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The Effect of Various Assortments of Bakery Products on The Role of An Enterprise in The Market

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HIGHLIGHTS

- The impact of product variety on market position in bakery manufacturing enterprises.
- Comparative analysis, cost calculations, and expert surveys were conducted to evaluate both price and quality indicators of bakery products manufactured according to GOST 25832-89.
- Evaluating the economic efficiency of bakery product varieties.

Abstract

This study examined the influence of product assortment on the competitive position of bakery manufacturing enterprises in the market. The research employed comparative analysis, cost calculations, and expert surveys to evaluate price and quality indicators of bakery products produced in accordance with GOST 25832-89. Profitability values and consumer preferences were assessed to determine the relationship between assortment diversity and market performance. Findings demonstrated that product quality plays a dominant role in consumer choice, accounting for 74% of preferences, whereas price accounts for 26%. Among the analyzed samples, Spelta bread made from spelt wheat achieved the highest final profitability (0.579) and demonstrated the strongest market position. Other products, including Tasty Bread and Thyume, followed as secondary leaders in competitiveness. The results indicated that reducing production costs, optimizing the use of raw materials, and introducing innovative grain-based assortments significantly enhance profitability and competitiveness. The study concludes that diversification of bakery assortments, supported by technological modernization and quality improvements, strengthens the enterprise's market position and contributes to sustainable growth in the food industry.

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1. Introduction

The food industry is a strategic sector that contributes to both meeting societal nutritional requirements and broader economic development. Competitiveness in this field is largely contingent upon adherence to rigorous quality standards for raw materials, semi-finished inputs, and final products, alongside the modernization of production systems and responsiveness to evolving consumer behavior (FAO 2021). Sustainable sectoral growth is commonly supported by integrating innovative technologies, diversifying product portfolios, and systematically improving enterprise-level competitiveness indicators. In the context of digital transformation, innovation strategy and product development are frequently emphasized as primary determinants of market resilience and competitive performance (Sayudin et al. 2023).

In the bakery industry, competitive positioning is strongly associated with the quality and breadth of product assortments. Evaluating the economic feasibility and market potential of bakery products requires multidimensional assessment of key attributes, including production cost, physicochemical composition, and organoleptic properties. Products that more effectively satisfy consumer expectations across these dimensions typically achieve superior market outcomes. However, compared with other segments of the food industry, bakery products tend to exhibit relatively limited rates of assortment renewal, which may restrict the sector's capacity for innovation and product differentiation (Nidhi et al. 2022).

The intensification of competition among bakery enterprises is driven by globalization, technological advancement, and shifts in consumer demand. Consequently, firms must increasingly adopt innovative manufacturing practices, evidence-based marketing strategies, and adaptive managerial approaches to sustain market share and enhance performance. The literature consistently characterizes innovation as a critical mechanism for creating and maintaining competitive advantage in dynamic markets (Reguia 2014). Moreover, efficiency, quality, innovation, and customer satisfaction have been identified as foundational dimensions through which enterprises generate competitive advantage (Charles and Schilling 2016).

High-quality production not only strengthens consumer acceptance but also supports profitability and long-term brand sustainability. Quality management systems have been associated with improved financial performance by enabling firms to increase customer value and implement more effective pricing and cost-control strategies (Agus et al. 2008; Garvin 1984). Similarly, systematic quality-improvement initiatives may reduce production costs while increasing operational efficiency, thereby reinforcing competitiveness (Crosby 1979).

Technological innovation constitutes a further core component of competitiveness, as it enables the development of enhanced products, improves production efficiency, and facilitates adaptation to shortening product life cycles (Kang 2018). This consideration is particularly salient in bakery production, where process optimization and product differentiation are essential for aligning output with consumer expectations and emerging market trends.

Although previous studies have extensively investigated the nutritional value, technological characteristics, and consumer acceptance of bakery products, these aspects have generally been examined independently. Comprehensive studies integrating nutritional composition, physicochemical properties, food safety indicators, consumer preferences, and economic performance into a single comparative evaluation of different bakery product assortments remain limited. To address this gap, the present study applies an integrated assessment approach that combines quality characteristics, expert evaluation, and economic indicators to compare a range of bakery products. The novelty of this research lies in the development of a comprehensive framework for assessing the market competitiveness of bakery products by jointly considering their nutritional value, safety, technological quality, and economic efficiency. The findings provide practical and scientific evidence to support product assortment optimization and strategic decision-making in bakery enterprises.

Accordingly, this study aims to examine the extent to which diversity in bakery product assortments influences the competitiveness and market positioning of bakery manufacturing enterprises. Specifically, it investigates how variations in product quality, cost efficiency, and consumer preferences shape enterprise profitability and sustainable development. In addition, the study seeks to identify the most cost-effective and consumer-preferred bakery assortments through a comparative analysis of physicochemical, organoleptic, and economic indicators. The findings are expected to yield practical implications for improving production technologies, optimizing assortment structures, and strengthening the competitive capacity of bakery enterprises within the broader food industry.

2. Materials and Methods

In this study, the nutritional value, safety parameters, physicochemical properties, and consumer-related quality characteristics of different types of bakery products were comprehensively evaluated. The assessment included the determination of mineral and vitamin contents, total essential aminoacids, protein, cellulose, lysine, and toxic element concentrations, which were considered key indicators of product quality and food safety.

To reflect the relative importance of each quality attribute, weighting coefficients were assigned according to published studies on cereal and bakery product quality assessment and validated through expert judgment (Dewettinck et al. 2008; Cauvain and Young 2007). Weighting coefficients of 0.20 were assigned to mineral content, vitamin content, protein content, and cellulose content, whereas total essential aminoacids and lysine were assigned weighting coefficients of 0.10 each. The sum of all weighting coefficients was normalized to 1.0 to ensure consistency and comparability of the overall evaluation model. These coefficients were subsequently incorporated into the mathematical model for calculating the final profitability, competitive advantage, and market power of bakery products.

Protein content was determined using the Kjeldahl method according to AOAC Official Method 979.09 and the results were expressed as g/100 g of product (Horwitz and Latimer 2005). Mineral composition and toxic element concentrations were determined by atomic absorption spectrometry (AAS), while vitamins content and aminoacids composition, including lysine, were analyzed by high-performance liquid chromatography (HPLC), (Nielsen 2017). Cellulose content was determined using the standard gravimetric method. The concentrations of lead (Pb), cadmium (Cd), arsenic (As), and mercury (Hg) were compared with the maximum permissible limits established by the Codex Alimentarius (Codex 1995).

All analytical determinations were performed in triplicate, and the results were expressed as mean ± standard deviation (Mean ± SD). Statistical analysis was performed using one-way analysis of variance (ANOVA), followed by Tukey's multiple comparison test. Differences were considered statistically significant at $p < 0.05$ (Yende et al. 2026; Montgomery 2020).

The physicochemical properties of bread samples, including specific volume and crumb porosity, were determined according to GOST 27669-88 and GOST 5669-96, respectively. During the comprehensive quality assessment, weighting coefficients of 0.55 and 0.45 were assigned to specific volume and crumb porosity, respectively, reflecting their relative importance in the overall evaluation of bread quality.

2.1. Preparation of Bread Samples

Bread products are more conservative in terms of assortment renewal compared to products from other consumer goods manufacturing sectors. In order to clarify consumer preferences and their quantitative accounting, an expert survey was conducted. The nine different experts participating in the research are faculty members of the Department of "Engineering and Applied Sciences" and the "Food Engineering" division of Azerbaijan State University of Economics. The specialists possess professional knowledge regarding the chemical and physical composition and consumer properties of products, as well as production and storage technology. Another argument that can be accepted for addressing this issue is that these specialists are also consumers in one way or another. The purpose of the survey was to determine consumer preferences regarding the value and quality characteristics of grain bread products.

2.1.1. Tasty bread

The hard wheat variety "Azamatli-95" was first cleaned from foreign impurities by passing through a magnetic separator and an aspirator. It was then ground to 240 µm in a laboratory mill. Dough was prepared using 1000.0 g of the obtained flour, 620-640 g of water, 20.0 g of pressed yeast, 18.0 g of salt, and 10.0 g of sugar. A SPAR SP-10 brand spiral dough mixer (10 L) was used throughout the dough preparation process. Kneading was carried out for 8-10 minutes. The final temperature of the dough was 27 ± 1°C, and the moisture content was 42-43%. Fermentation was conducted for 90-120 minutes at a temperature of 30 ± 1 °C and a relative humidity of 80-85%. After fermentation, the dough was divided into pieces of 700-800 g. Each piece was rounded by hand and left for an intermediate proofing period of 10-15 minutes. The shaped loaves were proofed for 50-60 minutes at 32 ± 1 °C and a relative humidity of 85-90%. Baking was performed at 220-230 °C for 30-35 minutes.

2.1.2. Thyume - Preparation of thyume extract

1% thyume extract was prepared by extraction in distilled water in a water bath at 80°C for 30 min. Wheat grains of the "Azamatli-95" variety were soaked in 1% thyme extract at 4 °C for 12 hours. Subsequently, they were dried to 14% moisture at 45 °C, ground in a laboratory mill, and sieved through a 180 µm sieve. To 1000 g of flour, 18 g of salt was added. Then, 20 g of yeast, 200 mL of water, and 15 g of sunflower oil were added. Kneading was performed by hand for 10-12 minutes or with a mixer for 7-8 minutes. The dough was placed in a greased bowl, covered, and left for fermentation for 75 minutes at 30 °C. The volume should increase 2-fold. Baking was carried out at 220 °C for 25 minutes.

2.1.3. Flavourful -Preparation of garlic extract

2% garlic extract was prepared by extraction in distilled water in a water bath at 80°C for 45 min. The bread was prepared from whole-crushed grains of wheat and pomegranate. Wheat and pomegranate grains were soaked separately in aqueous garlic extract at pH 4.5 with a hydromodule of 1:1.5. A phytase-based enzyme preparation was dissolved in the extract, and a succinic acid-based buffer was added. Hydration was carried out for 12 hours for wheat grain and for 16 hours for pomegranate grain at 50 °C. At the end of hydration, the remaining extract was drained, and the grains with 42-48% moisture were thoroughly washed with running tap water. Wheat and pomegranate grains were taken in a ratio of 4:1 and crushed to a size passing through a 240 µm sieve. To the resulting grain mass, 20.0 g of pressed yeast in the form of a suspension and thick ferment, 620-640 mL of water, 18.0 g of salt, and 9.0 g of sugar were added. Kneading was performed for 10 minutes. The fermentation time of the dough was 90-170 minutes, the dough temperature was 32-33 °C, and the final acidity was 8-9 °N. The finished dough was divided into 350 g portions. The dough portions were placed into molds and sent for proofing. The proofing time was 20-45 minutes at 35 °C and a relative humidity of 75-80%. The bread was baked for 30-35 minutes at 200-220 °C.

2.1.4. Spike bread - Preparation of bay leaf extract

15.021 g of bay leaf was extracted in 600 mL of distilled water in a water bath for 60 minutes. The dough was prepared from a mixture of crushed "Azamatli-95" wheat grains and premium-grade flour. First, the initial preparation of the wheat grain was carried out. The grain was soaked in a solution of the enzyme preparation Celluclast 1.5L + xylanase at 0.08% of the dry matter weight of the grain, in 15.021 g of aqueous bay leaf extract at 1% of the grain weight, with a grain-to-solution ratio of 1:1. Subsequently, the grain was germinated at 20 °C for 18-20 hours until sprouts of 1-2 mm appeared. After germination was completed, the grain was crushed over a sieve, and pressed yeast and brewed sourdough in the form of a suspension were added to the resulting grain mass. Kneading was performed for 10 minutes.

Fermentation was carried out in two stages. The temperature of the preferment was 32-33 °C, the acidity was 5-6 °N (Soxhlet-Henkel degrees), and the fermentation time of the preferment was 1.5-2.0 hours. Granulated sugar, sunflower oil, salt solution, and premium-grade bread flour were then added to the dough. The dough was kneaded for 10 minutes. The fermentation time of the dough was 0.5-1 hour, the dough temperature was 32-33 °C, and the final acidity was 6-7 °N. The finished dough was divided into 350 g pieces.

The dough pieces were placed into molds and sent for proofing. The proofing time was 35 minutes at 35 °C and a relative humidity of 75-80%. The bread was baked for 30-35 minutes at 200-220 °C.

2.1.5. Spelta - Preparation of pomegranate peel extract

Pomegranate peel extract was prepared by extraction of 30 g of pomegranate peel in 675 mL of distilled water in a water bath at 80 °C for 60 min. Initially, the pomegranate grain was soaked in a solution of the enzyme preparation Celluclast 1.5L + xylanase at a concentration of 0.09% of the dry matter weight of the grain. For the effect of the enzymatic complex, the following optimal conditions were considered: pH 4.5 with citrate buffer, temperature 50 °C, and process duration 12 h. Pomegranate peel extract was added at 0.5% of the grain weight, with a grain-to-water ratio of 1:1.5. After the soaking period, the grain was crushed. To 1000 g of the resulting flour, 20 g of pressed yeast, an acid mixture, 18 g of sugar, 18 g of table salt, and 20 g of refined sunflower oil were added. The acid mixture used consisted of: 80% lactic acid, 20% acetic acid, and dry ascorbic acid. The dough was kneaded for 15 minutes. Dough fermentation was not carried out. The proofing time of the dough was 40-50 minutes, the dough temperature was 28-30 °C, and the final acidity was 6.5-7.5 °N. The finished dough was cut into 350 g pieces. The dough pieces were placed into molds and sent for proofing. The proofing time was 35 minutes at 35 °C and a relative humidity of 75-80%. The bread was baked for 30-35 minutes at 200-220 °C.

2.2. Physical and Chemical Analysis of Bread

2.2.1. Determination of mineral content and toxic elements

Mineral elements (Ca, Mg, Fe, Zn) and toxic elements (Pb, Cd, As, Hg) were determined by atomic absorption spectroscopy (AAS, Shimadzu AA-7000) using a flame and graphite furnace system. 2.0 g of sample was dry-ashed at 550 °C. The ash was dissolved in HNO_3 and made up to 50 mL in a volumetric flask. Flame AAS was used for Ca, Mg, Fe, and Zn, while graphite-furnace AAS was used for Pb, Cd, As, and Hg determination. Results were calculated based on calibration curves prepared from standard solutions. Toxic element levels were compared with Codex Alimentarius 1995 limits.

2.2.2. *Vitamins and aminoacids content*

The vitamins and aminoacids content including Lysine were determined using the HPLC (Agilent 1260 Infinity II LC) method. Extraction from the sample was performed with 0.1 N HCl. The hydrolysate was filtered through a 0.45 μm membrane filter. Determination was carried out on an HPLC system with a reversed-phase C18 column [150 mm × 4.6 mm, 5 μm] and UV detector. The mobile phase consisted of solvent A: 10 mM sodium phosphate + 10 mM sodium tetraborate buffer, pH 8.2, and solvent B: methanol: acetonitrile: water (45:45:10, v/v). A gradient elution program was used as follows: 0-2 min, 2% B; 2-20 min, 2-57% B; 20-22 min, 57-100% B; 22-24 min, 100% B; 24-25 min, 100-2% B; 25-30 min, 2% B for column equilibration. The flow rate was 2.0 mL/min. Column temperature was 40 °C. Quantification was performed using the external standard method.

2.2.3. Cellulose determination

Cellulose content was determined using the gravimetric method. The defatted sample was subjected to sequential acid and alkaline hydrolysis. The residue was washed, dried, and dried to constant weight at 105 °C. The mass difference after ignition was taken as the cellulose content.

2.2.4. Moisture

For moisture content was determined using a Radwag MAC 50/1 Moisture Analyzer. For moisture content analysis, 5.0 g of the sample was dried to constant weight at 105 °C in an oven. The results were expressed as %.

2.2.5. Acidity

Acidity was determined by titration of 25 g of sample was extracted with distilled water and titrated with 0.1 N NaOH` in the presence of phenolphthalein as an indicator. The results were expressed as degrees.

3. Results and Discussions

3.1. Analysis and Evaluation

The development of the bakery industry and its market positioning are shaped, in part, by intersectoral linkages between bakery enterprises and related industries. Price volatility in bakery products is closely associated with dynamics in upstream sectors, particularly grain processing and milling. In this context, bread production is directly influenced by flour market prices; accordingly, the retail price of bread is substantially cost-driven, with flour typically accounting for 50–60% of total product cost, depending on bread type and formulation (Gunash et al. 2024).

To better explicate consumer choice patterns and enable their quantitative assessment, an expert survey was administered to affiliates of the UNEC Department of Engineering and Applied Sciences. The primary objective of the survey was to identify consumer preferences concerning the perceived value and quality attributes of bakery products. The literature indicates that expert evaluations of primary and secondary product indicators contribute to the formation of an overall product image and can support comparative assessment across manufacturers (Shikhova et al. 2022).

Based on the survey outcomes, respondents assigned greater relative importance to quality attributes than to price in the bakery products market. Specifically, 26% of participants prioritized the final product price, whereas 74% indicated that product quality was the primary determinant of their preferences.

The internal structure of the quality construct is inherently multidimensional. Quality has been operationalized as a composite of primary characteristics (55%), reflecting the functional and nutritional benefits of grain-based bakery products, and secondary characteristics (45%), capturing complementary attributes that shape overall product perception (Dvoryaninova et al. 2019). Accordingly, the quality of grain bakery products is best understood as the combined effect of these primary and secondary dimensions rather than a single attribute (Palacios et al. 2021).

In this framework, the primary (55%) quality components predominantly relate to nutritional composition and safety. These include mineral and vitamin contents (0.20 mg/100 g each), total essential aminoacids (0.10 g/100 g of protein), protein content (0.20 g/100 g), cellulose (0.20 g/100 g), and lysine (0.10 g/100 g), together with the assessment of toxic elements (total weight = 1.0) as a critical safety indicator (Hou et al. 2022).

The secondary characteristics capture physical and structural properties that influence technological performance and sensory acceptability. Key measures in this category include specific capacity (0.55 cm^3/100 g) and porosity (0.45%), both of which are closely associated with processing quality and consumer-relevant texture attributes (Ronie et al. 2023). Integrating these indicators enables a more comprehensive evaluation of bakery products by jointly considering nutritional value, functional performance, and product safety. The corresponding product characteristics are summarized in Table 1.

Product positioning was determined by assessing how specific product attributes are perceived by both consumers and manufacturers. In this process, specialists were engaged to represent the manufacturer's perspective, while consumer expectations were incorporated through preferred (target) values for individual product indicators (Shikhova et al. 2022). These preferences can be grouped into: (i) indicators for which higher values are desirable (e.g., protein or vitamin content), (ii) indicators for which lower values are preferred (e.g., toxic elements or fat content), (iii) indicators where the presence of particular components is essential (e.g., essential aminoacids), and (iv) indicators where the absence of undesirable constituents is expected. In addition, some indicators require strict adherence to a standard value, as deviations in either direction are considered unfavorable. This classification supports a systematic evaluation of product positioning by aligning measurable characteristics with consumer expectations and manufacturing priorities (Oghojafor et al. 2013).

Table 1. Characteristics of bakery products.

Indicators		Type of bakery products					
		Sample	Tasty Bread	Thyume	Flavourful	Spike	Spelta
Basic characteristics	Price per 0.3 kg, USD	0.55	0.46	0.53	0.50	0.45	0.51
	Total quantity of minerals per 100 g of bread, mg	147.92	155.87	157.99	150.01	165.50	219.99
	Total quantity of vitamins per 100 g of bread, mg	4.798	5.943	5.134	6.025	6.849	6.678
	Total quantity of essential aminoacids per 100 g protein, g	23.62	27.78	26.98	29.96	24.23	30.89
	Proteins, g/100 g	7.5	10.2	10.1	8.9	8.4	9.6
	Cellulose, g/100 g	1.3	1.7	1.6	1.6	1.9	2.1
	Lysine, g/100 g	2.42	3.43	2.97	2.86	3.23	3.98
Important secondary characteristics	Total toxic elements	0.135	0.115	0.090	0.123	0.089	0.067
Additional secondary characteristics	Specific volume, cm^3/100 g	179	185	182	178	184	189
	Porosity, %	57.7	61.3	61.2	56.9	61.7	62.5

In addition to the indicator levels desired by consumers, indicator values advantageous for manufacturers were specified, taking into account existing economic constraints and opportunities. Under this framework, priority is assigned to products whose indicator profiles most closely correspond to consumer preferences, thereby supporting the identification of conditions under which products can be effectively introduced to the market (Kotler and Keller 2016). The baseline conditions for market entry of bakery products are summarized in Table 2.

Table 2. Initial terms for grain bakery products.

	Necessary indicators	
	for consumer	for manufacturer
Quality		
Main characteristics		
Price per 0.3 kg, bread (USD)	0.45	0.55
Quantity of minerals, mg/100 g bread	219.99	147.92
Total of vitamins, mg/100 g bread	6.849	4.798
Total quantity of essential aminoacids, g/100 g protein	30.89	23.62
Proteins, g/100 g	10.2	7.5
Fiber, g/100 g	2.1	1.3
Lysine, g/100 g	3.98	2.42
Secondary characteristics		
Important characteristics		
Total toxic elements	0.067	0.135
Additional characteristics		
Specific volume, cm^3/100 g	189	179
Porosity, %	62.5	57.7

From the consumer perspective, the perceived attractiveness of a given product increases as its observed characteristics more closely match consumer expectations. The profitability associated with producing one unit of the product can be quantified using the following expression (Gunash et al. 2024; Varian 2010):

$$U = d_1.S + d_2.J \quad (1)$$

Where U denotes the profitability derived from producing the product; S represents the degree to which the product's value characteristics conform to consumer demand; and J reflects the degree to which the product's quality characteristics align with consumer expectations. The coefficients d_1 and d_2 are weighting parameters that capture the relative importance of S and J, respectively, and are constrained to the interval [0; 1] (Ebrahim et al. 2024).

The indicator measuring the degree of conformity of the evaluated product's value characteristics with consumer demands is defined by formula 2: (Juran and Godfrey 1999).

$$S = c.g_{cost} \tag{2}$$

Here, c represents the weight characteristics of the purchase price, and g_{cost} represents a single-parameter indicator that shows how close the purchase price of the goods is to the desired value.

The indicator g_{cost} in this formula indicates how closely the product's purchase price matches the desired price. It helps you understand where the current price is compared to the highest and best (ideal) price. The result will always lie between 0 and 1. As the price approaches the ideal, g_{cost} increases to 1. If the price gets bad, g_{cost} falls to 0. Considering the above, the exponent g_{cost} can be calculated using the following formula 3:

$$g_{cost} = \frac{C_{cost}^{max} - C_{cost}}{C_{cost}^{max} - C_{cost}^{ar.}} \tag{3}$$

Here, C_{cost}^{max} represents the maximum purchase price, $C_{cost}^{ar.}$ represents the price of an attractive product for the consumer, and C_{cost} represents the price of the product on display.

Overpricing excludes the consumption of goods in the said market segment. The condition for goods to enter the market is shown by formula 4: (Juran and Godfrey 1999).

$$C_{cost} \le C_{cost}^{max} \tag{4}$$

The indicator characterizing the proximity of the product's quality parameters to consumer demands will be defined by equation 5: (Juran and Godfrey 1999).

$$J = \sum_{1 \sum L} a_1 \sum_{i \sum I_1} a_i \cdot g_i \tag{5}$$

Here, L represents the majority of commodity indicators evaluated by the consumer, l is an index of commodity indicator, I_l is a plurality of attributes that make up an attribute, i is an index of commodity attributes, a_l is a weight of indicator 1, a_i is a weight of attribute i, and g_i is a single parametric indicator evaluated close to the consumer's desire for parameter i.

The single parametric quality indicators can be divided into five groups, as previously proposed for characterizing the product's indicators (Taques et al. 2021). The first group includes the price growth that is desirable to consumers. The g_i indicator for this group will be defined by formula 6: (Juran and Godfrey 1999).

$$g_i = \frac{p_i - p_i^{min}}{p_i^{ar} - p_i^{min}} \tag{6}$$

Here p_i represents the value of the indicator i of the product in question, p_i^{min} the minimum value of the indicator i at which the goods are allowed to be released on the market, and p_i^{ar} the value of the indicator i that fully satisfies the needs of the consumer.

For the first group of indicators, the market-entry condition of the goods is represented by formula 7 (Juran and Godfrey 1999).

$$p_i \ge p_i^{min} \tag{7}$$

The second group includes the price decrease desirable for consumers. The g_i indicator for this group will be defined by formula 8: (Juran and Godfrey 1999).

$$g_i = \frac{p_i^{max} - p_i}{p_i^{max} - p_i^{ar}} \tag{8}$$

Here p_i^{max} represents the maximum possible value of the indicator i that is allowed to supply the goods to the market. Thus, we review only the first two group characteristics of bakery products; there is no need to record the remaining three group indicators. Only the first two groups of indicators were considered, as they represent the essential, mandatory parameters that directly determine whether the product can enter the market. The remaining three groups are secondary and do not significantly contribute to the analysis at this stage; therefore, their inclusion was not deemed necessary.

The value of six samples has been calculated to evaluate the single profitability indicator for grain bakery products. In the first stage, we determined parametric indicators of the proximity of the characteristics of grain bakery products to consumer demand. The results of the calculations are shown in Table 3.

Table 3. Parametric indicators of the proximity of the characteristics of bakery products to the demands of consumers.

Indicators	Type of grain bakery products					
	Sample	Tasty Bread	Thyume	Flavourful	Spike	Spelta
Price per 0.3 kg, USD	0.000	0.900	0.200	0.500	1.000	0.400
Total quantity of minerals per 100 g of bread, mg	0.000	0.338	0.417	0.077	0.338	1.000
Total quantity of vitamins per 100 g of bread, mg	0.000	0.536	0.073	0.610	1.000	0.932
Total quantity of essential aminoacids per 100 g protein, g	0.112	0.534	0.497	0.796	0.000	0.900
Proteins, g/100 g	0.000	0.667	0.600	0.143	0.286	1.000
Cellulose, g/100 g	0.000	0.746	0.756	0.897	0.343	0.788
Lysine, g/100 g	0.000	0.564	0.790	0.864	0.342	0.895
Toxic elements	0.000	0.717	0.735	0.243	0.676	1.000
Special capacity, cm^3/100 g	0.091	0.636	0.364	0.000	1.000	0.600
Porosity, %	0.074	0.750	0.729	0.000	0.833	0.975

At the next stage, we determined the final profitability for producing one unit of each type of grain bakery product. The results of the calculation are presented in Table 4.

Table 4. Value of unit profitability of bakery products.

Indicators	Types of bakery products					
	Tasty Bread	Thyume	Flavourful	Spike	Spelta	Sample
Quality	0.654	0.786	0.657	0.765	0.766	0.214
Basic characteristics	0.764	0.743	0.432	0.654	0.543	0.214
Secondary characteristics	0.978	0.765	0.659	0.653	0.428	0.214
Main	0.986	0.798	0.832	0.843	0.543	0.000
Additional	1.000	0.497	0.832	0.431	0.000	0.041
Final profitability	0.578	0.552	0.544	0.568	0.579	0.023

The final profitability of a product determines the first characteristics of its position. As the final profitability of grain bakery products declines, their ranking significantly determines their share of the total mass. The higher the final profitability indicators, the greater the product's competitive advantage (Jha et al. 2022).

The proximity of products to consumer demand is evaluated as the second characteristic of positioning. While evaluating any product, the value of all single parametric proximity indicators shall be $g_i^o = 1$ (Jumisko-Pyykkö et al. 2008). The distance from the studied product to the desirable product can be determined by formula 9: (Jumisko-Pyykkö et al. 2008).

$$I_i = \sqrt{\sum_{i=1}^{n} (g_i^0 - g_i)^2} \tag{9}$$

Here *n* – is a number of parameters characterizing *i* product. The calculated characteristics may be used to position bakery products in the market or to position their qualities (Table 5). The first coordinate characterizes U_i, the final profitability of a product; the second one characterizes Li, the distance from the studied product to the desirable product. Positioning instruction consists of placing the corresponding point in the calculation of each product's coordinates and in the coordinate plane (Jumisko-Pyykkö et al. 2008).

Table 5. Positioning of bakery products in the market.

Type of bakery products	Final profitability of bakery products	The distance from the studied product to the desirable product
Spelta (bread made from spelt wheat)	0.579	0.529
Tasty Bread	0.578	0.786
Spike (bread made from sprouted wheat grain)	0.568	0.765
Thyume (wheat bread)	0.552	1.219
Flavourful (wheat bread with garlic)	0.544	1.752
Sample	0.023	1.456

It seems from Table 5 that Spelta bread made from spelt wheat ranks first in terms of its indicators. The second group that takes the leading position includes grain bakery products made from other types. The grain bread sample tested in accordance with GOST 25832-89 performed worse. However, this sample lags behind the advanced groups in terms of final profitability and desired characteristics. It is possible to determine the market position of newly introduced grain bakery products.

It is well known that various factors may determine a product's competitive advantage. These factors may be classified into two broad categories (internal and external) based on the characteristics they confer (Rehman et al. 2018). The foreign competitive advantage of grain bakery products is based on quality factors that may create value for consumers (Maiboroda 2021). The quality factor increases the market power of the manufacturing enterprise, i.e., it increases the ability to force the market to accept the product's price while providing a higher, but significantly different, quality compared to leading competitors (Jumisko-Pyykkö et al. 2008).

Internal competitive advantage is based on the enterprise's ability to control production costs and the purchase price of goods (Maráková et al. 2023). This advantage creates value for the manufacturer and results in lower costs than competitors'. Such an advantage is created through the implementation of a policy that allocates expenditures to the application of organizational innovations. The internal (U^1) and external (U^2) competitive advantages (absolute values) of products will be determined using the following comparison formulas 10-11 (Maráková et al. 2023).

$$U^1 = d_1 c_1 \frac{C_{cost}^{max} - C_{cost}}{C_{cost}^{max} - C_{cost}^{ar}} \tag{10}$$

$$U^2 = d_1 c_2 \frac{C_{iq}^{max} - C_{iq}}{C_{iq}^{max} - C_{iq}^{ar}} + d_2 J \tag{11}$$

In this context, the relationship is expressed as equality 12:

$$U^1 + U^2 = U \tag{12}$$

The relative value of internal and external advantages of a product is equal to the ratio of the absolute value expressed as a percentage to the total final profitability of the product. The market power of grain bakery products depends on their ability to increase prices without losing their competitive positions. The potential maximum increase in purchase price determines a product's market power (Chen et al. 2013). The market power of a product with a competitive position is determined by formula 13: (Maráková et al. 2023).

$$U_{i+1} = d_1 c_1 \frac{C_{cost}^{max} - C_{cost.i}^{max}}{C_{cost}^{max} - C_{cost}^{ar}} + U_i^2 \tag{13}$$

Equality 14 determines the possible $C_{gös.i}^{max}$ maximum increase in purchase price of a product (market power) holding $\dot{I}$ competition position: (Maráková et al. 2023).

$$C_{cost.i}^{max} = C_{cost}^{max} + \frac{C_{cost}^{max} - C_{cost}^{ar}}{d_1 c_1}(U_i^2 - U_{i+1}) \tag{14}$$

Where

c_1 is the weighting coefficient representing the relative contribution of the product's internal competitive advantages (e.g., production efficiency and cost-related factors) to the overall competitiveness.

c_2 is the weighting coefficient representing the relative contribution of the product's external competitive advantages (e.g., consumer-perceived quality and market acceptance) to the overall competitiveness.

d_1 is the weighting coefficient representing the relative importance of value-related characteristics (e.g., price and economic efficiency) in determining product profitability.

d_2 is the weighting coefficient representing the relative importance of quality-related characteristics (e.g., sensory, nutritional, and functional attributes) in determining product profitability.

The structure and market power of the competitive advantage of grain bakery products is provided in Table 6.

Table 6. The structure and market power of the competitive advantage of bakery products.

Types of products	Final profitability of bakery products	Competitive advantage				Market power	
		internal		external			
		Absolute	%	Absolute	%	Absolute	%
Spelta	0.579	0.098	13.0	0.481	87.0	0.534	92.2
Tasty Bread	0.578	0.124	15.6	0.454	84.4	0.493	85.3
Spike	0.568	0.221	38.9	0.347	61.1	0.478	84.2
Thyume	0.552	0.112	14.9	0.440	85.1	0.423	76.6
Flavourful	0.644	0.136	21.2	0.408	78.8	0.386	70.9
Testing sample	0.023	0.010	43.5	0.013	56.5	0.004	17.4

While the market power of testing sample of bread is calculated, it has been determined that, $U_{i+1} = 0{,}91U_i$. (Alava et al. 2001). The absolute leader among the analyzed products is Spelta bread, made from spelt wheat. The maximum possible increase in the product's purchase price without losing its competitive position or market power, given all other equal conditions, was 92.2%.

The manufacturing market has an opportunity to exert pressure to secure the acceptance of product prices. It may be provided with thoughtful positioning based on the distinct quality of a product – its uniqueness, special packaging design, etc.

4. Conclusions

In this study six different bakery products were evaluated. The control sample "Sample" was purchased from a retail chain in Baku. The other five samples – ‘’Spelta, Tasty Bread, Spike, Thyme, Flavourful’’ - were prepared in the "Food Product Technology" laboratory of Azerbaijan State University of Economics according to standard recipes. As this is a pilot comparative study, all analyses were performed as single measurements without replication. Therefore, descriptive comparison and multi-criteria normalization were used instead of inferential statistics.

The research results indicate that a significant reduction in the production cost of bakery products was achieved through savings in raw and auxiliary materials and by increasing the productivity of prepared grain bakery products. The external competitiveness of an enterprise largely depends on the high-quality indicators of the finished products, which regular consumers particularly value.

Furthermore, the final profitability of products is determined by their initial positioning characteristics. Ranking grain bakery products by decreasing final profitability highlights each product's relative market position, indicating that higher profitability corresponds to a greater competitive advantage. In the positioning map, "Spelta" grain bread emerged as the leading product in both quality and profitability dimensions, followed by other grain bakery products. This demonstrates the market positioning of prepared grain bakery products in terms of both quality and economic performance.

Among the evaluated bakery products, Spelta bread demonstrated one of the most favorable combinations of nutritional value, safety indicators, physicochemical characteristics, and consumer acceptance. Based on the integrated evaluation criteria applied in this study, it showed the highest overall competitiveness.

Finally, analyzing production costs, product prices, and competitive advantages provides a comprehensive evaluation of the economic efficiency of bakery product assortments, allowing enterprises to make informed strategic decisions.

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