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THE "JUST-IN-TIME" CONCEPT IN OPERATIONS MANAGEMENT

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КОНЦЕПЦІЯ "JUST-IN-TIME" В ОПЕРАЦІЙНОМУ МЕНЕДЖМЕНТІ

The "Just-In-Time" (JIT) concept is a powerful tool for optimizing core operational and other processes. Therefore, it is a fundamental approach to developing operational management strategies for entities involved in economic activities that require production, supply, processing, and delivery of goods to be replenished. The purpose of the article is to describe the specific features of applying the "Just-In-Time" concept in operational management. Based on the research results, attention has been drawn to the fact that the "Just-In-Time" concept is characterized by its individualized nature. This characteristic focuses on general principles of operational management but creates a unique specificity of impact. This specificity can vary across several aspects, including the optimal inventory levels of raw materials, components, and finished products; responsiveness to changes in demand; product quality levels; logistics, lead times, and delivery accuracy; and the level of operational risks. It has been concluded that the main aspects shaping the uniqueness of JIT's impact on inventory levels are based on key factors such as demand-driven supply, avoidance of inventory accumulation, effective supplier management, reduction of storage-related losses, and the enhancement of production productivity and quality. The main aspects that shape the uniqueness of JIT's impact on responsiveness to changes in demand are rooted in key factors such as minimal inventory levels, rhythmic production, order responsiveness, and maximizing resource utilization. The main aspects that shape the uniqueness of JIT's impact on product quality are based on key factors such as ensuring production stability, defect detection, continuous improvement, and employee involvement. The main aspects that shape the uniqueness of JIT's impact on logistics processes are grounded in key factors such as precise delivery, reduction of production cycle time, and monitoring and tracking. The main aspects that shape the uniqueness of JIT's impact on the nature of operational risks are based on key factors such as minimizing the risk of losses (including those related to significant inventory volumes), reducing the risk of inventory obsolescence, enhancing flexibility and responsiveness to changes, and minimizing the risk of reduced efficiency in production processes.

Концепція "Just-In-Time" (JIT) є потужним інструментом оптимізації (переформатування) базових операцій та інших процесів. Відтак, це є базовим підходом до створення операційних стратегій управління діяльністю тих суб'єктів економічної діяльності, які потребують відновлення процесів виробництва, постачання, обробки та доставляння продукції. Метою статті

є характеристика особливостей застосування концепції "Just-In-Time" в операційному менеджменті. За результатами дослідження звернено увагу на той факт, що особливістю концепції "Just-In-Time" є її індивідуалізований характер. Цей характер, хоча орієнтує на загальні правила операційного управління, створює унікальну специфіку впливу. Така специфіка може відрізнятися за цілим рядом аспектів, серед яких оптимальність запасів сировини, компонентів та готової продукції; реагування на зміни попиту; кінцевий рівень якості продукції; стан логістичних процесів, час циклу постачань і точність доставлення; рівень операційних ризиків. При цьому зроблено висновок, що основні аспекти, які формують унікальність впливу JIT на стан запасів ґрунтується на таких ключових аспектах, як: постачання за потребою; уникнення накопичення запасів, ефективне управління постачальниками, мінімізація втрат через зберігання, підвищення продуктивності і якості виробництва. Основні аспекти, які формують унікальність впливу JIT на реактивність до змін попиту ґрунтується на таких ключових аспектах, як: мінімальний обсяг запасів, ритмічне виробництво, реагування на замовлення, максимізація використання ресурсів. Основні аспекти, які формують унікальність впливу JIT на якість продукції, ґрунтується на таких ключових аспектах, як: забезпечення стабільності виробництва; виявлення дефектів; постійне вдосконалення; залучення працівників. Основні аспекти, які формують унікальність впливу JIT на стан логістичних процесів, ґрунтується на таких ключових аспектах, як: точне постачання; часу циклу виробництва; моніторинг та відстежування. Основні аспекти, які формують унікальність впливу JIT на характер операційних ризиків ґрунтується на таких ключових аспектах, як: мінімізація ризику втрат (у т.ч. пов'язаних зі значними обсягами запасів); мінімізація ризику застарівання запасів; збільшення гнучкості та реагування на зміни; мінімізація ризику зниження ефективності виробничих процесів.

Key words: resource utilization; production processes; supplier management; rhythmic production; supply cycle; delivery accuracy.

Ключові слова: використання ресурсів; виробничі процеси; управлінню постачальниками; ритмічне виробництво; цикл постачань; точність доставки.

Target setting. The "Just-In-Time" (JIT) concept originated in Japan, specifically in the latter half of the 20th century, and from its inception, it has demonstrated high effectiveness as an approach in production and supply management for the Toyota company. It is worth noting that this concept was formed based on ideas and methods borrowed from the experience of American companies but developed its own unique adaptation within the Japanese manufacturing environment. It should be noted that this concept significantly expanded its influence as it underwent testing as an approach to shaping operational strategies for production and logistics during the period of the recovery of Japanese companies and the Japanese economy after World War II. At the time, this concept was successfully applied as an approach to creating operational management strategies aimed at increasing profitability by leading businesses from various sectors of the economy. For instance, Nissan achieved higher profitability through operational actions related to optimizing production processes, Honda through optimizing inventory and production processes, Sony through optimizing production and cost-related operational actions etc. Currently, JIT has not lost its relevance, as it remains a powerful tool for optimizing (streamlining) core operational and other processes. Therefore, it is a fundamental approach to developing operational management strategies for entities involved in economic activities that require the replenishment of production, supply, processing, and product delivery.

Analysis of research and publications. Questions of operational management are the subject of research by many domestic and foreign scholars, such as O.V. Mykhaylenko, N.I. Komarytska, and D.O. Sarychev. However, these mentioned scholars, while emphasizing the advantages that businesses gain from implementing the "Just-In-Time" concept in operational management, primarily focus on ways to improve the efficiency of employees and managers.

Research on the management of operational activities of economic entities in the context of implementing the "Just-In-Time" concept in operational management is the focus of scholarly work by S.P. Dunda, T.V. Rybachuk-Yarova, I.V. Tyukha, and S.

Yu. Kulakova. However, time management as a direction for enhancing the effectiveness of an enterprise's operational strategy remains insufficiently explored.

The wording of the purposes of article (problem). The purpose of the article is to characterize the specific features of applying the "Just-In-Time" concept in operational management.

The paper main body with full reasoning of academic results. Within the research, the "Just-In-Time" (JIT) concept is defined as an approach to creating operational management strategies aimed at continuous production according to customer demand.

For this approach, what is important is not general rules, but an individualized management approach chosen by the economic entity. It is natural to identify the key principles of JIT, which include:

1. Minimizing material, component, and finished product inventories through mechanisms of precise, on-time delivery in the required quantities. This allows companies to reduce storage costs and avoid associated capital expenses.
2. Stability and rhythmic production are based on mechanisms of continuous improvement in manufacturing and supply processes to achieve efficiency and productivity. This includes the Lean methods implementation aimed at eliminating wasteful operations and optimizing resources.
3. Reducing production cycle time through process transformation mechanisms aimed at shortening the time from the beginning of production to product completion. This is essential to minimize waiting time and increase productivity.
4. Continuous improvement of manufacturing and supply processes based on mechanisms to achieve maximum efficiency and productivity. This means that the company should constantly seek ways to enhance its operations and resource utilization.

According to the above, it is possible to outline the following conceptual framework for implementing operational management approaches based on "Just-In-Time" (see Figure 1).

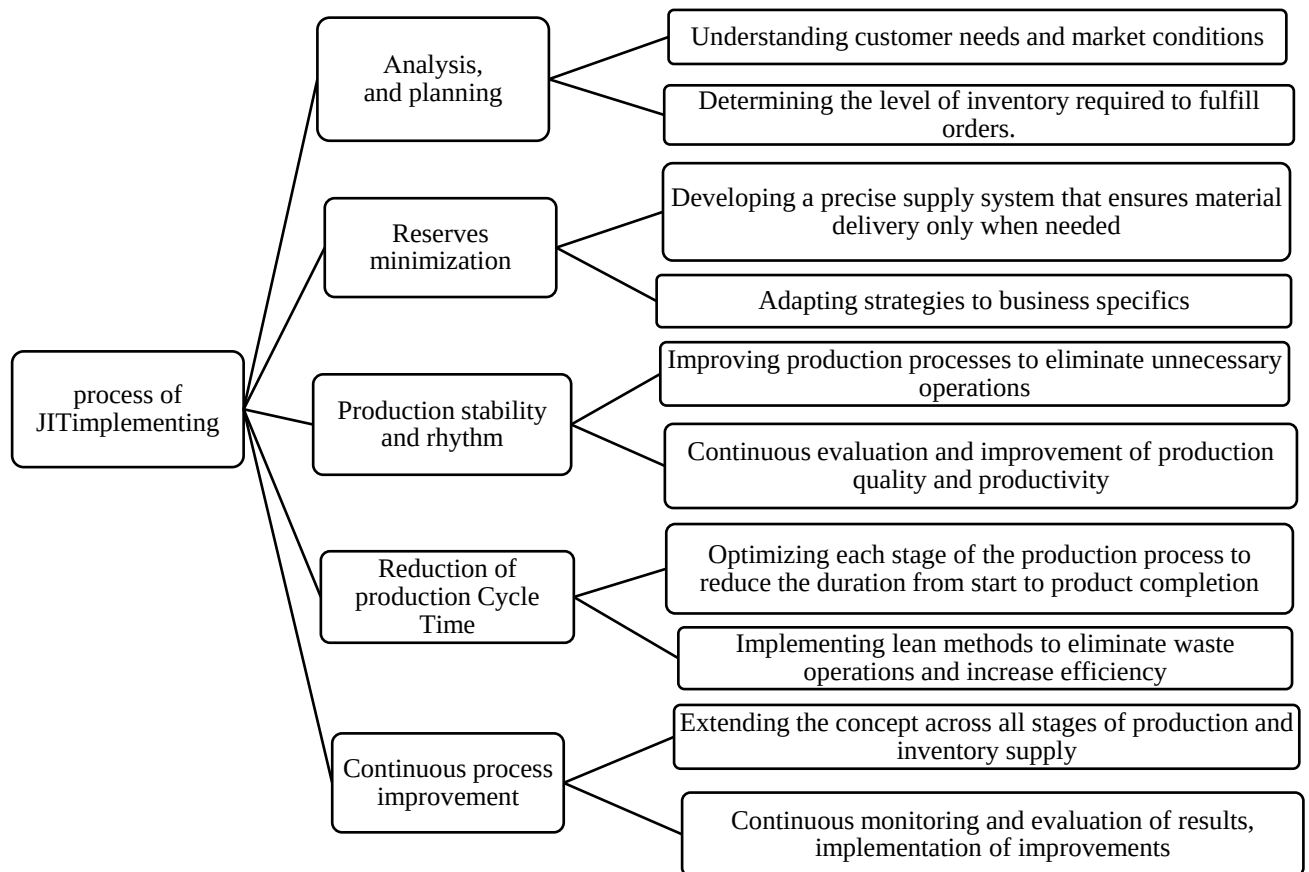


Figure 1. Conceptual diagram of implementing operational management approaches based on "Just-In-Time".

Source: formed based on [1; 3; 6]

It should be noted that the outlined conceptual framework is only a basic outline of management and lacks detailed specifics. Nevertheless, in a general sense, this scheme demonstrates how JIT can be implemented in an enterprise to achieve continuous production according to customer demand. It is important to consider that although implementing JIT is a costly procedure (as it requires significant efforts and internal preparation within the company, including changes in the production culture, adoption of new technologies, improving the quality and skills of employees, as well as planning and coordination with suppliers), this concept remains relevant in management.

According to the analysis of JIT implementation experience, this is driven by several inherent differences. Among these differences are:

- The approach to inventory management.
- The approach to responding to changes in demand.
- The approach to ensuring product quality.
- The approach to logistics management, lead time, and delivery accuracy.
- The approach to controlling the content of operational risks.

The analysis of the business entities experiences of JIT application (Table 1) highlights that the uniqueness of the "Just-In-Time" concept lies in its individualized nature.

Table 1. Analysis of the business entities experience of JIT application (stated benefits by users)

Business entities that are users of JIT	Stated benefits of JIT by users				
	Impact on the optimality of raw material, component, and finished product inventory	Impact on flexibility and rapid response to changes in demand	Impact on product quality	Impact on the optimality of logistics processes, lead time, and delivery accuracy	Impact on operational risk levels
Nissan	+		+		+
Honda		+		+	
Sony	+		+		
Toyota		+		+	+
Komatsu	+	+	+	+	+
Tesla	+	+	+	-	-
Berkshire Hathaway	+	-	+	+	-

Source: formed based on business entities data

The individualized nature of JIT, while it does orient towards general rules of operational management, creates a unique impact profile.

This specificity can vary in several aspects, including the optimality of raw material, component, and finished product inventories; responsiveness to changes in demand; product quality levels; logistics processes, lead time, and delivery accuracy; and the level of operational risks. Let us examine the nuances of JIT's manifestation and influence more closely.

The main aspects that shape the uniqueness of JIT's impact on the state of raw materials, components, and finished product inventories are grounded in several key aspects. Among these aspects are precise on-demand supply; avoiding the accumulation of obsolete or unnecessary inventory; effective supplier management; minimizing losses through storage; and enhancing productivity and production quality.

Thus, the primary aspects of JIT's influence on the optimality of raw materials, components, and finished product inventories are organized in Table 2.

Table 2. The key aspects of JIT's impact on the optimality of inventories of raw materials, components, and finished products of economic entities.

Key influencing factors	Basis of influence	Key specificity of influence
Precise on-demand supply	JIT involves precise supply of materials, components, and finished products when needed.	Inventory is minimized as components arrive in production when they are needed ¹
Avoidance of overstocked inventory	One of the key concepts of JIT is avoiding overstocked inventory.	Thanks to regular deliveries and rhythmic production, companies can avoid accumulating stocks that may become obsolete or unnecessary ² .
Effective supplier management	JIT requires effective supplier management.	Suppliers must deliver components and materials on time and with high quality ³ .
Minimization of losses through storage	JIT helps minimize losses.	Inventory located at the company for the shortest possible time
Enhancement of productivity and quality	JIT helps focus on value-added processes.	The approach contributes to increased productivity and product quality because companies are compelled to work more efficiently ⁴

Note:

1. It allows the company to minimize storage costs and free up capital that that used relate to inventory.
2. It reduces the risk of inventory value loss and enables the company to be more flexible in responding to changes in demand and market conditions.
3. It can contribute to improving interactions with suppliers and ensuring reliable deliveries.
4. It helps avoid unnecessary expenses on unproductive operations and additional control measures.

Source: formed based on [1-2; 4]

Therefore, the impact of JIT on inventory optimization is reflected in the outcomes it produces. The results are measured by the rationality of inventory

management, the achieved improvements in efficiency and production quality, as well as the attained flexibility and efficiency of the supply system.

The primary aspects that shape the uniqueness of JIT's impact on responsiveness to changes in demand are since the production of economic entities is demand driven. This makes their operations more adaptive to current market conditions [1].

The main aspects of this impact include minimizing inventory, rhythmic production, responding to orders, and maximizing resource utilization.

Thus, the key aspects of JIT's impact on ensuring flexibility and rapid response to changes in demand are summarized in Table 3.

Table 3. The key aspects of JIT's impact on enabling flexibility and rapid response of economic entities to changes in demand.

Key influencing factors	Basis of influence	Key specificity of influence
Minimization of resources	JIT involves resources minimizing, allowing businesses to be less tied to large stocks of unused materials or finished products.	This makes the activities of economic entities more flexible in response to changes in demand. Instead of having inventories of goods that may remain unsold, economic entities can produce only what is needed now.
Rhythmic production	JIT encourages rhythmic production, where goods are produced in small consignments with known production lead times.	This allows for quick transitions to the production of other goods if demand or production priorities change.
Responsive to orders	JIT approaches may prompt companies to manufacture goods only after receiving orders from customers.	It enables businesses to produce goods that precisely match the needs of specific customers and avoid storing unsold items.
Maximization of resource utilization	JIT encourages the optimization of resource utilization.	Economic entities focus on producing what they need right now. This helps reduce costs and increase productivity.

Source: formed based on [1]

So, the impact of JIT transforms the activities of economic entities. This impact is reflected in results such as inventory-related flexibility and the ability to quickly respond to changes in demand and market conditions. This approach contributes to production optimization and increased competitiveness.

The main aspects that shape the uniqueness of JIT's impact on product quality are related to configuring processes through which managers monitor the production process of economic entities and ensure the minimization of defects [3].

The main aspects of this impact include ensuring production stability, implementing defect detection systems, continuous improvement, and involving employees.

Thus, the main aspects of JIT's impact on improving product quality in Table 4 are summarized.

Table 4. The main aspects of JIT's impact on improving the product quality of economic entities.

Key influencing factors	Basis of influence	Key specificity of influence
Ensuring production stability	JIT encourages stable and rhythmic production.	Specifically, each stage of the production process has clear and predictable schedules *.
Implementation of defect detection systems	JIT also encourages the implementation of defect detection systems at early production stages	Specifically, algorithms for addressing quality issues at initial stages are developed, leading to a reduction in the number of defective products.
Continuous improvement	JIT ensures continuous improvement of production processes.	Specifically, managers are constantly seeking ways to improve production efficiency and quality.
Involvement of employees	In the JIT system, employees play an active role in monitoring and improving processes.	Employees should be actively involved in identifying quality issues and making suggestions for their resolution.

Note / * This allows managers to effectively monitor production processes and avoid unforeseen disruptions that could impact product quality.

Source: formed based on [3; 5]

According to the provided statements, it is evident that the impact of JIT is reflected in the level of production costs, which is achieved through process optimization and the elimination of unnecessary operations.

The main aspects that shape the uniqueness of JIT's impact on the logistics state, lead time, and delivery accuracy are centered around optimizing these processes, avoiding unnecessary delays, and addressing logistic issues. In this context, the key aspects of this impact include precise supply; reduction in production cycle time; monitoring, and tracking [3-4].

Thus, the main aspects of JIT's impact on production costs are systematized in Table 5.

Table 5. The main aspects of JIT's influence on the logistics processes of economic entities, lead time, and delivery accuracy

Key influencing factors	Basis of influence	Key specificity of influence
Precise supply	In the JIT system, suppliers must be dependable and accurate	Such supply encourages suppliers to improve their logistics processes and delivery accuracy
Reduction of production cycle time	JIT encourages a reduction in the production cycle time, which includes the time from raw material supply to the production of finished goods.	This approach to the production cycle helps companies respond more effectively to changes in demand and speeds up the production process.
Monitoring and tracking	JIT requires monitoring and tracking systems for supply and logistics operations	The presence of monitoring and tracking systems allows for the timely detection of problems and the implementation of measures to resolve them

Source: formed based on [3-4]

The impact on the nature of logistics processes, lead time, and delivery accuracy is reflected in the efficiency and competitiveness of the enterprise. Thanks to JIT, components, and materials are delivered precisely now they are needed for production. It reduces the time they spend in the logistics system and lowers the risk of loss or product damage.

The key aspects that shape the uniqueness of JIT's impact on the nature of operational risks are based on approaches to inventory accumulation and cost management. The main aspects of this influence include risk minimization; avoidance of inventory-related costs; reduction of inventory obsolescence risk; increased flexibility and responsiveness to changes; and minimizing the risk of decreased efficiency in production processes.

The main aspects of JIT's impact on the level of operational risks are summarized in Table 6.

Table 6. The main aspects of JIT's impact on the level of operational risks for economic entities

Key influencing factors	Basis of influence	Key specificity of influence
Minimization of the risk of losses	In the JIT system, inventory is kept at a minimum level	This approach helps avoid the risk of loss due to spoilage, damage, or obsolescence of inventory
Avoidance of inventory-related costs	JIT helps reduce inventory-related costs	Large inventory volumes are not allowed, reducing the need for significant expenditures on inventory management, insurance, and maintenance
Minimization of the risk of material obsolescence	In the JIT system, materials are ordered and used only when needed.	Materials are not stored for extended periods, so they cannot become obsolete or outdated.
Minimization of the risk of reduced efficiency in production processes	JIT encourages economic entities to continually improve their production processes	JIT encourages businesses to analyze their production processes, eliminate unnecessary operations that do not add value to the product, and thereby enhance efficiency

Source: formed based on [1; 3; 5]

In general, the impact of JIT is reflected in the ability of an economic entity to avoid fundamental operational risks, especially those related to cost escalation and increased flexibility in production and inventory management.

Conclusions from this study and prospects for further exploration in this area. The research results highlight the fact that the distinctive feature of the 'Just-In-Time' concept is its individualized nature. This nature directs towards general principles of operational management but creates a unique specificity of its influence. This specificity can vary in several aspects, including the optimal levels of raw material, component, and finished product inventories; responsiveness to changes in demand; product quality levels; logistics processes; lead time and delivery accuracy; and the level of operational risks. The following conclusions have been drawn from the research results:

1. The main aspects that shape the uniqueness of JIT's impact on inventory levels are based on the following key aspects: demand-driven supply; avoidance of inventory accumulation; effective supplier management; minimization of storage-related losses; and the enhancement of production productivity and quality.

2. The main aspects that shape the uniqueness of JIT's impact on responsiveness to changes in demand are based on the following key aspects: inventory minimization, rhythmic production, order responsiveness, and maximization of resource utilization.
3. The main aspects that shape the uniqueness of JIT's impact on product quality are based on the following key aspects: ensuring production stability, defect detection, continuous improvement, and employee involvement.
4. The main aspects that shape the uniqueness of JIT's impact on the logistics state are based on the following key aspects: precise supply, reduction of production cycle time, monitoring, and tracking.
5. The main aspects that shape the uniqueness of JIT's impact on the nature of operational risks are based on the following key aspects: risk minimization (including that associated with significant inventory volumes), minimization of inventory obsolescence risk, increased flexibility and responsiveness to changes, and minimization of the risk of reduced efficiency in production processes.

The obtained results provide opportunities for their application in the development of a methodology for implementing JIT by economic entities of various scales and types.

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