risen from 10th to 6th place in the world in terms of value. Moreover, Poland is the fourth biggest furniture exporter in the world and

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the third biggest furniture exporter from among EU countries. Furniture exports from Poland accounted for 6.3% of global furniture turnover in 2014 – the highest share among all the sectors of the Polish economy [Grzegorzewska and Stasiak-Betlejewska 2014; Grzegorzewska and Więckowska 2016b; Polish Chamber of Commerce of Furniture Manufacturers 2016]. To maintain its competitive position in the market, Polish furniture manufacturers have to foster the continual development of their businesses. Research across industries [Hovgaard and Hansen 2004; Szymanowski and Olkowicz 2010; Olkowicz and Grzegorzewska 2014] has shown that new product development is critical for long-term competitiveness. However, Hansen [2010] indicates that many companies in the forest products industry are weak and unprofessional at developing new (or innovative) products. Furthermore, a traditional culture, a commodity mentality and resistance to change are significant hurdles to innovation in the wood sector [Hansen 2010; Szymanowski and Olkowicz 2010; Olkowicz and Grzegorzewska 2014]. The implementation of innovation by furniture companies is dictated more by internal factors than by issues that might prove important from the perspective of the final buyers [Grzegorzewska and Więckowska 2016a]. This shows that furniture manufacturers may limit company competitiveness because of their lack of flexibility and conservative attitude. Meanwhile, the global furniture market is changing continuously as consumers' expectations about furniture evolve. Consumers are becoming increasingly conscious of products, and some product requirements gradually become the standard [Olkowicz and Grzegorzewska 2014]. For this reason, environmental concerns have increased over the past decades. Coupled with public pressure and stricter regulations, these concerns are changing the way people do business across the world. Knowledge of the environmental impact of the materials and processes typically used in a specific industrial sector is a key factor in enabling companies to improve their products from an environmental perspective [Çınar 2005; Parikka-Alhola 2008]. To date, efforts in the wood furniture industry have been focused on the study of the different environmental properties of wood-based panels and their various finishes: volatile organic compounds (VOCs) in particleboard with diverse coverings; industrial surface coatings; emission factors for particleboard and medium density fiberboard; low speed impact on polyethylene and aramid FRP laminates; ballistic simulation of impact on composite laminates; the use of manufacturing technologies for wood-based materials and coatings, and the mechanics and structure of wood-based composite materials. Other studies have investigated formaldehyde emissions from various wood composites, such as the reduction in formaldehyde emissions from plywood and particleboard made from various species, based on manufacturing parameters [Çınar 2005; Nemli and Çolakoğlu 2005; Parikka-Alhola 2008; Michelsen and Magerholm 2010; Oleńska et al. 2014].

This paper investigates the market chances and threats of asymmetrical veneering techniques used on wood-based boards for furniture manufacture.

## Literature review

The selection of substances, materials and components, prolongation of product lifetime and creation of products that consume less energy during their lifetime and are recyclable or reusable after the use phase – these are just a few examples of the challenges for furniture manufacturers [Parikka-Alhola 2008; Plouffe et al. 2011]. Another important aspect is the establishment of criteria for selecting materials with a low environmental impact during the design of wood-based furniture [Çınar 2005; Parikka-Alhola 2008]. Interior fit-out specialists and furniture manufacturers are using increasing proportions of surfacing materials for the decoration of wood-based panels (particleboard and fiberboard). Both of these panels are manufactured as uniform, flat panels which provide excellent surfaces for the application of coating materials [Nemli and Çolakoğlu 2005]. The purposes of coating wood-based board surfaces with decorative overlays are to suppress the absorption of water and humidity, and to eliminate the release of formaldehyde [Vansteenkiste 1981]. The boards have to be treated to meet the specific requirements of their final usage since the application of wood-based panels involves specific qualities that the crude board does not have [Nemli et al. 2005]. One treatment method is the application of barriers by overlaying or coating with paint, print, varnish, veneers, laminates, impregnated papers, foils, etc. [Vansteenkiste 1981]. Symmetrical and asymmetrical lamination techniques are used for the coating of particleboard surfaces. The particleboard surfaces are usually coated with decorative wood veneers, melamine impregnated papers, plastic sheets, continuous press laminates and high-pressure decorative laminates or balance paper [Nemli et al. 2005; Bulian and Graystone 2009]. Fibreboard surfaces may also be coated with lacquer paint. Over the last 50 years, alternative eco-friendly options to traditional wood veneer have become available around the world in the form of reconstituted veneers [Gurău et al. 2010].

Wood is a non-uniform and directional material, which changes dimensions with changing environmental conditions, and as there are numerous production variables, its application for furniture manufacture requires professional and complex knowledge [Cassenes et al. 2003]. For this reason, to ensure success in the production of laminated veneer products, it is necessary to acquire a basic understanding of the behaviour of wood, and to understand the inherent reactions of wood to adhesives, heat, moisture, strain and stress [Shmulsky and Jones 2011; Blomqvist et al. 2013; Oleńska et al. 2014]. Nevertheless, besides superior decorative attributes, wood has one essential feature which distinguishes it from other materials: it is completely natural and absolutely safe for the environment. On the other hand, wood has become a luxury good due to the significantly reduced supply of saw-logs from the natural forest and the overwhelming demand for plantation wood resources [Ratnasingam et al. 2013]. According to Cao and Hansen [2006], the global trend of shortening product life

cycles and the emergence of new technologies provide market opportunities for furniture manufacturers who are able to develop better products, in a faster manner, and at lower costs. However, the current trend does not favour wood furniture manufacturers and, in addition, carries the risk of specialization in low-profit and low-margin furniture manufacture. In this context, manufacturers are always on the lookout for any methods, ways, materials or technologies for raising competitiveness in the wood furniture industry and reducing the consumption of precious or endangered wood species for furniture [Hovgaard and Hansen 2004]. As Ratnasingam et al. [2013] claim, innovation and creativity within forest products is a necessity for the sustainable forest products industry throughout the world. Furniture is a fashion-sensitive product [Hovgaard and Hansen 2004; Ratnasingam et al. 2007; Hansen 2010]. Kizito et al. [2012] indicate that furniture durability, design details and finish are the most important attributes that determine consumer satisfaction. However, previous studies [Bumgardner and Bowe 2002; Nicholls and Roos 2006; Ratnasingam et al. 2007] have shown that people have divergent perceptions of different wood species, and if recognized and understood, these perceptions can be leveraged for marketing and product development in the furniture industry. Moreover, as Sun and Hammett [1999] indicate, since the number of high-income customers has increased greatly in recent years, the demand for hardwood lumber, of a specific dimension, and with a specific veneer, will continue to increase in furniture manufacturing. For these reasons, research to determine the market chances and threats of asymmetrical veneering techniques used on wood-based boards for furniture manufacture was conducted. In this paper, only one method for asymmetrical veneering was taken into consideration: when the wood-based panel has the visible side covered with a precious veneer (for example mahogany, ebony, wenge), while on the hidden side, the veneer is made from inexpensive species such as poplar, pine, alder, etc. This method is environmentally-friendly and may help reduce the consumption of endangered species in furniture-making. Nevertheless, the coating of wood-based board surfaces in this way reduces the dimensional stability of wood-based panels. However, this technological problem and others are the subject of ongoing research [Oleńska et al. 2011; Oleńska et al. 2014; Oleńska et al. 2015]. The authors of this study were concerned with an assessment of the market potential for furniture using wood-based boards veneered asymmetrically. Therefore, the aims of this study were to determine how customers perceived wood-based boards veneered asymmetrically and used as furniture material, and to determine the main kinds of risks occurring in their production.

## **Research methodology**

The primary goal of the empirical research was to define the market threats and opportunities resulting from the application of asymmetrical veneering for

wood-based panels used in the furniture industry. The first stage consisted of a study conducted in 80 medium-sized and large companies operating in the furniture business. The analysis was carried out in September and October, 2015. It should be noted that, at that time, 462 companies were operating in the furniture market with a level of employment exceeding 49 people. It follows then that 17% of the population was involved in the study. At that stage, a questionnaire composed of 31 questions and divided into 4 parts was the primary research tool. The four parts were as follows:

- I – information on the enterprise,
- II – development and innovation of the enterprise,
- III – technology for refining wood-based panels,
- IV – information on the respondent.

In questions referring to the implementation determinants for the asymmetrical veneering of wood-based panels and the threats and opportunities connected with this technology, the interviewed defined the importance of particular occurrences with the use of a three-level scale. The following reference was used:

- 1 – little significance,
- 2 – medium significance,
- 3 – large significance.

In the second stage of the study, quantitative research was conducted, the aim of which was to gather expert opinions on the subject of selected aspects of the asymmetrical veneering of wood-based panels used in the furniture industry. The research carried out in December 2015 and January 2016 consisted of individual in-depth interviews. Twelve representatives of the furniture industry took part in the talks (directors, owners, and technologists) and nine experts representing research and development centers connected with the furniture industry. The findings of the study comprised 42 pages of stenographic records.

The conducted research, that is, the survey research and the in-depth interviews, complemented one another. The questions asked within the second stage of the research were not exactly the same as in the survey questionnaire from the first stage. However, they constituted an important component of the studies, and as a result broadened the scope of the research. Conducting two-stage empirical research including both the quantitative and qualitative analyses made it possible to compare opinions concerning the threats and opportunities connected with the application of asymmetrical veneering in the production of wood-based panels in the furniture industry.

## **Results by issues**

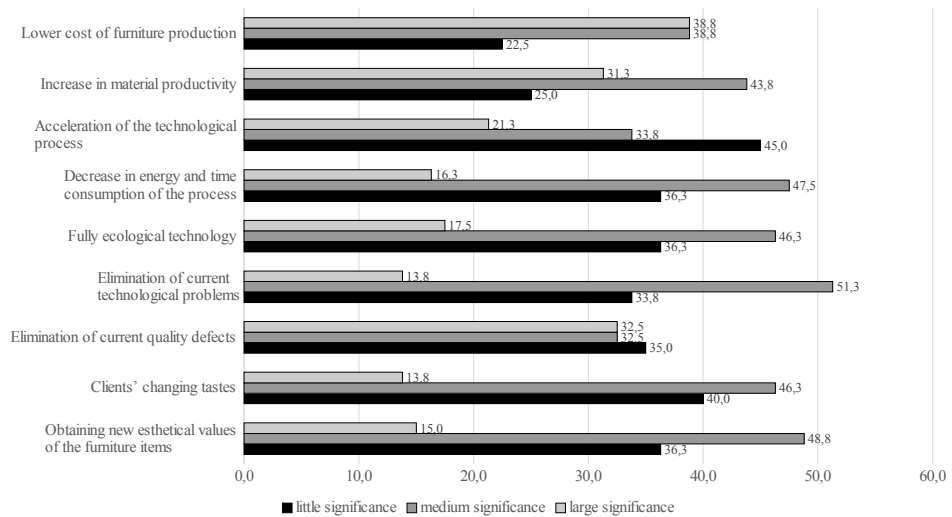
From the study conducted it was found that the process of veneering was used in 25% of the enterprises studied. In three quarters of the companies under analysis, where the practice was applied, the technology of asymmetrical

veneering was used for the wide surfaces of chipboards. The same percentage of companies used the method of asymmetrical veneering in the case of medium-density fiberboards (MDF boards). In this process, the most often applied refining materials for chipboards were: artificial veneer (paper, foil) and laminate (36.2%). Among the less often applied materials, were: artificial veneer with domestic natural veneer (14.3%), or balance paper together with laminate (12.3%). Similar tendencies were observed in the case of the asymmetrical veneering of MDF boards. Again, the most often used combination of refining materials were artificial veneer (paper, foil) and laminate, which comprised 40.9%. Other most often applied materials included the combination of: artificial veneer and domestic natural veneer (16.1%), or balance paper together with laminate (11.4%).

### **Implementation determinants for the asymmetrical veneering of wood-based panels**

Among the respondents there was a conviction that the most important implementation determinants for the process of asymmetrical veneering were: the lower costs of furniture manufacture and an increase in material productivity. Trust in the great significance of the above was shared by 38.8% and 31.3% respectively, of those interviewed (fig. 1). Every third respondent also indicated that the elimination of quality defects was important. The least significant factor when arriving at a decision concerning the introduction of the asymmetrical veneering of wood-based panels was the acceleration of the technological process. Indeed, 45.0% decided that it did not have much significance. Moreover, 40.0% of the respondents said that the changing taste of consumers was not an important factor in determining the implementation of the asymmetrical veneering of wood-based panels.

From the qualitative research it was revealed that specialists asked about the determinants defining the choice of asymmetrical method for veneering wood-based panels emphasized that, first of all, the technology should be thoroughly investigated, both as regards the technological and economic aspects, as to be attractive and reliable for the entrepreneur who wishes to implement it. The provider of the technology should have a thorough understanding of it and know how it might be adapted, should the need arise, to the conditions in a given company. One argument outweighing the advantages of new technology, in the case of two-side asymmetrical veneering, might be its limited availability, for example, conditioned by the purchase of the license which in turn could deliver a competitive advantage in the market for the enterprise deciding to implement it.



**Fig. 1. Implementation determinants of asymmetrical veneering of boards according to respondents [%]**

Source: own studies.

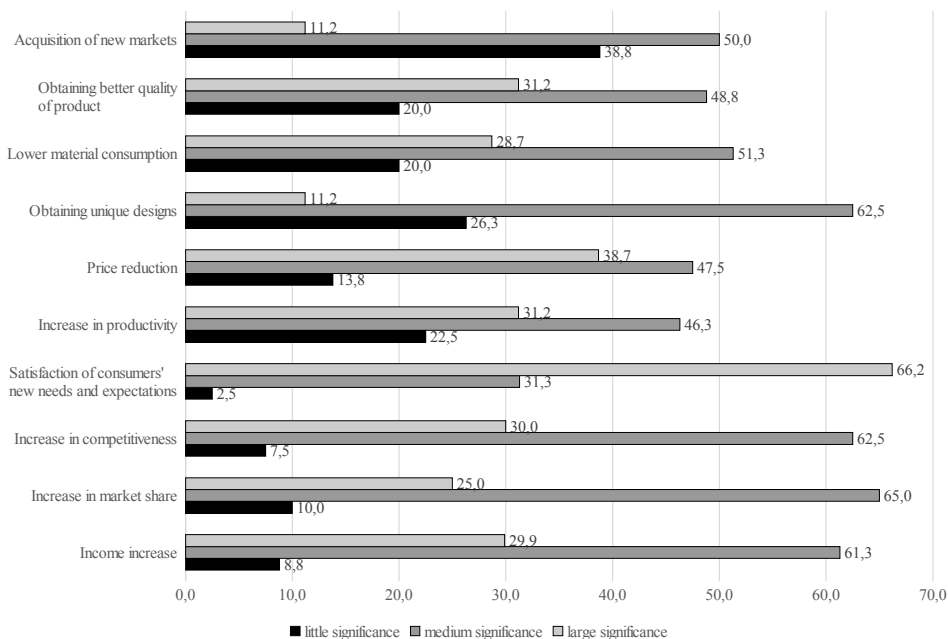
The interviewed, both the representatives of the furniture industry and the experts from the R&D centers, indicated that the technology implemented for asymmetrical veneering was by no means a new phenomenon. It was present in enterprises using natural veneering for furniture manufacture. However, up to now, the technical and esthetic aspects of this solution have not been exposed. It has been used rather for a decrease in the production costs of veneered furniture, applying cheaper types of natural veneering (or substituting them for artificial veneering) on the so-called hidden surface or inside the furniture.

### **Benefits derived from the introduction of asymmetrical veneering of wood-based panels**

Each innovation introduced in a company may, on the one hand, be a source of unpredictable results, while on the other hand, it carries with it considerable risk and lead to considerable losses. In the quantitative research, the respondents indicated that the satisfaction of consumers' new needs and expectations was one of the greatest benefits derived from choosing an asymmetrical method of veneering wood-based panels. This answer was chosen by 66.2% of those surveyed (fig. 2).

The second position was occupied by a price reduction (38.7%). Moreover, every third respondent indicated the following as the greatest opportunities connected with the implementation of asymmetrical veneering: a better quality product, an increase in the productivity, competitiveness and income of the company. As regards the benefits of the least importance, those interviewed

chose winning new markets (38.8%) and obtaining a unique product design as the least significant (26.3%).



**Fig. 2. Benefits derived from the production of asymmetrically veneered furniture according to the respondents [%]**

Source: own studies.

In the qualitative research, the respondents were presented their viewpoints on the subject of market opportunities derived from the possibility of producing two-sided asymmetrically veneered furniture on an industrial scale. Both the representatives of the furniture industry and the experts from the R&D units emphasized the greater profitability derived from the possibility of a partial substitution of more expensive veneer for a cheaper one. Furthermore, the emphasis was laid on a new design using veneer from different types of wood.

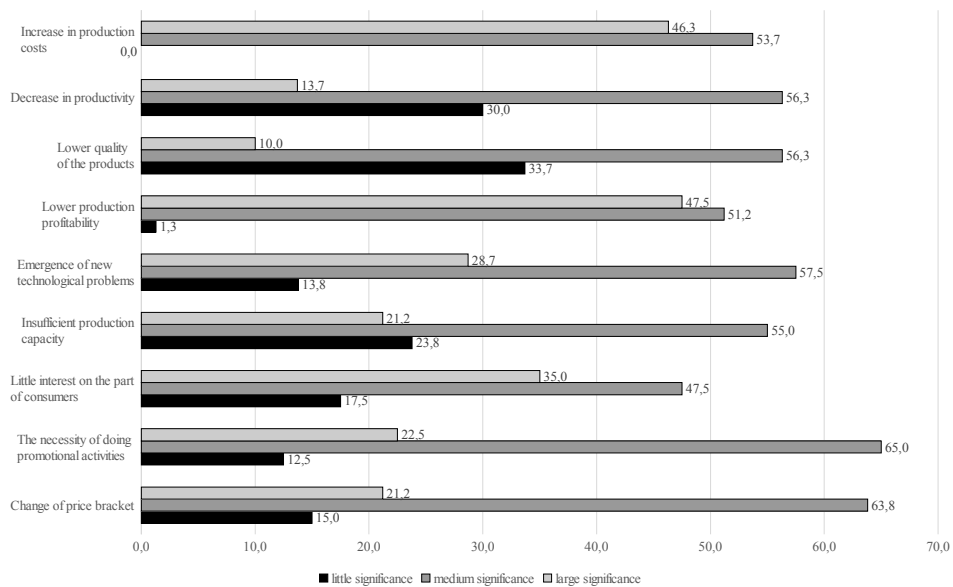
Among the opportunities derived from the production of two-sided asymmetrically veneered furniture on an industrial scale, the representatives of the furniture industry indicated the potential increase in competitiveness in the market, the acquisition of new consumers and the stylistic diversification of mid and high-end furniture. It was emphasized that the final product has to be considered from a different perspective, that is the application of different types of veneer should not be concealed, on the contrary, it should be exposed. It is a chance for designers of furniture and functional art, offering them an opportunity to create a new stylistic design. The representatives of the furniture industry and experts unanimously admitted that new market opportunities



directed at furniture producers could not emerge together with the creation of a fashion for ecological furniture with an atypical design.

### Threats derived from the implementation of asymmetrical veneering of wood-based panels

The introduction of new technology for the production process is also connected with certain threats. From the survey it was found that the greatest risks linked to the choice of the asymmetrical method of veneering wood-based panels were: an increase in production costs (46.3%) and the consequent decrease in production profitability (47.5%) (fig. 3). What is more, there were significant threats in the opinion of the respondents: little interest in the product (35.0%) and the emergence of new technological problems resulting from the implementation of this technology (28.7%). Among the threats of the least significance, 33.7% of the respondents indicated a decrease in the quality of the manufactured items as well as a decrease in productivity.



**Fig. 3. Types of risk in the production of asymmetrically veneered furniture according to respondents [%]**

Source: own studies.

In the qualitative research, the respondents indicated different areas of risk connected with the manufacture of two-side asymmetrically veneered furniture on an industrial scale. The representatives of the furniture industry paid attention to: under/over-estimated economic results, the poor quality of the products at the production stage, complaints about depreciation resulting from furniture

exploitation. Moreover, the dimensional instability of the items was emphasized resulting from the stress of the asymmetrically veneered furniture item. This technology is usually used for furniture sold as fitted / assembled parts (assembling levels the stress). An attempt to market such furniture in packages for independent assembly may result in an increase in complaints.

Another issue was a fear of the cost intensity of two-sided asymmetrical veneering. Some of those interviewed, as a probable source of cost increase indicated, among other things, the application of natural veneer of various types, the need to maintain inventory of asymmetrically veneered elements, investing in machines and technologies, and the increase in material consumption exploited in the production process. Additionally, there is also the fear of a greater number of technological problems resulting from the application of natural material such as wood (difficulties in acquiring the desired, homogeneous, repeatable dyeing and design; because of the type of wood, the different flexibility of the veneer for processing, the need for manipulation of wood defects, etc.).

What is more, in the opinion of manufacturers, as with the quantitative research findings, there was the threat of not appealing to consumer tastes, as nowadays there is a limited demand for naturally veneered furniture. On account of this, the implementation of the above-mentioned technology needs to be supported by an in-depth analysis of the market and research to gauge consumer interest.

As regards the opinions of the experts representing R&D centers, when implementing the researched technology on an industrial scale there are two types of risk: technological and economic. The technological risk is connected with difficulties resulting from different types of hygroscopicity of veneering and a lack of knowledge about the process. Moreover, experts from scientific centers, in a similar way to representatives of the industry, indicated the cost intensity of the process and the uncertainty of the reception of the new product by end-purchasers.

## **Conclusions**

The primary goal of the empirical research was to define the market threats and opportunities emerging when applying asymmetrical veneering to wood-based panels. The empirical research was composed of two stages. The first one comprised a survey carried out in 80 medium-sized and large furniture enterprises. The second stage covered qualitative research conducted among 12 representatives of furniture manufacturers and 9 experts from scientific units.

From the conducted research it was found that in 25% of the analyzed companies the process of veneering is applied. In three quarters of the enterprises under analysis, which use the process, technology for the asymmetrical veneering of the wide surfaces of wood-based panels is applied. In

this process a combination of natural veneer and laminate is used most often as refining material for both chipboards and MDF boards.

Among the most significant factors in the implementation of asymmetrical veneering were: the lower costs of furniture manufacture and an increase in material productivity. Moreover, 30% of the respondents indicated the elimination of the current quality defects. As regards determinants of the least importance, those surveyed named the acceleration of technological processes as the least significant.

From the qualitative research it was found that the most significant benefit resulting from the choice of the asymmetrical method of veneering was the satisfaction of the new needs and expectations of consumers. Moreover, there was price reduction, acquiring better quality, and an increase in productivity and competitiveness. The least significant aspect indicated by the respondents was the acquisition of a unique design for the product. What this means is that most enterprises pay attention to the economic and production aspects of running a business when implementing new technology.

In the qualitative research the greatest attention was paid to the higher profitability of the production resulting from the possibility of the partial substitution of the more expensive veneers for cheaper ones. This opinion was shared by both the furniture manufacturers and experts from the scientific units. Representatives of the furniture industry indicated the following as potential benefits: an increase in competitive position on the market, acquisition of new consumers and the diversification of furniture stylistic design from the mid and high-end sector.

From the questionnaire, it was found that fears regarding the implementation of asymmetrical veneering were connected with an increase in production costs. This answer was given by people who did not perceive the new technology as economically beneficial. Additional sources of threats were: little interest on the side of consumers, and the emergence of new technological problems resulting from the implementation of this technology.

In the qualitative research, it was emphasized that when implementing the discussed technology on an industrial scale, there were two types of risk: technological and economic. The first type of risk refers to difficulties resulting from the varying hygroscopicity of veneers and asymmetry of humidity stress and insufficiently tested technology. Moreover, experts from scientific units, as well as the representatives of industry, also named the cost intensity of the process and the risk of a lack of interest in the product by end-purchasers. To sum up, the implementation of new technology for the asymmetrical veneering of wood-based panels calls for additional laboratory research proving the high quality of the new products and detailed analyses of the market demonstrating the significant interest of consumers.

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