STM JOURNALS

Research & Reviews: A Journal of
Crop Science and Technology

ISSN: 2319-3395
Volume 13, Issue 2, 2024
May–August
DOI (Journal): 10.37591/RRJoCST

https://journals.stmjournals.com/rrjocst

Research RRJoCST

# Product Life Cycle Management and Its Influence on Food Product Development

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***Abstract***

*This article examines the significance of product life cycle management (PLM) in the food industry, with a particular focus on how it affects the development of new products (NPD). This review addresses the intricacies and difficulties that food companies have in the current cutthroat industry, emphasizing the necessity of an organized approach to NPD to preserve market relevance and competitive advantage. Reviews describe the introduction, growth, maturity, and decline phases of a product's life cycle as well as the tactics needed at each to maximize the product's longevity and profitability. To improve product development outcomes, the evaluation emphasizes the significance of innovation, cutting cycle time, and utilizing corporate knowledge assets. This assessment also looks at how PLM, an information-driven, integrated strategy, has expanded beyond engineering to cover the whole product life cycle, helping companies manage their intellectual property and maintain a competitive edge. This thorough investigation offers insights into the ways in which PLM technologies can be applied successfully in the food industry to manage regulatory issues, promote innovation, improve product differentiation, and boost market performance.*

**Keywords:** Product development, product life cycle (PLC), new product development (NDP), competitive analysis

## INTRODUCTION

New product development is essential for most food firms' survival. Moreover, although new product development (NPD) is essential to a business, the majority do not share a common strategy. This perplexing discrepancy results from the various expectations of NPD departments and specialists, which can lead to distinct and occasionally contradictory expectations. Whether based on academic views or corporate case histories, there is one consensus: a substantial quantity of data and inputs from both NPD practitioners and market performance should form the foundation of the "best" and "optimal" techniques. Historical data and empirical observations should serve as a foundation for the success of NPD. The food industry is currently regarded as one of the most significant economic sectors and has attracted the interest of numerous authorities and organizations. Even with the food industry's widespread recognition of its significance, controlling products and competition in the market continue to be major obstacles for businesses in this field [1]. Product life cycle expertise is essential for modern business. The stage at which a product or service can help determine how best to go with it right now and how much money to invest in its advancement or marketing. To ensure that a product's sales increase for as long as possible, there are numerous strategies to prolong its lifecycle [2]. Food firms have faced an increasing number of tasks in recent years, forcing them to concentrate on innovation to preserve or increase

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Received Date: August 28, 2024
Accepted Date: August 30, 2024
Published Date: August 30, 2024

**Citation:** Divyanshi Tiwari, Suvarsha Raj, Neelesh Kumar Maurya. Product Life Cycle Management and Its Influence on Food Product Development. Research & Reviews: A Journal of Crop Science and Technology. 2024; 13(2): 24–31p.

 

their competitive advantage [2]. In this environment, these companies face various problems, most of which are associated with enacting new regulations and raising the bar for product development. Successful businesses must recognize these obstacles, embrace them, and develop strategies and tactics that center on the creation and innovation of new products [2].

Three key areas must be excelled at for a new product to be successful:
1. Cutting down on cycle time
2. Boosting creativity in product development
3. Repurposing firm knowledge assets.

Companies need to focus on people, knowledge, and processes that fuel innovation if they want to succeed in these three areas. Employees can exploit the company's knowledge and experience more effectively, develop innovative ideas, and produce profitable products thanks to the latter (systems). One of the main forces behind success and innovation is the product lifecycle management (PLM) solution. Even though PLM solutions have been successfully applied since the late 1990s in what are known as discrete manufacturing industries—of which the automotive sector has been the most adoptive—very little is known about the effects of PLM solution implementations in New Product Development (NPD) within the category of process manufacturing businesses, which includes the food industry [1].

The complexity of food and beverage NPD is to a significant part traceable to the spectrum of tasks and professions that play crucial roles in all phases of the process. Failure in any part of the spectrum may ripple down into failure of the NPD effort. Many textbooks and articles try to shore up the many different parts of this spectrum by focusing on critical areas, such as consumer research, concept development, innovation, multifunctional teams, marketing, management, sales, and advertising. However, the bottom line remains the same. The overall integration of jigsaw pieces representing the various functions taking part in NPD is far from resolved [3].

**Stages of Product Life Cycle**

There are four stages of the product life cycle:
1. Introduction
2. Growth
3. Maturity
4. Decline

**Introduction of PLC**

The process of launching a new product is rife with uncertainties, unknowns, and unfathomable hazards. Demand typically needs to be "created" in the early stages of a product's market development. The complexity, degree of novelty, suitability for customer demands, and the existence of viable alternatives in the market influence how long this takes. Proven cancer treatment would receive enormous support right away and require very little commercial development. A much longer procedure is required for an allegedly better alternative to the lost-wax sculpture casting method [4]. "A strategic business approach for the effective management and use of corporate intellectual capital" is the broad definition of PLM [5]. PLM systems are becoming more widely used to manage all product-related data for businesses over the course of a product's lifespan. One of the main reasons that many organizations have adopted PLM systems and adopted the PLM idea is global rivalry. The PLM aims to improve manufacturing innovation and expedite the process of developing new products. As a result, from a product's inception until retirement, the PLM concept is a strategic business method for efficient production, management, and use of company intellectual capital [6].

PLM systems originate from product design software; therefore, engineering executives, who have historically overseen their technology rollouts, are typically given the PLM idea by corporate

 

management. This laissez-faire attitude works well for selecting discrete solutions, such as CAD software, but it is ineffective for an integrated platform that spans the entire organization. Disparate business departments create and handle product data differently. Purchasing, which also depends on authorized vendor lists and catalogs, uses a different version of a bill of materials than manufacturing and engineering, which uses a different listing of the parts and subassemblies that constitute a product [4].

To successfully implement the PLM idea, problems such as creating data standards and building integration architectures that span the whole organization must be solved. Only then will people be able to access previously dispersed information in a manner that suits them. In this manner, rather than midway during the component procurement stage or even during manufacturing, individuals in various divisions will be prepared to make critical decisions, such as what goods to offer or what features to add in a product's design phase, when they are most cost-effective [7].

PLM systems help businesses to apply PLM principles. One of the primary inquiries concerning PLM systems is: "What is the functionality of the PLM systems?" The individual parts shown in Figure 1 can accomplish the entire capability of the PLM system. These consist of [3]: infrastructure for information technology (IT) [1]. Architecture for product information modeling [2]. Development environment and toolkit [4]. Collection of Business Applications. The base of an IT system consists of distributed objects and components, underlying representation and computation languages, hardware, software, and internet technologies [8]. The architecture of product information modeling comprises interoperability standards and a product ontology. The development environment and toolkit offer a means to create Business Applications that both extend and improve the functionality of the PLM concept. Examples of these tools and environments include databases, visualization tools, data exchange standards and mechanisms, and kernels (e.g., math and geometry) (Figure 1) [1].

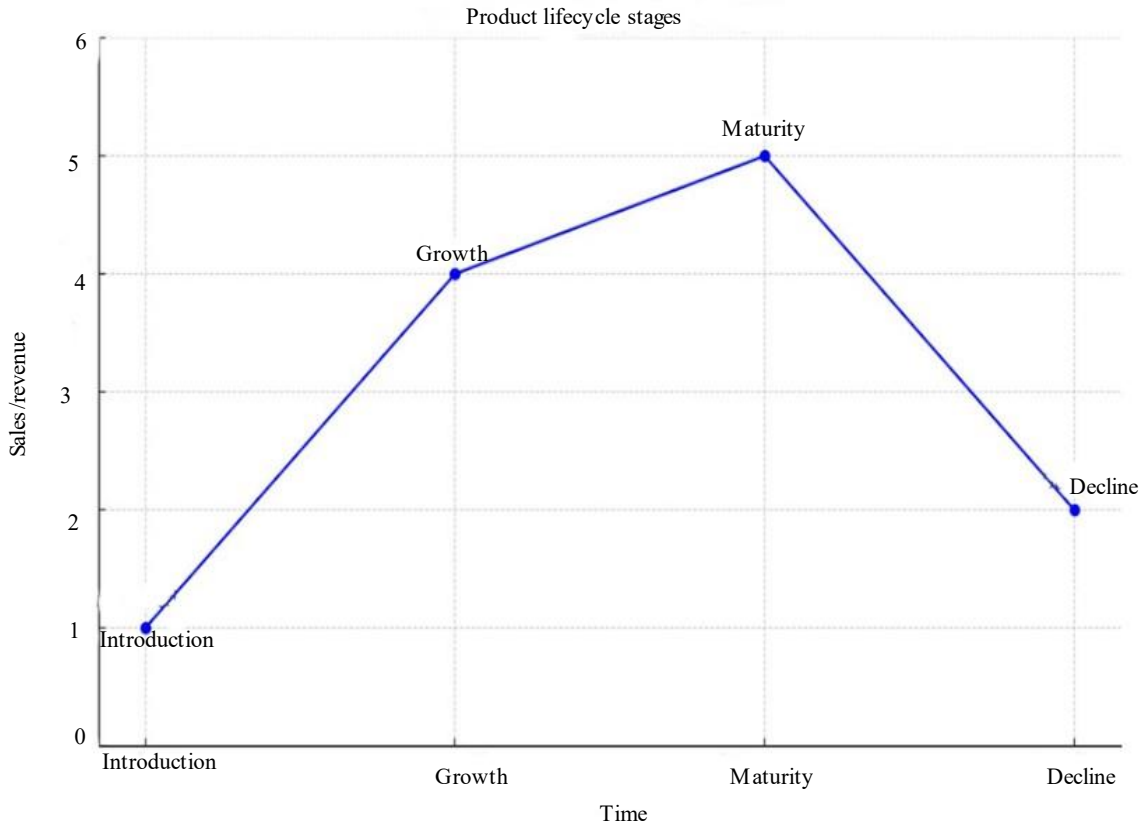


**Figure 1.** data exchange standards and mechanisms, and kernels

 

Thus, it should come as no surprise that some severely damaged and demoralized businesses have lately embraced a more conservative stance—what I refer to as the "used apple policy." They consistently avoid becoming the first firm to recognize and take advantage of an opportunity, as opposed to striving to be the first. They allow others to sample the juicy apple that piques their curiosity before they do. They delegated the pioneering to others. If the plan is successful, they immediately adopt it. They essentially say, "The trouble with being a pioneer is that the Indians kill the pioneers."

As a result, they remark, fully combining their metaphors, "We don't have to take the first bite out of the apple." The second approach is adequate [4].

**Growth**

A successful new product often has a sales curve that gradually increases during the market development period. At some point during this growth, there was a noticeable boost in customer demand, and sales started to soar. The boom has begun. The second stage, the market expansion stage, begins. Potential rivals who have been following the developments during Stage. I now enter the battle. Usually, the first people in are the ones with a really strong "used apple policy." Some people release duplicate copies of the original product in to the market. Others enhance design and functionality. This is where the development of product and brand distinctions begins [7]. Many consumers have made their selections, and market leaders are well known, notwithstanding the disappearance of the tornado, and sales income is still rising. In addition, the investment risk has decreased. Customers begin to place greater value on pricing, quality, and services. Therefore, depending on how the life cycle entrance stage affects a brand's growth and how its sales react to marketing initiatives, later entrants may have specific benefits. Establishing additional retail locations and distribution networks usually becomes easier as customer acceptance rates increase [5]. Factory sales for the entire industry typically increase faster than retail sales because of the distribution of filled pipelines.

This gives the false impression that there is much room for profit, which draws in additional rivals. Some of these will start charging less owing to subsequent technological advancements, production efficiencies, the need to accept smaller margins to obtain distribution, and other factors. This eventually forces the sector to develop a new level of competitiveness [9].

**Maturity**

The market has matured to this new stage. Evidence of market saturation is an initial indication of its occurrence. This implies that the product is owned or used by the majority of consumer companies or homes that are potential customers. Presently, sales growth roughly matches population growth. There was no need to fill additional distribution pipes. The price rivalry is fierce. Competitors are currently attempting to attain and maintain brand preference by differentiating their products, services, and promotional strategies, and claim ever more finely [4]. Product Lifecycle Management (PLM) is an information-driven, integrated strategy that involves technology, people, processes, and practices. Its purpose is to combine data from all stages of a product's lifetime and surroundings, including conception, design, production, distribution, support, and end-of-life [10]. PLM has grown to be a crucial component of the global manufacturing industry in the past 10 years [8]. By offering a common platform for the generation, arrangement, and distribution of product-related information within the broader organization, its explicit goal was to advance information sharing past the engineering stage of a product. PLM's main purpose of PLMs is to holistically manage product information [4]. PLM is frequently seen as a technological investment that boosts operations and gives businesses a competitive edge in several domains. Nonetheless, businesses would come to see PLM as an investment that strengthens and expands every aspect of the enterprise if they saw it as a tool to accomplish broad organizational objectives as opposed to just seeing it as a technological support for operations [1]. As with most women's fashion fads, the market maturity stage can be quickly reached. Alternatively, as with household staples, such as men's shoes and industrial fasteners, it can last for decades, with per

 

capita consumption being constant. Alternatively, maturity may endure, but only in a condition of slow, progressive per capita decrease, as with steel and beer [10].

## Decline

*Stage 4:* Market decline is when the product goes after market maturity tapers off and, as a result, ends. All instances of decline and maturity result in industrial transformation. Some businesses can withstand ferocious competition. The overcapacity that was evident throughout the maturity era has now become endemic as demand drops [7]. Even though some producers can see the writing on the wall, they believe that with the right strategy and resourcefulness, they will survive the industry-wide catastrophe they have accurately predicted [11]. They begin a variety of aggressive depressive tactics, propose mergers or buy-outs, and generally engage in activities that make life incredibly burdensome for all firms and make death the inevitable consequence for most of them to hasten their competitors' eclipse directly or to scare them into an early voluntary withdrawal from the industry [10]. A small number of businesses managed to weather the storm and continue to operate despite the industry's apparent downward trend. Production is centralized in a small number of hands. Margins and price declines occur. The customers were disinterested. The only situations in which monotony and slow euthanasia are alleviated are those in which style and fashion play a continuously reinvigorating function [11].

## Pattern

The story of the most successful products is the history of passing through certain recognizable stages. These are shown in Exhibit I and occur in the following order (Table 1).

**Table 1.** Strategies of each product life cycle phase (*Source:* Avlonitis G)

| | Development phase | Introduction phase | Growth phase | Maturity phase | Decline phase |
|---|---|---|---|---|---|
| Strategic Goal | Announce your product and set up a trial period. | Obtain a dominant market position. | Preserve and enhance your market position. | Protect your place in the market from rivals and enhance your offering. | "Milk" all leftover product earnings. |
| Competition | Almost not there. | aggressive rivals' early arrival in the market. | Pressure on price and distribution channels. | creation of a climate of competition. | Several rivals have already decided to pull out from the market. |
| Product | Fewer than possible variants. | introduction of different product iterations. | Enhancement - advancement of the item. | Price decrease. | Models and variations that are not lucrative are removed. |
| Price Goal | High sales to middlemen. | aggressive pricing strategy (cut) in exchange for more sales. | Reevaluating the pricing strategy. | Defensive price policy. | Maintain price level for small profits. |
| Promotion Goal | Increasing consumer knowledge of products in the industry. | Strengthening of product knowledge and inclination. | Strengthening of intermediary men. | Maintain loyalty to middlemen. | Gradual decrease. |
| Distribution Goal | distribution that is exclusive and exclusive via certain channels, as well as the generation of large profit margins for middlemen. | Enhanced and comprehensive dissemination across all accessible methods of distribution. | a broad and strengthened distribution that provides middlemen with ample supply but small profit margins. | a broad and strengthened distribution that provides middlemen with ample supply but small profit margins. | withdrawal from all distribution channels save those employed during the development stage. |

 

## Competitive Advantage

A company is said to have a sustained competitive advantage if its high profit rate is maintained for several years and a competitive advantage if its profit rate exceeds the average rate of the relevant industry. When Adam Smith released his well-known book The Wealth of Nations, competition difficulties were first mentioned in literature. Because there was no theoretical framework for analyzing, maintaining, and enhancing competition for a nation or industry until the late 1980s, economic evaluations of competition were conducted based on a variety of factors. In the competitive analysis discipline, Michael's strategy books were well-regarded in the 1980s [12]. The relationship between competitive advantage and product performance competition is particularly crucial in industries in which technical competition is the norm. One point that must be addressed is the reason for the inverse correlation between the success of product innovation and operation in an industry where ongoing product innovation serves as the primary means of competitiveness. We speculate that one explanation for the inverse association may be that consumers may be less able to distinguish between differentiating product performance in situations that are unstable or constantly changing [13]. To ensure customer satisfaction and profitability, businesses must not only improve their current products but also develop new products to survive in the competitive market. New products must be developed with superior quality, at a lower cost, and in a shorter time (from design to market launch). It is a given that all businesses eventually want to maintain profitability during their mature stages; how exactly they do this is debatable. Creating new products is a crucial strategy for business success in the cutthroat industry [14]. Various viewpoints have been proposed regarding the factors that determine competitive advantage. Porter (1990) asserts that a firm's profitability is contingent on the industry's attractiveness and its relative position within it. This idea holds that an organization's strategy determines how it conducts its business differently from its rivals, and that the adoption of diversity and distinctiveness is facilitated by critical competencies, which give the organization a competitive edge [12]. By enhancing product performance, businesses can implement a differentiation strategy. However, differentiation benefits stem from the degree of consumer proficiency in product analysis. Consequently, customer evaluation of relative product performance is necessary if enhanced performance results in a differentiation advantage. It could be harder to differentiate items in an industry if businesses are all competing to advance functional performance metrics at the same time [13].

Liand et al. (2010) examine the relationship between innovation and stable competitive advantage in Chinese businesses and conclude that innovation is a new resource for companies that produce stable competitive advantage and offer a comprehensive framework for performance improvement. Innovation is influenced by various factors and their interaction [14]. According to Porter (1985), technological advancements have an impact on both industrial structure and competitive advantage; thus, they are not significant when it comes to the relationships between innovation and competitive advantage. According to Scott Kamis, a corporation requires innovation to establish and maintain a competitive position. Innovative thinking is a key component of successful business strategies [14].

## CONCLUSION

The development of new products (NPD) is essential for the long-term viability and expansion of food sector businesses. The assessment emphasizes that although NPD is important, there is not a single, widely accepted approach, mostly because different businesses and experts have different expectations and definitions. Substantial empirical data and historical observations of NPD techniques and market performance should serve as the foundation for any effective NPD approach. By managing a product's complete life cycle, from conception to retirement, Product Life Cycle Management (PLM) is positioned as a crucial foundation in supporting new product development (NPD). This optimizes innovation and strategic decisions throughout the product development process. The food sector has several obstacles to overcome, including changing laws, fierce competition, and the need for constant innovation to stay ahead of the competition. By guaranteeing improved collaboration across many departments within an organization, increasing efficiency, and shortening the time-to-market for new goods, PLM offers an organized method to address these issues. The research emphasizes that although PLM has been extensively implemented in discrete manufacturing domains, such as the automotive

 

industry, its possible influence on process manufacturing, encompassing the food industry, is still not fully investigated. The product lifecycle consists of four stages: introduction, growth, maturity, and decline. For businesses, each stage offers different opportunities and problems. Creating demand and overcoming uncertainty is critical during the introduction phase. The growing competition during the growth period necessitates innovation and distinction. While the Decline stage entails managing overcapacity and selective departures, the maturity stage calls for methods to sustain market share amid saturation. To extend the life cycle of a product and increase its profitability, businesses must modify their tactics to match the unique requirements and dynamics of each phase. The assessment underscores the need for dedication to ongoing innovation and distinction to establish and maintain a competitive advantage in the food industry. This entails creating new, higher-quality, and more affordable items, in addition to improving the ones that already exist. By offering a thorough platform for managing product information and encouraging innovation at every stage of the product lifecycle, the adoption of the PLM system can help with this process. Businesses that successfully use PLM systems in their NPD procedures may gain a long-term competitive edge by coordinating their strategic objectives more effectively with customer and market demands. Companies should concentrate on creating an atmosphere that promotes creativity, making use of current knowledge assets, and combining cross-functional teams to successfully implement NPD and PLM initiatives. To facilitate information flow between different departments, it is also necessary to create integration structures and standardize the data processes. Businesses should adopt a well-rounded approach that combines risk management with creative methods to avoid being unduly aggressive or cautious in their market tactics. Businesses that do this can improve the efficiency of their processes for developing new products, cut expenses, improve the calibration of their output, and eventually gain a competitive edge. In summary, the integration of NPD and PLM in the food industry is essential for handling the intricate issues of product creation and preserving a competitive edge in a rapidly changing market.

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