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Innovation and Sustainability in Barilla's Supply Chain: The Adoption of the CHEP Pallet Pooling Model

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Abstract

This master's thesis explores the logistical and strategic renewal undertaken by Barilla S.p.A., which in 2025 began the transition from the traditional EPAL pallet management system to a pallet pooling model developed in collaboration with CHEP, a world leader in shared logistics and the circular economy.

This project represents a significant turning point for the company, not only operationally but also culturally: logistics becomes a field of innovation, capable of combining efficiency, sustainability and strategic vision, fully in line with the values that guide the history and identity of the Barilla brand.

This paper aims to analyse the motivations, process and implications of this transformation, demonstrating how the transition to a shared system not only responds to technical optimisation needs, but also represents a paradigm shift in supply chain management, based on principles of responsibility, collaboration and circularity.

The paper opens with a first chapter dedicated to outlining the theoretical and historical framework of pallet pooling within contemporary logistics. This section illustrates the evolution of handling systems and the structural differences between the EPAL interchange model and the pooling model, highlighting the management limitations of the former and the advantages of the latter in terms of efficiency and sustainability.

This is followed by an in-depth analysis introducing CHEP as a key player in this change: from its inception to its establishment as a global network, to the definition of the “share & reuse” model, which reduces waste, extends the life cycle of materials and digitises flow control.

The next section offers an overview of the Barilla group, tracing its evolution from a family business to an international company and analysing its production structure, brand portfolio and distribution network. Particular attention is paid to the growth of the company's identity, increasingly oriented towards values of authenticity, responsibility and sustainable innovation, which made the choice of a regenerative and shared logistics model a natural one.

The central part of the work explores the transition to the CHEP model, describing the starting point, the critical issues of the EPAL system and the main stages of implementation. It illustrates how Barilla planned the conversion of its logistics network, integrating digital

systems, automated warehouses and external partners (including co-packers and packaging suppliers) into a unique and collaborative ecosystem based on control, traceability and the reduction of inefficiencies.

The analysis then focuses on the economic and operational results of the transformation. Although the project is still ongoing, the data collected and the available projections show a tangible improvement in terms of cost reduction, streamlining of flows and increased warehouse productivity. Greater pallet standardization and simplification of administrative processes contribute to creating a more streamlined, reliable and integrated system.

In the last part, the thesis examines the environmental and strategic impacts of the project, highlighting how the pooling model reduces CO_2 emissions, limits wood consumption and decreases waste production. These results not only strengthen Barilla's sustainable positioning, but also offer a long-term perspective for Italian logistics, promoting the spread of more collaborative practices and shared management standards.

The research is based on an extensive documentary and bibliographic analysis, including company sources, sustainability reports and academic literature in the sector, supplemented by comparisons with similar cases at European level. This approach has made it possible to combine theoretical soundness with an applied vision, providing a complete picture of the complexity of the project and its strategic value.

In conclusion, the transition to the pallet pooling model represents much more than a logistical evolution for Barilla: it is a process of corporate and cultural transformation that combines innovation, sustainability and competitiveness. It is an example of how a large company can rethink its supply chain not only to improve performance, but also to generate shared value and make a concrete contribution to building a more responsible and circular future.

Chapter 1 The Pallet Pooling Concept in Global Logistics

1.1 The Evolution of Pallet Management in Logistics

The pallet, a seemingly simple wooden platform, has played a transformative role in logistics since its introduction in the early twentieth century. Initially developed to simplify the loading and unloading of goods, pallets soon became essential to the growth of modern distribution systems. By the 1960s, with the spread of supermarkets and the development of automated handling equipment, pallets had established themselves as an indispensable part of global supply chains [1].

Over the decades, different models of pallet management have emerged. In Europe, the most widespread solution for many years was the EPAL exchange system, where standardized pallets (800x1200 mm) circulate within an open network and are returned in equal quantity and quality. Alongside this traditional model, however, new solutions began to take shape in response to growing demands for efficiency, automation, and sustainability. Among these, the pooling system has emerged as a leading practice, turning pallets from assets owned by individual companies into shared resources managed by specialized providers [2].

Figure 1.1 - Pallet EPAL 800x1200mm

1.2 The EPAL Exchange Model: Strengths and Weaknesses

The EPAL system was born in the railway sector and progressively expanded across Europe, eventually reaching an estimated circulating stock of nearly half a billion pallets. Its strength lies in interoperability: companies can use pallets across borders without changing ownership, which historically simplified transport operations and reduced costs in fragmented supply chains.

Two main modalities characterize the exchange process:

- Direct exchange (*pallet for pallet*): at the time of delivery, the carrier returns an equivalent number of empty pallets of the same quality.

- Deferred exchange with pallet notes: if immediate return is not possible, a “pallet voucher” is issued to guarantee future restitution, usually within three months.

While effective in many contexts, this system has several limitations. Companies must dedicate resources to the administrative reconciliation of vouchers, which increases complexity and costs. The transport of empty pallets also generates additional expenses and environmental impact, especially when return trips are only partially loaded. Moreover, the variability in palle[1]t quality can cause problems in automated warehousesand with AGV (Automated Guided Vehicle) / LGV (Laser Guided Vehicle)[1] handling systems, forcing companies to invest in inspection equipment or purchase higher-grade pallets [3].

Studies conducted in the European retail and manufacturing sectors estimate that the average cost per pallet cycle in EPAL exchange exceeds €2, when accounting for returns, losses, repairs, and administrative costs. These inefficiencies, coupled with sustainability concerns, created the foundation for the development of alternative models [4].

1.3 The Emergence of Pallet *Pooling* as a New Model

Over time, the traditional EPAL exchange model, despite its widespread use, began to show limitations that were difficult to reconcile with the demands of modern supply chains. The rapid growth of international trade, the diffusion of automated warehouses, and the increasing pressure to reduce environmental impact all created the need for a more efficient and sustainable alternative. It was in this context that the pooling system gained momentum.

The idea behind pooling is simple but innovative: instead of each company owning its own pallet pool, a specialized provider (commonly referred to as a *pooler*) retains ownership and manages the entire cycle [5]. Companies therefore do not buy pallets but rent them on demand, paying a fee based on factors such as time of use, transport distance, and logistics complexity. This marks a significant shift in accounting terms as well: what was previously a capital expenditure (CAPEX) for pallet purchase and maintenance becomes an operating expense (OPEX) for a service, providing companies with greater financial flexibility [6].

Pooling also transforms the operational side of pallet management. The provider delivers empty pallets of guaranteed quality to the manufacturer, who uses them to ship products to retailers

[1] AGV (Automated Guided Vehicle) or LGV (Laser Guided Vehicle): these are self-guided vehicles that move within a predefined work area without direct operator intervention. AGVs follow paths traced by magnetic tapes or cables, while LGVs use laser-based systems.

or distribution centers. Once the goods are unloaded, the provider organizes the collection of empty pallets, which are sent to the nearest service center for inspection, repair, and sanitization before being put back into circulation. This ensures that every pallet re-enters the system in line with strict technical and safety standards, an aspect particularly crucial for industries such as food and beverage.

The adoption of the pallet pooling model represents one of the most significant transformations in consumer goods logistics today, introducing an approach capable of combining operational efficiency, quality control, and environmental sustainability.

One of the primary distinguishing features of this system lies in the qualitative standardization of pallets. Centralized management of pallets ensures compliance with rigorous technical standards, essential for integration with automated handling systems such as AGVs and LGVs, and for product safety throughout the entire supply chain [7]. Each unit undergoes systematic inspection, maintenance, and repair cycles, thus reducing the discrepancies and risks that characterize traditional exchange pallets, which are often heterogeneous in quality and size.

An additional advantage concerns the reduction of operational complexity. The pooling system eliminates the need to manage pallet vouchers, compensations, and disputes arising from losses or damages, easing the administrative burden and simplifying accounting procedures [7]. This simplification, as reported by GS1 Italy, allows companies to focus on higher value-added activities, improving the fluidity of logistics processes and punctual deliveries.

The pooling model is also characterized by a high level of traceability and digitalization of flows. The main operators in the sector have developed advanced digital platforms – including myCHEP or LPR Connect – that allow for the recording and monitoring of pallet movements in real time, integrating with corporate ERP systems such as SAP [8]. This interoperability offers end-to-end visibility across the supply chain, improving companies' decision-making capacity and reducing the margins of error in handling processes.

From an environmental perspective, pallet pooling represents a strategic choice aimed at optimizing resources and reducing ecological impact. Studies have demonstrated that logistics support reuse systems significantly reduce CO_2 emissions compared to models based on disposable or open-exchange pallets [9]. The centralization of flows and the systematic recovery of supports reduce empty kilometres and wood consumption, favoring a circular model in which each pallet is regenerated and reintroduced into the circuit [8].

However, the introduction of a pooling system also entails significant management challenges. The main one concerns dependence on the service provider, since outsourcing the pallet pool implies an often exclusive contractual relationship, which can limit operational flexibility and impact negotiation margins [7]. Furthermore, the full effectiveness of the model requires complex IT integration between company systems and the provider's digital platforms, a process that can involve initial costs and the need for specific technical skills [8].

The success of pooling depends on collaboration along the entire supply chain. Copackers, packaging suppliers, and end customers must join the system and respect its return rules, so that the circuit remains efficient and sustainable over time [7]. Only through joint participation is it possible to maximize the economic, environmental, and organizational benefits resulting from this shared logistics practice.

Over the years, the pallet pooling model has spread more rapidly in countries characterized by high-volume markets and highly standardized supply chains, such as the United Kingdom, France, Germany, and the United States. In these contexts, the presence of large industrial and distribution entities has favored the adoption of shared logistics support management systems, capable of ensuring efficiency and operational uniformity. In Italy, however, the penetration of pooling has occurred more gradually, reflecting a more fragmented production and distribution structure, composed of small and medium-sized companies and less uniform supply chains. In recent years, however, interest in this model has grown steadily, supported by the growing attention towards more sustainable, digitalized, and collaborative logistics practices along the entire value chain [10].

In recent years, the pallet pooling model has demonstrated an extraordinary capacity for evolution, adapting to the new needs of the market and modern logistics. To meet the growing demand for flexibility in product management, this system has expanded beyond the traditional wooden pallet, also including special-sized supports, such as those measuring 660 × 400 mm, as well as reusable plastic crates, foldable containers, and roll containers [11]. The goal is to ensure increasingly versatile and customizable solutions, capable of adapting even to complex production sectors or those characterized by non-standardized formats.

At the same time, the pooling market is undergoing a phase of strong international expansion, supported by the digitalization of processes, the need to reduce management costs, and increasingly significant pressures regarding sustainability [12]. Companies that choose this model consider it an evolutionary strategy capable of combining operational efficiency,

environmental sustainability, and management simplification, elements that are now essential for competing in increasingly dynamic and interconnected supply chains.

The environmental aspect represents one of the system's most recognized strengths: the possibility of reusing supports and centralizing logistics flows contributes concretely to the reduction of CO_2 emissions and the consumption of raw materials [14]. Each pallet is checked, repaired, and put back into circulation, reducing waste and extending the useful life of materials, in full compliance with the principles of the circular economy.

In this direction, the shared management of supports and the use of digital platforms for tracking movements allow for greater transparency and control along the entire supply chain [14]. Thanks to digitalization, companies can monitor the life cycle of each support in real time, optimizing collection and maintenance times and improving flow planning.

While pallet pooling was originally widespread especially in contexts characterized by high volumes and strong standardization, its application is now also extending to less structured supply chains, driven by the need for leaner, more digital, and more sustainable supply chains. This evolution reflects a broader shift: logistics is no longer just a set of technical operations, but a strategic area in which innovation and sustainability now go hand in hand.

1.4 Main companies supplying pallets with the pooling management model

The pallet pooling market in Europe and globally is dominated by a small number of operators who have transformed a simple logistics activity into a highly structured and technologically advanced service. These companies, known as poolers, manage the entire pallet life cycle: from supply and maintenance to recovery and reintroduction into the circuit, thus offering client companies the opportunity to outsource a complex and costly function.

Among the main players who have established themselves as reference points in the sector are CHEP, LPR (La Palette Rouge), and IPP Logipal. Although they share the same circular economy and reuse logic, each has its own specificities related to geographical scope, volumes handled, and the type of service offered.

1.4.1 CHEP

CHEP (Commonwealth Handling Equipment Pool), controlled by the Australian group Brambles, represents the most structured and recognized company in the world in the pooling

sector [5]. With an active network in over sixty countries and more than 300 million pallets in circulation, the company has built a model based on standardized processes and fully integrated logistics.

CHEP pallets, known for their blue color, have dimensions of 800 × 1200 mm, are compatible with the EPAL standard, and are designed to ensure resistance, safety, and interoperability in automated warehouses. A key element of the system is the widespread presence of proprietary service centers, where pallets are recovered, repaired, and recirculated, thus ensuring uniform quality and operational continuity.

The entire management system is supported by advanced digital tools such as myCHEP, a platform that allows companies to monitor logistics flows, plan deliveries, and optimize usage cycles [5]. CHEP's approach also integrates sustainability as an integral part of the business model: through collaboration with customers such as Coca-Cola, the company has demonstrated that asset sharing can reduce CO_2 emissions related to pallet handling by up to 60% [15].

Figure 1.2 - Pallet CHEP 800x1200 mm

1.4.2 LPR

LPR (La Palette Rouge) belongs to the Euro Pool Group, a leading European group in reusable packaging systems [6]. The company operates mainly in France, Spain, Italy, Germany, Belgium, and the Netherlands, where it manages approximately 100 million pallets each year.

Its offering is based on a full-service model that includes pallet delivery to the customer's production or distribution centers, subsequent collection from stores, and reconditioning at LPR's warehouses.

LPR is easily identifiable by the red color of its pallets, synonymous with quality and market recognition. All pallets are regularly inspected to ensure their integrity and safety. On a technological level, the company has developed LPR Connect, a digital platform that enables

movement traceability and automated flow management, integrating with company ERP systems.

Compared to CHEP's global model, LPR favors a more regional and personalized management, with a strong focus on customer relationships and operational flexibility. This approach enables it to respond quickly to the needs of medium and large companies operating in the FMCG, food and retail sectors, offering a balance between efficiency, control and sustainability [6].

Figure 1.3 - Pallet LPR 800x1200 mm

1.4.3 IPP

IPP Logipal, part of the Netherlands-based Faber Group, represents a more modular and adaptive management model than large international players [16][17]. The company operates mainly in Northern and Central Europe, with a consolidated presence in countries such as the Netherlands, the United Kingdom, and Germany.

The orange pallets, made of wood or plastic, are a symbol of the brand and are distinguished by a management system based on a combination of IPP centers and authorized partners, who handle repair and maintenance activities. This more flexible and collaborative approach allows IPP to effectively adapt to the needs of different supply chains—from large-scale retail trade to the manufacturing industry—offering tailor-made solutions for companies that do not operate with standardized flows [17].

The company also places a strong emphasis on transparency and sustainability: it invests in material recycling, pallet reuse, and digital tools for movement traceability, thus reducing the overall environmental impact of logistics operations [16][15].

Figure 1.4 - Pallet IPP 800x1200 mm

1.4.4 Comparative analysis

Although based on the same philosophy of shared and sustainable pallet management, the three operators present different approaches.

CHEP is characterized by a global and highly structured model, which guarantees uniform standards and significant economies of scale thanks to a proprietary and digitally integrated network [5]. LPR, on the other hand, has chosen a regional strategy, built on customer proximity and the ability to offer customized solutions while maintaining high quality standards [6]. IPP stands out for its greater operational flexibility, based on collaboration with local partners and a balance between cost efficiency and sustainability [16][17].

In summary, each model reflects a different interpretation of pooling: CHEP as a global industrial system, LPR as a service-oriented European network, and IPP as a highly adaptable collaborative platform. Despite their differences, all three companies are helping to redefine contemporary logistics, demonstrating that circularity and innovation can coexist with competitiveness and economic efficiency.

1.5 A Benchmark Case: Coca-Cola European Partners

In 2019, CHEP published the results of a study on Coca-Cola European Partners' (CCEP) transition to a pallet pooling model in the Spanish and Portuguese markets, launched with the aim of making tertiary logistics more efficient and sustainable [18].

The collaboration, based on a five-year contract, allowed CCEP to outsource pallet management and adopt a pay-per-use system, which requires payment only for pallets actually used. In this way, the company was able to significantly reduce operating costs related to maintenance, handling, and empty pallet management, while eliminating hidden transportation and administrative costs [19].

The study, conducted according to LCA (Life Cycle Assessment) criteria compliant with the ISO 14044 standard, highlighted significant results from both an environmental and economic perspective [20]. Among the most significant benefits is a 60% reduction in pallet-related CO_2 emissions, corresponding to approximately 6,600 tonnes of CO_2 avoided and the equivalent of 151 trips around the world in terms of kilometres saved [21].

CHEP's Collaborative Transportation Solutions program has also enabled CCEP Iberia to share over one million transport routes, reducing empty trips and improving vehicle saturation rates. This optimization has generated significant fuel savings and faster delivery cycles.

From an environmental perspective, the benefits extend beyond emissions: the project has avoided the felling of over 5,000 trees and the production of approximately 570 tonnes of waste, equivalent to the amount generated by 1,200 people in a year [22]. The introduction of the Carbon Neutral Pallet, made from 100% regenerated plastic, further strengthened CCEP's sustainability strategy, contributing to the company's recognition as a Positive Partner and the CHEP Sustainability Certificate reported in the Brambles Sustainability Review 2024 [21].

Compared to traditional exchange systems or the use of disposable pallets, CHEP's pooling model has guaranteed CCEP superior results in terms of efficiency, supply chain stability, and reduced logistics costs. The Spanish and Portuguese experience demonstrates how, if structured according to measurable and verifiable criteria, pallet pooling can become not only an advanced logistics practice, but a real competitive lever for the optimization and sustainability of distribution chains.

Chapter 2 CHEP: Setting the Standard for Shared Pallet Networks

2.1 CHEP: A Global Model of Circular Logistics

CHEP is one of the most significant players in the global logistics landscape and is the main operating brand of the Brambles Group, an Australian company among the most important in the sustainable supply chain solutions sector [5].

The company is now recognized as a benchmark for shared load carrier management, a model that has revolutionized the way logistics flows are conceived globally. Its activities span various industrial sectors, from consumer goods and fresh produce to the beverage, automotive, and retail sectors, where standardization and traceability of materials are essential elements for operational efficiency.

CHEP's success is based on a management model based on a circular principle that transcends the traditional ownership logic. Instead of producing or purchasing new pallets, the company adopts a system of rental, recovery, and continuous reuse that extends the useful life of the carriers and reduces waste. Each pallet is used in various logistics cycles, subjected to quality controls, and then put back into circulation, creating a virtuous mechanism that combines economic efficiency and environmental sustainability [23].

This approach fits perfectly with Brambles' vision, which promotes a connected, collaborative, and digitalized supply chain, geared toward reducing emissions and continuously improving system performance [24].

CHEP's origins date back to 1946, when the Australian government established the Commonwealth Handling Equipment Pool to manage the logistics equipment bequeathed by the US military after the Second World War. The return of the US military left the country with a legacy of approximately 46 million blue pallets, which became the physical basis on which the new organization developed. From a war resource to a tool for economic reconstruction, those pallets were initially used for the distribution of civilian goods, giving rise to a shared management system that anticipated modern pooling models by decades [5].

In 1958, the company came under the ownership of Brambles Limited, marking its entry into a phase of significant commercial and technological expansion. From a national entity, CHEP transformed into an international operator, progressively expanding its service network and building a stable presence in key industrial markets. Joining the Brambles Group enabled an

organizational evolution based on three fundamental pillars: process standardization, centralized maintenance, and digital innovation.

A key factor in the company's rapid development was the availability of a large initial capital base of assets, which allowed it to operate without incurring the costs of producing new media. This represented a decisive competitive advantage, enabling CHEP to immediately implement a large-scale rental model and invest in the infrastructure necessary to ensure continuity, safety, and quality throughout the entire supply chain [24].

Today, CHEP stands out for its ability to integrate operational efficiency, sustainability, and innovation. The company does not limit itself to supplying pallets, but builds shared logistics networks that reduce the number of empty trips, promote the traceability of flows and optimize the use of resources. Its collaborative approach, oriented towards reducing environmental impact, represents a reference model for the entire pallet pooling sector and a concrete example of how logistics can become a strategic factor for sustainability and global competitiveness.

Figure 2.1 summarises the circular model adopted by CHEP, based on the principles of sharing, repairing, and reusing logistics materials. The flow begins with the manufacturer, passes through the retail channel, and reaches service centers, where pallets are inspected, refurbished, and reintroduced into the circuit. This continuous process optimizes resources, reduces waste, and extends the life cycle of materials, making a tangible contribution to more sustainable logistics [5].

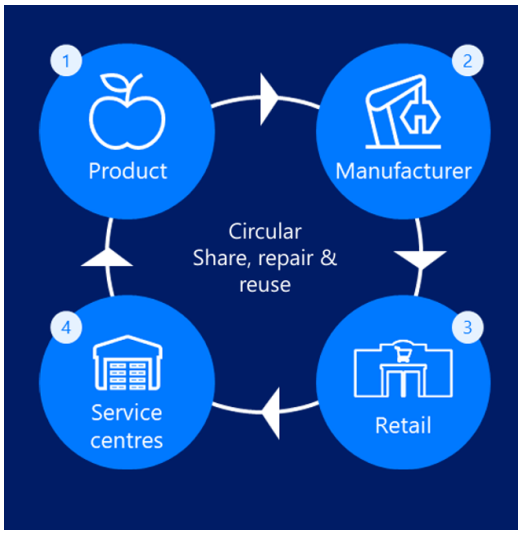

Figure 2.1 - CHEP circular pallet management model diagram

2.2 CHEP's Global Infrastructure

CHEP's organization is distinguished by the scope and complexity of its international logistics network. The company is present in approximately sixty countries and manages a total of over 347 million assets, including pallets, crates, and containers, which circulate within a seamlessly integrated system [24].

To ensure efficient control of operations, the global structure is divided into three major operating regions: CHEP Americas (North and South America), CHEP EMEA (Europe, the Middle East, Africa, and India), and CHEP Asia-Pacific (Australia, New Zealand, and Asia). This territorial division allows services to be adapted to the diverse logistical and regulatory needs of local markets, while maintaining consistency and uniform quality standards.

The operational heart of the system is its service centers, over 750 worldwide, which serve as key hubs for the collection, inspection, repair, and redistribution of pallets. These facilities are not limited to a warehouse role, but represent the key element of the circular model, ensuring that each medium is constantly recirculated and maintains optimal performance.

CHEP's network has approximately 13,000 employees and over 500,000 commercial touchpoints, serving some of the largest multinational groups such as Procter & Gamble, Unilever, Nestlé, Kellogg's, Ford, and Johnson & Johnson [24]. The scale of this infrastructure makes CHEP's model extremely difficult to replicate: the costs and resources required to build a similar network represent a significant barrier for competitors.

At the same time, this consolidated structure serves as an innovation platform, on which the company develops new digital services and sustainability projects, constantly strengthening its leadership position in the sector.

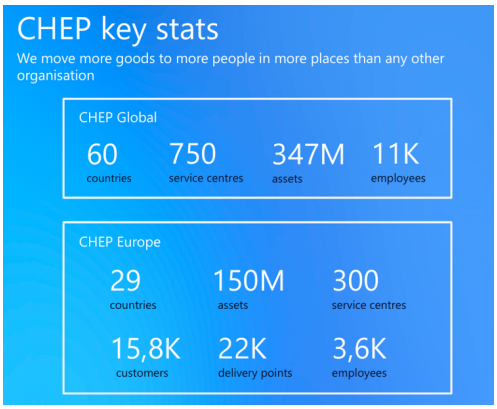

Figure 2.2 - CHEP's key global and regional indicators

The figure 2.2 summarizes key data relating to CHEP's global presence and operational structure. The group operates in 60 countries and has 750 service centers, with over 347 million assets under management and approximately 11,000 employees globally. In Europe, it operates in 29 countries, where it has 300 service centers, 150 million assets, over 15,000 customers, and more than 3,600 employees. These data confirm the extent of the network and the group's ability to operate efficiently in diverse markets, demonstrating the strength of the circular logistics model on an international scale [24].

2.3 Economic Structure and Contractual Logic of the CHEP Model

One of the elements that make CHEP's business model distinctive is the approach the company uses to determine the value of its service. Unlike traditional pallet suppliers, CHEP does not sell physical goods, but offers a comprehensive service that includes the provision of equipment, its recovery, repair, and subsequent reintroduction into the operational cycle. In this way, the customer does not purchase a product but rather accesses an integrated logistics solution, in which the price reflects the activities actually performed along the entire supply chain [25].

The economic framework underlying the contracts is built according to the so-called Activity Based Pricing Architecture (ABPA), a pricing system that breaks down service costs based on the operations actually performed and the degree of logistical complexity of each flow. This methodology, developed to ensure transparency and cost traceability, links each expense item to a specific activity—such as rental, handling, or cross-border transfer—avoiding the logic of a single, undifferentiated rate.

The core of the model is the Single Fee (SF), which consolidates standard rental costs into a single reference fee, calculated as a weighted average of volumes handled, product type, and operating region. This effectively represents the economic basis that covers the normal use cycle of pallets within a geographic area with regular and predictable flows [25].

Added to this are the Channel Fees (CF), which take into account the difficulty of recovering pallets at certain delivery points, such as distribution centers or retail stores. Since the risk of loss or collection costs vary depending on the context, CHEP divides destinations into different bands, from 0 to 4, updating them periodically—twice a year, in January and July—to maintain realistic alignment with operational performance.

An additional component is the Regional Transfer Fee (RTF), applied whenever pallets cross national borders. This fee compensates for logistical imbalances generated by asymmetric flows between countries: for example, when a nation receives more pallets than it exports, additional resources must be used to rebalance the pool. The RTF ensures that these costs are distributed equitably among the users who originate them [25].

The most significant surcharge is the Out-of-Pool Fee (OOP), an extraordinary fee applied when a pallet is sent to areas where CHEP does not operate or where the specific pallet type is not accepted in the local circuit. In these cases, the company cannot recover the support, and the circular system suffers a disruption. For this reason, the OOP is intentionally high – up to twelve times the cost of a standard trip – to discourage behaviors that would hinder the sustainability of the network.

In addition to the cost components, a central aspect of the contractual relationship with CHEP concerns the management and communication of pallet movements. Customers are required to promptly declare all transfers—whether shipments to resellers, branches, or other partners—as such declarations trigger or suspend rental billing.

Daily rental begins when a pallet is reported as shipped and ends when delivery or return is confirmed. If reporting is delayed, the system cannot update the asset's status, and the charge continues to accrue unnecessarily [25].

To maintain pool efficiency, CHEP encourages companies to submit declarations on a daily or, at most, weekly basis. Extended delays not only slow down pallet recovery but can result in financial penalties.

The two main ones are the Late Declaration Charge (LDC), which applies if the declaration is made more than ninety days after the actual transaction date, and the Lost Equipment Charge (LEC), which is charged when a pallet has been missing for more than 365 days. In the latter case, the customer is charged a cost equivalent to the purchase of a new pallet, generally between 20 and 25 euro per unit [25].

Data accuracy is also crucial. Each transfer must be identified with a unique reference code, which allows the movement to be associated with an actual delivery. Advance declarations, not yet supported by an actual transaction, are not accepted, as they could compromise the reliability of the system.

Essentially, the pricing structure and reporting rules form an integrated mechanism: the former distributes costs based on actual usage, the latter ensures the accuracy and timeliness needed to maintain the pool's efficiency.

This combination of economic transparency and operational accountability is what allows CHEP to sustain such a large global network, avoiding hidden inefficiencies and ensuring the economic and environmental sustainability of its circular logistics model [25].

2.4 What “share & reuse” looks like on the ground

CHEP's offering is based on a core principle that epitomizes the essence of its industrial model: "Share & Reuse." This approach reduces waste and optimizes resource use through a circular packaging management system, in which pallets are used, recovered, repaired, and recirculated multiple times within an integrated network of logistics partners [25].

The company does not sell physical media, but provides a comprehensive management service, offering standardized yet flexible solutions that can adapt to different production and distribution needs. These solutions are designed to ensure interoperability and reliability in automated storage systems and throughout the entire large-scale retail supply chain [21].

The main formats include Euro pallets (1200x800 mm), UK/US pallets (1200x1000 mm), as well as smaller versions such as Half Pallets (800x600 mm) and Quarter Pallets (600x400 mm), alongside plastic models and dollies intended for in-store operations. All pallets share distinctive elements such as the blue color and the CHEP logo, which facilitate visual recognition and rapid retrieval within the pooling network [25].

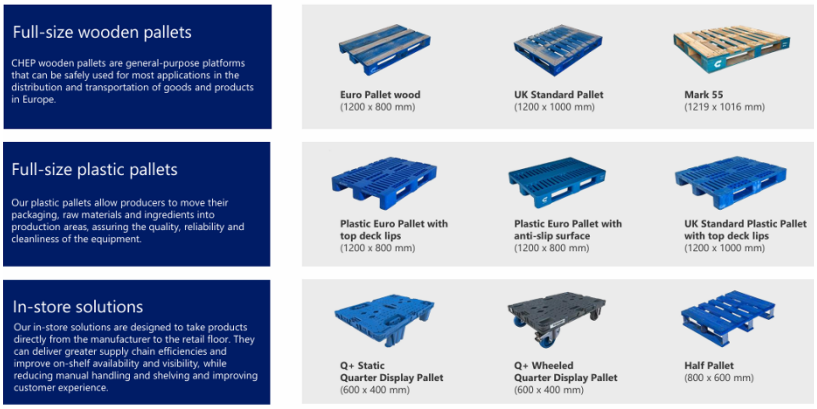

Figure 2.3 - Types of pallets and reusable tools in CHEP's circular model

The image shows some of the main types of pallets and modular pallets used in the company's logistics flows. In addition to the standard wooden and plastic formats, in-store solutions are highlighted, developed to optimize the transfer of products directly from the manufacturer to the point of sale [21].

The system's efficiency is guaranteed by a widespread network of service centers, where each unit undergoes inspection, maintenance, and digital tracking. Depending on operational needs, CHEP offers various usage modes, which differ in the level of inspection and management responsibility.

Quality Assured pallets are inspected and certified at service centers before delivery. After an operating cycle, they are recovered and re-inspected, thus ensuring consistent performance and safety. This formula is particularly suitable for companies that use automated or robotic handling systems, where dimensional accuracy and pallet stability are essential requirements [21].

Another usage category concerns Trade Quality pallets, i.e., pallets returned to the circuit after being used in retail outlets or distribution centers. In this case, CHEP does not perform a prior inspection, and quality verification is entrusted to the customer, who performs a visual inspection upon receipt.

To manage these return flows, CHEP has developed two distinct operating models:

- Managed Exchange: a fully digitalized system that replaces the old paper-based exchange methods. All movements are recorded through the myCHEP platform, which allows for real-time monitoring of transfers, inventory management, and optimization of logistics planning. This approach increases data transparency and reduces administrative errors [25].

- Managed Recovery: an evolution of the previous model, CHEP directly handles pallet collection from sales outlets or customer warehouses. Loads are consolidated and returned to service centers, reducing partial transports and non-productive routes. This strategy, in addition to improving operational efficiency, contributes to the reduction of CO_2 emissions and strengthens the group's commitment to sustainable logistics [21].

The Share & Reuse model represents much more than an operational strategy: it is a resource management philosophy, based on cooperation between supply chain stakeholders and shared

responsibility. By combining technical standardization, digital innovation and environmental sustainability, the company has managed to build an efficient system, capable of combining logistical performance and respect for the environment..

2.5 The pallet maintenance and reconditioning cycle in CHEP service centers

In CHEP's Share & Reuse model, pallet lifecycle management is a fundamental aspect of the service. The company does not simply provide handling supports, but follows their entire operational process: from delivery to the customer to recovery, repair, and subsequent reintroduction into the logistics circuit. This system, fully consistent with the principles of the circular economy, ensures consistent quality, reduced waste, and maximum efficiency in resource management [25].

The reconditioning process is at the heart of this mechanism. Each pallet, after being used, returns to a CHEP service center in two ways: through direct collection organized by the company or through delivery to the destinations declared by the customer. A portion of the pallets returned to the warehouse do not show significant structural damage: these may be units rejected for operational reasons or due to slight dimensional deviations incompatible with automated systems. In these cases, the supports are simply re-inspected and reintroduced into the production cycle, reducing the need for new processing [21].

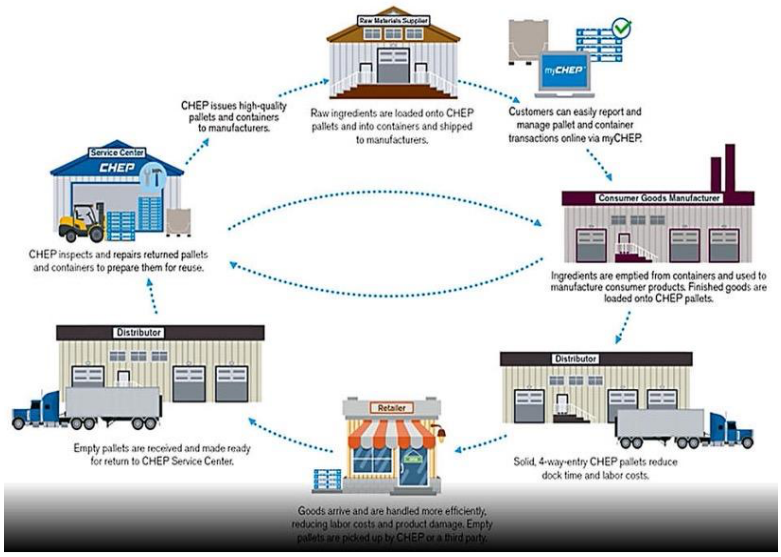

Figure 2.4 - The pallet operating cycle in the CHEP circular model

Figure 2.4 represents the overall operation of the *Share & Reuse* circuit: pallets are delivered to manufacturers, used along the distribution chain, collected from distributors and points of sale, and finally redirected to service centers. Here, they are inspected, repaired, and prepared for a new cycle of use, maintaining constant asset availability and limiting environmental impact [21].

Within the service centers, the reconditioning process is structured into three operational phases, inspection and sorting, repair, finishing, and reinsertion, which ensure quality standardization and complete traceability of each pallet [25].

1. Triage and vision check:

   Returned pallets are unloaded in dedicated areas and sent for the first visual inspection by personnel. During this phase, any residues, labels, or foreign elements are removed. Next, each pallet passes through an automated inspection system equipped with cameras that evaluate its geometry and structural integrity, comparing them to preset parameters. Based on the assessment results, pallets are classified into three categories:

   - compliant and ready for reintroduction;
   - with minor repairable defects;
   - severely damaged and ready for the next processing stage.

   This system allows for large volumes to be handled quickly and consistently, maintaining the overall quality of the pool [25].

2. Repair paths:

   Pallets with defects are routed to manual or automated repair lines, depending on the type and severity of the damage. Simpler operations—such as replacing a block or a board—are performed by specialized operators. In more advanced centers, however, repairs are supported by robotic systems that automatically cut and nail the damaged components, ensuring precision and consistency. When pallets contain damaged parts, but still contain reusable elements, they are recovered using disassembly machines such as the MAYPRO, which allows components in good condition to be reintroduced into the cycle. This system significantly reduces the use of virgin wood and improves the overall efficiency of the model [21].

3. Finishing and Reintroduction into the Circuit

Once the repair is complete, the pallets undergo a finishing phase: the units are painted with CHEP's signature blue color, which ensures visual uniformity, recognizability, and traceability. After a final quality check, the pallets are stacked and transferred to storage areas, ready for a new operational cycle. The entire process is digitally monitored through the myCHEP platform, which records every movement and optimizes logistics planning. Thanks to the automation and digitalization of processes, in 2024 CHEP reduced the use of virgin wood by 35% and the material destined for disposal by 20%, with concrete benefits in both economic and environmental terms [25].

The reconditioning process therefore represents the most strategic link in CHEP's circular model. This represents the transformation of a traditional logistics system into a sustainable model, in which maintenance, digital traceability, and the efficient use of resources combine to generate shared value along the entire supply chain.

2.6 CHEP's Environmental and Collaborative Performance

CHEP's operating model is based on a collaborative and regenerative approach that translates the principles of the circular economy into industrial practice. Through the Share & Reuse system, the company coordinates a global network of manufacturers, distributors, and retailers, promoting a shared approach to sustainability. Collaboration among supply chain stakeholders is a strategic element: collaborative transport programs, active in several European regions such as Italy and the Iberian Peninsula, optimize vehicle routes, reduce empty journeys, and lower fuel consumption. This synergy, made possible by coordinating return flows and pallet recovery, translates into a reduction in logistics costs and climate-altering emissions, strengthening the competitiveness of partner companies [26].

Figure 2.5 - The pillars of Brambles' "Positive" program

Figure 2.5 illustrates the three strategic axes around which the group's sustainability plan is based:

- Planet Positive, which aims to protect natural ecosystems and reduce environmental impact;
- Business Positive, aimed at building regenerative supply chains and ethical and inclusive collaboration models;
- Communities Positive, which connects environmental sustainability with the well-being of local communities, promoting the circular economy and food solidarity [21].

Brambles' 2024 Sustainability Report highlights the progress made towards the objectives set for 2025. The program's main goals include: reforesting two trees for every unit used, reducing waste to zero in landfill, and completely decarbonizing company operations. These environmental objectives are accompanied by social and inclusive goals, such as increasing the presence of women in leadership roles, collaborating with food banks to redistribute food to over ten million people, and adopting accessibility programs in various geographical areas [21].

Figure 2.6 - Brambles Group's sustainability goals for 2025

The figure 2.6 summarizes the main environmental and social targets set by the "2025 Targets" plan: reforestation, climate neutrality, zero waste, and the development of supply chains that are positive for people and the planet [21].

The results achieved in 2024 demonstrate the concreteness of the Share & Reuse model, which extends the useful life of pallets and minimizes material waste. According to the group's official

data, CHEP's operations have saved 1,861 kilotons of CO_2, 4,265 million liters of water, 2.2 million m^3 of wood, and 1.3 million tons of waste, compared to linear or single-use logistics systems.

These results are certified through independent LCA (Life Cycle Assessment) analyses compliant with the ISO 14044 standard, which confirm the environmental effectiveness of the circular model [21].

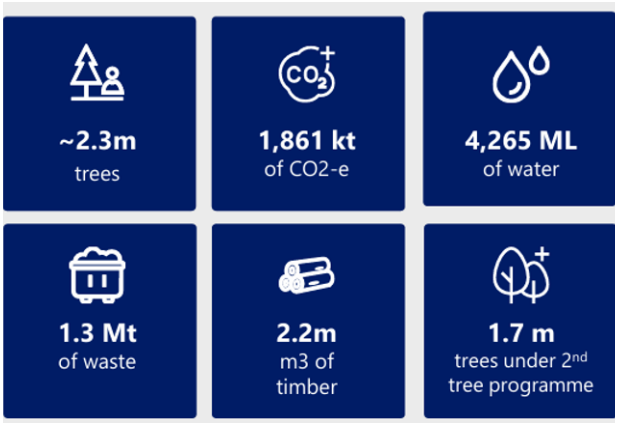

Figure 2.7 - Environmental results of CHEP's circular model (year 2024)

The image shows the positive impacts resulting from the application of the Share & Reuse system: reduced carbon dioxide emissions, water savings, reduced use of virgin wood, and increased reforestation programs.

These results are based on rigorous resource management and a strategy of constant investment in innovation and digitalization. The use of sustainable and reusable pallets, combined with advanced monitoring systems such as the myCHEP platform, allows for timely control of logistics flows, promoting the rapid recovery of assets and their reintroduction into the production cycle [26].

All handling supports are made from wood sourced 100% from FSC or PEFC-certified forests and, at the end of their life cycle, are dismantled to recover reusable components. This approach reduces the use of virgin wood and prevents still-usable materials from being disposed of [24].

In addition to the environmental benefits, the CHEP model has produced significant economic and social results, obtaining international recognition such as the EcoVadis Gold certification, inclusion in the Dow Jones Sustainability Index, and second place in the Corporate Knights

Global 100 ranking, which evaluates companies with the greatest positive impact on the planet and society [21].

CHEP represents an emblematic case of industrial sustainability applied to logistics, where economic efficiency is intertwined with environmental responsibility. Through business collaboration, digital traceability, and circular asset management, the company demonstrates how a production system can evolve toward a regenerative form, capable not only of reducing environmental damage but also of restoring value to the community and natural ecosystems.

2.7 Collaborations, Awards, and Recognition

In an increasingly global and interconnected economic environment, the ability to build strong partnerships and achieve authoritative recognition has become an essential lever for any company's reputation.

Companies that successfully establish lasting relationships with leading players, while maintaining a strong focus on sustainability, innovation, and social responsibility, stand out not only for their business results but also for the consistency of their values and actions.

The organization analyzed stands out precisely for this dual focus: it has successfully forged impactful collaborations and won prestigious awards that confirm the validity of its path and the solidity of its vision.

2.7.1 Strategic Partnerships

In recent years, the company has formed strategic alliances with international institutions and associations that share its vision of sustainable and inclusive development.

One of the most significant is with the Ellen MacArthur Foundation, which has long promoted the principles of the circular economy. Thanks to this collaboration, the company has been able to rethink the design of its products and materials for a more sustainable approach, reducing waste and extending the life cycle of resources.

In terms of social responsibility, the collaboration with the European Food Banks Federation plays a concrete and direct role: through the redistribution of surplus food, the company helps combat food waste and support vulnerable communities. It is a way to translate sustainability into everyday actions that produce real benefits for people and the environment.

A further sign of commitment comes from joining the LEAD Network, a European network that promotes gender diversity and the professional growth of women in consumer goods sectors. The company's participation in this initiative demonstrates its commitment to promoting a work environment based on equality, meritocracy, and inclusion.

Internationally, its membership in the United Nations Global Compact confirms its adherence to ethical and universal principles regarding human rights, labor, environmental protection, and the fight against corruption. Through this platform, the company strengthens its commitment to a more responsible and transparent global economy.

Finally, the company also participates in The Valuable 500, a global movement dedicated to the inclusion of people with disabilities, and collaborates with the Business Disability Forum, helping to integrate accessibility and equal opportunities into its corporate policies. These choices demonstrate a vision of sustainability that extends beyond environmental aspects to social and human ones.

2.7.2 Awards and Recognitions

The company's commitment to sustainability, innovation, and people's well-being has been recognized by numerous international institutions.

The Global Top Employer title confirms its focus on employees and its ability to create a positive, open, and inclusive work environment where people can grow and feel part of a shared project.

The company has also achieved significant environmental certifications: the EcoVadis Platinum rating places it among the most virtuous companies worldwide for responsible resource management and ESG practices, while the Lean & Green Award recognizes its achievements in reducing emissions related to logistics and transportation.

In the field of design and innovation, the prestigious Red Dot Award recognized the company's attention to detail, functionality, and ability to combine aesthetics and sustainability, elements that characterize the company's product development philosophy.

Further confirmation of its reputation comes from its inclusion in the Dow Jones Sustainability Index (DJSI) and recognition by Corporate Knights, which recognize its leadership in corporate sustainability.

TIME Magazine also included the company among the most influential companies in the world, recognizing its active role in driving not only market innovation but also social and cultural change.

Finally, the positive results achieved in the Carbon Disclosure Project (CDP) reports and the high ratings assigned by MSCI ESG Ratings further strengthen the company's credibility in terms of transparency and environmental governance.

Overall, these awards represent much more than a list of prizes: they are concrete evidence of a way of doing business that combines economic results, responsibility, and long-term vision, demonstrating that sustainability can be a real driver of competitiveness today.

Chapter 3 The Barilla Group

This chapter traces the evolution of the Barilla Group, from its origins as a small family-run bakery in Parma to its expansion into a multinational food company, then delves into the organization of its logistics and production network.

From history to strategic decisions, from acquisitions to innovation, Barilla's journey is a prime example of how tradition and modernity can coexist in an industrial model focused on quality and sustainability.

3.1 The Origins and Development of the Barilla Group

Barilla's history begins in 1877, when Pietro Barilla Sr. opened a small bread shop in Parma, in the heart of Italy's Food Valley, an area destined to become one of Europe's leading agri-food hubs [27].

Soon, pasta production began in the back room, handcrafted and sold directly in the store. The family business grew rapidly thanks to the commitment of his sons Riccardo and Gualtiero, who introduced a more organized production management system. At the end of the 19th century, production capacity reached 50 kg of pasta per day, which rose to 400 kg in 1903 and over 2.5 tons in 1905: a growth that foreshadowed the transformation from a simple artisanal business to a structured industrial reality [28].

Figure 3.1 - Inauguration of the first Barilla S.p.A. factory, Parma (1911)

The decisive break with the shop logic came in 1910, when Barilla inaugurated its first industrial plant in Parma, bringing bread and pasta production under one roof. It was the beginning of modernization: production cycles became more efficient, innovative machinery and new drying methods were introduced. The factory pushed daily pasta output to around 8 tons, employing about 80 people. The transition to industrial production represented a cultural

as well as technological leap, allowing the company to expand distribution and consolidate its brand nationwide [27].

Since the early decades of the twentieth century, Barilla understood the importance of image and visual communication as fundamental tools for building its brand identity. In those years, the company introduced its first official logo, known as "the apprentice with the egg," created by sculptor Emilio Trombara.

The image, depicting a young apprentice pouring an egg into flour, represented a clear reference to the authenticity of the raw materials, the transparency of the production process, and the artisanal pride that have always distinguished the brand [29].

Through this choice, Barilla managed to transform the product into a true visual narrative of its values: a synthesis of tradition, quality, and passion that would accompany the company throughout the following century.

In the 1950s and 1960s, as Italy embraced modernity and mass media, Barilla was among the first companies to understand the power of television advertising. Campaigns by prominent directors and actors like Giorgio Albertazzi, Dario Fo, Mina, Massimo Ranieri, made Barilla synonymous with home, affection, and Italianness [30]. During this period, the company defined its communicative identity, transforming promotion into a true tool for culturally building the brand.

Figure 3.2 - Barilla TV commercial from the 1960s featuring a well-known Italian singer Mina

Two key moments marked the turning point for the Barilla Group in the post-World War II era. The first dates back to 1952, when the company decided to permanently discontinue bread production to focus its resources on semolina and egg pasta, areas that offered greater development prospects and scope for innovation [28]. This decision marked the moment when

Barilla abandoned the traditional bakery approach to establish itself as a modern, specialized, and quality-oriented food company.

The second crucial step is linked to Pietro Barilla Jr.'s trip to the United States in 1950. The overseas experience led him to explore a new, more dynamic and visual approach to marketing and distribution. Upon his return, he decided to introduce a groundbreaking innovation: the cardboard "blue box" with a transparent window, which replaced loose pasta sold in paper bags. This new design, together with a renewed focus on communication, helped define a clear and consistent visual identity, making Barilla an immediately recognizable brand on the shelves and synonymous with trust and transparency [28].

At the same time, the company increased its production capacity and invested in new facilities. In 1965, the Rubbiano di Solignano (Parma) plant was opened, dedicated to the production of crackers, breadsticks, and rusks, marking the return to the baked goods sector [31]. A few years later, in 1969, Barilla inaugurated the large Pedrignano (PR) plant, destined to become – and still remains today – the largest pasta factory in the world, with a production line over 120 meters long and an annual capacity of approximately 320,000 tons [27]. This plant represents the technological heart of the company and symbolizes the definitive transition from a family business to a modern industrial group.

In 1971, in an unstable economic and political climate, the Barilla family decided to temporarily sell the company to the American multinational W.R. Grace & Co. Despite foreign ownership, the company continued to innovate and expand its portfolio: in 1973 it acquired the Voiello brand, a historic Neapolitan pasta producer, and in 1975 it launched Mulino Bianco, destined to become an icon of Italian home cooking and naturalness [32]. After an initial failed attempt in 1978, Pietro Barilla managed to regain control of the company in 1979, restoring its original direction and relaunching its founding values [27].

The 1980s and 1990s represented a period of rebirth. The company invested in communication and entrusted its commercials to directors such as Federico Fellini, Nikita Michalkov, and Giuseppe Tornatore, who transformed advertising into a narrative language made of emotions, family, and Italianness [30]. This new creative era contributed to strengthening the bond between Barilla and the public, while industrial expansion continued at a rapid pace. The group doubled its turnover in a decade and consolidated its international position with a series of strategic acquisitions: Pavesi (1992), a leader in the baked goods market, Misko in Greece, Filiz in Turkey, Wasa in Sweden, Yemina and Vesta in Mexico, and Harry's in France [33]. These

operations made Barilla a global player, capable of adapting to different production cultures and markets without sacrificing its identity.

Between the late 1990s and early 2000s, growth also extended beyond Europe. In 1999, the Ames, Iowa, plant was inaugurated, followed in 2007 by the Avon, New York, plant, allowing the group to directly serve the North American market with local, more efficient and sustainable production [34]. At the same time, Barilla expanded its cultural and scientific presence: in 2004, Academia Barilla was founded, a project dedicated to promoting Italian cuisine and its traditions [35]; in 2009, the Barilla Center for Food & Nutrition (BCFN), now the Barilla Foundation, was established, committed to research on nutrition, the environment, and food sustainability [36].

Figure 3.3 - Logo of the Barilla Center for Food & Nutrition, Barilla's foundation for research on food, sustainability, and health

In recent years, the company has progressively linked its brand identity to the principles of social and environmental responsibility. The communications platform "Good for You. Good for the Planet" epitomizes this, with concrete actions that go beyond the slogan: between 2016 and 2017, Barilla purchased approximately 190,000 tons of durum wheat from sustainable supply chains and invested over 1 billion euros in innovation and sustainability projects for the following five years [37].

Between 2021 and 2022, growth continued through targeted acquisitions such as Catelli (Canada), Pasta Evangelists (UK), and Back to Nature (US), strengthening the group's presence in key international markets [38].

In 2025, Barilla confirmed its position as the world's leading food company for reputation in the Global RepTrak®100 ranking for the second consecutive year, a recognition that reflects the trust built over time through consistency, innovation, and transparency [39]. In the same year, it signed a multi-year partnership with Formula 1, becoming the competition's Official

Pasta Partner, and introduced the Al Bronzo and Protein+ lines, designed to meet new consumer needs in terms of taste, well-being, and sustainability [40].

Through this long journey, Barilla has demonstrated how the ability to innovate while remaining faithful to its founding values—quality, ethics, and Italianness—represents the key to building a solid, global, and sustainable business model. [38].

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Figure 3.4 - Barilla Protein+ pasta, an example of the brand's innovation focused on nutrition and high-protein content

Through this long journey, Barilla has demonstrated how the ability to innovate while remaining faithful to its founding values—quality, ethics, and Italianness—represents the key to building a solid, global, and sustainable business model.

3.2 The Barilla Group's Portfolio and Geographic Distribution

Over the course of its evolution, Barilla has built a broad and stratified portfolio, progressively developing its business areas without ever losing sight of its core production. The company has consolidated its leadership in pasta and ready-made sauces, while simultaneously expanding its presence in the bakery sector, thus addressing different consumption moments and capturing new eating habits [27][33].

Today, Barilla produces over 1.9 million tons of food each year, distributed in more than 100 countries worldwide [34]. To ensure high quality standards, the company performs

approximately four million checks annually on raw materials and finished products, ensuring traceability, safety, and consistency with its sustainability principles [37].

Production is organized into three main business areas—Meal Solutions, Bakery, and Food Service, distributed across 30 production plants, equally divided between 15 sites in Italy and 15 abroad [34][38]. This balanced industrial structure allows for a flexible response to the needs of different markets, reducing distribution times and optimizing global logistics flows.

In terms of financial results, the pasta segment continues to represent the core of the group's activity, generating approximately 48.1% of total revenue, followed by the bakery category with 41.4% and condiments with 9.6%. The "other" segment, which includes, for example, the fresh pasta business linked to Pasta Evangelists Ltd., covers 0.9% of the total [41].

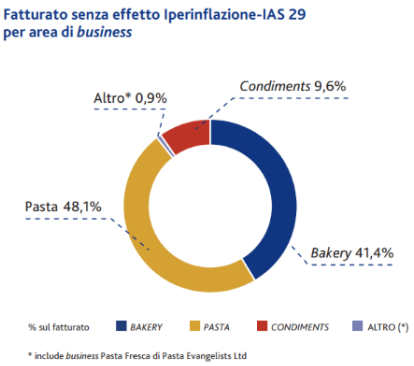


Figure 3.5 - Breakdown of Barilla revenue by business area

Analyzing the geographical distribution of turnover, in 2024 the Italian market contributed approximately 36.1% of the total, while 38.4% came from the rest of Europe and Russia, including Northern, Eastern, and Western Europe, as well as the Middle East and Africa. 23.6% of turnover comes from the Americas, and 1.9% from the Asia-Pacific region, which nevertheless represents one of the areas with the greatest potential for future growth [41].

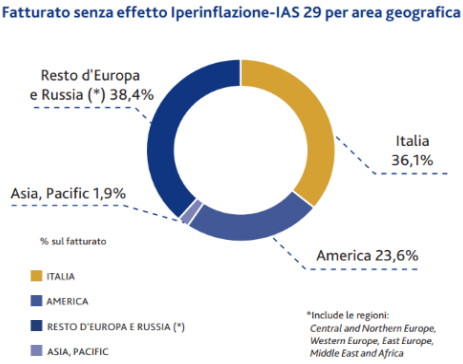


Figure 3.6 - Distribution of Barilla turnover by geographical area

In the medium term, the group's strategy aims to further strengthen the bakery division on international markets, with particular attention to expansion in Europe, where Barilla intends to consolidate its leadership in the breakfast sweets and healthy baked goods segments.

At the same time, the company continues to invest in improving its production and logistics chains, to ensure efficiency, sustainability and an increasingly widespread presence in global markets.

3.2.1 Meal Solutions

The Meal Solutions category represents the historical and strategic heart of the Barilla Group, encompassing the production of pasta and ready-made sauces, a symbol of the Italian gastronomic tradition [27].

Over time, the company has successfully combined craftsmanship and technological innovation, creating an increasingly broad offering that includes durum wheat, whole wheat, organic, and multigrain pasta, as well as an assortment of condiments and ready-made sauces [37].

Production is organized in eight main pasta factories distributed across Italy, Europe, and the Americas, with a total capacity of approximately 900,000 tons annually [42].

Among the Italian plants, Pedrignano (PR), the technological heart of the group, Foggia, Caserta, and Muggia (TS), stand out, alongside the foreign sites in Thiva (Greece), Bolu (Turkey), Ames (Iowa), Avon (New York), and San Luis Potosí (Mexico) [34].

Additional production facilities are located in Canada, Russia, and Latin America, confirming the group's industrial reach and its ability to serve over 100 markets worldwide [41].

The Barilla brand, founded in Parma in 1877, today represents the global benchmark for quality pasta. Through the use of selected grains and advanced technologies, the company has built a reputation based on quality, transparency, and sustainability, bringing millions of pasta dishes to the tables of consumers around the world every day [37].

Voiello	Voiello, founded in 1879 in Torre Annunziata (Naples), in the heart of Campania's pasta-making tradition [43]. Always tied to the region, Voiello uses exclusively 100% Italian Aureo wheat, a variety selected for its high protein content and cooking properties. Since 1973, the year it became part of the Barilla Group, the brand has maintained its original spirit, offering a product that combines craftsmanship and industrial quality, becoming a symbol of Neapolitan authenticity [28].
MISKO	In Greece, the Misko brand, founded in 1927, is deeply rooted in the local culture. Its historic logo, depicting a monk on a donkey delivering pasta to village markets, conveys a genuine connection with the simplicity of rural life. After joining the Barilla Group in 1991, Misko benefited from important production innovations, while continuing to preserve the characteristics of traditional Greek pasta, becoming the leader in the Greek market [38].
filiz	The Filiz brand, founded in Turkey in 1977, represents one of the main production companies in the country [9]. Since joining Barilla in 1994, Filiz has strengthened the group's role in the Middle Eastern markets, thanks to a pasta offering that combines Italian technology and local flavors, with particular attention to sustainability and packaging recycling [38].

Yemina	In the Americas, Barilla has expanded its presence through the acquisition of historic brands such as Yemina, founded in Mexico in 1952. Having joined the group in 2002, thanks to a partnership with Grupo Herdez, Yemina is now among the leading pasta brands in Latin America. The brand integrates Mexican gastronomic tradition with Italian production quality, offering formats and recipes designed to adapt to local consumption habits [34].
CATELLI	In Canada, the acquisition of the Catelli group, which also includes the Lancia and Splendor brands, marked a strategic step in consolidating the North American presence. With over a century of history, these companies embody the evolution of Mediterranean taste on an international scale, focusing on local ingredients, a controlled supply chain, and sustainable packaging, in line with the Sustainability Linked Financing Framework adopted by the group [45].
PASTA EVANGELISTS	Pasta Evangelists is a British brand specializing in fresh artisanal pasta and gourmet home delivery services. Acquired in 2021, the brand has revolutionized the consumer experience by bringing the quality of Italian cuisine directly to customers' homes, through a food e-commerce model based on creativity, storytelling, and digital craftsmanship [46]. The entry of Pasta Evangelists into the group reflects Barilla's commitment to exploring new ways of enjoying food and adapting its offering to the cultural and technological changes of the global market.

Table 3.7 - Meal Solutions Brand Barilla

Overall, the Meal Solutions category expresses the Barilla Group's ability to integrate diverse cultural heritages and industrial expertise into a coherent and global vision.

Each brand contributes to strengthening the group's positioning as a symbol of "Good for You, Good for the Planet," combining quality, sustainability, and responsible innovation [36]. This approach translates into a production and communication model that not only enhances the Italian identity, but promotes a concept of sustainable, accessible, and culturally inclusive nutrition.

3.2.2 Bakery

The Bakery segment represents one of the Barilla Group's most consolidated and recognizable areas, including a wide range of baked goods such as biscuits, snacks, crackers, breadsticks, and soft bread. This division was born from the need to diversify the offering and address different consumption moments, particularly breakfast and snack breaks, combining Italian confectionery tradition, innovation, and a focus on well-being. The production plants dedicated to the bakery sector are strategically located between Europe and North America, ensuring coverage of the main international markets and the ability to respond flexibly to different consumer habits [34].

	The most iconic brands in the category is Mulino Bianco, founded in 1975 as a Barilla project aimed at proposing an image of authenticity and simplicity inspired by Italian rural life. From its origins, Mulino Bianco has successfully intertwined family and narrative values, becoming the symbol of the Italian breakfast and earning a prominent place in consumers' daily habits. Through warm and reassuring advertising campaigns, the brand has built a narrative centered on the quality of its raw materials and the pleasure of small daily gestures [32]. Today, it represents one of the group's broadest lines, with products ranging from biscuits to snacks, from breads to breakfast cereals, while maintaining a constant commitment to sustainability and reducing environmental impact.

	Alongside Mulino Bianco is Pan di Stelle founded in 1983 as a sub-brand and becoming an independent brand in 2007. Pan di Stelle embodies a dreamlike and poetic imagery, made of sweetness, dreams, and sharing, elements that have made it one of the most beloved brands among young people and families. Its offering has progressively expanded to include cakes, spreads, biscuits, and snacks, up to ice cream, maintaining a strong visual and narrative coherence [47].
	Another leading brand is Gran Cereale, launched in 1989 with the aim of offering a natural, fiber-rich baked product. Gran Cereale's philosophy is based on the values of authenticity and respect for nature, through simple ingredients and recipes inspired by a healthy and sustainable lifestyle. The brand has also stood out for its environmental initiatives, such as the use of recyclable packaging and adherence to the principles of the circular economy promoted by the Barilla group [48].
	In the international sector, Wasa represents globally recognized excellence. Founded in Sweden in 1919, it is today the world's leading producer of crispbread, the typical crunchy bread made from rye and wheat. Since 1999, the year it joined the Barilla Group, Wasa has strengthened its health-conscious identity, offering wholemeal, light, and fiber-rich products, perfectly in line with new trends in conscious eating [16]. The company, based in Filipstad, has also embarked on a journey towards carbon neutrality, making the brand a point of reference in the field of food sustainability [48].

	Pavesi, on the other hand, represents one of the most important historic brands in the Italian panorama. Founded in 1937 in Novara, the company became part of the Barilla Group in 1992. Over the decades, it has created products that have become true classics, such as Pavesini (introduced in 1948) and Gran Pavesi (1954), synonymous with lightness and crunchiness, respectively. The brand has been able to renew itself over time with an increasing focus on quality and variety of formats, maintaining the Piedmontese confectionery tradition at its core [25].
	Another historic name in the portfolio is Harrys, a French brand founded in the early twentieth century and acquired by Barilla in 2002. Specializing in soft breads, brioches, and breakfast products, Harrys is now a leader in the French packaged bakery market. The company has built its reputation on the values of quality, convenience, and authentic flavor, positioning itself as a point of reference in the daily lives of French consumers [38].
	In the international bakery scene, Back to Nature, an American brand that joined the group in 2017, also stands out. The brand is known for its natural and plant-based nutrition philosophy, offering products such as crackers, granola, biscuits, and dried fruit made with non-GMO ingredients. Its integration into the Barilla portfolio has strengthened the group's presence in the US market for healthy, quality products [49].

Table 3.8 - Bakery brand

Among the most popular brands in the confectionery segment are Ringo, Togo, and Gocciole, which represent the group's younger, more playful side.

	Ringo, founded in 1967, became famous for its two-tone filled biscuit, an icon of the 1980s and 1990s. Over time, it has been able to renew itself with flavor variations and new formats, maintaining a strong connection with a young audience.
	Gocciole, introduced in 1987 by Pavesi and becoming an independent brand in 1998, represents one of the most beloved biscuits in Italy. Their playful and familiar image is now an icon of the Italian breakfast, and the brand has expanded its range to include ice cream and chocolate snacks while maintaining its original identity intact [25].
	Togo, launched in 1970, conquered the market thanks to its crunchy chocolate-covered sticks, a symbol of pleasure and lightness.

Table 3.9 - Confectionery segment brand

Overall, the Bakery segment reflects the Barilla Group's ability to combine tradition and modernity, offering a portfolio that satisfies different tastes, lifestyles, and cultures. Each brand, while maintaining its own personality, contributes to consolidating Barilla's role as an ambassador of "Made in Italy" and promoter of a sustainable, accessible, and authentic food model [49].

3.2.3 Food Service

The Barilla Group's Food Service division represents the intersection of Italian culinary tradition, technological innovation, and gastronomic culture, establishing itself as a benchmark for the professional catering and hospitality industry [28]. Through a network of brands and specialized initiatives, this strategic area serves chefs, restaurateurs, hotels, offering products and solutions that guarantee consistent quality, operational reliability, and creative inspiration

in the kitchen. The philosophy that guides the Food Service division is the same that has always characterized Barilla: combining technical expertise and authentic values, supporting a model of nutrition that combines pleasure, well-being, and sustainability [48].

Founded in Parma in 2004, Academia Barilla was created with the aim of promoting and protecting Italian gastronomic culture worldwide [35]. It is the first international center dedicated to the valorization of the national culinary heritage, conceived as a meeting place between tradition, research, and education.

Through cooking classes, cultural events, masterclasses, and partnerships with international gastronomic institutes, Academia Barilla contributes to the dissemination of the principles of the Mediterranean Diet as a model of balanced, sustainable, and healthy living. In addition to its educational activities, the institution also plays a role in promoting Made in Italy, spreading an image of Italian cuisine around the world that is linked to the quality of its raw materials, respect for local areas, and the creativity of its interpreters [48].

Over the years, Academia Barilla has transformed into a true cultural laboratory, capable of connecting tradition and innovation, becoming an ambassador for the "Good for You, Good for the Planet" concept promoted by the group [49].

Within the Food Service division, Barilla for Professionals plays a key role, offering products and services dedicated to restaurant and catering professionals . The goal is to support chefs, cooks, and company and school canteen operators with a portfolio that combines quality, practicality, and consistent performance even in large-scale contexts. The brand offers a complete range of pasta, sauces, condiments, and baked goods, designed to ensure stability and cooking resistance, as well as a personalized consultancy service on culinary techniques and professional kitchen management [50].

Barilla for Professionals stands out for its ability to combine technical expertise and social responsibility, integrating principles of sustainability, waste reduction, and energy optimization into its production processes, in line with the group's environmental strategy The approach is not limited to product supply, but extends to an educational vision: Barilla organizes refresher courses and workshops for industry professionals, promoting a cuisine that respects the environment and people, consistent with the group's ESG objectives [49].

Among the division's most innovative projects is BluRhapsody, now relaunched under the name Artisia, a brand that represents a new frontier in pasta. Developed entirely in the Barilla

Group's Research & Development laboratories, Artisia was born as the first 3D-printed pasta line.

The project combines digital design and food craftsmanship, rethinking the very concept of production through the custom creation of three-dimensional shapes intended for haute cuisine and gourmet restaurants. Each shape is designed to optimize the interaction between pasta and sauce, offering a unique aesthetic and sensorial experience [51]. This type of innovation reflects Barilla's vision of combining technology, creativity, and sustainability, exploring a new way of understanding gastronomy as a cultural and artistic expression.

Within the same innovation logic, the FIRST project represents the group's commitment to developing solutions for the food retail and fast food segments. This initiative was born to respond to evolving eating habits and the growing demand for ready-made and on-the-go meals, a growing market especially in urban and international contexts.

FIRST integrates industrial expertise and logistical know-how to create ready-to-eat products, maintaining the same quality and authenticity as traditional Italian dishes. Through this project, Barilla positions itself as a leading player in the innovation of contemporary consumption models, promoting a concept of modern, accessible, and sustainable nutrition, capable of combining convenience with environmental responsibility [48].

Overall, the Food Service division represents one of the clearest manifestations of the Barilla Group's ability to combine Italian heritage and technological innovation, interpreting gastronomic tradition as a platform for sustainable development and growth.

Thanks to projects such as Academia Barilla, Barilla for Professionals, Artisia, and FIRST, the company contributes to the definition of a new global restaurant model, based on quality, creativity, and respect for the planet.

Figure 3.7 - Food Service

3.3 The Supply Chain

The Barilla Group's supply chain is designed to ensure a dynamic balance between operational efficiency, product quality, and cost sustainability, coordinating all phases from planning to final distribution.

The internal organization integrates five functional areas: Planning, Procurement, Production, Logistics, and Engineering & Packaging, each of which contributes to the creation of a continuous and synergistic production and distribution flow [52].

Barilla's logistics system is structured around three main flow models, which reflect the complexity of its international industrial network:

- Plant-to-Plant Transfers (STO – Stock Transfer Orders): product transfers between owned plants or warehouses, essential for rebalancing inventory and optimizing production line saturation.
- Primary Network: direct shipments from plants to end customers, primarily destined for large-scale retail channels (GDO) and the main European markets.
- Secondary Network: flows connecting the plants to intermediate logistics platforms, i.e., HUBs and Transit Points (TPs), which serve as sorting points for widespread distribution throughout the country.

Added to these is a network of auxiliary warehouses (AUX), used for the temporary management of surpluses when the plants' storage capacity is saturated. This structure, supported by an advanced information system, allows for service continuity and constant traceability throughout the supply chain [35].

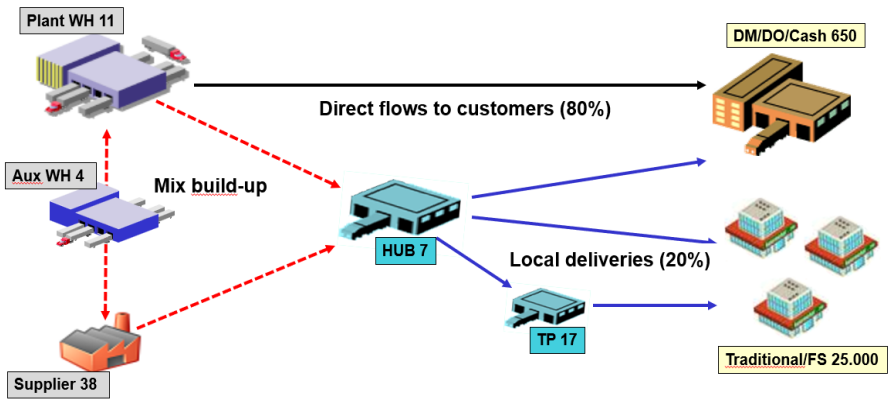


Figure 3.8 - Chart of the network flows

The logistics network is further integrated with that of copackers, partner companies responsible for producing specific products that do not fall within the group's internal volumes or technologies (such as snacks or gluten-free products). These flows are organized along three main directions:

- From copacker to end customer: for integrated copackers authorized for direct shipments;
- From copacker to Barilla warehouse, for product storage prior to distribution;
- From copacker to logistics hub, for subsequent management of assortment mixes.

Copackers are divided into integrated, enabled for direct delivery, and non-integrated, which must deliver the products to the plant warehouses before distribution. However, approximately 97% of total production is internal, confirming the company's strategy of maintaining direct control over production lines and preserving technical and industrial know-how [52].

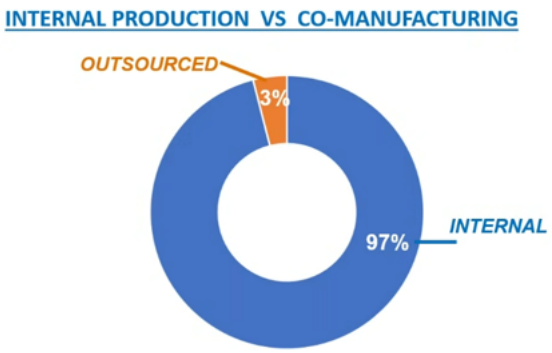


Figure 3.9 - Percentages of internal and external production

Barilla's primary network, illustrated in figure 3.9 , manages approximately 500,000 tons of goods each year, equivalent to 80,000 FTL (Full Truck Load) shipments and over 3 million pallets. It is a highly efficient system, primarily dedicated to direct movement between plant warehouses and customers, optimized through digital processes and coordinated by SAP platforms integrated with the Warehouse Management System (WMS) developed in collaboration with Reply Logistics [35].

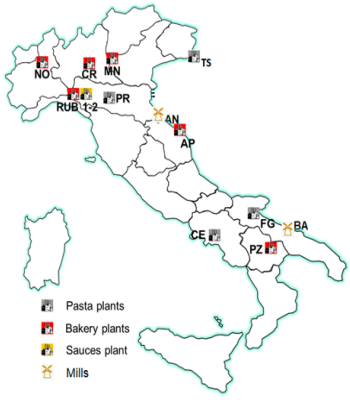


Figure 3.10 - Primary network

The secondary network, on the other hand, moves approximately 100,000 tons of product per year, divided into 10,000 FTL and 500,000 LTL (Less-than-Truckload), for a total of approximately 1 million pallets shipped to end customers [34]. The main national hubs are strategically located in Milan Pioltello, Parma (UNIONE), Rome, Caserta-Capua, Corato (Bari), Cagliari, and Catania, ensuring high logistics coverage and competitive delivery times in all areas of the country [52].

Figure 3.11 - Secondary network

Regarding internal management, the factory warehouses are located in the immediate vicinity of the production plants and store the entire range of locally manufactured items. The Rubbiano Sughi and Caserta plants, which do not have their own warehouse, send production daily to the Pedrignano and Foggia hubs, which operate as secondary collection and distribution centers.

Warehousing and handling operations are managed in collaboration with 3PL (Third Party Logistics) partners, who ensure flow continuity, inventory management, and full-load shipments.

Barilla warehouses are characterized by high levels of automation, especially in key hubs such as Pedrignano, equipped with over 118,000 pallet spaces and 50 LGVs (Laser Guided Vehicles), and Cremona, where automated handling systems minimize picking times and increase logistics saturation.

The average storage capacity varies from 150 to 440 SKUs per plant, with movements predominantly involving full load units (LUs) and large-volume shipments [35].

Furthermore, the digitalization of processes—enabled by the WMS system integrated with SAP—offers real-time visibility of inventory and flows along the entire chain, improving delivery accuracy and reducing operational inefficiencies.

This approach helps create a responsive, sustainable, and customer-centric supply chain, capable of rapidly adapting to fluctuations in demand and reducing transportation-related emissions, also thanks to growing collaboration with shared logistics service providers such as CHEP and Brambles [8].

Overall, Barilla's distribution model represents one of the most advanced logistics infrastructures in the European food sector, integrating in-house production, warehouse automation, and third-party networks into a unified, digital structure designed to ensure resilience, efficiency, and sustainability at every stage of the value chain.

3.4 Barilla Plants and Warehouses

Barilla's logistics network is based on an integrated system of production plants and warehouses designed to ensure a balance between efficiency, storage capacity, and product quality. Plant warehouses are located directly adjacent to the production areas, reducing handling times and optimizing material flow. Their capacity varies depending on production volume and the type of goods handled, ensuring the availability of the entire product range produced on site. Only the Rubbiano Sughi (Parma) and Caserta plants do not have an independent warehouse: in these cases, the finished product is transferred daily to the main logistics centers in Pedrignano (Parma) and Foggia via internal shuttles (shuttle flow), ensuring continuity and freshness along the supply chain [53].

All warehouses are owned by Barilla, which oversees their maintenance and infrastructure investments; Daily storage, handling, and order preparation operations are instead entrusted to external logistics operators (3PL), supported by companies specialized in managing internal

flows [54]. The storage system is characterized by high density, with a limited number of SKUs (SKUs)—generally between 150 and 440 per site—and movements predominantly at the full pallet level. Shipping occurs almost exclusively in Full Truck Load (FTL) mode, to meet the significant daily volumes [55].

Distribution warehouses (hubs), on the other hand, are strategically located throughout the country and managed by external logistics partners who, in some cases, also operate for other companies. The level of automation varies significantly based on storage capacity, the age of the facility, and the type of product: pasta sites, for example, handle higher volumes and have higher levels of automation than those in the bakery sector [56].

3.4.1 Meal Solutions Business Unit Warehouses

- Pedrignano (Parma)

  The Pedrignano facility represents the logistics hub of the Barilla Group. With a capacity of approximately 118,000 pallet spaces and a daily turnover of over 150 full loads, it is the main hub for pasta and sauces. Approximately a quarter of shipments are destined for the domestic market, while the remaining 70–75% serves the export network, via road and sea containers.

  The warehouse is fully automated and integrates two high-capacity stacker cranes (44,000 pallets each) and a fleet of approximately 50 laser-guided vehicles (LGVs), coordinated by an advanced Warehouse Management System (WMS) that optimizes flow distribution in real time. When the automated areas reach saturation, goods are diverted to the drive-through section, ensuring operational continuity even in the event of a technical downtime. This configuration, which combines automation and redundancy, makes Pedrignano the most efficient and technologically advanced logistics center in the entire network [57].

- Muggia (Trieste)

  The recently acquired Muggia warehouse has approximately 66,000 pallet spaces and handles an average of 50 full-load pallets per day. Fully automated, it uses latest-generation stacker cranes and benefits from its proximity to the port of Trieste, which facilitates intercontinental shipments by sea. Despite its technological complexity, flows are lower than those at Pedrignano, resulting in lower operational intensity [53].

- Foggia

  Built in 1983, the Foggia site can accommodate approximately 40,000 pallets and handles 50 full-load pallets per day. Part of the facility is automated, while the rest uses traditional racking. Modernization efforts are underway to introduce a semi-shuttle system for greater storage and handling efficiency [58].

- Caserta

  The Caserta warehouse is smaller, with a capacity of approximately 5,000 pallets and a throughput of 25 full-length pallets per day. It primarily serves the "Voiello" and "Bronze-drawn" lines, which have lower production volumes. The traditional facility primarily serves as a transit point to larger hubs, such as Capua [57].

3.4.2 Bakery Warehouses

In the Bakery division, automation levels vary: Castiglione delle Stiviere and Novara are the most technologically advanced sites, while Cremona, Rubbiano, Ascoli Piceno, and Melfi still operate with traditional storage methods.

- Novara

  The Novara plant, operating since 1953 and historically linked to the Pavesi brand, produces biscuits and snacks such as Baiocchi, Abbracci, and Ringo. With a capacity of 13,000 pallet spaces and approximately 35 full-size pallets per day, the warehouse employs a mixed system with semi-automatic shuttles and drive-in areas, ensuring high storage density and rapid flow management. It is also equipped with a 2,400-pallet refrigerated cell for seasonal products.

- Cremona

  Operating since 1974, the Cremona site produces fresh products such as Cornetti and Pan Bauletto, which require faster logistics due to their shelf life of less than 90 days. The warehouse, with 8,000 pallet spaces and 40 full-size pallets per day, uses drive-in racks and a dedicated area for manual picking.

- Melfi (Potenza)

  The Melfi plant, inaugurated in 1986, specializes in the production of flauti and focaccia. The warehouse, with 11,000 pallet spaces, operates with traditional systems and picking spaces organized at heights of 2.40 m, handling approximately 40 full-length trays per day.

- Ascoli Piceno

  Since 1981, the site has produced tartlets, plum cakes, and sandwich bread. The warehouse, with a capacity of 4,000 pallets and 18 full-length trays per day, uses drive-in racking with dedicated areas for order preparation.

- Castiglione delle Stiviere (Mantua)

  Among the Group's most productive plants, Castiglione boasts 18,000 pallet spaces and a daily handling of approximately 50 full-length trays. It is the first bakery warehouse to introduce a fully automated system, integrated with stacker cranes and shuttles for high-intensity handling.

- Rubbiano di Solignano (Parma)

  Constructed in 1965, the Rubbiano site focuses on the production of rusks and breadsticks. The warehouse, with 6,000 pallet spaces, is organized with drive-in racks and a storage height of 1.6 m, with an average flow of 25 full-loaded tonnage per day [59].

3.5 Channels as Tailored Value Propositions

Barilla's omnichannel approach is not only breadth of access it's different service models:

- GDO (Modern Retail). Roughly 38–40% of sales. The company co-manages stock with customers, tuning promotions and service levels to reduce over/under-stock, a must-have in high-velocity categories [48].

- HoReCa / Foodservice. Barilla for Professionals offers chef-ready formats (cooking stability, portion control) with technical support and menu know-how turning pasta and sauces into consistent kitchen performance.

- D2C and Premium Services. Pasta Evangelists (UK) brings gourmet, data-rich, direct relationships; "Dedicato a te" personalizes iconic products and packaging, boosting conversion with bespoke experiences.

- B2B & Specialized Distribution. Independent grocers and wholesalers keep coverage deep and local, ~100,000 points of sale in Italy alone, especially strong in Southern regions.

3.6 The Evolution of Barilla's Brand Identity and Its Sustainable Turn

From the very beginning, Barilla has recognized visual communication as not just an aesthetic element, but a true strategic lever for building relationships and trust with its audience. Through the language of colors, shapes, and images, the company has built a visual identity capable of representing the values of quality, craftsmanship, and innovation that have defined its international reputation. Over time, the brand has adapted to cultural and social changes, transforming its visual imagery into a narrative of continuity and renewal—a constant dialogue between tradition and modernity [27][28].

3.6.1 The Origins of the Visual Identity: From the Apprentice with the Egg to the "Blue Box"

The roots of Barilla's visual communication date back to 1910, when sculptor Emilio Trombara created the first company logo, known as the apprentice with the egg. The image, depicting a young man pouring an egg yolk into a mountain of flour, surrounded by curious passersby, embodied the value of authenticity and transparency: a tribute to the craftsmanship and authenticity of the Parma artisan workshop [33].

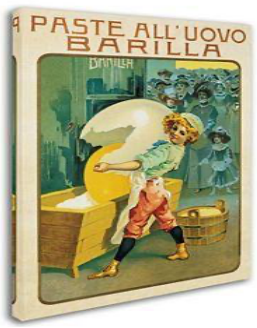


Figure 3.12 -"Il garzone con l'uovo", Emilio Trombara, 1910

A profound transformation took place after World War II. After an educational trip to the United States, Pietro Barilla introduced the first blue cardboard packaging, the famous Blue Box, in 1956. Until then, pasta had been sold loose, wrapped in simple sheets of blue paper.

Figure 3.13 - The First Blue Box by Barilla S.p.A., 1956

The new packaging, featuring a dark red oval with the white Barilla logo, represented the modernity of the industry and its approach to contemporary advertising language. The red symbolized egg yolk, the white purity, while the blue—which became more intense in the 1960s—became an emblem of reliability and recognizability, eventually becoming a universal symbol of identity [41].

3.6.2 The Emotional Dimension of the Brand

While graphics and color consolidated recognizability, Barilla's emotional communication helped root the brand in collective experience. The historic slogan "Where there's Barilla, there's home" was born in the 1980s, one of the most iconic campaigns in Italian advertising. Through images of everyday life, homecomings, lavishly laid tables, and affectionate gestures, the brand evoked universal values such as family, hospitality, and domestic warmth, without the need for words: just images and music [30].

Figure 3.14 -The evolution of Barilla S.p.A.'s 1952 logo

In recent years, the logo has been progressively simplified into a more contemporary and minimalist form. In 2022, to mark the company's 145th anniversary, a restyling was introduced consistent with the new positioning, "A Gesture of Love." A more intense and vibrant red replaces the white outline to convey passion, care, and inclusion. This color choice reflects not only love for people but also for the planet, marking the transition to a more sustainable and humane visual identity [29][31].

3.6.3 Sport as a Storytelling Tool

Alongside emotional communication, Barilla has chosen sport as a narrative vehicle for its values of commitment, balance, and dedication. From its historic sponsorship with A.S. Roma in the 1980s to more recent collaborations with Roger Federer, Cori "Coco" Gauff, Mikaela Shiffrin, and Alberto Tomba, the company has used the images of champions to portray pasta as a symbol of energy and daily well-being [32].

Figure 3.15 -Barilla's presence in professional alpine skiing through sports sponsorship

Campaigns like The Master of Pasta or the limited-edition Blue Boxes dedicated to Shiffrin's victories have strengthened the connection between balanced nutrition, athletic performance, and brand identity. The emerging idea is clear: choosing Barilla means choosing good, authentic, and sustainable energy, capable of accompanying both daily life and major competitive challenges [34][35].

Figure 3.16 - Example of Barilla's use of limited-edition packaging to enhance brand visibility through sports partnerships

3.6.4 From emotion to responsibility: sustainability as a brand evolution

Over time, the narrative of the "gesture of love" has expanded from the family level to the global level, transforming Barilla's ethical and visual identity into a concrete commitment to sustainability.

The 2024 Sustainability Report identifies four fundamental pillars of the Group's ESG strategy: sustainable product innovation, people development, responsible supply chains, and climate action [36].

On the packaging front, the company has taken decisive steps towards circular design: today 99.8% of the packaging is completely recyclable, thanks also to the removal of the plastic window from the Blue Box, which has allowed the annual consumption of plastic to be reduced by over 126 tonnes.

On the packaging front, the company has taken decisive steps toward circular design: today, 99.8% of its packaging is fully recyclable, thanks in part to the removal of the plastic window from the Blue Box, which has reduced annual plastic consumption by over 126 tons [45]. Initiatives such as the Secondhand Box project, developed in collaboration with Marie Kondo, promote the creative reuse of packaging by transforming it into containers for secondhand clothing, with the aim of raising consumer awareness of more conscious consumption [37].

Figure 3.17 -Barilla campaign promoting the reuse of pasta boxes for sustainable shipping

Energy and resource management also reflects the desire to reduce environmental impact. Over 48% of the energy used comes from renewable sources, and the "Energy & Water 2030" plan envisions increasing photovoltaic capacity from 4 to 24 MW by 2030, with investments of €168 million. The new systems installed in Rubbiano di Solignano (Parma) in 2024 will cover up to an entire day of production powered solely by solar energy during the summer months [38].

At the same time, water management has been made more efficient: in the areas with the highest water stress, the company has increased water reuse by 164%, reaching a recycling volume of approximately 2.5 million liters in Rubbiano, equivalent to twenty-four Olympic-sized swimming pools [36].

In the agricultural sector, the Barilla Sustainable Farming program involves over 7,000 farmers and guarantees more than 800,000 tons of raw materials sourced from sustainable practices. Educational initiatives such as the Basil Academy disseminate the principles of regenerative agriculture, which aims to improve soil fertility and biodiversity while reducing CO_2 emissions [28][39].

The stated goal for 2030 is to obtain at least 250,000 tons of ingredients from regenerative crops, with a positive environmental and social impact.

The evolution of Barilla's identity demonstrates how the brand has been able to reinvent itself while maintaining its founding values intact. From the artisan workshop of the early twentieth century to the contemporary global group, the company has translated its visual, emotional, and sustainable language into a coherent narrative: today, loving people also means caring for the planet.

3.6.5 Sustainable Logistics and Partnership with CHEP

Sustainability is now a central pillar of the Barilla Group's logistics. In recent years, the company has embarked on a transition toward a circular logistics model, launching a structured collaboration with CHEP, a world leader in pallet pooling systems.

This approach replaces traditional pallet ownership with a rental and continuous reuse model, in which packaging is shared among multiple stakeholders in the supply chain and cyclically reintroduced into the system. The initiative, gradually implemented between February and October 2025, significantly reduces environmental impact: according to internal estimates, the new model will prevent approximately 290 tons of waste and 3,700 tons of CO_2 emissions each year, and save over 3,100 m^3 of wood, thanks to the multiple reuse of logistics equipment [27].

In addition to the environmental benefits, the pooling system has introduced tangible advantages in terms of operational efficiency and flow control. Pallet traceability along the entire distribution chain enables more precise inventory management, fewer empty shipments, and reduced handling times. This collaboration demonstrates how sustainable logistics can represent not only an ethical choice but also a management lever capable of combining economic performance and environmental responsibility [33][41].

The partnership with CHEP is fully integrated into Barilla's philosophy of "innovating by caring," extending the concept of a "gesture of love" to materials management, waste reduction, and improved network performance. This model strengthens the principle of circularity in the supply chain, making a concrete contribution to the ESG objectives outlined in the Group's sustainability reports [29].

3.6.6 A brand that grows with its values

Barilla's history, from the boy with the egg to the "A Gesture of Love" campaign, recounts over a century of cultural, communicative, and value-driven evolution. Each stage—from the

birth of the Blue Box, to the emotional campaigns of the 1980s, to international sports partnerships and sustainable logistics and agriculture projects—forms a coherent narrative founded on authenticity, trust, and responsibility [31].

Today, Barilla's identity embodies both Italian tradition and a global awareness: a brand that continues to evoke warmth, family, and sharing, but that translates these sentiments into concrete actions for the planet. Every innovation, industrial decision, or design choice is oriented toward a common goal: creating food that is "good for people and the world," transforming corporate values into a coherent visual, social, and environmental language.

3.7 Systems, visibility, and control

On an operational level, Barilla's warehouse management is based on a WMS (Warehouse Management System) developed by Reply and fully integrated with the SAP platform. This integration enables end-to-end visibility of logistics flows, thanks to the synchronization of master data, real-time monitoring of inventory, and the traceability of every operational event—from goods receipt to picking, up to shipping [35].

In the transportation phase, the system applies planning based on logistics corridors (lanes) that allows for load consolidation, the definition of time windows, and route monitoring. This approach allows for balancing service costs with performance levels, improving vehicle saturation and reducing empty trips [36].

The result is a logistics network capable of harmonizing efficiency and sustainability, in which the digitalization of processes becomes a key element to support the analysis of profitability by customer, route, and product. This system, aligned with Industry 4.0 standards, represents an integrated and responsible logistics model, in which technology and sustainability operate as two sides of the same strategy.

Chapter 4 Transition to the CHEP Pooling Model

4.1 Introduction: the reasons behind the change

The evolution of the collaboration between Barilla S.p.A. and CHEP represents one of the most significant milestones in the Group's logistics innovation journey in recent years. Back in 2009, Barilla began experimenting with the pallet pooling model on specific export flows, using CHEP pallets to serve some European customers, while the domestic market continued to be managed through the traditional EPAL exchange system.

Over time, experience gained abroad had shown that the CHEP system could guarantee high quality standards, greater operational efficiency and a reduction in environmental impact thanks to the principle of circular reuse of pallets [14][11]. The advantages observed on European routes, from reduced returns to less damage in warehouses, gradually highlighted the gap with internal management in Italy, which was still based on traditional and unsustainable practices.

The main critical issues with the EPAL model were the complex management of pallet vouchers, the inconsistent quality of the pallets, compatibility problems with automated warehouses, and a significant environmental impact due to empty journeys to recover pallets. Added to this were thefts, breakages and inventory losses, which forced the company to make continuous investments to maintain a stable pallet fleet.

In view of these limitations, in January 2024 Barilla signed an exclusive ten-year agreement with CHEP to extend the pooling model to all major domestic customers and additional European markets. This decision marked a strategic shift towards more efficient, digital and sustainable logistics, perfectly in line with the Group's ESG objectives and the Zero Waste World approach promoted by CHEP and Brambles [46].

4.2 Legacy pallet management systems before pooling

4.2.1 Exchange model (EPAL exchange)

The EPAL exchange system has been the standard in the Italian food supply chain for decades. It is based on a compensation mechanism: the customer receives the product on EPAL pallets and undertakes to return an equivalent number of pallets in similar condition. This model, which appears balanced, actually generates considerable management complexity. Each delivery requires the issuance and reconciliation of pallet vouchers, which involves

administrative overhead and frequent discrepancies between records. Inventory differences (‘pallet delta’) represent a recurring loss item for manufacturers. In addition, the quality of pallets circulating in the EPAL system is highly variable, as there is no uniform control over the condition of the pallets.

For a company such as Barilla, which makes extensive use of automated warehouses and robotic handling systems, these differences in structural tolerance can compromise productivity and increase the risk of blockages in loading and unloading lines [41].

4.2.2 Rental model and customer-billed pallets

Alongside the interchange system, Barilla had adopted a rental model through CHEP for some European flows, which allowed it to outsource the physical and administrative management of the pallets. The experiment had shown greater fluidity of flows and a reduction in indirect costs, thanks to CHEP's integrated pallet collection, maintenance and supply service [14].

At the same time, for smaller customers or those with specific needs, the company used a customer-billed model, i.e. the direct sale of pallets to the customer. Although practical in isolated cases, this scheme proved inefficient on a large scale, as it multiplied accounting codes, complicated reconciliation and did not guarantee full traceability of the pallets.

4.3 CHEP's operational reorganisation to meet Barilla's needs

4.3.1 Expansion of the asset base and redesign of pallets

The entry of Barilla's Italian customers into the pooling circuit has led to an increase of approximately 4 million pallets per year managed by CHEP in Italy. To ensure continuity of service, the company had to expand its asset base and introduce a new structural design for wooden pallets, which is more resistant and stable under heavy loads.

The new model features wider top boards and a higher nail density, with the central boards positioned closer together. These changes have increased the bearing surface, improving stability during storage and transport. CHEP's internal studies have shown a 35% reduction in defect reports and an annual saving of around 500 trees, thanks to the longer average lifespan of the pallets [60].

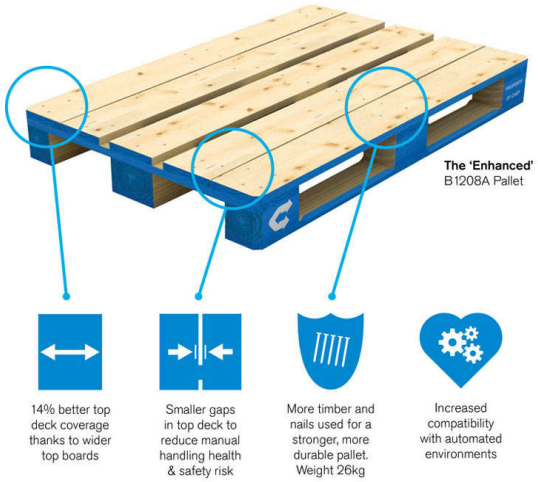


Figure 4.1 - The new CHEP pallet design

4.3.2 Logistics network and service centres

The increase in volumes handled required a redesign of CHEP's logistics network in Italy. To compensate for the geographical imbalance generated by Barilla's strong export focus, CHEP organised balanced return flows from its centres in France and Slovenia to the Italian plants in Novara and Muggia, thus optimising international transport and reducing empty kilometres.

At the same time, to support quality control and maintenance, CHEP opened two new service centres: one in Salerno, supporting operations in southern Italy, and one in Parma, dedicated to plants in the north. Thanks to these openings, the national network now has 22 direct centres and 19 centres in partnership with major distributors, including Esselunga (Biandrate, NO) and Ferrarelle (Riardo, CE) [60].

Figure 4.2 - The distribution of CHEP service centers in Italy

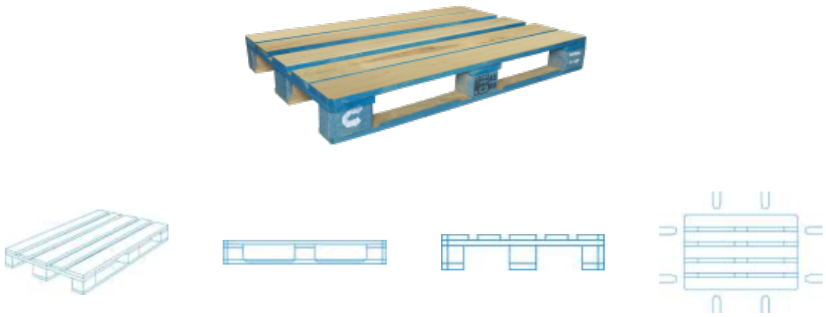
4.3.3 Proactive demand management

To ensure constant pallet availability throughout 2025, a crucial switchover period, a timber forecast system has been introduced, shared between the logistics teams at Barilla and CHEP. Each plant, through its Production Planner and Warehouse Manager (PPWM), produces a monthly forecast of the pallets needed for the following three months.

This flow of information makes it possible to anticipate peaks in demand, avoid shortages and ensure continuity of production even during periods of peak seasonal demand [60].

4.4 CHEP products adopted by Barilla

Barilla has selected three main types of pallets from the CHEP catalogue, each designed for a specific function in the logistics chain:

80x120 cm CHEP wooden pallet	This pallet represents the operational basis of Barilla's logistics. It is used for finished products and must meet dimensional accuracy requirements compatible with AGV and LGV systems and high-density automated warehouses. Thanks to its new design, internal tests have shown a rejection rate of 2% compared to the average of 8% for EPAL pallets. 
80×60 cm CHEP pallet	This pallet known as a demi-pallet, it is used for deliveries in the secondary network and in traditional points of sale. Composed of wooden boards and bases with galvanised steel blocks, it guarantees greater resistance during manual handling and supports loads of up to 500 kg, while maintaining great manoeuvrability..

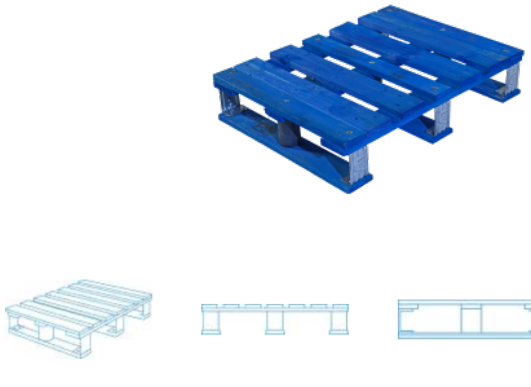
	
60x40 cm CHEP plastic pallet	The so-called quarter pallet, made entirely of plastic, used for promotional purposes and displays in retail outlets. It supports loads of up to 25 kg and is ideal for bakery products, which are lighter and easier to place on shelves. 

Table 4.3 - CHEP product adopted by Barilla

4.5 Implementation phases and project roll-out

The introduction of the CHEP system within Barilla's complex logistics ecosystem was a transformation project in every sense, characterised by careful planning, progressive timing and strong coordination between business functions. After signing the ten-year agreement in January 2024, the project team involved the entire value chain, from production departments to external partners, including IT, distribution planning, suppliers and 3PLs [60][61].

4.5.1 Customer clusters

The first operational phase involved identifying the customer base to be included in the transition. The selection was conducted jointly by Barilla and CHEP, based on criteria of reliability in pallet returns and the economic sustainability of the pooling model.

The main customers, representing approximately 93% of the total, were included in the project, as their logistical characteristics and order frequency guaranteed positive economic and

operational returns. For smaller customers (approximately 7%), belonging to channel fee category 4, management remained temporarily linked to the EPAL exchange, as the risk of non-return and the incidence of costs could have negated the benefits of pooling. However, a gradual inclusion of these customers is already planned for 2026, thanks to customised agreements and dedicated solutions, so as to gradually extend the uniformity of the model [60].

4.5.2 Transition of production sites

In parallel with the definition of the customer perimeter, a conversion plan was drawn up for the production plants, differentiated between the Group's two main product areas: meal solutions and bakery.

This distinction was necessary because meal solution products (sauces, gravies, ready meals) have longer life cycles and therefore require more time to dispose of stocks on EPAL; conversely, bakery products, which are more perishable, have a rapid turnover and more immediate pallet replacement.

The switchover process was planned over a period of approximately nine months, with a sequence designed to avoid service interruptions and operational overlaps:

Sites	Date of switch
Rubbiano bakery	3 June 2025
Melfi	9 June 2025
Novara	7 July 2025
Ascoli Piceno	14 July 2025
Castiglione delle Stiviere	8 September 2025
Cremona	6 October 2025

Table 4.4 - The switchover sites of meal solutions

After the completion of the first wave of plants, a two-month running-in period was planned, which was useful for disposing of the last EPAL stocks and testing the full efficiency of pallet flow tracking between plants, auxiliary warehouses and customers.

Subsequently, the second phase, dedicated to the bakery sector, involved:

Sites	Date of switch
Rubbiano	3 february 2025
Pedrignano	10 february 2025
Foggia	3 march 2025
Caserta	10 march 2025
Muggia	7 april 2025

Table 4.5 - The switchover sites of bakery

The entire transition was completed by the end of 2025, with the complete switch to CHEP pallet production and storage.

4.5.3 Internal operational phases of the transition

Each plant went through three operational phases, calibrated according to stock availability and production rates:

1. Controlled start-up: production began on CHEP pallets, but most of the stock was still on EPAL pallets. Shipments to customers therefore continued mainly with EPAL pallets, with a few “wood changes” to standardise batches.
2. Mixed period: with the gradual disposal of EPAL stock, a phase of coexistence between the two systems begins. Customers are updated in the management records and orders are marked “CHEP wood type”. Mixed shipments are only allowed for internal transfers (Stock Transfer Orders) between Barilla warehouses.
3. Consolidation: production and stocks are now almost entirely on CHEP. Customer orders are fulfilled only on CHEP pallets, and the last remaining EPAL units are gradually replaced until they are completely eliminated.

This approach has allowed for operational continuity throughout the process, avoiding misalignments in IT systems and distribution flows [60].

4.5.4 HUB transition and warehouse network integration

In parallel with the conversion of the plants, the transition of the nine logistics hubs and two auxiliary warehouses was initiated. The first switch took place on 21 July 2025 at the hub adjacent to the Pedrignano plant.

From that date onwards, the other centres also progressively adopted the CHEP system on a weekly basis, completing the migration by the end of August.

As the finished product warehouses and HUBs are managed by five external 3PL operators, the success of the project required extensive training and operational alignment. Some partners, such as Number1, Futura Srl and GXO, already had experience with CHEP pallets for managing export flows and were able to actively support the transition [12].

4.6 Digital integration

In the transition to the pooling model, the digital aspect assumed a crucial role, representing the true glue between the various components of the supply chain. The IT assessment, launched in the early stages of the project, had the function of analyzing the compatibility between Barilla's existing information systems and those of its logistics partners, laying the foundation for integrated management of physical and data flows.

Before the change, the Group's IT network was composed of a heterogeneous set of tools, each managed independently by the different players in the supply chain: plants, 3PLs, co-packers, and packaging suppliers. This fragmentation made the traceability of pallet movements complex, generating duplications and long update times. The objective of the IT assessment was therefore to create a coherent system capable of unifying communication between Barilla and CHEP and ensuring timely control over the assets moved, through an automated, precise, and transparent data flow [61][62].

Digital integration was not limited to the interface between the two companies, but extensively involved the entire logistics network, redefining the data recording, control and validation processes. In this sense, the work carried out made possible a continuous reconciliation between management and operational data, improving the timeliness of information and the reliability of stock analyses. The result is an information ecosystem capable of supporting Barilla's current needs and adapting to future evolutions of the logistics model, with a view to interoperability and digital sustainability [22][62].

4.6.1 System architecture and data flows

Previously, Barilla relied on two main tools to monitor exchanged EPAL pallets: the Number1 Manager system, used to record incoming and outgoing movements, and Click Reply, an internal Warehouse Management System (WMS) that ensured autonomous accounting of

logistics flows. While this dual structure ensured operational control, it also required manual data reconciliation, resulting in a waste of time and resources [60].

With the launch of the CHEP model, the company simplified its entire information flow architecture. Today, all movements are recorded directly on Click Reply and automatically transmitted to Barilla's SAP system several times a day. SAP then generates an XML file that is sent three times a day to CHEP's systems, allowing the myCHEP platform to be updated in real time and thus ensuring a complete and synchronized view of movements between the two partners [5][23].

For copackers and packaging suppliers, the communication method was calibrated based on their digital maturity. Companies with advanced infrastructures can communicate directly with CHEP via XML, while smaller companies send standardized Excel reports that are uploaded manually. In both cases, the goal is to maintain accounting consistency between Barilla, CHEP, and external partners, ensuring uniform pallet tracking and complete traceability throughout the supply chain [22].

This digital architecture, the result of a shared design, has made SAP the true nerve center of Barilla's logistics network, transforming it into a platform capable of consolidating data from plants, hubs, and warehouses. The integration of the systems has led to a tangible improvement in data quality, reducing discrepancies and enhancing management's decision-making capacity through real-time indicators [62].

4.6.2 The myCHEP platform

The myCHEP platform represents a fundamental element of the new digital ecosystem. It is an operational portal that allows Barilla to independently manage pallet flows, interacting in real time with CHEP systems. Each plant, hub, and warehouse has personalized credentials that allow them to monitor their own activities exclusively, while the central team in Pedrignano enjoys an aggregated view of the entire national and international network [60].

Through myCHEP, operators can plan deliveries of empty pallets, organize collections of damaged ones, and view the operational calendar with scheduled movements. It is also possible to download periodic reports relating to volumes moved, residual stock, and logistics performance. The adoption of this platform has increased the level of transparency and control,

reducing the need to manually interface with CHEP representatives and decreasing operational response times [62].

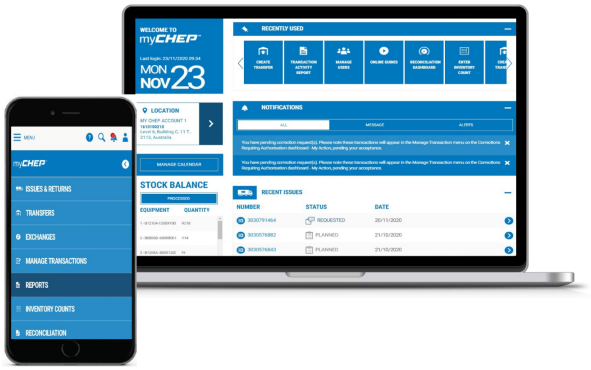


Figure 4.6 - MyCHEP platform home screen

The ability to integrate myCHEP data with SAP and Click Reply enables a more comprehensive performance analysis, improving planning capabilities and enabling Barilla to intervene promptly in the event of anomalies or inefficiencies. This continuous monitoring system has helped strengthen flow management and collaboration among supply chain partners, confirming the centrality of digital as a tool for efficiency and management sustainability.

4.6.3 SAP customisation and new functionalities

Alongside the introduction of pooling, Barilla enhanced its SAP system by developing dedicated transactions for the management of CHEP pallets. These functions were created to automate movement recording, ensure accounting accuracy, and simplify communication with CHEP [41][66].

The main new features introduced include:

- ZREPORTINGPALLET, which allows for detailed analysis of pallet movements by plant, trip, or order, offering complete flow traceability;
- MIGO, used to record deliveries of empty pallets and correct any discrepancies through Stock Adjustment;
- VL01NO, for returns of unsuitable pallets, which automatically updates the stock levels of the affected plants;
- ZINVOICEPALLET, dedicated to verifying CHEP invoices, capable of comparing cost items (Channel Fee and Regional Transfer Fee) with internal accounting data.

The adoption of these features has improved information accuracy and reduced audit times, making the system more flexible and intuitive.

The SAP–CHEP integration has also strengthened Barilla's ability to manage its logistics assets in a predictive way, anticipating any critical issues and ensuring more effective planning of outgoing and incoming flows.

4.7 Involvement of co-packers and packaging suppliers

The project's implementation not only involved Barilla's internal structures but also extended to external parties that operate daily in support of production and distribution. Copackers and packaging suppliers represent a strategic link in the supply chain, whose adherence to the new model was essential to ensure operational consistency [60].

Barilla collaborates with approximately thirty copackers who collectively move over 250,000 pallets each year. For partners already integrated into the CHEP circuit, the transition was immediate and without any problems; for the others, preferential financial agreements and a dedicated training program were introduced to familiarize them with the pooling procedures [22][23]. This support phase allowed for the standardization of management practices, ensuring a continuous flow of materials and information.

A similar process involved packaging suppliers, who move approximately 200,000 pallets per year to the Group's plants and warehouses. Larger companies, already CHEP customers, integrated quickly, while smaller suppliers were able to temporarily maintain the EPAL system, avoiding excessive economic impacts. This flexibility, agreed upon with CHEP, allowed the overall network balance to be preserved, minimizing delays and minimizing the entry of non-compliant pallets into the Barilla network [63].

This modular approach allowed for the consolidation of a more fluid and integrated supply chain, improving overall visibility of flows. The extension of the pooling model to co-packers and suppliers represented a fundamental step for the efficiency of the system and the consistency of the Group's sustainability strategy.

4.8 Overall Assessment: Benefits and Areas of Focus

The adoption of the CHEP model has led to a profound transformation of Barilla's logistics, both operationally and strategically. The benefits that have emerged are numerous:

- Uniformity and quality of logistics support, thanks to the standardization and constant reconditioning of pallets, which reduce the risk of blockages in automated lines and improve operational safety.
- Efficiency and simplification of processes, due to the elimination of pallet vouchers and the reduction of administrative activities related to exchanges.
- Economic optimization, with the transition from capital expenditure (CAPEX) to operating expenditure (OPEX), making the cost structure more predictable and transparent [22].
- Reduction of environmental impact, as CHEP's share & reuse model allows for the limitation of CO_2 emissions and the consumption of natural resources, in line with ESG principles and the environmental sustainability objectives set by Barilla [61].
- Strategic innovation, which provides the foundation for future automation projects and the expansion of intermodal transport, areas in which pallet quality and standardization become essential requirements [60][63].

Alongside these results, the project nevertheless presents some areas for attention. The choice of a single supplier inevitably entails a contractual and organizational dependency constraint: any tariff changes, supply delays, or asset shortages during peak periods could generate operational impacts. Furthermore, the pooling model entails additional costs in the event of declaration delays (Late Declaration Charge) or lost pallets (Lost Equipment Charge), making a reliable and constantly updated digital tracking system essential.

The initial phase of the project required a significant coordination effort for the temporary coexistence of the two systems (EPAL and CHEP), requiring strong collaboration between the plant, hub, and 3PL. However, this very adaptation phase has allowed the consolidation of a corporate culture more oriented towards data control, information sharing, and the sustainability of logistics processes.

Overall, the digitalization of flows, the integration of external partners, and the new pallet governance have allowed Barilla to build a more efficient, transparent, and sustainable logistics model, capable of responding to the sector's future challenges and aligning with international best practices.

Chapter 5 When Efficiency Meets Sustainability: The Outcomes of the CHEP Transition

5.1 Assessing the Shift from EPAL to CHEP: A Comparative Overview

The transition from an EPAL exchange-based system to a CHEP pooling model has had an impact on three levels: economic, operational and environmental. In this section have been analyzed the economic and operational levels; in the following chapter, the topic of environmental impact and sustainability will be addressed. Domestically, the exchange required intensive administrative work (pallet vouchers, reconciliations, returns), inconsistent quality management and indirect costs associated with breakages, losses and reconditioning. Abroad, where Barilla was already using CHEP on several flows, the experience had shown more predictable service levels, standardised and inspected pallets, inclusion of collection in the service and fewer returns: hence the decision to extend the model to the domestic market (exclusive agreement 2024) and to "pool" what worked in the EU [60][61].

In summary:

- EPAL (exchange) → greater administrative complexity and technical variability; "hidden" costs (repairs, replenishments, empty trips, vouchers to be reconciled). [4].
- CHEP (pooling) → service fee (OPEX), consistent quality standards for automated warehouses, better planning of pick-ups and availability, and an intrinsic contribution to ESG objectives ('share & reuse' cycle) [60][23].

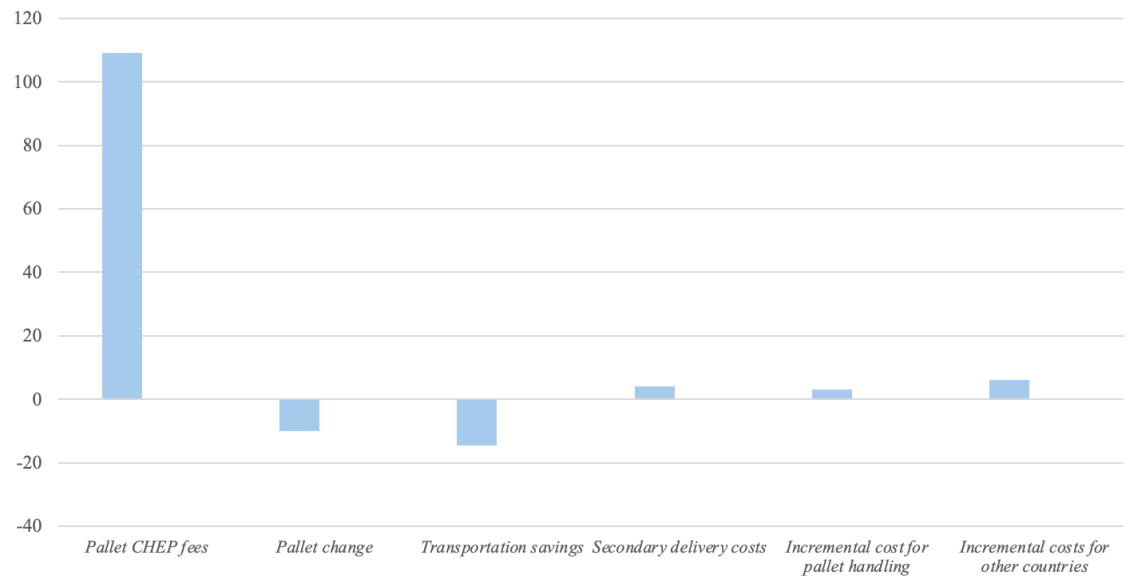
5.2 Measuring the Economic Benefits of Pooling

To estimate the economic benefits, Barilla compared cost E (domestic EPAL regime, ≈ 3.5 million movements/year) with cost C (full domestic CHEP regime). When CHEP model will be fully operational, it is expected that 88% of the ~3.6 million domestic pallets will be pooled with CHEP, with the remaining 12% in EPAL mainly allocated to smaller customers (called FIRST clients) at high risk of non-return.

The analysis breaks down C into incremental and decremental components:

Incremental components:	Decremental components:
CHEP fee: main item, ~94% of C today, set to grow as a percentage if smaller customers migrate to CHEP (up to ~109% of the percentage "mix", due to the reduction in other items).	Transport savings: –13% of C (–14% at convergence) thanks to better saturation and fewer empty returns.
Purchase of special EPALs (countries with specific wood/size requirements that are not economically viable in pooling): ~7% stable.	Reduction in wood exchanges: –6% of C in the first phase, up to –11% at convergence, as EPAL stocks are depleted and residual customers switch to CHEP.
CHEP empty pallet handling (3PL): ~3% of C, with a possible slight increase (~4%) due to volume saturation.	
Residual EPAL rental (non-converted customers): ~15% of C, with a target of ~5% at convergence	

Table 5.2 - Incremental e decremental components of C



Graphic 5.3 - Cost components of C with the transition to CHEP for Barilla's smaller domestic-market customers

The comparison between C and E already shows a net saving of ~3% for Barilla. With the extension to smaller customers, the delta could rise to ~8%, due to the combined effect of: (i) reduction in residual EPAL rental; (ii) further decrease in wood changes; (iii) fewer empty pallet movements thanks to inbound reuse (inbound pallets from suppliers/co-packers directly reused to palletise the finished product), which also reduces the costs of delivering empty pallets (savings of ~50% on the cost of a standard order when the return covers part of the requirement).

This approach is consistent with the literature and benchmarks on pooling: more transparent costs (OPEX), fewer ancillary activities and better control of expenditure drivers along the supply chain.

5.3 Operational Improvements Across Barilla's Logistics Network

The most visible operational effect is the drastic reduction in pallet replacements (wood changes) during order preparation. Historically, warehouses serving foreign markets (Pedrignano, Muggia, Foggia and, to a lesser extent, Novara and Castiglione delle Stiviere) had to convert EPAL → CHEP to meet the requirements of pooling customers; Conversely, Cremona sometimes converted foreign pallets to EPAL for domestic deliveries. These activities slowed down the bays, impacted resources and introduced risks of error. With the 2025 switch and the progressive alignment of plants, HUBs, co-packers and suppliers, replacements are falling structurally.

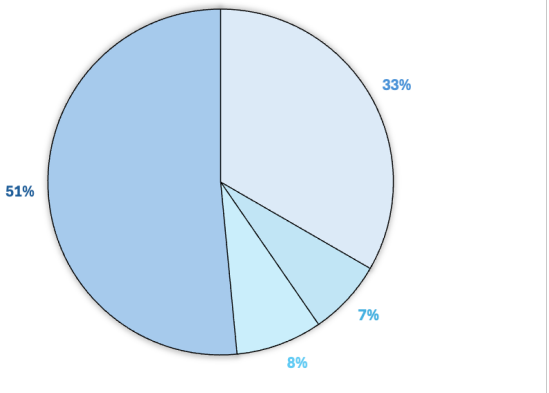
Once fully operational (early 2026), with the depletion of class C stocks on EPAL and the extension of agreements to smaller suppliers and customers, the number of expected wood changes will be reduced by at least ~60% compared to the pre-project. This translates into shorter preparation times, improved daily processing capacity, fewer interruptions and greater stability for automated systems (AGVs/LGVs, stacker cranes). These results are perfectly consistent with the technical drivers of pooling (standardisation, inspection/reconditioning, coordinated collection) [60][8].

5.3.1 Reduction of Pallet Replacements and Downtime in Automated Warehouses

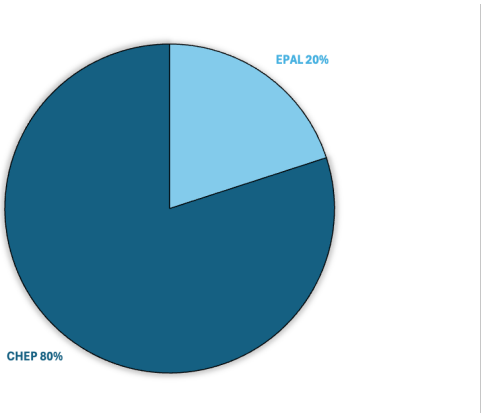
Typical patterns were observed in the first waves of conversion: in the initial months, the switch shifts production to CHEP, while shipments are still affected by dwindling EPAL stocks → in this phase, replacements may even increase compared to the previous year. When other plants switch to CHEP and start supplying the HUBs with uniform pallets, the curve changes direction and wood replacements drop sharply, absorbing even seasonal peaks with less risk to automated systems (tighter tolerances, lower scrap rates). The logic is well known in literature and industrial practice: quality of support and reduced variability mitigate machine downtime and rejects in automated bays [7][2].

5.3.2 Case Focus: Performance at the Pedrignano Finished Goods Warehouse

Pedrignano is the main MPF in the network (capacity ~120,000 pallet spaces) and handles the most heterogeneous flows: typically ~60% export and ~40% domestic on OUT journeys. Analysing the data from 1 January to 31 August 2025, OUT journeys are ~67% foreign and ~33% Italian.Within foreign countries: ~7% containers (without palletisation), ~8% EXW extra-EU (EPAL invoiced to the customer; out-of-pool countries), ~51% Europe in CHEP (with recent extensions: Switzerland from February 2025, Slovenia and Croatia from April 2025, Malta from September 2025). On palletised trips abroad (~89%): ~80% CHEP and ~20% EPAL.

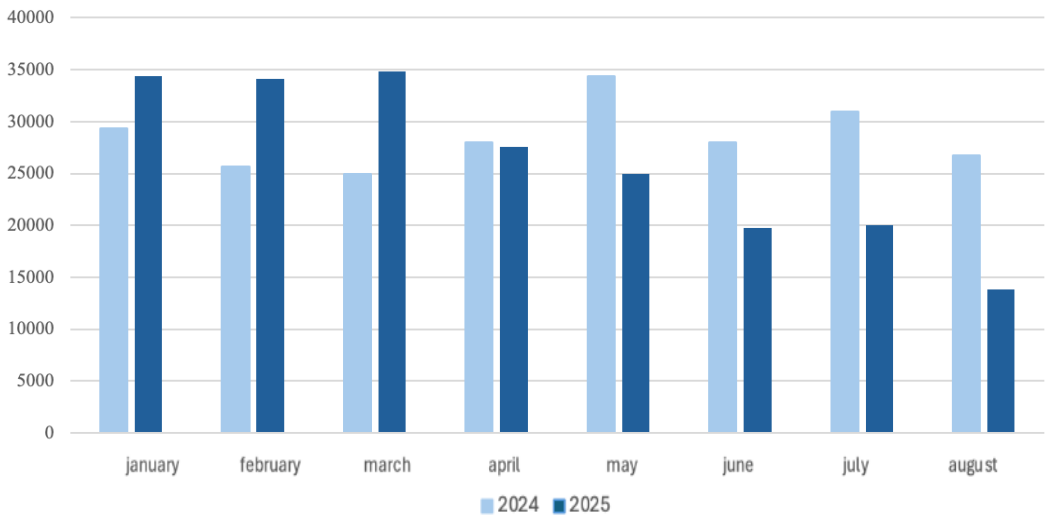


Graphic 5.4 - Outbound trips from the Pedrignano MPF between January 1, 2025 and August 31, 2025



Graphic 5.5 - Types of pallets used in the palletization of OUT trips from the Pedrignano MPF to foreign markets between January 1, 2025 and August 31, 2025

The wood exchange rate effect: comparing Jan–Aug 2024 vs 2025, exchange rates are higher in the first 3 months of 2025 (phase 1: production on CHEP, shipments still on EPAL). The first significant drop comes in April 2025 (Muggia switch; Foggia and Caserta start shipping on CHEP). In July and August 2025, exchanges fall to ~60% and ~53% of 2024 levels, respectively. The trend continues with the bakery switches (Rubbiano and Melfi in June; Novara and Ascoli in July) and with the completion of Castiglione and Cremona (Nov–Dec 2025). From 2026, there will be further benefits from Malta joining the pool (~7,500 pallets/year from Pedrignano) and from the future domestic agreement with smaller customers (–~30,000 exchanges per year; ~97% of wooden exchanges are currently concentrated in Pedrignano).



Graphic 5.6 - Comparison of wood exchanges carried out in 2024 and 2025, from January to August, at the Pedrignano MPF

5.4 Financial Transparency and Administrative Efficiency Gains

An often underestimated benefit is administrative simplification: pooling “wipes out” most of the non-value-added activities of the exchange (issuing/checking pallet vouchers, reconciliations, negotiations on inventory differences), transforming them into a more readable OPEX structure.In terms of systems, three levers have made the difference:

- myCHEP: delivery/collection scheduling, movement tracking, stock reports by plant, consolidated view for the central team → fewer emails/phone calls, greater operational transparency.
- Click Reply → SAP → CHEP flows: multiple daily XML transmissions from SAP Barilla to CHEP systems to align movements and keep records and stock consistent [60].
- Dedicated SAP transactions: MIGO (empty container receipts; Stock Adjustment), VL01NO (returns to CHEP), ZREPORTINGPALLET (traceability by order/journey/delivery), ZINVOICEPALLET (invoice control with Channel Fee and Regional Transfer Fee): these functions enable robust reconciliation between “declared” and “invoiced” and support LDC/LEC control control (late declarations and losses). [60][22].

The result is twofold: a reduction in repetitive accounting work and greater control over cost drivers (declaration times, average dwell times, losses), with ‘asset accounting’ closer to real time.

Chapter 6 – The Circular Payoff: Environmental and Strategic Results

6.1 Sustainability Achievements of the CHEP–Barilla Partnership

The transition to pallet pooling with CHEP is not just a measure of efficiency: it is an applied sustainability project that affects the daily life of the supply chain and, at the same time, Barilla's ESG profile. The principle is simple: sharing, reusing, repairing and recycling instead of purchasing and managing pallets. In practice, pallets become a service and remain in circulation, undergoing inspection and reconditioning at service centres to extend their useful life and minimise waste. This approach, which CHEP and Brambles summarise in the "Share & Reuse" model, has already demonstrated a tangible impact on a global scale in terms of emissions, waste avoided and resources preserved [61][22].

Within Barilla, the decision to extend to the domestic market what had already been working on European flows since 2009 has resulted in progressive results in three areas:

- Less waste thanks to the systematic repair of pallets;
- Lower emissions due to fewer empty journeys and better vehicle saturation;
- Lower wood consumption due to the greater durability of assets and coordinated recovery.

This operational alignment strengthens Barilla's positioning as a "Good for You, Good for the Planet" company, integrating logistics into the Group's broader environmental responsibility journey.

6.2 Long-Term Environmental Impact: Carbon, Waste, and Resource Savings

The literature and corporate data clearly indicate that pooling networks enable structural savings on key environmental drivers. On a global scale, in fiscal year 2025 alone (June 2024–June 2025), Brambles estimates 1,992 kt of CO_2 avoided, 4,371 ML of water saved, 1,339 kt of waste avoided, and ~2.3 million m^3 of timber preserved thanks to the shared model [23].

Applying the closed-loop logic to the Barilla case, the projections for the project when fully operational (after the complete disposal of residual EPAL stocks and extension to smaller partners) indicate:

- ~290 tonnes/year of waste avoided: wood waste decreases because pallets are repaired and reintroduced into the circuit, rather than discarded as in the interchange model. This is in line with Brambles' goal of “zero product waste to landfill” (over 93% of service centres diverting from landfill by 2025).
- ~3,700 tonnes/year of CO_2 avoided: pooling enables coordinated collections and reduces empty journeys associated with the return of EPALs; the effect is increased by the standardisation of flows and co-loading and joint planning projects.
- ~3,100 m^3/year of wood saved: the longer service life of CHEP pallets and lower loss rate reduce the need for new raw materials; the timber used is FSC®/PEFC certified to protect sustainable forest management [23].

These figures have a concrete meaning: less waste, fewer emissions from road transport (the predominant channel in Italy), less pressure on natural resources. Above all, they are scalable: they grow as smaller customers, co-packers and packaging suppliers converge on the same operating standard.

6.3 Toward a Shared Logistic Standard and Collaborative Supply Chains

One of the less visible but most significant effects is the progress toward a 'common language' in logistics. When an entire network – plants, HUBs, 3PLs, copackers, suppliers, and customers – operates under the same physical standard (homogeneous, controlled pallets with known tolerances) and information standard (declaration rules, traceability, KPIs), the supply chain becomes collaborative by design. For Barilla, this means: Reduction of variability in picking, storage, and transportation (fewer exceptions to manage); Greater reliability in planning (pallet forecasts, myCHEP slotting, stock visibility); Easier integration of new players (onboarding copackers/suppliers with unified data templates and rules).

At the ecosystem level, shared standards facilitate inter-company projects: consolidated pickups, multi-client optimizations on main routes, data exchanges to anticipate peaks. Literature on collaborative models and the practice of CHEP programs show how pooling shortens the gap between efficiency and sustainability, enabling initiatives that individually would be difficult or uneconomical.

6.4 Broader Effects on National Logistics and the “Made in Italy” Competitiveness

The widespread adoption of shared standards can have systemic effects on national logistics: Fewer empty kilometers and better use of carrier capacity, with cascading impacts on time, costs, and carbon footprint; Increased reliability of flows in an exporting country like Italy, with direct benefits on punctuality to shelf in the GDO and in food exports; Strengthening 'Made in Italy': when products arrive with fewer damages, less waste, and better continuity, the country's image benefits. Looking ahead, the maturation of the pooling model – in synergy with intermodal transport and European corridors – contributes to supply chain competitiveness, favoring a positioning where product quality and logistics quality advance together [10] [13].

6.5 Innovation Catalyst: From Digitalization to Logistics 4.0

Collaboration with CHEP has also accelerated the digital transition of Barilla's network: myCHEP enables scheduling of deliveries/pickups, tracking, and reporting for plants with a centralized view; the Click Reply → SAP → CHEP flows via XML (multiple daily shipments) have made the data timely and reconcilable;

In SAP, dedicated transactions (MIGO, VL01NO, ZREPORTINGPALLET, ZINVOICEPALLET) have provided transparency for movements and invoices (Channel Fee, Regional Transfer Fee), containing LDC/LEC and strengthening governance [41][47][64].Looking ahead, the natural evolution is the integration of IoT and automatic identification (tags, sensors, data fusion with carrier telematics) to:- estimate ETA and pallet availability more accurately;- measure dwell time and lifecycle to optimize stock;- enable predictive asset maintenance and damage cause analysis (by lane, customer, vehicle).These digital levers shift pallet management from an ancillary function to a "smart" component of the network – consistent with the principles of Logistics 4.0 and Brambles’ innovation programs [62].

6.6 Future Scenarios and Ongoing Commitments

The 2025 experience demonstrates that the gradual approach (three phases per plant, extension to HUB, onboarding co-packers/suppliers) is the most effective way to change without stopping. The priorities for 2026–2027 are clear:Complete the convergence of smaller domestic

customers: this is the leverage to consolidate economic benefits (further reduction in wooden exchanges, optimization of pick-ups) and environmental benefits (fewer empty returns).Fully align the supplier network: maximizing inbound reuse reduces empty orders and 3PL handling.Bring KPIs into full operation: Swap Ratio, Declaration Timeliness, Lost Equipment Rate, Truck Turnaround, CO_2 per delivered pallet – with monthly audits between ZREPORTINGPALLET and ZINVOICEPALLET.

Expand collaborative projects: co-loading, empty kilometer optimization, and a higher intermodal share on suitable routes.Digital development: IoT experimentation on asset tracking and integration of predictive analytics, focusing on peak planning and maintenance of automated systems.One point of concern remains: dependence on a single provider. This is mitigated with clear SLAs, capacity plans for seasonal peaks, data governance, and continuous improvements (kaizen) in forecasting and reporting – elements already embedded in the current model.

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