

INTEGRATING R&D MANAGEMENT PRACTICES IN THE DEVELOPMENT OF NOVEL CONFECTIONERY PRODUCTS

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Abstract: *The confectionery industry faces increasing pressure to innovate while addressing consumer demands for novel textures, flavors, and sustainable ingredients. This study explores the integration of structured Research and Development management practices in the systematic design of innovative cookie-category pastries with minimal processing, free from additives and preservatives, while maximizing nutritional value. This approach ensures compliance with dietary standards while aligning with consumer preferences for clean-label products. The product development strategy employed in this study encompasses: (1) new product conceptualization, (2) product design and development, (3) identification of key competitors, (4) market price determination and (5) formulation of marketing and commercialization strategies for the newly developed products and (6) sustainability considerations. The performed SWOT analysis identified organizational strengths in innovative product development with clean-label and high-quality attributes, while highlighting reduced product shelf-life compared to industry benchmarks as the primary weakness stemming from strict adherence to natural ingredient formulations. Three new cookie varieties were selected for development based on market research findings: plain fennel cookies, fennel-sesame cookies, and fennel-cayenne pepper cookies. This research provides actionable insights for SMEs and large manufacturers navigating the challenges of sustainable product development in the global sweets market.*

Key words: *cookies, innovative products, development strategy, clean-label cookies*

INTRODUCTION

Innovation is an essential element of economic development and a source of sustainable competitive advantage. It is indispensable for organizations seeking to maintain and strengthen their market position, facilitating adaptability and progress in a dynamic competitive environment [2,15]. The relevance of product innovation in optimizing marketing and financial performance, as well as in underpinning the long-term operational sustainability of enterprises, has been the subject of extensive debate. Organizational capabilities, including internal culture and structure, are key determinants in the process of new product development. However, the specific impact of these factors on different forms of product innovation remains insufficiently clarified [1,4,8]. The product development process is a succession of essential steps including conceptualization, design, development and commercialization of newly created or rebranded goods or services. It covers the entire life cycle of a product, from initial conception to market introduction, and plays a fundamental role in ensuring competitiveness and innovation in the business environment [7,9,12]. From a strategic perspective, product development aims to strengthen, expand and optimize a company's market share by satisfying consumer demands and preferences. In terms of the customer, the primary objective is to provide a product that delivers value and superior quality standards, whether a tangible good or a service [17,19]. Given the diversity of consumer preferences and segments, not every product will appeal to the entire customer base, which is why accurately defining the target market is a fundamental step to be taken at an early stage in the development process [6,16]. The product development process includes five essential steps: *i) identify design criteria* (brainstorming new concepts and integrating them into a development strategy); *ii) idea analysis* (assessing feasibility through market research and concept studies); *iii) concept generation* (turning

the opportunity into a concrete model); *iiii*) *prototyping* (creating a working prototype for testing and fine-tuning); *iiiiii*) *product development* (concept validation and integration into production). These steps ensure product viability and market success [11,14]. The development of innovative pastry products constitutes a strategic endeavor that integrates culinary creativity with systematic research and analysis of consumer trends [18,20]. Innovation in this domain extends beyond the refinement of traditional recipes to encompass the incorporation of novel ingredients, advanced preparation methodologies, and original conceptual approaches designed to align with evolving consumer preferences [5,13]. Consequently, pastry innovation not only broadens the spectrum of available products but also plays a pivotal role in distinguishing brands within an increasingly dynamic and competitive market landscape [3,10]

MATERIALS AND METHODS

The model presented in this paper was developed by analyzing and implementing the literature on the application of Research and Development Management in the development of three innovative cookie varieties. The selected products included: plain fennel cookies, fennel-sesame cookies, and fennel-cayenne pepper cookies. All fennel cookies are designed to be prepared from wholemeal flour. The product development strategy implemented in this study integrates a structured approach that encompasses: (1) new product conceptualization, (2) product design and development, (3) identification of key competitors, (4) market price determination, (5) formulation of marketing and commercialization strategies for the newly developed products and (6) sustainability considerations. The identification of the main competitors and similar products sold by them was realized by visiting some IKA (International key account) network stores.

RESEARCH RESULTS

New product conceptualization

In recent years, the field of research has faced significant challenges in identifying novel products capable of simultaneously delivering nutrition, health, and well-being benefits to consumers while ensuring cost-effective and streamlined manufacturing processes for the industry. Furthermore, Clean Label Products have gained increasing significance in consumer preferences, as the market has become saturated in recent decades with heavily processed foods containing excessive additives and preservatives. Historically, the food industry has prioritized production efficiency, cost reduction, and maximizing product shelf life, often at the expense of ingredient transparency and nutritional quality. In this context, the present work aimed to design a process for the development of innovative pastry products within the cookies category using additive-free and entirely natural ingredient compositions.

Prior to initiating the development process of this product range, a study was conducted on consumer preferences in relation to fennel cookies. Based on the results obtained, the products to be integrated into the company's portfolio were determined, thus ensuring optimal alignment with market requirements and consumer expectations.

The main commercialized assortment, the packaging method, the weight/unit of packaging and the marketing prices are presented in Table 1. Based on identified prices, were calculated maximum, minimum and average price of main commercialized cookies.

Table 1.

The main commercialized cookies assortment and the corresponding packaging method, the weight/unit of packaging and the selling prices

Product	Weigh [kg]	Package	Price/unit of package		Price/kg		Maximum price lei/kg		Average price lei/kg		Minimum price/kg	
			with VAT	no VAT	with VAT	no VAT	with VAT	no VAT	with VAT	no VAT	with VAT	no VAT
Walnut cookies	1.8	Carton box	66	55.46	3.,67	30.81	244	205.4	56	47.05	36.67	30.81
Cookies with butter	0.350	Carton box	16	13.44	56	47.05						
Cookies with cocoa	1.0	Carton box	38	31.93	38	31.93						
Coconut cookies	0.135	Carton box	33	27.73	244	205.0						
Cookies with fruit	0.800	Carton box	45	37.81	56	47.05						

Conducted market research revealed that fennel cookies are not currently marketed. In this way there were formulated 3 assortments of cookies with fenicul (Tabel 2) and clean recipe, without additives, whose development strategy is presented hereafter.

Table 2.

The formulated assortments of cookies with fenicul

Product name	Packaging	Weight (kg)
Plain fennel cookies	Carton box with window	0.200
Cookies with fennel and sesame	Carton box with window	0.200
Cookies with fennel and cayenne pepper	Carton box with window	0.200

Based on the fact that the formulated assortments are premium due to the ingredients used and the clean recipe, without additives, we opted for a low selling weight of 200g.

A SWOT analysis was conducted to systematically evaluate the strengths, weaknesses, opportunities, and threats associated with the new product development initiative, with the results detailed in Table 3.

Table 3.

SWOT analysis associated with the new product development

<p>STRENGTHS</p> <ul style="list-style-type: none"> Distinct flavor and digestive benefits Enhanced nutritional value due the fiber from wholemeal flour and bioactive compounds from spices Adaptability to trends Sustainability due the full utilization of the plant 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> Limited consumer familiarity with fennel Higher costs Sensitive storage requirements due the volatile oils from fennel and and the preservative-free recipe which may shorten shelf life compared to traditional cookies
<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> Growing demand for functional foods Niche market potential Partnerships with specialty retailers 	<p>THREATS</p> <ul style="list-style-type: none"> Competition in the healthy pastry segment Strict regulations regarding the healty product declaration Price volatility of fennel

The novelty of the formulated cookies is demonstrated by:

Use of fennel in cookies, a less common ingredient in pastries, gives a distinct minty and slightly sweet flavor that sets the product apart from other traditional cookies.

The blend of sesame and cayenne pepper yields complex, exotic flavors, aligning with modern demand for unconventional taste profiles.

Substituting white flour with wholemeal flour enhances the nutritional profile of the product while increasing its appeal among health-conscious consumers.

Product design and development

To design and develop the novel products, manufacturing formulations for three varieties of whole wheat flour cookies containing fennel were elaborated (Table 4), and their production process was established.

Table 4.

The recipe for fennel cookies	
Ingredient	Wheight (g)
Plain fennel cookies	
Wholemeal flour	400
Butter	300
Fennel	100
Eggs	100
Baking powder	50
Salt	50
Cookies with fennel and sesame/ cayenne pepper	
Wholemeal flour	400
Butter	300
Fennel	100
Eggs	100
Baking powder	50
Salt	50
Sesame/ Cayenne pepper	50/50

The equipment required for the production of novel fennel cookies is presented in Table 5.

Table 5.

The equipment required for the production of novel fennel cookies		
No.	Equipment	Use
1.	Electronic scale	Raw material wghting
2.	Dosing machine	Dosage of dough
3.	Planetary Mixer	Kneading dough
4.	Pastry sieve	Sieving flour
5.	Cookie mold	Shaping the dough
6.	Packaging machine	Cookie packaging

The manufacturing process and operational parameters for fennel cookies production follow the steps chart-flow featured in Figure 1.

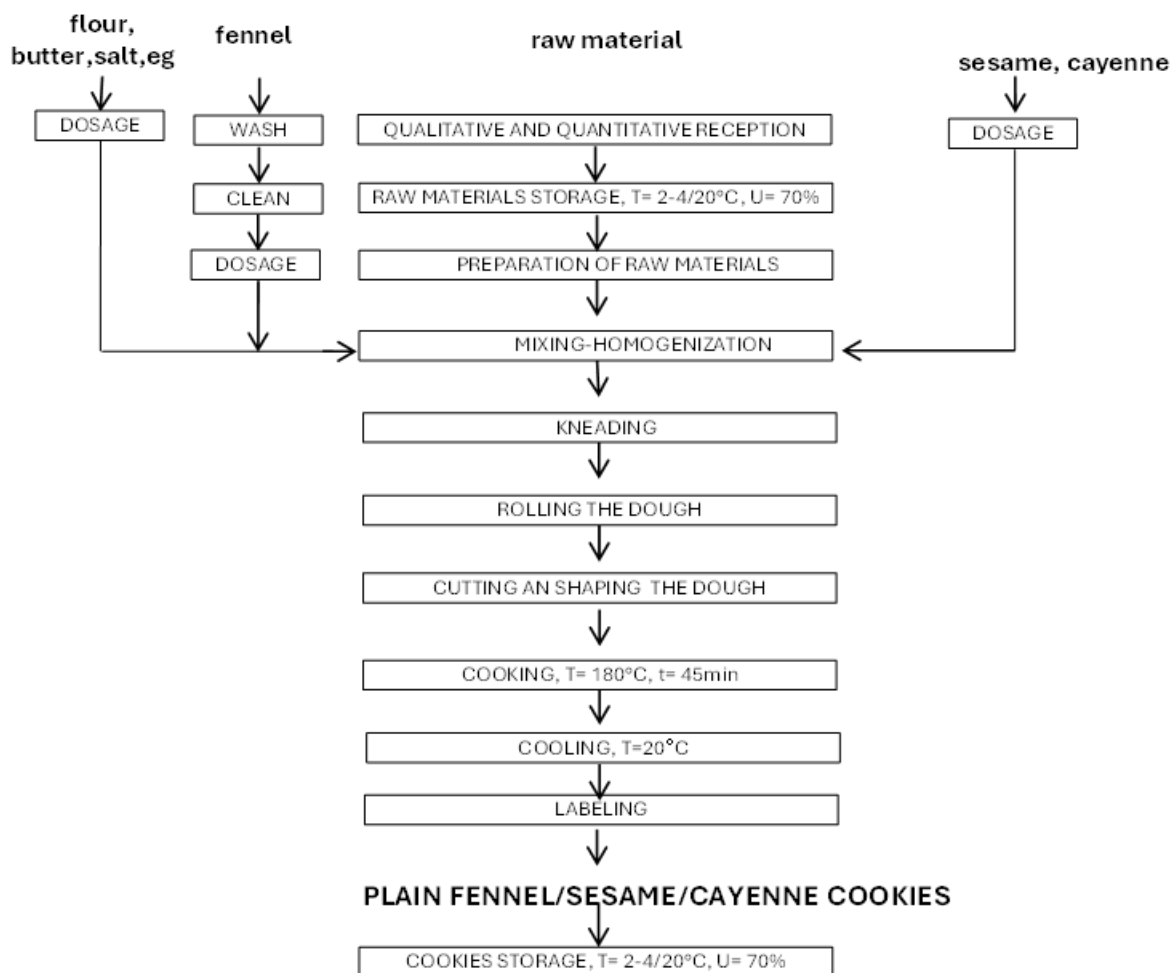


Figure 1. Chart-flow of cookies

Identification of key competitors

Table 6 presents the main cookie manufacturers identified as key market competitors.

Table 6.

The main cookie manufacturers identified as key market competitors

No.	Category	Producer
1.	Large-Scale Industrial Producers	Grupo Bimbo, Mexico: Vel Pitar, Trei Brutari, and Karamolegos Bakery Dulcinella Group Romania SC Croco SRL Romania Boromir SRL Romania
2.	Mid-Sized & Export-Oriented Manufacturers	Star Foods EM SRL Romania SC Chipita Romania SRL Macromex SRL Romania
3.	Artisanal and Niche Producers	Bio&Co Romania Small bakeries from Romania
4.	International Brands	Mondelez International: Oreo, Belvita Nestlé
5.	Private Label	Auchan România Kaufland România Lidl România Selgros Romania

Market price determination for fennel-enriched cookies

Cost calculations were derived from a monthly production volume of 750 kg, comprising 300 kg allocated to the innovative plain fennel cookie products. The analysis accounted for 20 operational days per production cycle. The calculated prices are presented in Tables 7-10.

Table 7.

Raw material, auxiliary material and packaging costs/month

Ingredient	Weight (kg/month)	Price [Lei/kg]	Total cost [Lei]
Wholemeal flour	120	2.7	324
Butter	90	50	4500
Fennel	30	30	900
Eggs	180	1	300
Baking powder	1.5	18	27
Salt	1.5	4	6
Raw and auxiliary material			6.057
Packaging materials	Weight (pieces/month)	Price [Lei/piece]	Total cost [Lei]
Carton box, 200g	300	3.0	900
Total production cost of plain fennel cookies			6,957

The production cost of fennel appetizer cookies/kg is: $6.957/300 = 23,19/\text{kg}$

Table 8.

Utility costs/month

No.	Utility	Cost [lei/month]
1.	Water	1,000
2.	Electricity	1,500
3.	Garbage+Sewage	800
Total utility costs		3,300

Utility costs include water, electricity, garbage and sewage at a total production of 700kg/month was calculated to 4.4lei/Kg.

Table 9.

Human resources costs including social contributions/month

No	Position	Number	Gross salary/person/month [lei]	Total salary cost/month [lei]
1.	Engineer	1	5,500	5,500
2.	Baker	2	3,500	7,000
3.	Accountant	1	4,500	3,500
4.	Laborer	6	3,000	18,000
Total salary costs/month		10		34,000

Table 10.

Operational expenditure costs/month

No.	Type of expenditure	Cost/month [lei]
1.	Fuel for equipment operation	350
2.	Maintenance	30
3.	Sanitation tools	33
4.	Sanitizing solutions and detergents	145.5
5.	Protective equipment	63
6.	Administrative	65
7.	Pest and pest control services	30
8.	Laboratory analysis services	30
9.	Fixed telephony	55
10.	Mobile telephony	170
11.	Internet	35
12.	Promotion materials	40
	Total operational expenditure	1,046.5

Total cost/kg of cookies with fennel at a production of 750kg/month including = 60.40 lei, respectively 12.10lei/200g box.

The selling price including 10% profit margin = 19.30 lei/200g box

Marketing strategy for the newly developed products

The primary objective of the proposed marketing strategy focuses on product promotion, market research, advertising initiatives, and business growth through the development of a fennel cookies addressed to all consumer categories, including: children older than 3 years, elderly populations, individuals with food allergies, health-conscious consumers monitoring caloric intake. The strategic implementation will proceed as is presented in Figure 2.



Figure 2. Marketing strategy for the newly developed products

Sustainability considerations

Energy efficiency: the integration of renewable energy sources, supplemented by natural gas, as a substitute for the conventional fuels predominantly utilized in the food industry for product distribution and raw material supply.

Packaging: implementation of recycled paper packaging and/or bulk product distribution.

Labeling: the implementation of product labeling indicating the CO₂ emissions generated during processing, enabling consumers to assess and compare the carbon footprint of products, thereby encouraging the selection of options with the lowest environmental impact.

Storage: the technological process exclusively utilizes fresh ingredients, thereby eliminating the energy consumption associated with freezing.

Transport - road transportation contributes to CO₂ emissions through the combustion of fossil fuels. Consequently, these emissions will be mitigated by optimizing the supply chain, sourcing ingredients from local distributors or retailers to minimize environmental impact.

The social responsibility and sustainable resource development: hiring young graduates and ensuring at least 1% of employees are individuals with disabilities; promoting women with strong leadership skills in managerial roles; providing employee training programs for skill development.

CONCLUSIONS

The study demonstrates that using of Research and Development Management practices can be considered a suitable guide for development of innovative, clean-label pastry products that align with evolving consumer preferences and sustainability demands. By integrating market research, product design and marketing strategy, a project was developed for the creation of three novel cookie products: plain fennel, fennel-sesame, and fennel-cayenne pepper. The products distinguish themselves through their innovative nature, exemplified by the incorporation of fennel as a key ingredient in their formulation, as well as their highly appealing sensory attributes, including enhanced nutritional properties.

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