STUDY ON THE PRODUCTION CAPACITY OF A BAKERY UNIT AND ITS CORRELATION WITH CONSUMER DEMAND AND PREFERENCES

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Abstract

In recent years, Romanian consumers have been increasingly seeking healthy bakery products that provide a unique culinary experience or superior nutritional value. This trend has contributed to the development of small artisanal bakeries, highly appreciated by consumers, as they produce sourdough bread, wholemeal flour assortments, or additive-free recipes, thus meeting the demands of an educated and quality-oriented market. The aim of this paper was to analyze the production capacity of a modern bakery unit in Bucharest, in order to observe how production can be correlated with consumer demand and preferences. The daily production of the unit amounts to 2,410 kg of products, of which bread and bakery goods represent 87.6% (2,110 kg), while the remaining 12.5% (300 kg) consists of fresh pastry products. The assortment with the highest share in the unit's total production (41.5%) is represented by white bread, followed by intermediate bread with a share of approximately 20% of the total. The results of the physicochemical and microbiological analyses demonstrate that both the raw materials and the finished products meet the food safety requirements.

Key words: *bakery, bakery products, flour, production capacity, pastry*

INTRODUCTION

The bakery industry in Romania holds major importance within the agri-food sector, being supported by one of the highest bread consumption levels in Europe. According to Eurostat data and recent analyses, Romanians consume approximately 85 kg of bread annually, which places Romania first in the EU and second worldwide, after Turkey [1; 2]. Compared to a decade ago, a slight decrease can be observed, as the average consumption at that time reached 92 kg/year [3; 4].

In recent years, the bakery market has undergone significant transformation: while total volumes have gradually decreased, demand for premium, artisanal, and healthy products has grown at an accelerated pace. This shift has prompted both producers and retailers to adjust their strategies through innovation, diversification of product ranges, and a greater emphasis on freshness and nutritional value [2].

Romanian consumers are becoming increasingly attentive in their choice of bread, focusing on freshness, authentic taste, and health benefits. Although white bread-particularly the traditional loaf-continues to dominate sales, sourdough, wholemeal, and seed-based varieties are gaining popularity, being preferred for their clean profile, free of additives and added sugars [2]. An increasing number of customers are looking for products that provide both a distinctive culinary experience and superior nutritional value, a phenomenon that has been amplified in recent years, especially in the post-pandemic context.

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The structure of the national bakery sector includes a large number of small and medium-sized production units, coexisting with major industrial companies. Recently, many Romanian producers have reoriented towards traditional bread-making methods, capitalizing on this aspect in the promotion of their brands [5]. This trend has encouraged the development of artisanal bakeries, highly appreciated by urban consumers. These bakeries specialize in natural sourdough bread, wholemeal flours, and additive-free recipes, thus meeting the demands of an increasingly educated market focused on quality [5].

Within this context, analyzing the production capacity of a modern bakery and fresh pastry unit becomes particularly relevant. It is essential to monitor how production can be scaled, diversified, and adapted to meet both the high volume demand and the emerging consumer preferences. Investments in automation, process optimization, and the integration of artisanal quality are shaping up as decisive factors for competitiveness [6].

MATERIAL AND METHOD

For the study on the production capacity of a small bakery and fresh pastry unit, a mixed approach was used, combining theoretical analysis with applied research.

The *study material* consists of a small-sized bakery and pastry unit, with a workforce of 10 employees, located in Sector 5, Bucharest, but equipped with modern technological lines for the production of bread, pastry products, and artisanal specialties. The research aimed to evaluate the degree of utilization of existing production capacities, to identify potential constraints, and to propose effective solutions for optimizing the factory's yield.

Working method. The analysis of the production capacity of the bakery unit began with the description of its history, location and business development, production organization, technological equipment, and product portfolio. The supply of raw materials and auxiliaries, essential for maintaining production continuity and quality standards, was also examined.

In addition to the quantitative analysis of production capacity (the number of products manufactured daily), the specific consumption of raw materials was calculated, as well as the production yield, which indicates the efficiency of resource utilization. The calculations were carried out using classical methods described in the specialized literature [7; 8; 9].

$$\text{Yield (\%)} = (\text{Quantity of raw and auxiliary materials used}/\text{Quantity of finished product}) \times 100;$$

Another point of interest was the physico-chemical and microbiological analysis of the raw materials and the finished products obtained within the unit, which allows the evaluation of their quality and compliance with food industry standards. The physico-chemical and microbiological tests were performed according to classical methodologies [7; 10].

Finally, the study also considered the methods of valorizing the finished products, including the distribution network and promotion strategy. The adopted methodology thus enables both the quantification of the actual and theoretical production capacity of the unit and the assessment of optimization possibilities through investments in equipment, reorganization of the technological process, or diversification of the product range.

RESULTS AND DISCUSSIONS

History and organization of production. The bakery and pastry unit analyzed in this study was founded in 2021 and is located in Sector 5, Bucharest. Positioned in a densely populated urban area, close to consumers and distribution networks, the company quickly consolidated its market position

through an offer adapted to the daily needs and preferences of its customers. Its main activity is the production of fresh bakery and pastry products, classified under CAEN code 1071, the choice being motivated by the constant demand in the Romanian market for high-quality bakery products, within a dynamic and competitive sector.

The business was initiated in a challenging economic context, marked by the post-pandemic adjustments and rising inflation. Nevertheless, the unit succeeded in establishing itself on its market segment through a business model focused on quality, freshness, and adaptability. During the first year of operation, significant investments were directed towards infrastructure and logistics, without generating revenues. In the following years, the annual turnover exceeded 1 million RON, this evolution being the result of reinvesting resources in operational growth and product diversification. Maintaining a constant number of 10 employees and ensuring a high level of production are clear indicators of the company's stability and maturity.

The organizational structure of production is designed to ensure a continuous and coherent technological flow, from the reception of raw materials to the delivery of the finished product. Raw materials-such as high-quality flour, yeast, milk, eggs, butter, and other necessary ingredients-are sourced from certified suppliers, and their reception is accompanied by strict quality control measures to guarantee compliance. The technological process comprises distinct stages (dosing, kneading, fermentation, shaping, baking, and packaging), all carried out in facilities arranged according to hygiene and food safety regulations, and supervised by trained personnel.

The unit operates on a semi-industrial model, combining the advantages of modern technology with artisanal attention to detail. Production in small batches ensures flexibility according to market demand, while specialized equipment covers the entire manufacturing flow. In addition, modern monitoring and quality control systems enable continuous tracking of critical parameters and prompt intervention in case of deviations, thus ensuring product freshness and food safety.

The production team consists of 10 employees, organized into clearly defined roles: bakers, pastry chefs, cashiers, cleaning staff, and an administrator/manager, each with specific responsibilities and solid technical skills. This structure supports compliance with hygiene and quality standards, while continuous training reinforces staff professionalism.

The product portfolio represents a central element of the market strategy. White bread remains dominant in terms of volume, alongside wholemeal and seeded varieties, while pastry products—such as croissants, brioche, pies, and pretzels—complement the assortment, responding to consumer preferences for quick and diverse snacks. Furthermore, the company adapts its product range according to seasonality, introducing traditional items such as *cozonac* and *pască* during festive periods. This flexibility, supported by a rigorous supply policy and collaboration with certified suppliers, ensures both the stability of the technological flow and the consistent quality of the finished products.

Table 1 illustrates the main supplier structure and the types of raw materials used monthly in the bakery and pastry unit. It can be observed that procurement is carried out through a diversified network of specialized suppliers, which guarantees both the stability of the technological process and the constant quality of the final products. The basic raw material, represented by white flour type 650 and wholemeal flour, is delivered weekly in significant quantities (2,000 kg), reflecting its central role in the bread production process.

In addition to flour, auxiliary materials such as fresh yeast (150 kg/month) and

food-grade salt (100 kg/month) ensure the standardized quality of the products, in accordance with traditional recipes. Granulated sugar (300 kg/month), milk and butter (200 liters and 100 kg/month, respectively) highlight the diversification of assortments, including pastry and sweet specialties. At the same time, the supply of eggs (1,500 pieces/month) and seeds (100 kg/month) emphasizes the orientation towards varied products with higher nutritional value.

The use of natural flavors and permitted additives (20 kg/month) suggests the company's focus on adapting its offer to modern consumer expectations, oriented towards distinctive and personalized tastes. Supply frequency ranges from weekly (for perishable raw materials such as milk, yeast, or eggs) to monthly (for ingredients with a longer shelf life, such as salt, sugar, and additives), indicating efficient stock management and internal logistics.

The supplier structure outlines a coherent image of resource management within the bakery and pastry unit, highlighting both the complexity of the supply chain and the necessity of aligning technological requirements with economic processes.

Table 1. Main structure of suppliers and raw materials used monthly

No.	Supplier	Raw material	Average quantity supplied (per month)	Supply frequency
1	Molinopan S.R.L.	White flour type 650, wholemeal	2,000 kg	Weekly
2	Fermix Prod S.R.L.	Fresh yeast	150 kg	Weekly
3	Salrom Distribuție	Food-grade salt	100 kg	Monthly
4	Zahărul S.A.	Granulated sugar	300 kg	Monthly
5	DairyFoods Romania	UHT milk, butter	200 liters / 100 kg	Weekly
6	Agrofruct S.R.L.	Table eggs, seeds	1,500 pcs / 100 kg seeds	Weekly
7	Aromex Impex	Natural flavors, additives	20 kg	Monthly

Production capacity. The production activity of the bakery unit is organized in such a way as to meet the constant market demand while maintaining a continuous and efficient manufacturing flow. The daily production capacity is adjusted according to orders, seasonality, and the diversification of the product portfolio.

The production figures vary depending on special orders, commercial contracts, or holiday periods. The maximum capacity is increased by introducing additional work shifts and by adapting the production volume accordingly.

Table 2 highlights the structure of the unit's daily production, emphasizing both the diversity of bakery and pastry products and their quantitative distribution. Out of a total of 9,500 pieces produced per day, traditional white bread holds the leading position, with 2,000 units representing 21% of daily production, yet contributing 1,000 kg-over 41% of the total daily output by weight. This underscores the status of white bread as the main staple product and the one with the highest quantitative contribution in production.

Conversely, intermediate bread, although produced in a smaller quantity (800 pieces), accounts for a significant share of the total weight (480 kg), reflecting consumers' preference for larger portions with distinct nutritional value. White rolls, the most numerous product in terms of pieces (3,000 units, approximately 31.6% of the total), contribute only 270 kg (11.2%), highlighting the contrast between consumption frequency and weight contribution.

Table 2. Daily average quantities of bakery and pastry products obtained in the unit

No.	Product type	Quantity obtained per day (pieces)	Total quantity per day (kg)
1	White bread (500 g)	2.000 pcs	1.000 kg
2	Intermediate bread (600 g)	800 pcs	480 kg
3	White rolls (90 g)	3.000 pcs	270 kg
4	Baguettes (300 g)	1.200 pcs	360 kg
5	Pastry products (croissants, pretzels, etc.)	2.500 pcs	300 kg
Total		9.500 pcs	2.410 kg

From the data in Table 2, it can also be observed that baguettes (1,200 pieces, 360 kg) and pastry products (2,500 pieces, 300 kg) complement the assortment, playing an important role in product diversification. It is noteworthy that pastry, although high in number (26% of the total), has a relatively low weight contribution (12.4%), which suggests a consumption pattern oriented towards small-sized products with high added value.

The analysis of the data in Table 2 reveals that the unit focuses its production on traditional white bread and pastry products, thus responding both to traditional demand and to modern consumption trends.

The balance between products with high weight (bread) and those with high numerical volume but lower weight contribution (pastries, rolls) reflects a production strategy adapted to consumer preferences and market diversity.

Calculation of specific consumption and conversion yield for traditional white bread.

Specific consumption refers to the quantities of raw materials and auxiliary materials required to obtain 1 kg of finished product, namely 1 kg of white bread. In bakery technology, the specific consumption of raw and auxiliary materials is calculated by relating the quantities actually used to the amount of finished product obtained.

The calculation starts from the production recipe, where all raw and auxiliary materials necessary to obtain a given amount of finished product from a batch of 100 kg of flour are specified. In this case, the amount of finished product obtained from 100 kg of flour is 129 kg of white bread.

The calculation of the specific consumption (Cs) per unit of finished product is made by relating the quantity of raw material to the quantity of finished product (Cs = Q raw material / Q finished product).

As a result of the calculation, the specific consumption of flour for obtaining 1 kg of white bread is 0.775 kg (100 kg flour / 129 kg bread), a value close to that found in the specialized literature [8; 9]. For the daily production of 1,000 kg of white bread, the specific flour consumption is 0.775 kg per 1 kg of finished product, while the other raw materials are consumed in adjusted proportions (experimentally determined) in order to obtain a dough of suitable quality.

Table 3 presents the specific consumption of raw and auxiliary materials, as well as the estimated quantities required for the daily production of 1,000 kg of white bread. Subsequently, based on the quantities of raw and auxiliary materials required to obtain 1,000 kg of white bread, the percentage conversion yield is calculated, which measures the efficiency of the production process [12].

After entering the data and performing the actual calculation, it was found that the yield value for traditional white bread is 73.8%.

Table 3. Consumption of raw materials and auxiliary materials for the daily production of 1,000 kg of white bread

No.	Raw material	Specific consumption (kg/kg finished product)	Daily consumption (kg)
1	White flour type 650	0.775	775
2	Water	0.55	550
3	Fresh yeast	0.008	8
4	Salt	0.012	12
5	Sugar	0.01	10

Yield (%) = (1000 ÷ 1355) × 100 = 73,8%;

A yield of approximately 74% means that around 74% of the raw materials and auxiliary materials used in the production process are transformed into the finished product on a daily basis, while the remaining 26% represents losses during various operations of the manufacturing process (fermentation, baking, transfer, cooling). Compared to the data reported in the specialized literature, the calculated yield value for obtaining white bread in this case is lower by about 5 percentage points (73.8% vs. 79%) [8; 13].

Physico-chemical and microbiological analyses. Quality control of raw materials, auxiliary materials, and finished products is essential for ensuring food safety, compliance with standards, and consumer satisfaction [7]. The unit periodically performs physico-chemical and microbiological analyses to verify quality parameters and to prevent risks associated with contamination or spoilage.

Table 4 presents the physico-chemical parameters analyzed for flour and white bread. Thus, the moisture content of the flour (13.5%) is below the maximum admitted limit (14%), which indicates proper storability and a low risk of developing spoilage microflora. For white bread, the determined moisture content (38.7%) is close to the maximum limit (40%), suggesting an optimal crumb structure with adequate water retention.

The ash content of the flour (0.58%) complies with the admitted limit (≤0.65%), indicating good extraction quality, while that of the bread (1.1%) is consistent with the maximum allowed value (≤1.2%), confirming the appropriate degree of mineralization.

Regarding pH, the values obtained (6.0 for flour and 5.8 for bread) fall within the recommended ranges (5.5–6.5 for flour and 5.0–6.5 for bread), reflecting natural acidity and a balanced fermentation process. Likewise, the determined acidity (1.8% for flour and 2.5% for bread) remains below the maximum admitted limits, confirming the freshness and stability of the products.

The results obtained are consistent with the values reported in the specialized literature, which confirms the quality of both the raw material and the finished product [7].

Table 4. Physico-chemical parameters for flour and white bread

Parameter	Flour (admitted limit)	Flour result	White bread (admitted limit)	Bread result
Moisture (%)	≤ 14	13.5	≤ 40	38.7
Ash (%)	≤ 0.65	0.58	≤ 1.2	1.1
pH	5.5 – 6.5	6.0	5.0 – 6.5	5.8
Acidity (degrees)	≤ 2	1.8	≤ 3	2.5

Table 5 summarizes the results of the microbiological analyses carried out on flour and white bread, compared to the limits established by current regulations. In all cases, the determined values fall within food safety parameters, which confirms the quality of both the raw material and the finished product.

The total number of aerobic microorganisms (800,000 CFU/g in flour and 500,000 CFU/g in bread) is below the maximum admitted limit (1,000,000 CFU/g), indicating a moderate microbial load, consistent with technological standards.

The presence of coliforms was low (5 CFU/g in flour and 3 CFU/g in bread), values being well below the admitted threshold (<10 CFU/g), which confirms compliance with hygiene requirements during the production process.

Major food safety pathogens, such as *Staphylococcus aureus* and *Salmonella spp.*, were absent both in flour and bread, an essential aspect for microbiological compliance. Regarding molds and yeasts, the values determined (800 CFU/g in flour and 600 CFU/g in bread) are below the admitted limit (≤1,000 CFU/g), demonstrating low and controlled fungal contamination.

The results obtained are within the ranges reported in the specialized literature and confirm that both the raw material and the final product comply with hygiene and food safety standards [10; 14].

Table 5. Microbiological parameters for flour and white bread

Parameter	Admitted limits (CFU/g)	Flour result (CFU/g)	Bread result (CFU/g)
Total aerobic microorganisms	≤ 1,000,000	800,000	500,000
Total coliforms	< 10	5	3
Staphylococcus aureus	Absent	Absent	Absent
Salmonella spp.	Absent in 25 g	Absent	Absent
Molds and yeasts	≤ 1,000	800	600

Methods of valorizing the finished products. In the Table 6 is presented the distribution area and geographical coverage of the unit's products, which is primarily concentrated in district 5 of the capital, where deliveries are made daily to supermarkets and local shops, the main beneficiaries in both the central and suburban areas.

For other districts of the city, the delivery frequency decreases to approximately three times per week, with the main clients being restaurants, cafés, and shops, which indicates a more diversified market segment but with a lower sales volume.

The localities surrounding Bucharest benefit from a lower delivery frequency, with supplies made twice a week to grocery stores and mobile outlets, thereby adapting to the logistical requirements and the consumption volume of less densely populated areas.

Table 6. Distribution area and geographical coverage

Area/Region	Coverage description	Main clients	Delivery frequency
District 5, Bucharest	Central and suburban area of Sector 5	Supermarkets, local shops	Daily
Other districts of Bucharest	Districts 1, 2, 3, 4, and 6	Restaurants, cafés, shops	Three times per week
Surrounding areas of Bucharest	Localities around Bucharest	Grocery stores, mobile outlets	Twice per week

The distribution of the unit's products is carried out through two main channels. The first channel is direct distribution to shops and retail outlets, through which products are delivered daily to supermarkets, local stores, restaurants, and partner cafés, using the company's own fleet of refrigerated vehicles that ensure optimal conditions of temperature and hygiene. The second channel is represented by direct sales to final consumers, either through the company's own store located on the premises or through mobile outlets (food caravans), which guarantee product freshness and allow direct interaction with customers.

CONCLUSIONS

Based on the conducted study, several final conclusions emerge, firmly anchored in the data presented.

The bakery unit, recently established and located in a densely populated urban area, has managed to consolidate its market position rapidly by maintaining a small workforce and a semi-industrial production model, which reflects both stability and organizational efficiency.

The continuous production flow (from raw material reception to packaging) is supported by modern equipment, small production batches, and monitoring of critical parameters, which ensures constant freshness, traceability, and a coherent technological organization focused on product quality control.

The structure of daily production highlights a balanced product portfolio, in which traditional white bread holds the largest share by weight, while pastry products and rolls, despite their smaller unit weight, dominate numerically, indicating an adaptation to diverse and modern consumer demands.

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