



## Research Article

## Examining the Effect of Lean Innovation on Production

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**ABSTRACT**

Lean production philosophy enables businesses to produce more effectively by eliminating waste in their processes. Innovation is defined as the realization of new or significantly improved products or services. Nowadays, businesses want to realize their innovative products or services effectively at low costs. In this context, the concept of lean innovation, which is the combination of both lean and innovation concepts, emerges. Lean innovation not only provides businesses with a competitive advantage in existing markets, but also has the potential to enter new markets and create growth opportunities. Businesses that adopt lean innovation can achieve a competitive position by quickly adapting to changing market conditions. Thanks to a culture of continuous improvement, businesses become more flexible and adaptable and can respond quickly to customer demands. This study aims to examine lean innovation, which is a new concept in the literature. In this context, the concepts of lean philosophy, innovation and lean innovation were introduced. Information about the features, importance and processes of lean innovation is given and how it can be implemented is explained. The study shows that lean innovation is an important strategy for businesses and will be more widely adopted in the future as it will enable rapid adaptation to changing market conditions and sustainable growth.

### 1. Introduction

In today's business world, innovation is becoming increasingly important in order to be successful and achieve sustainable growth in an intensely competitive environment. Businesses constantly focus on generating new ideas and developing innovative solutions to respond to changing consumer demands, enter new markets and differentiate themselves from their competitors. In this context, lean thinking and lean production philosophy stand out as an important approach that offers businesses the opportunity to optimize their innovation processes and gain competitive advantage. Nowadays, it is of great importance for businesses to rapidly develop their innovation strategies in order to maintain their competitive advantage and be successful. However, in this process, it becomes more and more difficult to obtain a predictable output and get results quickly. At this point, lean thinking and management philosophy come to the fore as a strategic necessity [1]. While lean thinking encourages businesses to use resources effectively, reduce waste, and adopt a culture of continuous improvement, innovation requires businesses to produce new ideas, improve their products and services, and offer customer-oriented solutions [2]. Therefore, the concept of lean innovation emerges, which enables companies to use their resources effectively while producing innovative products. Lean innovation is a newly developing approach in the management literature and there are still limited scientific studies on its implementation. However, observations show that this approach in the literature is being adopted by more and more businesses [1].

Lean and innovation are a powerful duo brought together to provide businesses with a competitive advantage in the modern business world. While the lean philosophy specifies effective and efficient working principles by focusing on reducing waste, the innovation process emphasizes the need to be customer-oriented, fast, agile and flexible. Innovation supports the sustainability of the business and ensures continuous development by increasing customer satisfaction. Constant communication with the customer is critical to understanding and meeting accurate expectations. The right satisfaction and solution relationship within and outside the business strengthens the business culture. Close relationships and regular communication with customers and suppliers play a critical role in the innovation process and are the key to successful results. The combination of lean and innovation increases the competitive advantage of the business by producing solutions that meet customer needs, enables it to quickly adapt to changing market conditions and constantly creates value. In this way, the business can maintain its leading position in the dynamic business ecosystem [3].

The relationship between innovation and lean manufacturing refers to similar but different approaches that focus on improving business processes. Innovation is the process of bringing new and valuable ideas to life. Lean manufacturing is a management philosophy that focuses on reducing waste, especially in business processes. Lean innovation combines these two concepts and aims to use resources effectively with the aim of creating continuous value. Lean principles emphasize continuous improvement by reducing waste. By combining these principles in innovation processes, it is possible to create more effective and

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efficient value. In innovation projects, the design of the value stream is aligned with the values determined by the stakeholders. Lean principles prevent resource waste and contribute to achieving more effective results by making innovation processes more structured, synchronized and constantly adaptable. In this way, businesses can be both innovative and efficient [4].

This study reveals the potential to provide competitive advantage to businesses by addressing the combination of lean thinking and innovation. It also explores the relationship between lean thinking and innovation and examines how lean innovation can transform businesses. In the second part of the study, lean philosophy is explained, in the third part, the concept of innovation is discussed, in the fourth part, lean innovation and its importance are mentioned, and in the last part, conclusion and evaluation are made.

## 2. Lean Philosophy

Lean is a thought system adopted by businesses to increase efficiency, reduce costs, improve quality and prioritize customer value. This approach is described as an alternative option to traditional business management. Lean emphasizes experimentation-based learning and rapid adaptation processes to succeed in an environment full of uncertainty. Lean prioritizes validating and improving ideas and products through customer feedback. Rather than relying on long-term planning and large investments, the lean approach encourages creating rapid prototypes, instantly measuring customer reactions, and continuously adapting products or services accordingly [2].

Lean thinking is an approach based on the basic philosophy of lean production. This way of thinking encourages continuous improvement, aims to reduce waste and increase efficiency. Lean thinking aims to eliminate unnecessary steps and waste to make any activity or process effective and efficient. It enables businesses to increase their efficiency by using their resources effectively and encourages focusing on customer satisfaction. By adopting lean thinking, businesses can increase quality and gain competitive advantage while reducing unnecessary waste. However, lean thinking helps businesses that require flexibility and adaptability in rapidly changing market conditions to gain competitive advantage by meeting their needs [4].

Lean production is a production philosophy that aims for businesses to use resources effectively by minimizing waste and at the same time maximizing efficiency. This philosophy provides cost savings and competitive advantage to businesses by eliminating unnecessary activities, wasted time, excess inventory and other types of waste. It optimizes the flow of processes, improves quality, increases the capacity to respond faster to customer demands, and creates a culture of continuous improvement by encouraging employee participation. This philosophy can be applied in many areas, from supply chain management to product development processes. Businesses that adopt lean manufacturing principles can increase their competitiveness, ensure customer satisfaction and promote a culture of continuous improvement [5].

## 3. Innovation

Innovation can be expressed as new or significantly improved structures, processes, technologies, services, ideas and applications built on creative ideas [7]. As a general definition, innovation is the sum of improvements made to add value to a product, service or system. Innovation does not mean redesigning or building the system from scratch. Instead, it makes the system a part of the continuous improvement cycle, keeps it in it and makes it a constant part of change, while also benefiting from the technological developments brought by the age. Moreover, a general characteristic of innovation is that it must be realized. A new or improved product is considered realized when it is released into the market. Similarly, new

processes, marketing methods or organizational methods are realized when they come into actual use in a firm's operations [8]. From the moment innovation is defined as improvement, renewal and innovation, it should not be limited to only considering the benefit within the system or company. While this concept is the result of all the work done since its emergence, it also holds an important place in the competitive environment. When companies that focus on continuous development and improvement achieve these goals by taking advantage of technological advances, they are in demand in the global market and customer satisfaction increases positively. In this context, innovation is an effort to renew, improve and optimize the current situation [7].

The concept of innovation has become an indispensable element of today's world since its emergence. By applying innovation processes systematically, organizations have the ability to develop, change and move existing processes forward with new ideas. These processes are of vital importance in order to survive in the global competitive environment and compete in the market. Systematic innovation processes play an important role in increasing customer satisfaction. Renewed or completely new products better meet customers' expectations and offer solutions to existing problems. Customer-focused innovation enables organizations to establish closer relationships with their customers and understand their real needs [8].

The systematic progression of innovation processes is important for organizations not only in terms of customer satisfaction but also in terms of internal efficiency and competitiveness. The benefits of innovation within the organization include the potential to reduce costs, increase efficiency and enable more effective use of resources [9, 10]. Lean innovation processes, which combine innovation and lean thinking, which is the subject of this study, offer organizations the potential to reduce costs and use resources more effectively by making their business processes more efficient.

## 4. Lean Innovation

Innovation management and lean management play an effective role in important areas such as the success of businesses, increasing profitability and reducing waste. While innovation creates new business values by transforming original ideas into products or services that meet customer needs, lean thinking focuses on cost savings. The combination of these strategies increases companies' market share and strengthens their global competitiveness. Service innovation is of great importance for companies, especially as we move towards a service-oriented economy. These innovations are a critical factor to maintain and strengthen competitive advantage. At the same time, the implementation of lean initiatives also targets operational excellence and offers strategies to increase the efficiency of businesses. Therefore, combining these two approaches in the service sector is a challenge that needs to be explored to achieve a sustainable competitive advantage. This combination is of great importance in creating a successful competitive strategy, providing companies with the ability to provide better service and the potential to increase customer satisfaction [11]. Lean manufacturing principles are increasingly being applied to promote lean innovation practices. These practices, which emphasize customer focus, repeated learning cycles and elimination of waste in the innovation process, provide advantages in various areas such as agile methods for new product development and business model creation [12].

In the Industry 5.0 transformation process, it is predicted that businesses will be able to be faster, more efficient and more innovative by using the lean innovation approach. Industry 5.0 is a transformation process that aims to create smart factories and smart systems by combining industrial production with cyber-physical systems. The lean innovation approach enables businesses to be more competitive by reducing waste in production processes, optimizing resources, responding to

customer needs faster and developing innovative ideas [13].

In this way, it is seen that innovation management and lean management approaches provide great benefits for businesses and put them in a competitive position. It should not be forgotten that innovation is a strategic advantage for businesses, increases customer satisfaction and strengthens competitiveness.

Lean Innovation is a management philosophy that applies lean thinking principles, a customer value-oriented approach, to innovation processes. This approach aims to maximize customer satisfaction while also increasing efficiency by minimizing resource waste and unnecessary activities [14]. Lean Innovation constantly adopts the principle of customer focus to maximize customer value in innovation activities. Understanding customer needs, establishing a close relationship with them and receiving constant feedback are important steps. In this way, it is possible to offer innovative solutions in line with customer expectations [15].

At the same time, lean innovation aims to eliminate idle resources. Unnecessary activities in innovation processes can lead to waste of time and resources. This approach enables more effective use of resources by analyzing and improving processes. Thus, it becomes possible to create more value with limited resources. It also emphasizes the principle of continuous improvement. Innovation processes are constantly reviewed, evaluated and improved. Efficiency gains are continually achieved by learning from feedback and experience. Lean innovation is an important tool for effective R&D management by providing support to businesses in doing the right things, doing things right and doing them better [2]. This approach provides companies with a competitive advantage and focuses on constantly improving innovation processes. In summary, lean innovation is an approach that aims to develop new ideas quickly and effectively and bring them to market by applying lean management and lean production principles to innovation processes [16].

Additionally, in an environment where resources are limited, lean thinking principles need to be applied to R&D management to achieve significant product differentiation. Similar guiding principles for lean manufacturing have not yet been established for lean innovation. The lean innovation approach presented here is based on 10 basic principles that should be applied in R&D given in Fig. 1. These 10 principles focus on the guiding theme of lean innovation and use a three-step approach: early configuration, easy synchronization, and secure adaptation. Early structuring aims to establish a motivated project team, concrete, transparent and prioritized requirements and values, and the establishment of the project and process as a basis for efficient and synchronized development. Easy synchronization requires value stream mapping, capacity planning and synchronization. Safe adaptation forms the basis for sustainable adaptation of robust products to changing market requirements [17].

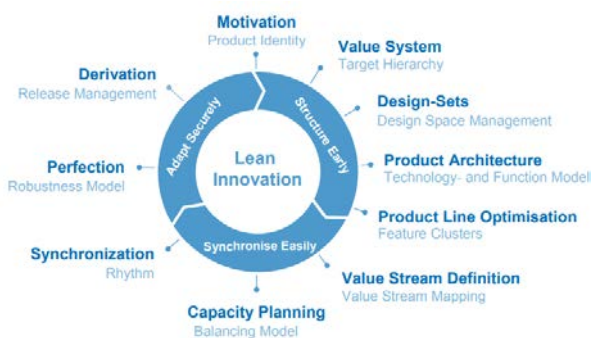


Fig. 1. Lean Innovation Principles [17]

#### 4.1. Features of Lean Innovation

Lean innovation has some features that differentiate it from traditional innovation approaches. These features are elements that reflect the basic principles of lean innovation. However, the implementation and characteristics of lean innovation may vary depending on the methods used and the needs of the organization. Since each organization has its own unique structure and goals, the lean innovation approach can be adapted to suit these different needs. These features are listed below [18, 19].

**Value orientation:** By focusing on customer value, lean innovation aims to ensure that innovative products and services provide real value to customers.

**Customer feedback:** In lean innovation, customer feedback is of great importance, and continuous improvements are made by taking into account customers' opinions and demands during the product or service development process. In this way, customer satisfaction is increased and products or services are made more suitable for customer needs.

**User experience:** In lean innovation, user experience plays a central role and the aim is for products or services to be user-friendly, to suit user needs and to meet users' expectations. User feedback is constantly taken into account and improvements are made to ensure that users can use it easily, increase their satisfaction and create loyal customers. In this way, the problems experienced by the users are solved and a better user experience is provided.

**Resource efficiency:** Lean innovation focuses on the efficient use of resources and aims to minimize waste and use resources in the most effective way during the innovation process. This means eliminating unnecessary costs, saving time and effort. In line with lean principles, processes are examined and unnecessary steps and excess stocks are eliminated, resources are optimized and efficiency is increased. In this way, limited resources are used more effectively and maximum value is achieved in the innovation process.

**Teamwork:** In lean innovation, teamwork is of great importance and the aim is for people with different abilities to come together, collaborate, share ideas and come up with innovative solutions. Because diverse perspectives and experiences create a rich pool of knowledge and ideas. By working together, team members benefit from different perspectives, complement each other's strengths, and focus on the common goal. In this way, more creative and effective solutions are developed, efficiency increases and the innovation process accelerates. Teamwork also increases synergy and motivation, encourages employee participation and provides strong solidarity to achieve a common goal.

**Continuous improvement:** Lean innovation effectively uses feedback to continuously improve business processes and products. This approach encourages innovative ideas to be quickly tested and optimized based on real-world data. The feedback obtained during the innovation process is constantly analyzed in line with the experiments and user feedback. As a result of these analyses, weak points in processes and products are identified and improvement opportunities emerge. Lean innovation quickly evaluates and implements these improvement opportunities. In this way, it is possible to achieve consistently better performance, efficiency and user experience.

#### 4.2. The Importance of Lean Innovation

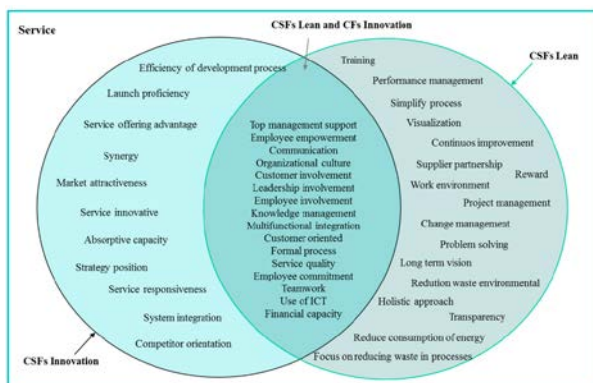
Lean innovation plays an important role in today's rapidly changing and competitive business world. As businesses face the need to constantly improve and innovate, they are looking for ways to innovate more efficiently and effectively. This approach offers businesses a number of significant advantages such as cost savings, rapid adaptation, customer focus and competitive advantage. It helps businesses become more sustainable, resilient and innovative, while also offering the potential to reduce risks

and increase chances of success. Therefore, the importance of lean innovation is increasing in the business world [20]. Lean innovation offers great advantages to businesses in terms of cost savings. Businesses can reduce costs by adopting lean principles when resources are limited. In the lean innovation approach, rapid prototypes are produced starting with minimum functionality and improvements are made based on customer feedback. In this way, unnecessary expenses are prevented and resources can be used more efficiently. However, lean innovation provides businesses with the ability to adapt quickly and flexibly. In rapidly changing market conditions, it is important for businesses to adapt faster. Lean innovation takes a flexible approach, enabling rapid experimentation and learning based on customer feedback. In this way, the ability to better understand customer demands and quickly adapt to change is gained.

Customer focus also stands out as an important element of lean innovation. Businesses use customer feedback to understand customer demands and needs and improve their products or services accordingly. Adopting a customer-focused approach increases customer satisfaction and ensures loyalty.

Lean innovation is also effective in reducing risk. Producing rapid prototypes based on minimum functionality allows businesses to evaluate their ideas based on real-world experience. In this way, it is possible to identify risks and possible errors before making large investments. These important advantages of lean innovation enable businesses to generate and implement new ideas in a more efficient, effective and customer-focused way [21].

Fig. 2 is a conceptual map that makes sense of the relationship between innovation and lean initiatives. On the one hand, success criteria for innovation are mentioned, and on the other hand, success factors for lean are mentioned. Later, these two topics were combined and critical success factors for lean innovation emerged [11].



**Fig. 2.** Conceptual map of critical success factors of innovation and lean initiatives [11]

Successful implementation of lean innovation requires a culture change beyond the right tools. It is important to create a culture open to change, constantly integrate systematic methods, and ensure that participants are involved in the continuous improvement process. Lack of employee participation can cause change processes to fail despite significant precautions [17].

Various companies have developed different products and services by adopting lean innovation principles. Here are some examples [22]:

Toyota - Prius: The hybrid car Prius, which offers an environmentally friendly approach and increases fuel efficiency, was developed by adopting lean production principles. Zara - Fast Fashion: started the concept of fast fashion using simple principles. Thus, it responds quickly to customer demands with high-frequency small production series and flexible production processes. Amazon - AWS (Amazon

Web Services): launched cloud computing service AWS using lean innovation principles. Tesla - Electric Cars: pioneered by using simple principles. It has found success in the electric car market by using rapid iterations, software updates, and continuous improvement processes based on customer feedback. Netflix - Content Streaming: developed its content streaming service by adopting simple principles. It has adopted lean innovation in personalized recommendations, rapid content distribution and user experience processes. Walmart - Supply Chain Management: by applying lean principles in supply chain management, it has reduced costs and increased operational efficiency through optimizing inventory, logistics organization and just-in-time practices. General Electric (GE) - Healthcare Equipment: used lean innovation in the development of healthcare equipment.

### 4.3. Lean Innovation Processes

The lean innovation process consists of five basic steps for generating innovative ideas and creating value. The first step is problem discovery. At this stage, potential problems or opportunities are identified based on sources such as customer feedback, market research and competitive analysis. In this way, businesses can identify customer needs, monitor market trends and gain competitive advantage [23]. The second step is problem analysis. At this stage, the identified problems are analyzed in more detail. The root causes and effects of the problem are investigated. An in-depth understanding of the problem is achieved through the use of data collection, customer interviews, surveys or other research methods. As a result of the analysis, areas that need to be focused on to solve or improve the problem are determined. The third step is idea generation. At this stage, creative ideas are revealed in the areas determined as a result of the problem analysis. New solutions and ideas are developed by employees or team members using different methods, techniques and brainstorming sessions. Diversity and originality of ideas are encouraged. This stage encourages creative thinking and uses various resources for innovation [24]. The fourth step is idea development and prototyping. At this stage, the process of evaluating and developing ideas continues. Prototypes can be created, tests can be run, and ideas can be further improved by getting feedback. Prototypes enable ideas to become concrete and offer businesses the opportunity to try them in real-world conditions. In this process, the feasibility of the ideas is evaluated in terms of technical, economic and operational aspects and it is aimed to meet customer needs. The final step is marketing and implementation. At this stage, marketing strategies of the ideas are created and presented to customers. Customer feedback and market reactions are closely monitored as ideas are commercialized and brought to market. Improvements are constantly made to adapt to customer needs and respond quickly [25].

The lean innovation process continues by constantly repeating these five basic stages. A cycle is created and these stages are repeated in each cycle. The innovation process begins with problem discovery. Potential problems or opportunities are identified and then a detailed analysis of these problems is carried out. Then, creative ideas are generated and prototypes are created. Prototypes are tested and ideas are further improved by receiving feedback. In the final stage, successful ideas move to the marketing and implementation stage, are introduced to the market and provide value to customers [17]. In his study, Nicoletti [20] showed these processes in 7 steps in total, as shown in Fig. 3.

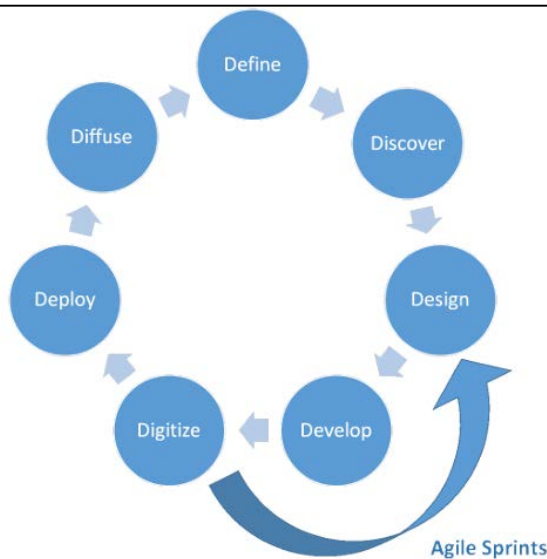


Fig. 3. Lean innovation processes and stages [17]

In this context, it has been mentioned that the transfer and application of lean and digitalization concepts to innovation is of key importance for the future success of businesses. This approach gives businesses agility, flexibility and competitive advantage. Integrating lean principles into the innovation process ensures that processes are managed efficiently. Digitalization, on the other hand, involves the use of technologies such as automation, data analytics and artificial intelligence, and enables businesses to make data-based decisions, improve customer experience and offer innovative products [17].

## 5. Conclusions

Lean innovation is an approach where businesses attach importance to customer focus. It relies on continuous customer feedback to understand customer needs and develop products in line with expectations. Rapid prototyping and iterations are key elements of lean innovation. These methods allow you to quickly test ideas and get real user feedback. Improving business processes is also an important part of lean innovation. Lean principles such as reducing waste, simplifying processes and increasing efficiency enable the innovation process to be managed effectively. Flexibility and adaptability support businesses' ability to quickly adapt to changing market conditions. A culture of continuous improvement is at the core of lean innovation. Evaluating feedback, learning from successes and failures, and continuous learning ensure that innovation continually advances. Collaboration and teamwork encourage different stakeholders to come together to share ideas and create innovative solutions. Risk management is also an important component of lean innovation. Identifying, analyzing and managing risks increases the chances of success of businesses. Data-driven decisions are also at the core of lean innovation. Data analysis and the use of real user data enable better decision-making and support the innovation process. With the combination of these factors, lean innovation offers businesses a more systematic, efficient and effective innovation process. Elements such as customer focus, rapid prototyping, improvement of business processes, flexibility, continuous improvement culture, collaboration, risk management and data-driven decisions enable businesses to gain competitive advantage.

Today, many companies are adopting lean innovation, and as they encounter the positive results brought by these methods, they are increasingly adopting the methods of this concept. Since lean innovation is a concept and method open to continuous development and change, its name may change over

time, but it will continue to be implemented on basic principles. What we can say about the future of lean innovation is that this concept will be an important part of both today and the future. Lean innovation has become an important tool for businesses to maintain their competitive advantage and maintain and grow their place in the global market. With transformations such as Industry 4.0 and future Industry 5.0, the concept of lean innovation will gain even more importance.

As stated in these studies, lean innovation encourages customer focus, continuous improvement culture, collaboration and risk management. While these factors provide competitive advantage to businesses, they also aim to increase customer value.

As a result, the effectiveness of lean innovation is achieved by the successful application and continuous improvement of these principles and methods. It accelerates innovation processes, increases customer satisfaction and enables businesses to gain a competitive advantage. Lean innovation will remain important in the future and will continue to provide sustainable success to businesses.

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The authors declare no competing interests.

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