

A Review of Literature on Risk Identification in New Product Launches: Focusing on Market Needs and the Role of AI Utilization

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Abstract

This comprehensive literature review explores the intricacies of risk identification in the process of launching new products, emphasizing the alignment with market needs and the strategic utilization of artificial intelligence (AI). As businesses increasingly rely on innovative approaches to gain competitive advantage, understanding potential risks becomes critical. This study synthesizes existing research on risk factors associated with new product introductions, examining traditional and emerging methods for identifying these risks. Special focus is given to the integration of AI technologies in predicting market trends and consumer demands, thus enhancing the efficiency and accuracy of risk assessment. By analysing case studies and empirical evidence, this review highlights the challenges and opportunities presented by AI in mitigating risks associated with market entry strategies. The findings aim to inform practitioners and researchers on best practices and future directions in leveraging AI for risk management in product development.

Keywords

risk identification, artificial intelligence, AI utilization, market trends

1. Introduction

In today's highly competitive business world, we are bombarded with an overwhelming amount of information related to globalization, technological advancements, and various social, economic, and political changes. The need for innovation has become increasingly prominent in this context. Innovation has evolved from its traditional form to a more exploratory state, requiring flexible and transient workflows that are sensitive to risks and depend on various social and political institutions, international connections, locational advantages, and production-technical environments with significant knowledge leverage. Launching new products is a crucial way to drive development, as it generates income, sales, market share retention, and customer interest, confidence, and reputation. Special incentives can substantially enhance these profits while minimizing risks. However, when uncertainty increases, workers may fear punishment for failures and feel overwhelmed by scrutiny, which can stifle innovation and discourage management from introducing new services [1, 3]. Risks in new product launches present challenges to businesses, as taxpayers may bear some of the risk before the product enters the market. It is important to scientifically identify, measure, mitigate, and manage these risks to ensure the product is ready for the business climate [1-3].

1.1. Definition and Importance of New Product Launches

A new product launch is frequently described as a firm's decision to introduce new products or services, including those with physical characteristics, price level, and quality, according to consumer preferences, in the market at the right time, based on market research [4-6]. It could be said that new product launches are planned events in firms' management teams to increase the number of customers and improve their loyalty [7]. It can also involve strategic product launching during competition. New product launches are important not only for the firms but also for the consumers. For the companies, new products provide new sources of revenue and profit, but for consumers, new products provide functional, symbolic, and hedonistic value [8-10].

For a typical firm, approximately two-thirds of the annual investment in new products is focused on radical or platform product launches, with the remaining investment in incremental products [11, 12]. The product launch might be considered a project within the context of project management while, at the same time, viewing it within the context of an organization's strategy and its portfolio of products and projects [12-16]. During the 1990s, the time available to a company to benefit from new product launches was under pressure in many high-technology sectors [17, 18]. The speed and scale of the increase in regulatory requirements meant that products that would have been of value to users were withdrawn by some major suppliers before the user base for the products reached commercial significance [10, 12, 15, 18].

1.2. Significance of Risk Identification in New Product Launch Process

In recent years, many firms have made significant investments for new product launches, and despite substantial marketing efforts, their products did not meet consumers' needs and failed in the marketplace [19]. The launch of a new product is necessary for sustainable growth of a company. In the historical context, an investment of US\$650 million into a more environmentally friendly gasoline led to a net loss of US\$1.5 billion.

Without proper upfront risk identification, firms face major hurdles in ensuring that they create high-quality products that are defect-free, at a reasonable cost, and that are launched on time. Executives note that it is reasonable to estimate that the implementation of upfront quality risk management techniques contributed to a 20:1 return on the investment over a 3-year time period [20-22].

Many researchers argue that the alignment of new product launches with consumer needs is a must [17]. The aim in developing risk identification methodologies and improving the existing ones must be to increase companies' profitability through reduced product life cycle time and reduced new product development costs, and decreasing the failure rate. Moreover, the final new product of the company should not only pass the five requirements for effective new product development but should also become a great success when introduced in the market. [23, 24].

What is lacking in these studies is a focus on market needs, as customer and user input is often overlooked. In addition, there is limited research using artificial intelligence in the risk identification process [22, 25]. The use of artificial intelligence allows for a faster and more comprehensive process as the amount of data used in risk identification increases, enabling organizations to start this work earlier in the product launch process [23].

Employing creative methods provides an opportunity to capture the benefits desired from new product launches with the contribution of customers and users. Efficiently managing the impact of risks on market needs will guide organizations in determining the success of a new product, ultimately contributing to the success of the organization. In this study, literature on new product success and risk management was thoroughly reviewed. Data on significant risks for new products were collected from engineering and design experts. Flexible and adaptive learning organization methods, as well as a decision-making trial and evaluation laboratory, were used to address important needs that arise in new products [24-26].

2. Theoretical Frameworks for Risk Identification in New Product Launches

The literature on developing new products emphasizes the importance of having a knowledge base that includes both technical and market components in order to successfully innovate products [26]. The first step in managing risk is to fully understand the market problem that the new product is intended to address [26]. Case studies of successful high-tech products have shown that engineers need to be aware that there are no simple solutions. In these studies, market experts defined a market need as a solution to an unsolved problem that provides real value [27-30]. In an empirical study, it was found that expertise in identifying and meeting customer needs, as well as understanding customer and context-related factors, had a significant impact on the performance of new products, even when other resources and capabilities were held constant [31].

Recent studies on new product development (NPD) risk and related issues have revealed that a major challenge early on in launching a new product is understanding the needs of potential customers [32].

We have analysed a subset of key factors that impact the performance of new product launches and reviewed literature on identifying embodied needs. It is crucial to focus on identifying these embodied needs in NPD due to their distinct characteristics. New methods have been developed and recent literature has proposed significant improvements in this area [33-35]. Additionally, there is a recognition of the need to address context-specific issues, particularly in relation to market needs, as research on needs and requirements is typically carried out in the initial phase context. It is believed that there is a necessity to consolidate efforts in identifying business needs within the development context, which often involves directly engaging market participants in the process. It is anticipated that future studies on performance transfer will require this specific approach.

The process of introducing new products involves passing through various stages, with some products being eliminated along the way. Only a limited number of products are thoroughly tested and then put on the market. However, there are numerous obstacles that act as formidable barriers between these stages, serving as the crucial "stages" of the funnel [1, 4]. Companies start with an expansive and diverse pool of product ideas that are skill-fully and meticulously narrowed down through a comprehensive and systematic evaluation process. Although some of these brilliant and innovative ideas may ultimately emerge as wildly successful new products, each and every concept provides invaluable and insightful lessons into the manifold challenges faced by novel products in their relentless pursuit of progress through the multifarious stages and the ultimate elimination of unfitting concepts. Case study research, an exceptional analytical tool, has been extensively utilized to meticulously examine and delve into the performance of these stages, with a particular focus on the "phase gate" products ingeniously employed by manufacturers to diligently and systematically reduce these daunting barriers and ensure a seamless transition [36-39]. This meticulous analysis has admirably shifted the focus from solely fixating on new product development to exploring the intricate intricacies of the complex processes these products undertake and the assortment of compelling issues they confront. The high level of inherent risk associated with this intricate and multifaceted process not only demands unwavering innovation and boundless creativity but also necessitates strategic and all-encompassing planning in order to meticulously identify and pre-emptively overcome any potential roadblocks that may hinder the development and subsequent triumphant market penetration of the product. To address these intricate and multifarious challenges, a ground-breaking and visionary new framework has been proposed, one that places paramount importance on the seamless integration and perfect alignment of project objectives and expectations [40]. Furthermore, this innovative framework adeptly resolves the innate elements of project-specific creativity and risk through meticulously structured and meticulously curated workshops that immensely focus on the critical aspect of business model risk. By doing so, this innovative framework not only expedites progress but also facilitates a remarkably rapid pace of development and market expansion, unparalleled by traditional methodologies [41].

A valuable insight on technological capability suggests that broad discussions of technical capabilities can serve as potential determinants of product development [40]. Two types of technological exploitation - technology use and technology deployment - are identified. Market demand for products encompasses technological requirements, and comprehensive classifications of technological potential are provided. Market-oriented innovation involves creating or embracing new technologies to better serve newly discovered consumers and their needs [41]. To create meaningful new values that inspire customers, products and their marketing must undergo thorough market analysis and careful monitoring of consumer expectations, including identification of needs and assessment of potential technical risks [42].

3. Market Needs Analysis in New Product Launches

Market needs, also known as needs, desires, wishes, or values, are essential elements that drive customer preferences and expectations when it comes to purchasing a new product or service. The objective of introducing new offerings into the market is to ensure that they align perfectly with the needs of the target customers, giving them the maximum benefits and values they seek. Products and services act as tools that customers utilize to meet their demands and fulfil their requirements, often

referred to as utilities. These utilities encompass a wide range of factors that influence consumer behaviour, including comfort, nourishment, profitability, and more [2, 44]. Such demands are intrinsic to the utility model and are perpetually present in the consumer landscape. The traditional demand model is a cornerstone in understanding market needs [44]. It delves into the exploration of the utility consumers derive from their multitude of purchasing choices. This model takes into account various factors and dimensions that define market needs, offering a comprehensive and interdisciplinary approach to understanding customer preferences. These factors that shape market needs are incredibly diverse and encompass a multitude of interpretations within the utility model [43-45]. Whether it be the physical attributes of a product, its convenience, its ability to meet specific requirements, or even its emotional appeal, each facet contributes to the overall understanding of market needs. As a result, businesses must constantly evaluate and adapt their offerings to cater to these ever-evolving market needs.

In economics, there are typical models like the utility demand model, which represents a hierarchy of needs. At the business level, the classic 4Ps model of marketing (product, price, promotion, place) is used to create new utility for customers. Recent literature focuses on outcome-raising marketing strategies and customer satisfaction, aiming for mutually beneficial relationships between a company and its customers [46-48]. These market needs are crucial for new product development. Existing NPD models provide valuable lessons on using a quality-driven approach to consider the match between product attributes and customer preferences, potential market environment changes, and societal needs and aspirations. Understanding market needs at the start of NPD can also be applied in reverse, transitioning from reactive to proactive stages in response to potential changes in customer preferences [46, 49, 51]. Companies must have a strategic mindset by understanding the evolution of market segments over time, rather than solely relying on their existing knowledge to maintain and foster long-term customer relationships [47, 50, 53].

Market research techniques and tools play a crucial role in gathering necessary information from the market. Marketing research techniques focus on quantitatively evaluating existing issues and needs, while market sensing techniques use technology to assess markets and quantify problems and needs, providing diagnostic information for new products in development [54, 56]. These methods can be divided into primary and indirect or derivative types, further categorized into exploratory, quantitative, or qualitative market research. The key techniques and tools in market research can be organized in a table.

Many businesses and organizations rely on traditional market research methods, which can lead to potential failure due to changing consumer preferences and market conditions. Additionally, early elimination of ineffective ideas during research can be a cost-effective strategy [50, 54]. The increasing use of AI tools suggests that business research could become more adaptable, focused, and revolutionized. AI-generated research, including human-like conversations with potential customers, has attracted some investors who see the potential for robots to mimic human thinking in real-world situations. The advancements in AI technologies have shown promise in planning product launches and delivering real-world applications. The use of AI tools allows companies to create feedback loops for continual improvement, gain insights into customer perspectives, and innovate in production planning and customer interactions. Overall, the use of AI in business research has the potential to drive innovation and improve customer engagement [55-57].

4. Role of Artificial Intelligence (AI) in Risk Identification

The use of artificial intelligence (AI) is gaining popularity as a means to address highly complex and uncertain problems. The role of AI in decision-making for new product development is increasingly acknowledged, particularly in the identification and evaluation of risks [58]. By examining recent literature [48-54], this section aims to demonstrate the current state of AI application for risk identification in new product launches. Additionally, it is underlined a framework that emphasizes AI's ability to interpret complex and uncertain market-related information. The review indicates that AI is increasingly used in identifying risks, particularly with process-related knowledge from big data analytics. Monitoring market needs is essential for maintaining competitiveness and success. Additionally, integrating AI with other stages of the process seems to be a comprehensive approach to

identifying risks and ensuring that market insights are appropriately considered. Thirty-four articles on the use of AI in new product launches have been analysed [24-58]. It was found that AI utilization in market needs is primarily focused on interpreting complex and uncertain information, and the approach to risk identification is still underdeveloped. Marketing researchers are encouraged to promote AI implementation by incorporating interpretive techniques to ensure the meaningfulness of new product launches. In the following are synthesized the result of the review.

4.1. Overview of AI in New Product Development

Since the introduction of artificial intelligence (AI), there has been a significant number of companies and scholars who have put forth the argument that AI should be employed across various sectors of business, ranging from marketing to finance [49-51, 53, 59]. The primary goal is to enhance overall business performance through the utilization of AI technology. By utilizing AI, businesses can leverage advanced algorithms and data analysis to identify and target specific customer segments more effectively. This, in turn, helps businesses to create personalized marketing campaigns and tailor their sales strategies to meet the unique needs and preferences of their customers. Additionally, AI can assist in optimizing the product development process by analysing market trends, customer feedback, and other relevant data to identify areas for improvement and innovation [44-48, 53]. In the realm of big data and analytics, the banking and communications industries have prioritized leveraging business intelligence analytics to enhance customer service. With the help of AI, these sectors can analyse vast amounts of data to gain insights into customer behaviour, preferences, and needs. By understanding these patterns, businesses can make data-driven decisions that improve their customer service offerings, leading to greater customer satisfaction and loyalty. In the retail sector, customer insights hold tremendous value for retailers. Therefore, many retailers are investing in retail analytics powered by AI. By utilizing AI algorithms, retailers can gather and analyse data on customer behaviour, purchase patterns, and preferences. These insights enable retailers to make informed decisions on pricing, product placement, and inventory management, ultimately resulting in a more personalized and satisfactory shopping experience for customers [48, 46-54].

Artificial Intelligence (AI) has the potential for:

- (1) predicting customer needs by leveraging advanced algorithms and machine learning techniques, enabling businesses to anticipate consumer desires and preferences;
- (2) enhancing product quality through automated quality control mechanisms and real-time monitoring, ensuring that products meet or exceed customer expectations;
- (3) implementing a unique marketing strategy by leveraging AI-powered algorithms to analyse consumer data, identify patterns, and create personalized marketing campaigns that resonate with individual customers;
- (4) managing return on investment (ROI) by utilizing AI tools to track and optimize marketing campaigns, identify cost-saving opportunities, and enhance overall business profitability;
- (5) driving new product innovation by using AI techniques to identify market gaps, uncover customer insights, and facilitate the development of ground-breaking products that address unmet consumer needs.

In synthesis, AI helps:

- (1) businesses to gain valuable insights, market trends by using leveraging patent data;
- (2) identify potential opportunities for new product development, by using advanced data analytics techniques;
- (3) patent search and process analysis, by automating the process, generating valuable input data or noise data (for testing).

4.2. Case studies: AI Applications in Risk Identification

Case studies were used to demonstrate the international real-world application of risk identification for new product launches throughout this chapter [51-53]. To date, it is generally observed that there is minimal understanding of the critical impact of market need risks and thereafter minimal proactiveness taken surrounding these critical risks. This thesis aims to raise awareness by shedding light on the lack

of proactiveness currently adopted regarding many critical markets need risks which determine market performance post-launch. Subsequently, increased attention on systematic identification and management of various categories of market need risks is highly encouraged across the international academic community. The case examples and overwhelmingly positive industry feedback confirm the urgent need for this research to address the existing gap and further enhance risk identification processes in a significant manner.

In all examples, AI is mentioned in the wider context of risk identification and management within the automotive domain, as such examples can be projected to provide more impact. These case studies will indicate existing work and will provide examples to be used for tasks and build on. Examples span from reactive and preventative actions or interventions to be carried out during a failure or near-collision scenario [48-53].

Case Study 1: Predictive Maintenance. Predictive maintenance is a cutting-edge approach that involves forecasting the precise timing of when an automotive component is likely to fail by analysing real-time observations and understanding the recorded behaviour in potential near-collision events [51, 52-53]. Advanced AI models are meticulously crafted specifically for the purpose of predicting when critical automotive components may fail [51, 53]. The implementation of these innovative AI techniques has led to a significant reduction in vehicle downtime and has also notably increased the overall lifespan of vehicles through the execution of timely and necessary maintenance actions [45-49]. However, it is important to note that these sophisticated systems necessitate extensive data collection to function effectively, and during the initial prototyping phase, they encountered various teething challenges and issues that needed to be addressed. Furthermore, throughout their operational use, data must be continuously fed into the cloud, which imposes the requirement for a reliable and constant internet connection to ensure smooth functioning and efficiency.

For, consider Strukton Rail, a Dutch company focused on railway maintenance. They aimed to create a model to accurately predict track switch failures, which are a major cause of railway disruptions. Tackling this issue was vital for improving infrastructure efficiency and reliability.

By adopting predictive maintenance strategies, Strukton Rail significantly boosted track availability and reduced costs. This method minimized unplanned disruptions and optimized resource allocation, highlighting the benefits of AI-driven maintenance solutions.

Case Study 2: Automotive accident analysis. In the intricate realm of dissecting automotive accidents, investigators are making significant strides by programming agents that incorporate advanced AI components to analyse exceptions and event outcomes with unprecedented detail [49]. In these specific lending scenarios, these sophisticated systems use programmed stereotypes to anticipate human occurrences and reactions in a multitude of given situations [50-57]. Stereotyping, while a foundational aspect of this technology, is often viewed as a crude imitation of skilled tacticians who may suffer from inadequate time management, limited understanding of complex human behaviours, as well as the challenges posed by learning effects and diverse cultural features. The continuous advancements in general information technology, particularly in vehicle perception and the interpretation of various inputs, significantly enhance the data available on surrounding conditions [56]. This increasing depth of analysis, combined with insightful comments, allows AI systems to meticulously assist incident and accident investigators in accurately characterizing and summarizing the vast array of vehicle-related accidents they encounter.

A AI in automotive accident analysis is NVIDIA's AI-based scenario generation tool, STRIVE (Stress-Test Drive) [51-57]. This method creates realistic accident scenarios for autonomous vehicles (AVs). STRIVE begins with a real-world scenario where the AV operates correctly, then uses adversarial optimization to adjust vehicle trajectories, causing collisions with the AV. This identifies potential accident scenarios the AV could face. By examining planner failures in these simulations, engineers can refine AV behaviour prior to real-world deployment, enhancing the vehicle's ability to manage unexpected road manoeuvres and reducing accident risks. STRIVE utilizes an AI traffic model trained on extensive real-world data to ensure realistic and accurate scenario generation. This enables safe and scalable AV testing, improving their capacity to navigate intricate traffic situations and boosting overall road safety.

Case Study 3: Volkswagen problem. Volkswagen actively conducts thorough risk prediction and consistently engages in the detection and monitoring of news that may potentially have adverse effects on the company's operational business [52-58]. The primary purpose of these actions is to identify risks at an early stage, assess them meticulously, and then derive risk-adequate actions based on this assessment. By utilizing a substantial number of both national and international information sources, all necessary information is continuously collected in real time, ensuring that the data is both current and relevant. Specialist teams dedicated to this purpose meticulously assess the gathered information and, if necessary, forward it promptly to the relevant units responsible for addressing these risks. This comprehensive analysis is grounded in an extensive examination based on worldwide news articles from a variety of reputable providers. These include not only national and international news agencies but also established newspapers and specialized car magazines that focus on automotive industry trends and insights.

Case Study 4: BMW AI sustainability and risk management. The BMW Group effectively applies advanced AI technologies specifically within the essential fields of sustainability and risk management, demonstrating its commitment to modern business practices [58]. This strategic business unit within BMW is thoroughly responsible for managing and meticulously controlling the entire value and supply processes. To proactively identify potential risks and significant opportunities at an early stage, as well as to generate and issue suitable recommendations for actionable steps, comprehensive data is diligently collected and thoroughly analysed by artificial intelligence when deemed necessary [58]. Additionally, the critical field of sustainability – which encompasses both ecological considerations and social responsibility – is continuously monitored for emerging regulations, relevant stakeholders, and significant new trends affecting the industry. Moreover, extensive data related to sustainability has been systematically gathered from various units within the company itself, as well as from external sources including BMW's suppliers, dealers, and valued customers. The collected information is meticulously analysed by leveraging advanced machine learning techniques, ensuring that responses are informed and timely [57-59].

Case Study 5: PepsiCo quality checks. Artificial Intelligence (AI) is revolutionizing quality control in the manufacturing sector. Detecting internal defects in equipment can be challenging, even for experts, but AI and Machine Learning offer an effective solution. These technologies can identify even the smallest flaws in equipment, ensuring robust quality control [56]. AI systems enhance manufacturing by monitoring equipment performance, identifying defects, boosting productivity, and reducing maintenance costs. Consequently, many manufacturing companies increasingly integrate AI automation into their production processes.

For instance, Suntory PepsiCo's factories in Vietnam encountered issues with reading product labels due to smudging on wet surfaces, causing costly production delays. To solve this, PepsiCo adopted a machine vision system using Matrox Imaging technologies. This AI-driven system uses cameras to inspect labels, quickly detecting and removing products with smudged, damaged, or missing labels from the conveyor, all without disrupting production.

This implementation has greatly improved quality control efficiency by reducing errors. Unlike manual inspections, which require detailed checking of each product, the AI system performs quickly and with high accuracy, allowing Suntory PepsiCo to uphold quality standards and minimize production losses.

5. Future Trends, Direction and Conclusions

The role of AI in product launches and risk identification looks exceptionally promising, with several significant trends and directions emerging. Based on the review of literature it can be established the following.

Future Trends in AI for Product Launches

- (1) **Personalized Product Development:** AI analyses consumer data to uncover preferences and trends, enabling companies to create tailored products that meet specific customer needs.
- (2) **Rapid Prototyping and Testing:** AI-driven simulations and digital twins facilitate quick prototyping and testing of new products, which significantly shortens time-to-market and development costs.

- (3) **Enhanced Market Research:** By processing large volumes of data from social media, surveys, and other sources, AI offers deep insights into market trends and consumer behaviour, shaping product development strategies.
- (4) **Automated Design and Innovation:** Generative design algorithms produce multiple design variations based on set parameters, allowing companies to innovate more swiftly and efficiently.
- (5) **Predictive Analytics for Demand Forecasting:** AI predicts market demand for new products, aiding companies in optimizing their inventory and production planning.

Future Trends in AI for Risk Identification

- (1) **Advanced Fraud Detection:** AI algorithms can identify fraudulent activities in real-time by examining transaction patterns and spotting anomalies, significantly decreasing financial losses.
- (2) **Predictive Risk Management:** By analysing historical data and identifying patterns, AI can foresee potential risks, allowing companies to implement proactive measures to mitigate them.
- (3) **Enhanced Cybersecurity:** AI-powered cybersecurity solutions detect and respond to threats more rapidly than traditional methods, safeguarding sensitive data and systems from cyberattacks.
- (4) **Regulatory Compliance:** AI assists companies in maintaining regulatory compliance by continuously monitoring and analysing compliance-related data, minimizing the risk of penalties.
- (5) **Operational Risk Management:** AI identifies operational risks by analysing data from various sources, such as supply chain disruptions, equipment failures, and workforce issues, enabling prompt action to address these risks.

6. Conclusions

Identification of risks is a crucial component of the risk management process, and various studies have indicated that using this process during new product development can reduce the number of failed projects. Researchers have consistently stressed the significance of considering market factors at the early stages of the new product development process, known as the front end of new product development. This study answers this call by systematically reviewing papers in diverse areas, encompassing both technology-focused and management-focused journals, and organizing them using an innovative categorization system. Along with summarizing the fundamental characteristics of these empirical studies, we conclude by discussing the research implications and suggesting future research areas to be explored. Two primary implications emerged from our analysis: the significance of market needs and the incorporation of artificial intelligence in research.

Since market-related problems often stem from similar causes in the early stages, issues unrelated to the market may not become evident until the product launch. Ensuring that a product meets the needs of the market can lead to better market performance, cost efficiency, company objectives, and organizational stakeholders. One major concern is avoiding systematic risk in the market. Another implication is the need for further research on decision-making tools that could directly impact the effectiveness of new product development processes in the market. Currently, only a few articles in the category of identifying risks in new product development use AI tools. Despite the overall growth in the AI community, the use of AI in identifying risks in new product development still seems to be in its early stages according to existing literature.

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