Logistics and Supply Chains Through the Game

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In today's dynamic world, logistics and supply chains are key to the functioning of society and the economy. Games and simulations offer an interactive approach and allow participants to explore and develop logistics concepts and solutions for improvement. Focused on overcoming key logistics challenges, these games encourage innovation and waste recognition. In the context of supply chains, the games show the complex connections between different nodes and the challenges that arise due to potential disruptions. Among the popular games we can find the Beer distribution game, Paper or lego airplane game, Scum ball Game or Marshmallow Challenge. Through the tekst, we find that games and simulations are a valuable tool for researching and improving logistics and supply chains and greatly contribute to a better understanding of the key processes of the modern way of life.

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1 Introduction

Logistics, defined as the process of planning, organising, managing, and controlling the flow of resources (materials, people, information, energy, capital, and knowledge), plays a vital role in modern life. By systematically managing these flows, value is added to the final product or service, satisfying end-users and enhancing organizational efficiency and success. In essence, logistics directs the movement of the key components that support both business operations and consumer experiences.

The importance of logistics can be seen in three key aspects. First, consider its value relative to gross domestic product (GDP). According to Statista (2023), the global logistics industry—one of the backbones of international trade—was worth over €8.4 trillion. In 2020, global logistics costs rose to $9 trillion, accounting for 10.7% of the world's GDP ($85.24 trillion that year).

Efficient logistics management is crucial for reducing costs associated with transportation, warehousing, inventory control, and other critical areas. Optimizing these processes enables companies to cut expenses, allocate resources more effectively, and gain a competitive market edge.

The second aspect of logistics' importance lies in its role in creating value. By reducing costs and providing high-quality services that overcome the constraints of time and space, logistics has a direct influence on customer satisfaction. Enhancing the user experience through timely and efficient deliveries, accurate order fulfillment, and reliable after-sales services demonstrates the value that logistics brings to both businesses and consumers.

The third aspect is logistics' central role in enabling a wide range of economic activities. It forms the backbone of global trade by facilitating the movement of raw materials, intermediate goods, and final products across regions. As Waters (2003) states: nothing is produced, no material is moved, no operation is performed, no product is delivered, and no customer is served without logistics.

Given the significant impact of logistics on the economy and daily life, understanding its principles is essential. Individuals with logistics knowledge can manage the flow and connections within supply chains more effectively, reduce

costs, and improve operational efficiency. Additionally, studying logistics develops critical problem-solving skills and the ability to navigate complex logistics challenges, making professionals valuable across various industries.

An increasingly effective way to learn about logistics and supply chains—which are closely interconnected —is through games and simulations. These methods offer an interactive approach, allowing learners to engage with simulated logistics scenarios and gain a stronger grasp of theoretical concepts. Participating in logistics-based games fosters critical thinking, decision-making skills, and a deeper understanding of the complexities of logistics processes. This better learners for the dynamic and demanding logistics environments of the real world.

The following sections explore the key features of logistics and supply chains and highlight the importance of integrating games and simulations into logistics education. Several specific examples of games used to better understand logistics concepts and their practical applications are also presented.

2 What is Logistics

As stated in the introduction, logistics is the process of managing the flow of resources in a way that adds value to the final product—satisfying the end user—and enhances the efficiency and success of an organization. Its crucial role in the modern world has already been highlighted; we will now summarize its key tasks and objectives.

2.1 Core Function

To better understand the importance of logistics in both the global context and our daily lives, it is essential to highlight its core function. Logistics is most commonly defined as the function that bridges the gap between supply and demand. These gaps can be categorized as spatial, temporal, quantity, diversity, and information gaps.

- The **spatial gap** refers to the physical distance between suppliers of resources and the end users.

- The **temporal gap** occurs when there is a time difference between the availability of a resource (product or service) and the customer's need or desire to use it.
- The **quantity gap** arises when there is a mismatch between the quantity available and the quantity desired by the customer.
- The **diversity gap** occurs when customers expect a greater variety of products than what is currently offered—either from a single supplier or across multiple providers.
- The **information gap** reflects the difference between the information customers seek and the information accessible from the supplier's side, and vice versa.

Addressing these gaps lies at the core of logistics. The essential question is: how can these gaps be bridged as effectively as possible? This leads to the primary goal of logistics—to ensure that the right product, in the right quantity, in the right condition, at the right place, at the right time, for the right customer, at the right cost, and with the right environmental impact is delivered.

But what does "right" actually mean? It is defined by the customer (e.g., buyer, or end user), whose expectations and requirements can vary depending on the context. As such, logistics must be organized in a way that consistently meets or exceeds these expectations, both within the organization and in interactions with external partners.

2.2 Finding Ways to Overcome Gaps – The 8 Wastes in Logistics

Further exploration of logistics reveals that processes must be executed in a way that consistently meets—or exceeds—customer expectations. This is achieved by creating value from the customer's perspective, primarily through overcoming the previously mentioned gaps and eliminating the inefficiencies or "wastes" in the process.

A commonly referenced concept in this context is the eight wastes in logistics, derived from the Kaizen philosophy, which emphasizes continuous improvement and the elimination of non-value-adding activities. These eight wastes are:

1. **Overproduction** – Producing or stocking more than is needed can be financially and operationally inefficient.
2. **Excessive movement and handling** – Unnecessary movement during transport and storage wastes time and energy.
3. **Waiting** – Delays caused by waiting for materials, products, or information reduce overall efficiency.
4. **Unnecessary transportation** – Extra transport increases costs and prolongs delivery times.
5. **Over-processing** – Unneeded or overly complex processes consume time and resources.
6. **Underutilized human potential** – Failing to use employees' knowledge, skills, and abilities may limit the organization's performance.
7. **Errors and defects** – Mistakes, rework, and defective products waste both time and materials.
8. **Overproduction** – Repeated deliberately because it often leads to or exacerbates other forms of waste.

Identifying and eliminating these wastes is key to improving logistics performance, reducing costs, enhancing quality, and increasing customer satisfaction.

3 Logistics and Supply Chains

When we talk about logistics, we cannot overlook the concept of the supply chain. The two are closely linked with the supply chain representing a broader perspective in which logistics plays a central role. The main focus of the supply chain concept is on interconnection, collaboration, trust, and the coordinated functioning of all participants within the chain.

A supply chain (SC) is a complete network of entities—both directly and indirectly involved—that work together to serve the same customer or end user. It begins with raw materials and ends with the final customer who uses the product, linking numerous companies along the way (CSCMP, 2025).

The structure of the supply chain includes key flows that connect different stakeholders through various processes and functions, all the way to the end-user. These flows begin with the initial supplier and continue through to final delivery to

the customer. Importantly, the final user is considered an integral part of the supply chain.

The main flows that form a supply chain are:

- Material and service flow – This mostly runs from suppliers to producers, distributors, and retailers, and finally to end customers. A reverse flow includes product returns, servicing, and disposal of waste.
- Information flow – supports the transmission of orders and coordination of the material flow. It also ensures product traceability.
- Financial flow – flows in the opposite direction to the product flow and ensures payment settlement for goods and services exchanged between supply chain members.
- Knowledge flow – usually flows both ways, such as in the exchange of experience or collaborative research and development.

These flows move between individual actors (also referred to as nodes, entities, or tiers) connected with the purpose of fulfilling the needs of the end-user. Key actors in the supply chain include:

- end customer (consumer);
- retailer;
- distributor or wholesaler;
- manufacturer;
- supplier.

The supply chain can be further extended to include service providers, which encompass a wide range of companies offering services related to the supply chain. These services include transport, warehousing, finance, market research, product development, technology, insurance, public services, sustainability, and reverse logistics. It is important to note that not all tiers are present in every supply chain.

A third critical element of the supply chain is the set of organizational processes that link the various actors into a chain and generate the previously mentioned flows.

Key processes include:

- planning;
- procurement (sourcing);
- production;
- sales and distribution;
- reverse logistics.

4 Role of Games in Understanding Logistics and Supply Chains

Game- and simulation-based learning has gained significant traction across many fields over the past 15 years, including in logistics and supply chain management. This approach involves a variety of so-called *serious games*, which incorporate different methods and media types. Most commonly, these include board games, role-playing games, card games, LEGO-based activities, sports-inspired games, or digital simulations (William et al., 2018).

Games have a strong potential to enhance traditional forms of education (Ruben, 1999). As emphasized by Pacheco-Velazquez et al. (2023), new generations of learners require educators who understand their audience and use diverse teaching methods that actively engage students in the learning process. Similarly, Monaco and Martin ((2007) found that students prefer to play an active role in their learning, while methodologies based solely on one-way information transfer are neither enjoyable nor creative.

Workshops and lectures that incorporate game-based activities provide participants with instant feedback and freedom to explore the subject matter, as pointed out by Vanany & Syamil (2016).

A growing body of literature emphasizes the benefits of using games in education (Hou, 2015; Pacheco-Velazquez idr., 2023; William idr., 2018). These include:

- encouraging active or action-based learning;
- enhancing learning and understanding of complex content;
- increasing engagement, motivation, and problem-solving capabilities;

- improving decision-making skills and fostering the development of social competencies;
- promoting better understanding and learning scientific concepts.

Games offer hands-on experience, requiring players to plan strategies, apply knowledge and skills in a simulated environment, and respond to the consequences of their decisions. This approach helps learners more easily translate theoretical knowledge into practical applications.

The added value of using games in education is also evident in the field of logistics and supply chains.

Games support active learning, enhance understanding of complex logistics concepts, and boost engagement, motivation, and problem-solving skills, all of which are critical in the fast-paced logistics environment.

Moreover, games help players grasp the intricate interconnections within supply chains, as they develop strategies, make decisions, and adapt to outcomes in simulated environments. A wide variety of games, tailored to different generations and levels of prior knowledge, creates numerous possibilities for effectively integrating game-based learning into educational settings.

In the next section, we will explore specific examples of games that can be used in various educational contexts.

5 Game Examples

5.1 The Beer Distribution Game

The Beer Distribution Game simulates material and information flows within a production–distribution system. Its purpose is to demonstrate supply chain management principles and the bullwhip effect—a phenomenon related to the transmission of information as it moves along the supply chain. Developed in the 1960s at MIT, this is one of the most well-known logistics games. It was originally designed to help students, managers, and executives visualize the challenges of

managing dynamic systems–in this case, a supply chain delivering beer from a brewery to the final customer.

The game's core objective is to explore human behavior in managing supply chains, emphasize the importance of information sharing, and demonstrate how distribution operates in a supply network ((Mitraa, 2020). Initially created to explain system dynamics, it has since become a widely used tool for illustrating the functioning of supply chains. It is most commonly used to:

- demonstrate the bullwhip effect;
- show how individual parts of the system influence each other;
- highlight the differences between individual and systemic thinking:
- illustrate optimization strategies and the value of information systems.

What makes the game so interesting and useful is that, although the supply chain structure and rules are simple, the resulting behavior is highly complex. The Beer Game is also well documented in the literature (Grasl, 2015).

The goal of the game is to minimize the total costs of the supply chain. The standard version involves four players: a retailer, wholesaler, distributor, and beer producer. Customer demand originates at the retail level, which is restocked from the wholesaler, who orders from the distributor, who in turn orders from the producer. Each period, players decide how much to order, and the brewery decides how much to produce.

There are lead times for both production and shipping. While materials move from production toward the customer, information flows in the opposite direction. Delays occur between placing an order and the supplier receiving it—both in terms of order processing and information flow.

The game can be played in about 90 minutes, with a minimum of four players, though it is possible to run multiple groups simultaneously (see Figure 1.1).

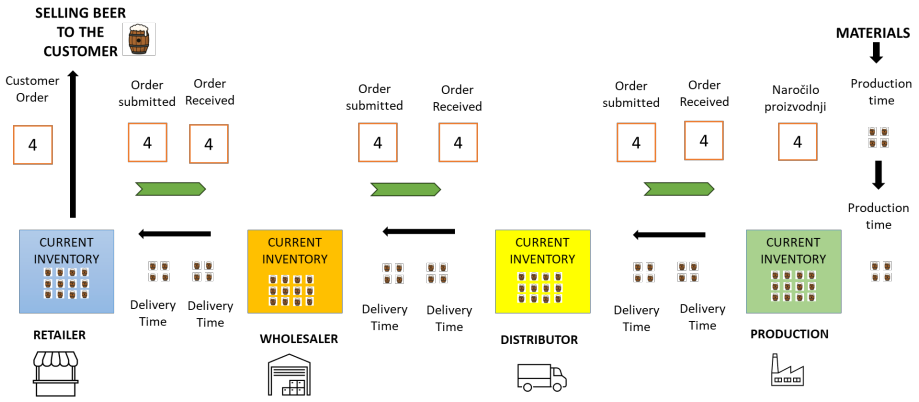

Figure 1.1: Beer Game playing board
Source: own source

5.2 The Ball Game

The Ball Game focuses on improving processes that address spatial and temporal gaps–two of the fundamental challenges in logistics. It encourages lean and agile process design, with an emphasis on waste elimination and continuous improvement, in line with the Kaizen philosophy.

Skills and tools developed through this game include:

- communication;
- continuous improvement;
- flow;
- PDCA (Plan, Do, Check, Act);
- SCRUM approach;
- teamwork;
- the eight types of waste in logistics.

This game can simulate almost any process–from transport and warehousing to customer service. The ball represents a task, and its movement represents the transfer of responsibility between team members.

Goal: Pass as many balls as possible from point A through the team and back to point A in two minutes. Alternatively, participants can measure how long it takes to process a set number of balls. Common props include tennis balls, ping pong balls, or lightweight plastic balls.

The game can be played by a single group or multiple teams.

Adding a storyline enhances engagement. For example, the team produces magic spheres, which only gain their magic after being touched by each person in the team. If two people touch the ball at the same time, the magic is lost. Additionally, magnetic forces prevent team members from passing the ball directly to their immediate neighbor. The person who starts/ends the process represents the customer, who wants the magic added to the balls. This narrative makes the rules more understandable and the activity more enjoyable (see Figure 1.2).

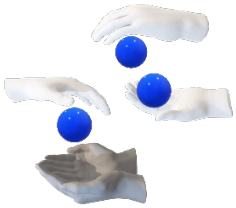

Figure 1.2: The Ball Game
Source: own.

The game can be tailored to different audiences: primary school students, high school students, university students, or organizational teams. Adaptations should reflect the group's age and prior knowledge of logistics, supply chains, or lean processes, with explanations adjusted accordingly.

5.3 Building an Airplane

This game involves assembling an airplane using either paper or LEGO bricks.
One version of the game includes four workstations with uneven task distributions, intentionally creating a bottleneck (e.g., at station three).

Both approaches explore lean production concepts, focusing on push vs. pull systems, as well as flow time, cycle time, quality, workload distribution, and the identification of logistical waste.

The objectives include demonstrating how lean methods reduce waste–especially through minimizing inter-stage inventory and lead time–by applying techniques such as pull production, Kanban, bottleneck analysis, cycle time optimization, line balancing, and observing worker behavior in operational settings.

One version of the game includes four workstations with uneven task distributions, intentionally creating a bottleneck (e.g., at station three).

The simulation progresses through several steps.

- Step 1: Each participant builds an airplane individually.
- Step 2: Tasks are assigned to workstations; this illustrates the push process, where each person works as long as there is material, without considering inventory buildup.
- Step 3: The process is redesigned so that only one airplane is built at a time, reducing inventory and lead time and highlighting the benefits of lean and Kanban.

You can make the game more engaging by introducing airplanes of different colors to simulate changing customer demand. Adding a quality control step further enriches the simulation.

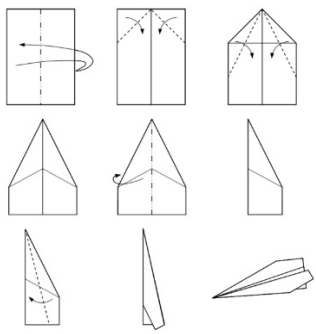

Figure 1.3: Example of paper airplane production
Source: (Čerin, 2013)

The game typically takes 20 to 90 minutes and requires at least four players (see Figure 1.3).

5.4 LEGO Construction Game

The LEGO Construction Game simulates logistics processes within a supply chain. illustrating the challenges of overcoming spatial and temporal gaps. The goal of the game is to reconstruct an object identical to the one specified by the customer, using various supply chain actors.

The game can be played in several variations. In one version a participant takes on the role of customer needs researcher, who observes a pre-built LEGO structure (representing the customer's requirement) and communicates its composition down the chain. Other participants assume roles such as retailer, wholesaler, distributor, manufacturer, or supplier–or even internal business roles like salesperson, designer, producer, or warehouse manager.

Through this game, players can explore disruptions and communication breakdowns that commonly occur within the supply chain.

5.5 The Marshmallow Challenge

The well-known Marshmallow Challenge tasks players with building the tallest possible free-standing structure in 18 minutes using spaghetti, tape, string, and a marshmallow, which must be placed on top.

This game encourages:

- out-of-the-box thinking;
- teamwork;
- the PDCA approach;
- problem-solving under constraints;
- group communication and leadership dynamics;
- collaboration, innovation, and strategic planning.

It teaches a lean mindset for managing risks and shows the value of continuous experimentation to reduce waste (see Figure 1.4).

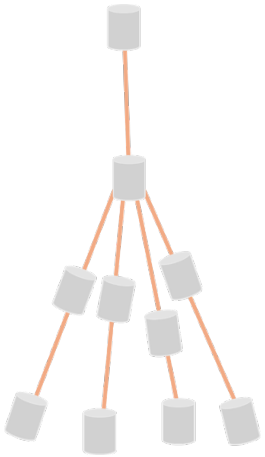

Figure 1.4: The Marshmallow and Spaghetti Tower Game
Source: own.

5.6 Paper Chain Game

This game focuses on how teamwork and organization affect the final outcome of a process. It emphasizes reducing process time (temporal gaps), improving information flow (informational gaps), meeting customer needs, and minimizing waste in logistics. Participants work together to create a chain of paper rings, learning how collaboration impacts process efficiency.

5.7 Walking Across the Galaxy

In this game, players use paper plates to cross a designated space from point A to point B, simulating the challenge of overcoming spatial gaps.

Rules:

- Players may only step on the paper plates.
- If no one is standing on a plate, it "flies off into space."

– At first, each player receives a certain number of plates (e.g., three), but this number is gradually reduced over time—simulating supply chain disruptions.

The game can be adapted to suit different age groups and learning levels.

5.8 5S Method Simulation

This word game simulates the 5S method, commonly used to design highly organized work environments. Players use number-based tasks to experience the five stages of 5S and learn how the method supports continuous improvement in logistics and operations (see Figure 1.5).

Figure 5.5: 5S Method Simulation Game
Source: own source

5.9 Drawing a Pig or Fish

This game demonstrates the importance of process standardization and the pursuit of continuous improvement, which are core principles in lean logistics. The objective is to draw a standardized pig or fish. Each participant receives a sheet with a grid and written or oral instructions on how to draw the standard figure. The game illustrates how clear standards and instructions influence process outcomes (shown in Figure 1.6).

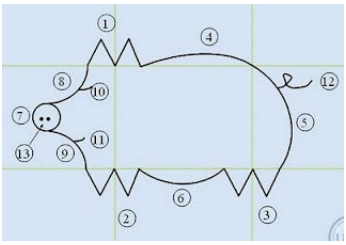

Figure 1.6: Standard Pig Game
Source: (Standard Pig, n. d.)

These are just a few examples of the many games available to explore logistics and supply chains. Literature offers a wide variety of similar games that, in addition to being fun, provide practical learning opportunities to improve efficiency in logistics and supply chains.

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