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IMPROVING INTERNAL LOGISTICS IN THE AUTOMOTIVE INDUSTRY (LEAN LOGISTICS) – CASE STUDY

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Purpose: The study aims to present the possibility of using Lean Management concept methods and tools in the logistics area. The analysis focuses on checking the logistics processes of the Automotive industry in order to determine the possibility of improving, indicating specific examples and the ability to optimize work. The purpose of improving activities is to eliminate waste and pattern work efficiency using proven Lean Management methods and tools.
Design/methodology/approach: Based on the analysis of literature related to the subject, and the analysis of the Automotive industry, areas to introduce improvements in accordance with the Lean Management principles were detected and defused.
Findings: The LM concept methods and tools can be used in the logistics area. The conducted Alaniza pointed to the occurrence in the logistics of waste, which were clearly defined in Lean Management as an actions that do not add values, i.e. not bringing benefits. In the examined case, attention was paid to the low degree of use of standardization and visual management in logistics processes, these two elements determining in Lean Management as two methods that make it possible to perfect processes. The analysis has shown that logistics processes in which standardization is at low levels have a lot of waste, in particular: expectations, transport, mistakes and unnecessary movements.
Originality/value: The article is trying to determine the potential Lean Logistic capabilities in the processes operating on the company market. The use of Lean Management solutions in logistics shows that Lean Logistic makes sense and can be implemented in industry.
Keywords: Lean Management, Lean Logistic.
Category of the paper: research paper.

1. Introduction

Car production is today one of the most significant industrial areas. The entire automotive industry is based on a production system developed over decades, currently known as Lean Management. The most important areas of the Lean Management concept are production (Lean Manufacturing) and logistics (Lean Logistics).

Both concepts are closely related to the development of Toyota's production system (Toyota Production System - TPS), which was developed by Taiichi Ohno and his team in the 1950s and 1960s in Japan (Ohno, 1988). This system was created as a response to the challenges Toyota faced after World War II, when the Japanese economy struggled with limited resources and space.

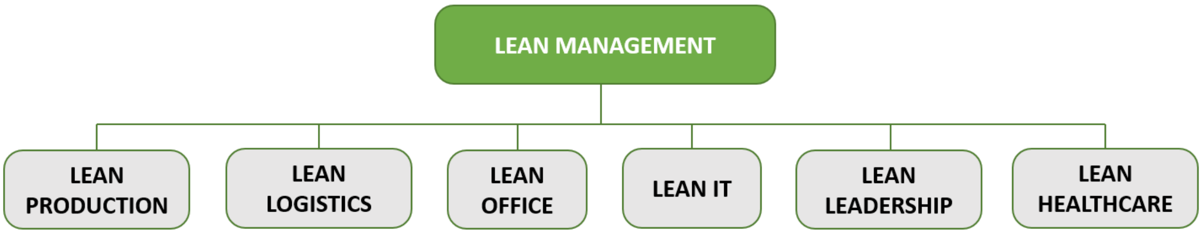


Figure 1. Division of Lean Management.

Source: Own elaboration.

Lean concepts gained popularity outside Japan in the 1980s and 1990s, when American companies began adopting TPS principles. The term "Lean" was popularized by the groundbreaking book "The Machine That Changed the World" (1990) by James Womack, Daniel Jones, and Daniel Roos, which for the first time comprehensively described Toyota's production practices and their impact on the automotive industry (Womack, Jones, Roos, 1990).

Despite extensive research on Lean Manufacturing applications, literature gaps exist regarding Lean Logistics implementation in internal logistics processes within automotive facilities. Recent systematic reviews reveal this research gap continues to grow. Research on lean logistics tools for internal environments (Braglia et al., 2024) emphasized that most studies focus on serial production contexts rather than complex internal logistics flows, particularly in automotive manufacturing where internal logistics can account for substantial operational costs.

Recent advances in Industry 4.0 and autonomous mobile robots in automotive logistics (Pizoń et al., 2024) highlight the need for combining traditional lean tools with modern technologies, yet empirical studies examining this integration in real manufacturing environments remain limited.

Research Questions and Objectives

Based on the identified research gap, this study addresses the following research questions: What types of waste commonly occur in internal logistics processes within automotive manufacturing facilities? How can lean logistics tools be effectively applied to eliminate waste in these processes? What are the measurable benefits of implementing lean logistics solutions in automotive internal logistics operations?

The aim of this study is to identify and analyze problems occurring in automotive industry enterprises, and then propose solutions using Lean Logistics tools. Through a comprehensive case study approach, this research aims to contribute to the limited body of empirical evidence on lean logistics implementation in real-world automotive manufacturing environments.

Structure of the Article

This article is structured as follows. Section 2 provides a literature review on Lean Logistics principles and their relationship to broader Lean Management concepts. Section 3 examines waste types in lean logistics and discusses implementation strategies. Section 4 presents the case study methodology and detailed analysis of internal logistics processes in an automotive manufacturing facility. Section 5 discusses the findings and their implications, followed by conclusions and suggestions for future research.

2. Lean Logistic

In the 1990s, the concept of Lean Logistics began to emerge as a separate discipline, focusing on eliminating waste in the supply chain, warehousing, transport, and distribution. The first formal definition of Lean Logistics was presented by Jones, Hines, and Rich in 1997, defining it as "a strategic approach to designing and managing logistics systems that maximizes customer value through waste elimination" (Jones, Hines, Rich, 1997).

Companies began to recognize that optimizing production alone was not sufficient - the entire logistics chain must operate according to Lean principles to achieve maximum efficiency. One of the key elements that influenced the development of Lean Logistics was the introduction by Taiichi Ohno of the Kanban system and Just-in-Time (JIT) philosophy, which originally served to optimize material flow in Toyota factories. Today, Lean Logistics is an integral part of the Lean management system.

Common Elements of Lean Logistics and Lean Management

Lean Logistics and Lean Management are based on the fundamental philosophy of waste elimination (Japanese: muda) and focus on creating value for the customer. Womack and Jones in their book "Lean Thinking" defined five basic principles of lean thinking, which form the foundation for both Lean Management and Lean Logistics (Womack, Jones, 2003).

Lean Logistics and Lean Management share several fundamental elements that form the foundation of both approaches. Both systems prioritize waste elimination, focusing on identifying and eliminating seven main types of waste: overproduction, waiting, transport, over-processing, inventory, unnecessary motion, and defects. This waste elimination philosophy is supported by continuous improvement practices (Kaizen), where both systems emphasize regular problem identification and systematic implementation of improvements. As Masaaki Imai emphasized, "Kaizen is the key to Japanese competitive success" (Imai, 2006).

The Just-in-Time concept represents another critical shared element, ensuring that materials are delivered at the right time and in the correct quantities across both logistics and production systems. Both approaches also emphasize value stream optimization through Value Stream Mapping to distinguish value-adding activities from those that should be eliminated. Furthermore, work standardization provides a systematic approach to performing tasks efficiently, while pull systems replace traditional push approaches, ensuring that both production and logistics respond to actual customer demand rather than forecasts.

3. Waste and Implementing Lean Logistic

Lean Logistics represents the application of Lean principles in the area of logistics and supply chain, focusing on eliminating waste in transport, warehousing, and distribution processes, while Lean Management encompasses a broader range of all business processes in the organization.

The application of the Lean Management system begins with process analysis from the customer's perspective, allowing separation of production stages that bring added value (what the customer wants to pay for) from those that do not bring this value - defined as waste (Burchart-Korol, Furman, 2007). The following categories of losses are distinguished (Antosz, Pacana, Stadnicka, 2013): overproduction, inventory, unnecessary transport, waiting, unnecessary motion, defects, errors, improper processing, underutilized employee potential.

When implementing the LM system, customer value must be defined. Next, the value stream must be identified and its smooth flow ensured. The next principle requires applying a pull system that will respond to customer orders. The last principle is the foundation of Lean Manufacturing and concerns continuous improvement of the production process (Pawłowski,

Pawłowski, Trzcieliński, 2010). The Polish Lean Management Association defines "lean" as: "waste elimination and creating greater value for the customer. Lean is good, common-sense management that, through lasting changes in organizational culture, people's behavior, and the use of useful tools, increases productivity. Lean helps build and maintain competitive advantage, effectively supporting both classic competitive strategies: cost leadership and market differentiation" (Polish Lean Management Association, 2023).

Table 1.
Principles, methods, and tools of lean management

Principles	Just-in-Time	Jidoka
Methods	Standarization	Visual Management
Tools	5S, VSM, SMED, TPM, Kaizen, Kanban, Problem solving, 5 Why	

Source: Own elaboration (Modig, Ahlstrom, 2013).

The Lean Manufacturing system offers many methods and tools that can be implemented in an enterprise depending on needs. All influence the elimination or reduction of losses. It's worth noting here the division of commonly known LM solutions into (Modig, Ahlstrom, 2013): principles, methods, and tools.

Seven Wastes in Lean Logistics

In Lean Logistics, similar to the general Lean philosophy, seven main types of waste (Japanese: "muda") are distinguished. However, in the logistics context, they take on a specific form adapted to supply chain processes:

1. **Overproduction**
   Examples: Ordering too much material or products than needed. Excessive inventory in warehouses, too frequent deliveries of small quantities of goods, transport of empty or partially loaded vehicles.
2. **Waiting**
   Examples: Idle periods when materials, information, or documents wait for processing. Waiting for customs documents, vehicle downtime waiting for loading/unloading, delays in information flow.
3. **Transport**
   Examples: Unnecessary movement of materials and products. Non-optimal transport routes, multiple movements of goods in the warehouse.
4. **Over-processing**
   Examples: Performing unnecessary activities that do not add value. Unnecessary repackaging, excessive documentation, multiple checking of the same goods.

5. **Inventory**
   Examples: Excessive warehousing of materials and products. Maintaining too high safety stock levels, inefficient warehouse management, unsynchronized deliveries with actual demand.
6. **Unnecessary Motion**
   Examples: Unnecessary employee movements during logistics tasks. Non-ergonomic order picking stations, inefficient goods placement in the warehouse, lack of appropriate tools.
7. **Defects/Errors**
   Examples: Errors in logistics processes requiring corrections. Wrong deliveries, damage during transport, inaccurate order picking, documentation errors.

In summary, it should be emphasized that Lean Logistics represents the application of Lean principles specifically in the area of logistics and supply chain, focusing on eliminating waste in transport, warehousing, and distribution processes, while Lean Management encompasses a broader range of all business processes in the organization.

4. Lean Logistics Project in the Automotive Industry – Case Study

4.1. Research Methodology

This study employed a comprehensive case study methodology focusing on the automotive industry due to its advanced lean logistics practices and complex internal material flow systems. The automotive sector was selected as the research environment for several strategic reasons. First, it represents one of the most advanced industries in terms of lean logistics implementation, providing an ideal setting for identifying both best practices and improvement opportunities. Second, the automotive industry's complexity in internal logistics operations offers sufficient variety to generate meaningful insights applicable to similar industrial environments.

The selected company operates multiple production halls with highly developed internal logistics systems, employing over 30 workers directly involved in internal logistics processes. This scale ensures sufficient complexity and variety in logistics operations while maintaining practical relevance for industrial applications. The company's size and operational scope provide an appropriate balance between complexity needed for comprehensive analysis and manageability required for detailed investigation.

The analysis was conducted by a team of two lean logistics experts over a five-day period, ensuring thorough examination of logistics processes across different operational conditions. The research team employed a systematic approach combining direct observation with structured interviews to ensure comprehensive data collection and triangulation of findings. This dual-expert approach enhanced objectivity through cross-validation of observations and independent assessment of identified waste sources.

The observation process was structured around the 3M methodology, focusing on Muda, Muri, and Mura, with particular emphasis on identifying the seven types of waste within internal logistics processes. The experts conducted real-time observations across multiple production shifts to capture variations in logistics performance and identify recurring patterns of waste. Each expert independently recorded observations, with findings subsequently compared and consolidated to enhance reliability and minimize observer bias.

Data collection combined direct systematic observation of logistics processes with structured interviews involving logistics personnel, production workers, and supervisory staff. The methodology incorporated process mapping to visualize current state logistics flows, time and motion studies to quantify waste occurrences, and comprehensive documentation review of existing logistics procedures and performance metrics. This multi-method approach ensured data triangulation and enhanced the validity of research findings.

4.2. Observation Results

The conducted analysis of internal logistics processes revealed a series of operational problems that can be classified as different types of waste in the Lean philosophy sense. The main problem areas included:

Problems related to material flow organization

The analysis revealed significant organizational deficiencies in material flow management. Drivers consistently experienced delays due to unclear goods locations, requiring repeated searches and inquiries about pickup locations.

The absence of designated and properly marked storage areas compounded these difficulties, forcing drivers to independently search for materials across production halls, tool warehouses, and various non-standard locations. Additionally, improper pallet placement frequently blocked access to shelves, creating further obstacles to efficient material flow.

Figure 2. Improper place for storing pallets with material.

Source: Own elaboration.

Figure 3. Improperly marked delivery location.

Source: Own elaboration.

Communication and organizational problems

Communication inefficiencies emerged as a significant source of operational disruption throughout the logistics processes. During a two-hour observation period, individual drivers received ten work-related phone calls, indicating poor information flow and planning coordination. The practice of conducting business communications through private mobile phones further highlighted the absence of standardized communication protocols.

The logistics operation suffered from an excessive number of pickup and delivery points for materials, creating complexity that necessitated frequent conversations between logistics workers and other departments to clarify locations, priorities, and requirements.

This constant need for verbal coordination suggests fundamental gaps in information systems and work standardization, forcing drivers to spend considerable time seeking clarification rather than performing value-adding transportation activities.

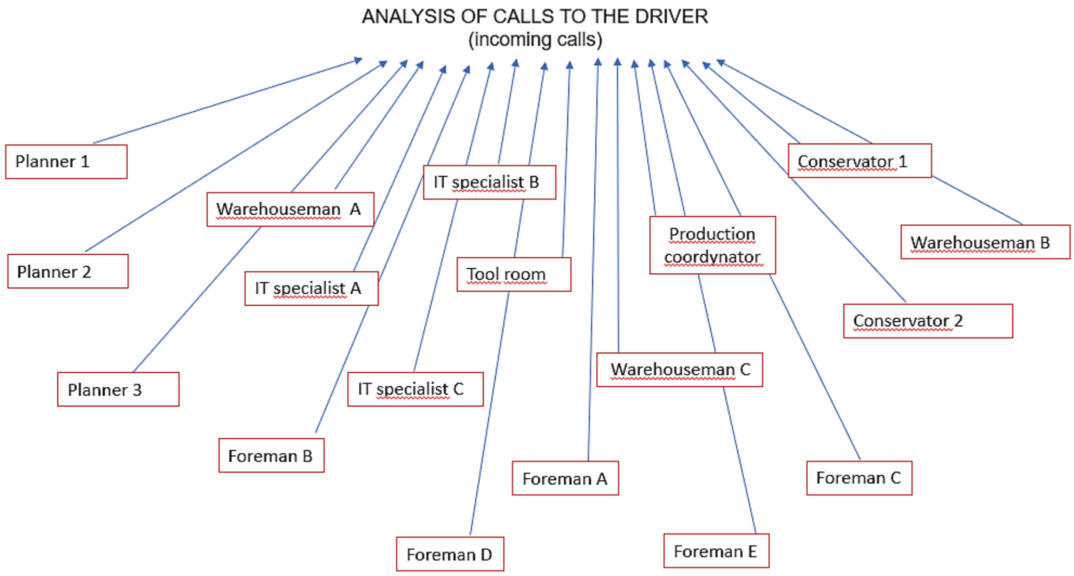


Figure 4. Incoming calls to logistics employee (driver).

Source: Own elaboration.

Problems with supporting processes

Supporting processes revealed several critical inefficiencies that significantly impacted overall logistics performance. Truck unloading operations experienced unnecessary downtime, particularly when drivers had to wait for forklift availability, indicating poor resource coordination and scheduling between logistics and warehouse operations.

Administrative burden further reduced operational efficiency, as drivers spent considerable time on transport documentation, suggesting potential over-processing waste in administrative procedures. Most fundamentally, the absence of clear work standards created systematic operational uncertainty throughout the logistics processes.

Without written instructions describing optimal routes or standardized material pickup schedules, drivers were forced to rely on personal experience and improvisation, leading to inconsistent performance and increased variability in service delivery times.

Figure 5. Vehicle with goods waiting for forklift arrival.

Source: Own elaboration.

4.3. Waste Analysis According to Lean Classification

The identified problems can be classified according to waste types in Lean Logistics.

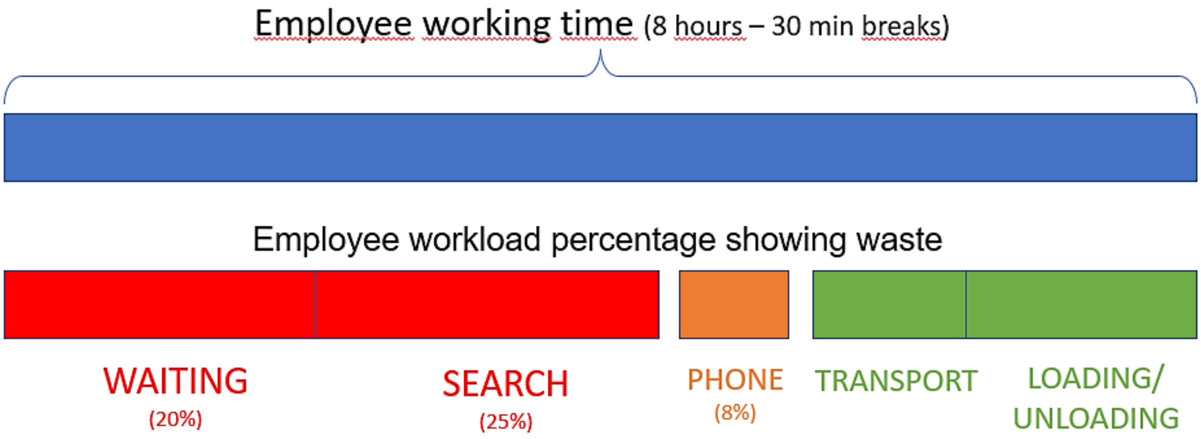
Table 2.
Detected waste

1. Waiting
• Waiting for forklifts to become available
• Time spent searching for the right materials
• Downtime due to lack of clear information about the location of goods
2. Movement
• Drivers moving around multiple times in search of materials
• Lack of ergonomic organization of workstations
• Inefficient distribution of materials in different locations
3. Transport
• Suboptimal routes due to lack of standards
• Unnecessary movements due to lack of storage location markings
4. Overprocesing
• Excessive time spent on documentation
• Multiple checks of the same information
• Duplicate checks
5. Other waste
• Failure to use drivers' knowledge to optimize routes
• Failure to use employees' experience to improve processes
• Employees do not participate in training and do not develop their competences

Source: Own elaboration.

Percentage share of waste in processes.

Table 3.
Work division with identified waste



Source: Own elaboration.

4.4. Solution Proposals Based on Lean Logistics Tools

Based on the conducted analysis, a comprehensive improvement strategy utilizing established Lean Logistics tools was developed to address identified waste sources. The proposed solutions focus on systematic implementation of foundational lean methods to eliminate the primary waste categories identified in the study.

The implementation of a 5S system forms the cornerstone of the improvement strategy, beginning with designation and marking of permanent places for bringing and storing materials. This systematic approach extends to standardization of tool and equipment locations, including vehicles, forklifts, and order cards, ensuring consistent placement and easy retrieval. The 5S implementation incorporates visual management principles through systematic marking of workstations and storage places, creating immediate visual clarity for all logistics personnel.

Work standardization represents a critical improvement area, requiring development of written instructions that describe optimal transport routes supported by clear diagrams. These standardized procedures include establishment of material pickup schedules from individual stations, eliminating the current ad-hoc approach that generates waiting and search waste. The standardization effort extends to communication procedures, providing clear protocols that reduce the excessive phone communications currently disrupting operations.

Visual management enhancement involves introduction of comprehensive marking and information board systems throughout the logistics area. Color coding systems for different material types will reduce search time and eliminate confusion, while electronic information boards displaying current tasks will improve information flow and reduce verbal inquiries. A work progress monitoring system providing real-time status information will further enhance operational visibility and coordination.

Information flow improvement focuses on centralizing communication through radio systems or mobile applications, replacing the current fragmented approach using private phones. The systematic elimination of private phone usage, coupled with proper enforcement of existing policies, will reduce communication-related disruptions. Implementation of an electronic order management system will streamline information flow and reduce documentation-related waste, addressing the over-processing issues identified in the current state analysis.

4.5. Discussion

4.5.1. Comparison with Previous Research

The findings of this study align with existing literature on waste identification in manufacturing environments. The dominance of search/unnecessary motion waste (25%) and waiting waste (20%) identified in our research corroborates the foundational work of Antosz, Pacana, and Stadnicka (Antosz, Pacana, Stadnicka et al., 2013), who identified waiting time and unnecessary motion as prevalent forms of industrial muda in Polish manufacturing. Our study extends these findings by providing specific quantification within automotive logistics contexts.

The waste distribution patterns observed align with the theoretical framework established by Womack and Jones (Womack, Jones, 2003), particularly their emphasis on identifying value-adding versus non-value-adding activities. The finding that 65% of observed activities constituted waste confirms their assertion that most organizational processes contain significant improvement opportunities through lean implementation.

Recent research by Braglia et al. (Braglia, Di Paco, Frosolini, Marrazzini, 2024) emphasized the research gap in lean logistics tools for internal environments, particularly noting that most studies focus on serial production contexts rather than complex internal logistics flows. Our study directly addresses this gap by providing empirical evidence of waste patterns specifically within automotive internal logistics processes.

4.5.2. Theoretical and Practical Implications

This research confirms the applicability of the traditional seven wastes framework, originally developed by Ohno (Ohno, 1988) and later systematized by various authors (Burchart-Korol, Furman, 2007; Antosz, Pacana, Stadnicka et al., 2013), to internal logistics processes. However, our findings suggest that waste distribution patterns in logistics differ from those typically observed in production environments, with waiting and motion waste being more prevalent than inventory-related waste.

The study validates the theoretical importance of work standardization and visual management as foundational lean methods (Modig, Ahlstrom, 2013). Organizations lacking systematic standardization exhibited significantly higher levels of waste, supporting Modig and Ahlstrom's (Modig, Ahlstrom, 2013) framework that positions standardization and visual management as core lean methods rather than tools.

From a practical perspective, the methodology developed provides logistics managers with a systematic approach for waste identification using established lean principles. The successful application of direct observation combined with the 7 Muda framework offers practitioners a proven assessment tool, addressing the need for practical lean logistics implementation guidance noted in recent literature (Braglia, Di Paco, Frosolini, Marrazzini, 2024; Pizoń, Wójcik, Gola, Kański, Nielsen, 2024, pp. 213-230).

4.5.3. Research Limitations and Future Directions

The single-company case study design limits generalizability, though the systematic methodology remains transferable to similar industrial environments. Future research should examine waste patterns across multiple automotive manufacturers to validate these findings and explore integration of digital technologies with traditional lean tools, particularly as Industry 4.0 adoption accelerates in manufacturing environments (Pizoń, Wójcik, Gola, Kański, Nielsen, 2024, pp. 213-230).

The observation period represents a temporal snapshot of operations, and extended studies would strengthen understanding of waste pattern variations across different operational conditions. Additionally, comparative analysis between organizations with varying lean maturity levels would enhance understanding of lean logistics implementation effectiveness.

4.6. Conclusions

This research contributes to lean logistics knowledge by providing empirical evidence of waste patterns in automotive internal logistics. The case study confirms theoretical assumptions regarding waste occurrence while revealing specific patterns characteristic of organizations lacking systematic lean implementation.

The investigation demonstrates that waiting and unnecessary motion waste dominate internal logistics operations, constituting the largest share of work time and directly impacting process efficiency. This finding extends existing lean theory by quantifying waste distribution specifically in automotive logistics contexts. The root cause analysis reveals that lack of work standardization represents the primary driver of these inefficiencies, confirming the fundamental importance of standardization in lean philosophy.

From a practical perspective, the research demonstrates that identified problems can be addressed through basic lean tools, particularly 5S methodology and visual management systems. However, the study reveals that isolated improvement actions yield limited results without comprehensive lean logistics implementation. This finding has significant implications for manufacturing managers, indicating that successful transformation requires systematic approach rather than piecemeal interventions.

The methodology developed through this research provides a replicable framework for waste identification in similar industrial environments. The systematic application of direct observation combined with the 7 Muda framework proves effective for revealing logistics inefficiencies, offering practitioners a structured approach for lean assessment.

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