Technology Strategy in Product Development for Sustainable Innovation in Global Markets

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A B S T R A C T

In an era of increasingly fierce global competition, companies need to develop innovative products to remain competitive in the market. One way to achieve this is by integrating technology in the product development process. The use of technology, such as engineering software, management information systems, and other information technologies, enables companies to accelerate product development cycles, increase quality, and create more efficient products. The success of product development depends not only on the application of the technology itself, but also on the alignment between the technology and the company's long-term goals. For this reason, companies need to ensure that the strategies used can support sustainability and continuous innovation. This also engages good management and upskilling of the workforce who are able to adapt to the latest technology. This research examines various approaches in utilizing technology for product innovation and how companies can adapt to rapid market changes. By paying attention to these factors, companies can be better prepared to face global challenges, produce innovative products, and achieve sustainable competitive advantage.

INTRODUCTION

In the rapidly evolving digital era, technology-based product development has become one of the main focuses in the industrial world. Organizations today are increasingly relying on information technology and engineering to design, develop, and market new products that are more innovative and can compete in the global market. With increasing consumer demand for more sophisticated, efficient and technology-based products, companies are required to integrate the latest technology in every aspect of their product development. This process includes the application of technology in the design, production, and distribution of final products that are tailored to the needs of an increasingly dynamic market (Ulrich & Eppinger, 2015).

Along with the rapid development of technology, many companies are starting to utilize big data, Internet of Things (IoT), and artificial intelligence (AI) in their product development process. This opens up great opportunities for companies to increase quality, reduce costs, and optimize production processes. Technology-based product development also brings its own challenges, including integration issues of various technologies, the need for higher technical skills, and difficulties in adapting products to evolving consumer expectations (Chesbrough, 2010). It is important for companies to be able to manage and integrate technology well in product development in order to create sustainable innovation (Darmawan et al., 2022).

While technology plays an important role in product development, many companies still face challenges in effectively integrating new technologies into their product development process. One of the main problems is the inability of organizations to manage rapid technological change, which causes them to fall behind in terms of product innovation. Many companies still use old technologies that do not support efficient and innovative new product development, affecting their competitiveness in the global market. For example, difficulties in adopting the latest technology or using technology that is not compatible with existing systems can add costs and hinder the development of better products (Bessant & Tidd, 2015).

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Companies often face the problem of aligning between business strategy and the technology used in product development. This occurs due to the many processes engaged in product design, as well as the need to engage various parties, from engineering teams to marketing and sales, in decision-making. A mismatch between managerial vision and technological capabilities can stifle innovation and result in products that do not meet consumer or market expectations (Pitt et al., 2006). It is important to understand and manage the interaction between technology and management in the new product development process.

In today's highly competitive business world, the ability to develop innovative technology-based products is one of the determining factors for a company's success. This is becoming increasingly important given the rapid development of technology and changing consumer preferences affecting the global market. By utilizing the right technology and integrating it in product development, companies can increase efficiency, reduce production costs, and produce products that are more in line with market needs. Learning how to manage and integrate technology in product development will not only help companies stay relevant, but also give them a significant competitive advantage.

The main objective of this research is to understand how companies can integrate the latest technology in their product development process to create sustainable innovation and increase competitiveness in the global market. This process engages an in-depth understanding of the challenges and opportunities associated with using technology in product design, production and marketing, and how management can manage technological change to align with existing business strategies.

RESEARCH METHOD

The literature study approach is an effective method to understand and analyze existing concepts, theories, and empirical findings related to the topic under discussion. In the context of technology-based product development, the literature study helps identify the latest trends, best practices, and theories used to integrate technology in the product development process. It also provides an overview of how these theories are applied in practice and their impact on product innovation. By reviewing relevant literature, we can identify knowledge gaps that may exist, as well as offer suggestions for areas that still need to be further explored (Cooper & Schindler, 2014). The literature used can come from scientific journals, books, industry reports, as well as related articles that have made significant contributions to this topic.

In this literature study, the researcher will critically analyze previous studies on technology-based product development and evaluate how engineering techniques and information technology are used to optimize the process. The main focus in this approach is to explore various methodologies and practices that have been successfully applied by companies in designing innovative technology-based products. According to Sweeney and O'Connor (2019), this approach provides a solid foundation for identifying the variables that influence the success of technology-based product development, including the challenges companies may face in the face of rapid technological change. Thus, the literature study not only provides insights into existing practices, but also helps assess the sustainability and effectiveness of technology integration in product development.

RESULT AND DISCUSSION

In the highly competitive era of globalization, companies must be able to adapt quickly to maintain sustainability and competitive advantage. One of the most effective ways to achieve this is by integrating technology in the product development process. Technology has the ability to accelerate the product development cycle, increase quality, and open up opportunities for greater innovation. Through the proper application of technology, companies can not only design more efficient products, but also create products that are more relevant and tailored to dynamic market needs.

The integration of technology encompasses not only the application of advanced engineering software in product design but also the enhancement of internal collaboration through sophisticated information systems. This technological synchronization enables more precise planning, streamlined workflows, and real-time data sharing between departments, which ultimately reduces inefficiencies and operational delays. By embedding digital tools into the core of organizational processes, companies can ensure that every stage of development is aligned with strategic goals and responsive to market demands (Negara et al., 2021).

Furthermore, technology serves as a catalyst in refining product testing and accelerating manufacturing cycles, significantly cutting down the time required to deliver new offerings to the market. This agility is crucial in industries where innovation speed determines competitiveness. More than a

supportive instrument, technology becomes an enabler of sustainable innovation, fostering adaptability and continuous improvement. It empowers companies to not only meet but anticipate consumer expectations, establishing a resilient foundation for global competitiveness.

In the process of developing technology-based products, companies must pay attention to managerial aspects that lead to the management of human resources and adequate infrastructure. Rapid and appropriate technology adoption is a determining factor, but it must be in line with a clear strategy and long-term vision. This integration not only engage changes in the company's internal processes, but also requires changes in organizational culture to support continuous innovation.

Modern companies face huge challenges in creating products that can compete in a highly dynamic global market. One effective approach to achieve this is through the integration of technology in the product development process. By utilizing technological advances, companies can design products that are more efficient, more innovative, and better suited to the changing needs of the market. This technology integration covers a wide range of aspects, from the use of engineering software for product design to the application of information and communication technologies to increase efficiency and collaboration within development teams. Technology also enables companies to collect more accurate data on consumer preferences and market trends, which can be used to inform decisions in product development (Hansen & Hamel, 2008).

The use of technology in product development not only increase a company's internal processes, but also contributes to the creation of products that are more relevant and competitive in the global market (Sajjapong & Irfan, 2022). For example, in the electronics industry, technologies such as the Internet of Things (IoT) or artificial intelligence (AI) can be used to create smarter and more connected products, thus providing added value to consumers. These technologies can affect various stages in the product lifecycle, from initial design to mass product testing and manufacturing. According to Christensen et al. (2015), companies that can adapt to technological changes quickly will be able to maintain their competitive advantage in the global market.

On the other hand, technology integration also enables companies to be more responsive to consumer demands and rapidly changing market dynamics. The innovation process can be accelerated through the use of technologies that enable product design simulation and product performance analysis more effectively. By using tools such as computer-aided design (CAD) or computer-aided simulation (CAE) software, companies can accelerate the design and testing phases of products, which in turn allows them to reduce time to market and increase the competitiveness of their products (Ulrich & Eppinger, 2015). In the automotive sector, for example, manufacturers can use augmented reality (AR) technology to increase the design and functionality of their vehicles.

The integration of technology in product development is not only concerned with increasing design and production processes, but also with aspects of team collaboration. Technology facilitates communication and collaboration between different departments within an organization, be it between engineering, marketing, or management teams (Abdullah et al., 2021). With digital collaboration tools such as project management platforms and cloud-based communication software, companies can manage workflows more efficiently and ensure that relevant information is accessible to all parties engaged in product development. This not only increases team efficiency but also reduces the likelihood of errors that can occur due to ineffective communication (Sweeney & O'Connor, 2019).

Companies must also consider sustainability in every aspect of their product development. Technology integration allows companies to focus more on environmentally-friendly and more sustainable products. For example, new technologies in the manufacturing process can reduce waste and increase energy use efficiency. By using technologies such as additive-based production (3D printing), companies can reduce wasted raw materials and produce products with more efficient materials. In the fashion industry, for example, technology can be used to create more environmentally friendly textile materials without compromising product quality and style (Grayson & Hodges, 2017).

It is important to note that while technology can speed up the product development process and increase product quality, companies must ensure that they have a well-thought-out strategy in managing technological change. Technology integration is not an instant process; companies must make significant investments in human resources and technology infrastructure. This includes training employees to ensure they have the needed skills to work with new technologies, as well as ensuring that the company's IT infrastructure is robust enough to support rapid technology adoption (Porter & Heppelmann, 2014).

Risk management is also an important part of technology integration in product development. While technology can bring great benefits, there are risks associated with data security, system crashes, and other operational mishaps. Companies need to develop a risk management plan that includes protocols for handling technical issues that may arise in the implementation of new technologies. Cyber security, for example, is a very important aspect in the tech industry that relies on consumer data to increase user experience. With threats to personal data, companies must ensure that the data is well protected through strict security policies and systems (Barton et al., 2017).

Companies need to consider the social and ethical impacts of technology integration in their product development (Arifin & Darmawan, 2021). Technologies such as AI and automation have the potential to replace human jobs, which can create tensions in a community. Companies should adopt a responsible approach to the implementation of new technologies, taking into account the well-being of employees and the impact on future employment (Brynjolfsson & McAfee, 2014).

One of the key challenges faced by companies in integrating technology in product development is the need to adapt to the rapid changes in technology. Companies need to be able to capitalize on rapidly evolving technologies, while also ensuring that the technologies implemented remain relevant and efficient in the long-term. The speed of technological change means that companies need to have strategies that are flexible and able to react quickly to coming market and technological changes. This requires companies to have a high innovation capacity and be ready to invest in technologies that can support their long-term goals (Hamel & Prahalad, 1994). According to the results of research by Zhang et al. (2022) shows the use of digital technology has a positive relationship with the company, where policy support strengthens the impact of using digital technology on strategic flexibility, but company regulation can have a negative impact.

In this process, stakeholder engagement is also very important. Companies need to ensure that they can collaborate with suppliers, customers and technology partners to create innovative solutions that can bring competitive advantage. This collaboration includes not only cooperation in product development, but also in research and development to ensure that the products produced match the changing needs of the global market. The integration of these various parties can help companies to gain better insight into market trends and unmet customer needs (Teece, 2010).

The use of technology also contributes to increasing the quality of products produced. With more advanced technology, companies can more tightly control the manufacturing process and ensure the products produced meet high standards. The use of sensors and automated technology can help companies to monitor product quality in real-time and detect defects at an early stage of production. This not only increases product quality but also reduces the costs associated with repairing or returning defective products once they reach consumers (Gunasekaran et al., 2004).

To achieve sustainable innovation, companies must be able to adapt their business models to evolving technology trends. This engages investing in continuous research and development, as well as building a culture of innovation within the organization. Companies that are successful in integrating technology in their product development are those that are able to think long-term and continuously adapt to the changes taking place in the world of technology. Only with an integrated and strategic approach can companies remain relevant in an increasingly competitive global market (Kaplan & Norton, 2008).

As technology continues to evolve, companies must continuously update their product development strategies to ensure competitiveness in the global market. The integration of technology in the product development process enables companies to be more efficient, innovative and responsive to changing market demands (Irfan & Hariani, 2022). Speed in utilizing technology, as well as the ability to adapt quickly to changes, are the main keys for companies that want to survive and thrive in this challenging era.

While technology opens vast opportunities for efficiency and innovation, it simultaneously introduces vulnerabilities that can compromise operational stability. One of the primary concerns is the overreliance on specific digital systems or platforms, which may become obsolete or misaligned with evolving market demands. Technological disruptions, cyber threats, and system failures can significantly hinder performance if contingency plans are not in place. Therefore, companies must critically assess their technological dependencies and regularly evaluate whether their digital infrastructure aligns with dynamic business environments.

Moreover, the integration of complex systems across departments often presents challenges in terms of compatibility, user adaptability, and maintenance. Without coherent coordination and

adequate training, the potential of such systems may remain underutilized or lead to operational friction. This highlights the need for a holistic and anticipatory strategy—one that not only implements cutting-edge tools but also prepares the workforce and organizational structure to embrace continual transformation.

In managing these risks, companies must adopt a flexible approach to technology implementation that supports long-term objectives without disregarding environmental and social considerations. The success of technological adoption lies not merely in its functionality, but in its ability to drive ethical, sustainable growth. This includes evaluating the broader implications of digital tools on labor dynamics, data privacy, and ecological impact. A balanced strategy ensures that technological progress strengthens corporate resilience while maintaining accountability to stakeholders and the broader society.

Finally, to achieve success in technology-based product development, companies must have a well-trained team and an infrastructure that can support the optimal use of technology. Only with a comprehensive and integrated approach can companies create innovative products that are globally competitive, sustainable, and relevant to changing market needs. The key to continuous increase is the ability to respond quickly, innovate sustainably and manage change effectively.

CONCLUSION

In the face of increasingly fierce global competition, companies need to utilize technology as a tool to accelerate and increase the product development process. The use of technology in every stage of product development allows companies to design and manufacture products more efficiently, reduce cycle time, and increase quality and innovation. Through the application of technology, companies can reduce costs and maximize the potential to create products that meet the demands of a rapidly changing market. In this case, the success of product development largely depends on how companies adopt and apply relevant technologies appropriately and sustainably.

To achieve optimal results, companies must ensure alignment between the technology used and long-term business goals. Companies need to ensure that this innovation process is supported by efficient management and human resources who are skilled in using technology. Companies that are able to do this will have stronger competitiveness, with products that are not only innovative, but also relevant and can meet consumer expectations in the global market. It is important that companies continue to invest in research and development and strengthen their technological and managerial capabilities.

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