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Toward a transportation management system: the Verallia company's digitalization of the shipping process

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Abstract

This paper, written during the internship experience, analyzes the logistics flows of the shipping process of Verallia, a leading manufacturer of glass packaging for beverages and food products.

The central problem considered in the thesis concerns the non-value-added activities and wasted time that occur during the shipping process in all Verallia plants worldwide. The lack of a common standard for all and the need for innovation led the company to create the "Easy Go" project to improve and digitalize the shipping process. The ultimate goals are standardization, increased security, elimination of waste, efficiency and creation of KPIs.

The problem was addressed by analyzing and mapping the processes of the "AS IS" situation and identifying critical points and inefficiencies. From there, a new digitalized shipping process was developed in which, using new devices and apps, the elimination of wasted time and real-time data capture is aspired for.

Within the paper, there is also a reference to Sixfold, another project under development for vehicle tracking. This, along with the Easy Go project are directed toward the formation of a transportation management system.

Finally, in order to understand what the results would be upon implementation of the project, a direct comparison between the current and future situations and a SWOT analysis is conducted. It emerges that the company expects to partially meet all the above-mentioned goals in the short term, while in the long term it aims to fully meet all the goals and have a complete TMS for booking, load management, and vehicle tracking.

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Introduction

The thesis work presented in these pages is the result of a 6-month internship experience carried out at the Verallia company in the plant of Lonigo (VI). The project exhibited originates from a problem common to all Verallia plants worldwide concerning non-value-added activities and time losses that occur during the finished product shipping process. From this starting point, the study then expands with the goal of standardizing but most importantly digitalizing the shipping process from the beginning until the end. For this purpose, the "Easy Go" and "Sixfold" projects were developed, which encapsulated in a digital transformation perspective have as a major goal the achievement of a transportation management system.

The purpose of the work is to propose a new digitalized shipping process in which the goals of standardization, increased safety, elimination of waste, efficiency and creation of meaningful KPIs are centered. To do this, the methods used to carry out a thorough study were based on process mapping, comparisons and analysis of data extracted from the various management systems used by the company (i.e., SAP, Transporeon, corporate spreadsheets), interviews with employees, customers, and partners, SWOT analysis, and teamwork.

The first chapter of the thesis is entirely devoted to the topic of Transportation Management Systems (TMS). Within it there are contents found in the literature regarding this topic. First an introduction to the subject of Digital Supply Chain is made from the book "The Handbook of Logistics and Distribution Management - Understanding the Supply Chain" [1], after which it gets into the heart of the TMS topic with its definition taken from SAP Insight [2] and supplemented with the scientific article "Business's Transportation Management System Technology - Adoption in Nakhon Pathom, Thailand" [3] and the book “Supply Chain Management for dummies” [4]. Then, it discusses the capabilities, benefits and future of these systems through content found on SAP Insight [2], Laura Baronchelli's article "Transportation management system (TMS): what it is and why it is necessary" [6] and Oracle's web page "What Is a Transportation

Management System?" [7]. In addition, a section is devoted to the comparison of adopters and non-adopters studied by Stanley E. Griffis and Thomas J. Goldsby in their article "Transportation Management Systems: An Exploration of Progress and Future Prospects" [8]. Finally, the last paragraph is devoted to a discussion of the TMS market performed in the study "Transportation Management System Compass - Navigate to a Transparent Transportation Market" by the Deloitte consulting firm [9].

The second chapter introduces the Verallia company by describing who it is, its history, values and purpose. Then, the "Easy Go" project is presented, and the scope of work is outlined. But the focus of the chapter extends with an analysis of the company's current situation in the case of the Lonigo plant. Within the analysis, all sub-processes of the shipping process are described in detail and mapped via swimlane. Finally, through data analysis and comparisons, all critical points of the current shipping process are highlighted and schematized.

The third chapter describes the proposal of the Easy Go project. After an overview of the new digitalized shipping process, the solutions and tools to be adopted during operational activities are presented. In addition, the topic of digital documents and their use is discussed. The chapter then continues with an explanation of the KPIs identified for all plants to measure performance and finally, with an exposition of the Sixfold project for truck tracking.

The last chapter deals with the expected consequences upon implementation to the Easy Go project. First, the direct effects on the process are listed, then the times acquired to calculate KPIs in the current and future process are compared in a direct way. Second, a SWOT analysis is conducted to best study the project, and finally the topics of digital transformation and change for the company and its partners are discussed.

1 Transportation Management System (TMS)

This chapter aims to introduce the world of the Digital Supply Chain with a particular focus on Transportation Management Systems. The chapter first describes what a Transportation Management System is and then discusses its functionalities, benefits, and adopters. It also takes a look at the future of these systems and then ends with a study on the TMS market.

1.1 Introduction to the Digital Supply Chain

The actual situation we are living, is characterized by changing customer expectations that strongly encourage developments, evolving ideas and concepts associated with the supply chain. These ambitious requirements seem difficult to accommodate, especially in challenging circumstances, but there are existing and developing concepts that make this feasible. During the so called Fourth Industrial Revolution (Industry 4.0), developing digital technologies have begun to significantly modify the scope of what is achievable. Examples of key technologies are: big data, IoT, AI, cloud computing, control towers, blockchain and many others. Evolving from this, it's born the Supply Chain 4.0 enabled by many different approaches and developments. One aspect of SC 4.0 regards sustainability and circular economy in which manufacturing and logistics operations have the goal to eliminate waste of material, recycling and reduced emissions in order to ensure the environmental concerns. Finally, also the concept of shared economy is very much considered in logistics developments.

Industry 4.0 and SC 4.0 includes the age of intelligent machines, production facilities and storage systems that can autonomously exchange data, quick react and control operations without human intervention. All this is possible through IoT and other interconnected networks of machine devices and vehicles, but the revolution in object is seen as a strong separation between humans and machine robots. The next stage in the cycle will be Industry 5.0 and SC 5.0 in which man and autonomous machine are reconciled to work together, producing the synergy of human intelligence and cognitive computing interacting harmoniously. According

to this vision, manufacturing and distribution are expected to reach new levels of speed and perfection while also protecting the environment through the incorporation of renewable energy and minimal waste.

The digital supply chain can be described in many ways, but there are 5 key elements important for the formulation of an autonomous and self-optimizing supply chain:

- *Supply chain transparency and sustainability*. The supply chain is completely transparent and sustainable including the reuse of materials and the integration of suppliers and other players. It is characterized by multi-level data flow and seamless connection of all data across the supply chain for products, logistics, customers and finance.

- *Closed loop and integrated planning and execution*. It means end-to-end planning from customers to sub-suppliers applied to all time horizons. It uses advanced analytics in order to integrate financial and capacity plans, demand and supply balancing, collaborative workflows and automated decision-making.

- *Smart logistics flow*. It covers inbound and outbound transportation looking upon all modes; automated warehouses, transport management system (TMS) and warehouse management system (WMS); optimized and dynamic distribution; omnichannel order management.

- *Dynamic supply chain segmentation*. The supply chain is very flexible and can be further segmented for each customer order, as well as readapt for alternative market conditions and product components. It uses segmentation strategies to support key business requirements, covering all realistic service, margin, cost and inventory parameters.

- *AI driven supply chain management*. Data networks and AI are able to provide enhanced demand forecasts via demand sensing, connecting along the supply chain. Based on machine learning, patterns and trends can develop within the supply chain triggering appropriate responses. This

allows a fully autonomous supply chain, making appropriate and effective optimization decisions.

[1]

1.2 What is a TMS?

A transportation management system (TMS) is a software system that helps companies manage logistics associated with the movement of physical of goods, both incoming and outgoing, by land, air, sea, or a combination of transportation modes. This kind of system is often part of a larger supply chain management system and plays a central role in it, improving every part of the process along the supply chain while ensuring that documents and shipments comply with regulations. TMS logistics software aids ensure timely delivery of goods by optimizing loads and delivery routes, tracking freight across local and global routes, and automating previously time-consuming tasks, like trade compliance documentation and freight billing. [2] TMS has recently expanded to include additional features that can handle real-time asset management, yard management, event management with shipment tracking, shipping demand forecasting, palletization, hazardous material transportation, reverse logistics, and performance management. [3]

A TMS provides visibility into day-to-day transportation operations and may help you analyze your freight history, tracking how many loads you ship in each lane. This history can be used as the basis of a freight forecast, estimating the expected amount to ship on each lane in the future. A TMS can include a routing guide that suggests which mode of transportation and which carrier is the most suitable for a shipment. When the contracts with the carriers are completed, this information is loaded into the routing guide of the TMS so that it's able to monitor the handoffs as a shipment moves through the supply chain. In fact, during the entire shipping process, there is a continuous exchanging of information with the TMS:

- TMS is notified when the shipment for a product is scheduled. This notification is called an advance ship notice.

- TMS is notified when the carrier comes to pick up the shipment and the status for that product is updated.
- TMS can be notified each time the carrier hands the product off in the supply chain. These notifications are called shipment status messages.
- TMS can set off additional actions, like invoicing the customer and authorizing payment to the carrier, after the product is received. [4]

Finally, the TMS has to exchange data with the software that creates the overviews, reporting and KPIs.

One important characteristic of Transportation Management System is the openness to other systems. This feature permits a better integration with other systems inside or outside the company while maintaining levels of security and efficiency. Most of TMS offer the possibility to work in conjunction with ERP and WMS (warehouse management system) forming a digital tripod that supports delivery of end-to-end process. With such integration TMS offers the maximum results. [2]

In any case, the software must be able to identify important data, relating to incoming or departing products, like the type of goods, the packaging, the destination, the means of transport and the times. The aim is to manage the technical parameters of the vehicles but also how to build the billing of the trip. So, some useful tools can be touch screens for the drivers, barcode and radio frequency for load unit and for vehicles, digital gates and GPS to track the position of the vehicle during the trips. All these tools are integrated in the structure of a TMS, depicted in Figure 1.1, to make feasible gathering data to produce overviews and reporting.

Figure 1.1 The general structure of TMS [5]

1.3 How does a TMS work?

Generally, a TMS software can be installed on-site on the company server, but nowadays they are increasingly widespread in their Cloud version, manageable and controlled remotely. A cloud-based transportation management system allows better economies of scale, decreases total cost of ownership, and has a rapid return on investment (ROI). Moreover, it requires less installation and update time and frequently holds out higher levels of security and reliability. Whether it's an on-site or cloud solution, a TMS can help any business plan, execute, and optimize the physical movement of goods:

- *Planning*: the software helps the business to choose the optimal mode of shipment of a specific goods for a certain destination according to costs, distances and routes. A strong TMS can provide a complete view of what may be international regulations to be respected and customs tariffs. Consequently, there is the simplification of freight transportation through rate comparison and automatic carrier booking.

- *Execution*: according to the type of system chosen, the TMS can include matching loads and communicating with carriers, documenting and tracking shipments, assisting with freight billing and settlement. Some advanced solutions also provide track-and-trace services, enabling real-time information exchange among the various actors in the supply chain. Another possible function concerns the sending of the correct import and export documentation making sure shipments are trade compliant.

- *Optimization*: Transport management systems include the ability to measure and track performances with timely reporting, dedicated dashboards, analytics, and transportation intelligence. It forecasts transportation demand, analyzes rates and profitability, and quickly adapts to unforeseen circumstances. Having real-time visibility into all aspects of the transportation process make possible taking immediate actions and data-driven decisions.

[6]

1.4 What are the benefits of a TMS?

Having a modern transportation management system provides many benefits to any company that ships goods. The main advantages offered by a TMS system can be grouped into the following topics:

Cost savings. A transportation management system can reduce the costs for both the business and the end customer.

- Firstly, it decreases the *administrative costs* comparing carrier rates to find the best option. Moreover, it automates the billing process and the documentation flow, and it introduces efficient digital booking for careers replacing time-consuming phone calls. Fewer manual steps result in fewer delays and faster delivery times.

- Secondly, it lowers the *shipping costs*. The use of algorithms allows to plan movements manually or automatically, optimizing the use of vehicles through fully loaded journeys and compressing delivery times. The digital technologies adopted ensure that the shortest route is chosen with real-time calculation with respect to the expected time of arrival and delivery.

- Thirdly, it acts on the *load optimization*. Using rule-based optimization to build pallets is a good practice to help companies gain efficiencies and operate at scale.

Real-time visibility. The TMS software improves visibility and security having the ability to track freight, in whatever transportation mode, on a single platform. It assesses the efficiency into all logistics operations tracking KPIs on a single centralized dashboard. Better reporting leads to faster improvement actions and help the creation of new business insights. Finally, a modern TMS can adapt in real time to unforeseen obstacles generating optimal routing proposals, in a dynamic way, identifying shorter or less congested routes.

Greater customer satisfaction. Nowadays customers request a strict adherence to the promised delivery schedule so, for competing in the global marketplace, it's fundamental to offer on-time delivery. A transportation management system can

raise the customer satisfaction because it implements the security during the transport of goods and, thanks to better planning of routes and vehicles, it reduces the transport time. Moreover, TMS improves the quality and the efficiency of the service offered through real-time updates and fewer shipment delays. It provides the visibility useful to address problems that might result in customer frustration and a decline of customer loyalty. At last, TMS software can improve the customer experience by allowing to track delivery progress and by streamlining the billing and payment process.

[2], [6], [7]

1.5 Who uses TMS?

Transportation management systems are adopted mainly by companies that need to ship, handle and receive goods continuously over time. Even the pandemic affected the spreading of the TMS because companies started to look for ways to deliver goods quickly, efficiently, and cost-effectively.

In general, companies that can benefit from a TMS system are:

- automotive and manufacturing industries;
- retail activities;
- large-scale retail or retail companies;
- pharmaceutical and healthcare industries;
- food service and restaurant organizations;
- companies that provide logistics services, such as third-party and fourth-party logistics (3PL and 4PL);
- aerospace, government, and defense organizations;
- distributors;
- freight forwarders, carriers and couriers;
- commercial or E-commerce companies;

Transportation management system is useful in several application areas, in fact companies in almost every sector, from construction to biology, use it. The primary users are companies that spend at least 100 million a year on freight, but even small

and medium-sized enterprises can opt for an affordable solution like a cloud-base TMS. In this way, also smaller businesses can take advantage of the benefits of incorporating a transportation management system into their supply chain.

[2], [6], [7]

1.6 Adopters VS non-adopters

A study conducted by Stanley E. Griffis (Air Force Institute of Technology) and Thomas J. Goldsby (University of Kentucky) highlights the distinction between adopters and non-adopters of transportation management system technology. On one hand, TMS adopters denote a varied group of companies with a high percentage of adopters using outsourced services for decision support activities. On the other hand, non-adopters view decision support for transportation activities as a low priority.

The article written by the two researchers examines the state of TMS development, with a focus on the motives, means, costs and benefits of adoption by considering 45 North American firms. The sample provides an ample snapshot for preliminary investigation and uses a survey quite long with numerous open-ended questions. Due to the open-ended nature of these questions, answers are closely to interview data than typical survey data.

The firms considered in the survey are in different stages of TMS adoption: 27% of respondents have committed to implement TMS in some way; 24% were actively considering a TMS implementation; 49% had either entertained the idea previously, but ultimately decided against TMS adoption, or had not considered a TMS. Using a Likert-type scale with 1 identified as “Not at all Strategic,” 4 as “Neutral,” and 7 as “Very Strategic,” adopting firms rated their transportation function as slightly more strategic than neutral (4.2). On the other hand, non-adopting firms rated the transportation function slightly below neutral (3.7). These scores were not significantly different from each other, and a true difference cannot be statistically supported. However, when comparing those who had fully implemented a TMS to those currently adopting the technology, a significant difference was found. In fact,

firms currently implementing a TMS saw transportation as very strategic (6.0) compared to the firms already using a TMS (4.2).

Firms that had completed or were currently installing a TMS were asked to provide insight into why the technology was applied. Respondents were asked to rank their top five priorities among a set of sixteen possible alternatives, including opportunities for open-ended response. The primary reasons for adoption are reported in Table 1.1.

Table 1.1 Primary reasons ranking for the adoption of TMS [8]

Motive	Average Rank
Improved shipment consolidation	1.9
Lower freight bill	2.2
Lower administrative costs	2.3
Improved lane analysis	2.4
Lower total logistics cost	2.5
Improved carrier selection	2.7
Improved network analysis	2.8

These results indicate that cost drivers, including fewer shipments, lower freight bills, and lower administration costs, are the chief reasons firms pursue a TMS, even if customer service issues and lane network analysis also have influence.

More in detail, firms that decided to adopt TMS technology done it in one of three ways. About 12% chose to install customized system modified specifically to fit the needs of their company, 38% chose to purchase off-the-shelf system to support their transportation needs, 50% of the firms chose to outsource the effort completely and allow a vendor or third-party provider to host the needed services. Moreover, TMS users reported a variety of functions that were important in the system they installed. These functions are related to the operational tasks of day-to-day management of transportation activity and can be listed as follows: shipment routing, shipment tracking, shipment scheduling, transportation performance measurement, overall freight cost management, and carrier selection. These functionalities don't directly overlap with the reasons of TMS adoption. In fact, the causes tend to regard high-level strategic concerns, while the functions most commonly employed involve support for operation-based decisions, those involving individual shipments and transactions.

In general, TMS users feel that the systems are helping the performance delivered by the firm. Adopters think that the implementation of TMS influences the lowering of logistics costs, while non-adopters think that the lowering of costs is not caused by TMS implementation. Additionally, adopters believe their service provision is better because of TMS and non-adopters believe that a TMS would not necessarily improve the service they offer to customers. Even better transportation decisions are presumed by the adopters a benefit of a TMS. In conclusion, upon achieving system implementation, the level of satisfaction associated with TMS appears to have met most expectations with an average score of 5.6 on the 7-point scale.

Non-adopters represented almost one-half of the research sample. These firms gave varied reasons for why they had not adopted the technology, 54% said “not a priority”, 31% said “we do fine without it” and 31% “we don’t manage transportation”. These answers indicate that some firms either view transportation as an area not requiring decision support or lacking sufficient strategic importance to order investment. Of those who do not manage transportation, there are companies that decided to outsource the transportation activities expecting that their third-party logistics provider has TMS support for operational decision-making. As for those companies that still manage transportation without a TMS, 30% continue to depend on a legacy IT system to accomplish the tasks a TMS might otherwise perform. Another 50% of non-users are performing their transportation management activities manually rather than with a TMS.

The general findings of the research show that many companies consider the risks of non-adoption to be greater than those of adoption. While expectations of system performance and return on investment vary greatly, TMS users demonstrate a generally high level of satisfaction. TMS seems to be fulfilling the promise of value, yielding efficiency gains that offset the required investment in a timely manner. Furthermore, the payback on TMS appears to be relatively quick and more certain than other technologies striving for shares of a company’s technology budget.

[8]

1.7 The future of TMS

Looking to the future, transportation management system should evolve, becoming more robust and feature rich. On one hand, customer expectations are continuously rising because users ask for real-time updates along the shipment process, so TMS must provide them faster responses. On the other hand, companies ask for better reporting, so TMS should be able to supply them more detailed information. In this perspective, businesses can decide to integrate their transportation and global trade management systems with emerging technologies to increase visibility and provide better customer service. Some of these innovative technologies are described below.

Artificial intelligence (AI). It brings innovation to the industry and significant time and cost benefits handling time-consuming routine activities all over the process. Enhanced AI will also allow TMS to develop more accurate and informed recommendations, like alternative delivery routes during high traffic conditions. Additionally, the introduction of self-driving trucks will bring even more dramatic changes. These autonomous vehicles will collect and analyzes more data than ever before that are very useful for brokers.

Machine learning. ML uses huge data sets to make accurate predictions in a short time. If we apply it to historical data and trends, we allow TMS to forecast transit time more precisely, plan capacity, identify at-risk shipments and much more. For example, ML is able to compare more expensive single-stop deliveries versus cost-effective multi-stop deliveries taking into account delivery geography and real-time progress milestones. Doing such activity, it supports companies manage important trade-offs between cost savings and on-time delivery.

Internet of Things (IoT). In TMS, Internet of Things devices and sensors collect valuable information such as real-time fleet monitoring, in-transit visibility of driving conditions, routes and assets. Some examples are touch screens for the drivers, barcode and radio frequency for load unit and for vehicles, digital gates, GPS for truck the position of the vehicle during the trips. The more these devices and sensors are installed on equipment throughout the supply chain, the more

efficient the process becomes. In this way, companies can improve driver safety as well as reduce delays.

Digital assistants. Digital assistants, often called chatbots, are technologies that can make TMS more efficient. These chatbots handle routine client queries, for example about shipment information, offering immediate conversational responses and lowering the administrative costs.

Blockchain. Blockchains are now used to construct complex integration between shippers, customers, and carriers. Applications like intelligent track and trace rise transparency and traceability across the supply chain, while providing accurate and secure information. An example of blockchain solution is the "cold chain management" that monitors the temperature of specific products across the supply chain providing real-time information to the companies and the regulators at the country of origin.

[2], [7]

1.8 Why is it important to have a TMS?

Nowadays the global trade environment is very dynamic and enforces to navigate in complicated processes around trade policies and compliance. To cope with such condition, it's important to have a transportation management system that covers the activities from planning and procurement to logistics and lifecycle management. The complete overview offered by a powerful system leads to better planning and execution of transportation which translates into greater customer satisfaction. In essence, a TMS permits the company to be effective and efficient, to lower costs and offer better services. It's an instrument consistent with the transformation in Industry 4.0.

In addition, the commercial and distribution system is ever-changing so many companies face difficulties in managing their supply chain. For example, the traditional management of information and documents about the handling of goods present some problems that translate in waste of time and resources and can generate errors like:

- mistakes during the phase of uploading and transferring data;
- lag in collecting information, handle it and transferring data to other actors in the supply chain;
- inadequacy or improper attribution of data;
- fragmentary documentation;
- twice as much data entry;
- required data are unavailable when and where needed;
- partially tracked information and waste of time in collect it;
- problems in managing and controlling the shipping process.

In conclusion, it's fundamental to reimagine a new management, distribution and shipping of goods that permits a right, up to the minute and efficient management.

[6], [7]

1.9 Deloitte Consulting's study on the TMS market

The logistic sector has always played a central role in the global interconnection and now, thanks to new digital technologies logistics managers have to cope to fast-growing transport volumes, shorter throughput times and fast reactions to disruptions in the supply chain. TMSs act as a key interface for engineers in the supply chain, giving freight forwarders digital tools to communicate with their partners and to monitor in an efficient and transparent way the shipments.

Deloitte Consulting offers an overview of the market for transport management systems thanks to a specific survey, conducted in 2019, in which it compares the offerings of different TMS vendors. It is a three-month market study based on Deloitte's leading 1 to 4th Party Logistics Service Provider structure and TMS Business Architecture Framework. It aims to capture insights on the TMS market like the following:

- how provider and service portfolios are structured in each region;
- which functionalities and business processes offer the TMS models;
- to what extent more recent developments are present in TMS.

By the year 2024, global freight volume is forecast to surge from 54.69 billion tons (2015) to 92.1 billion tons, and trends in the transportation market influence this high growth in volume. According to the perspective of Deloitte, these trends can be distinguished into:

- *Exogenous influence factors*. They are external factors that affect a company and cannot be influenced too much by the company itself. Examples: cost pressure; demand fluctuation; governance regulations/compliance; individualization; staff shortages; risk/interruptions; complexity; sustainability; changed consumer behavior.
- *Endogenous influence factors*. They are driven by a company and can be manipulated to favor the company's needs. Examples: digitalization of nosiness processes; business analytics; transparency in supply chain; automation; networking/collaboration; digitalization.

Transportation Management Systems are becoming fundamental tools to fulfill the challenges connected with these trends. In particular, there are 7 main aggregated trends for TMS which affect the entire TMS market:

1. *Machine-to-machine communication between companies*. It can connect different transport logistics companies via intelligent devices in a cyber-physical way.
2. *Mobile access for customers in a TMS*. Customers that have the visibility of the goods that are transported are more satisfied.
3. *Localization technology/RFID*. It helps to manage the whole transportation chain by allowing the tracking of vehicles and improving operating costs significantly respect to containers and freight stations.
4. *Automation and Robotics & AI*. They can help in improving operational process via, for example, automated hubs and gateways that interact with a TMS.
5. *Platform as a Service & Software as a Service*.
6. *Driverless transport systems*. This kind of system managed by a TMS improves the business process by reducing traffic congestion ad CO_2

emissions therefore increasing lane capacity and reducing fuel consumption.

7. *Predictive analytics*. It uses internal and external data to support operational efficiency. For example, it improves the demand forecast allowing to act in proactive rather than reactive ways.

Deloitte consulting creates a "TMS Business Architecture Framework" with the aim of help clients identify its structures and requirements. This framework is shown in Figure 1.2 and consists of four major modules:

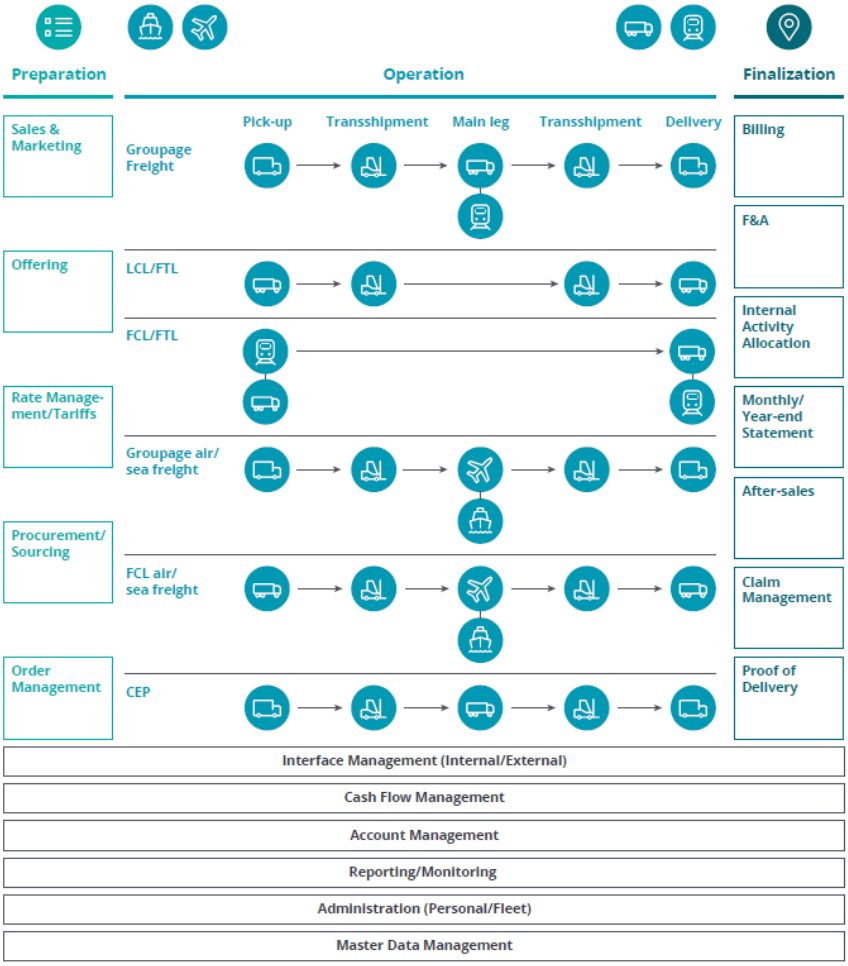

Figure 1.2 Deloitte's TMS Business Architecture Framework [9]

1. *Preparation*. It comprehends sales and marketing, offerings, rate management and tariffs, procurement and sourcing, order management activities.

2. *Operation*. It is the core of such architecture and includes pick-up, transshipment, main leg and delivery.
3. *Finalization*. It covers billing, F&A, internal activity allocation, after-sales, monthly/year-end statements, claim management, receivables management activities.
4. *Cross-cutting activities*. They are about interface management, cash flow management, account management, reporting and monitoring, administration, master data management.

This study wants to consider the global and diverse market of TMSs trying to categorize the selected vendors in a profound way. Following this idea, the sample is composed of an international selection of TMS vendors from Europe, America and Asia, both small and big ones, both new entrants and long-standing market players.

To assess the **structure of the vendors** Deloitte used three indicators that are the number of clients per vendor, the revenue and the number of employees. To sum up, it can be said that all these indicators show a growth from 2017 to 2018. Some numerical graphs are shown below.

Firstly, Deloitte analyzed *the number of clients per vendor*, visible in Figure 1.3. The segment of vendors who serve up to 100 clients has been reduced by 15% in one year. Simultaneously, in 2018 the segment of vendors who serve up to 5000 customers was born. The highest growth in percentage, of about 10%, is in the segment of vendors who serve up to 1000 clients. Finally, the highest possible segment includes up to 10·000 customers, and remained constant from 2017 to 2018.

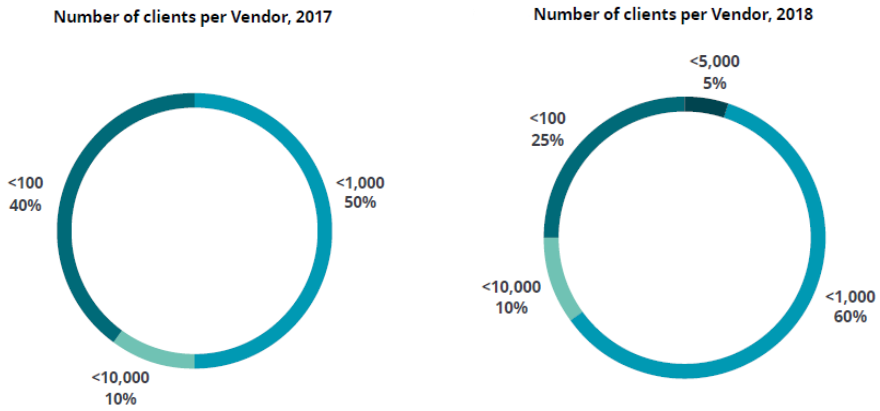

Figure 1.3 Number of clients per vendor of TMS, 2017 vs 2018 [9]

Secondly, Deloitte investigated the *revenues*, visible in Figure 1.4. The segment that represents the revenues up to 1 million euros, in 2018 no longer existed. However, the segment with revenues of up to 5 million euros doubled from 11% to 22%. The segment of 10 million euros, that was 33% in 2017 changed into 17% in 2018. Nevertheless, instead of 33% of revenues in the previous year, in 2018, 56% reported revenues of up to 100 million euros. Finally, the segment of revenues representing more than 100 million euros remained almost constant.

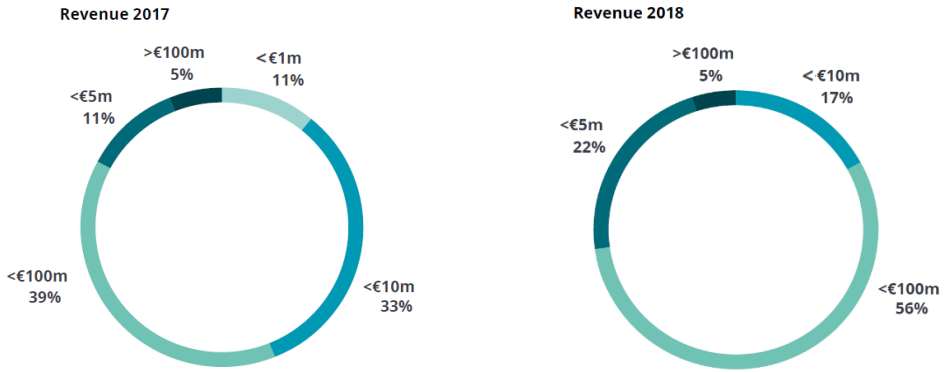

Figure 1.4 Revenues of TMS vendors, 2017 vs 2018 [9]

Thirdly, Deloitte studied the *number of employees*, visible in Figure 1.5. At first sight, this figure remained almost unchanged. In both 2017 and 2018, 25% of the survey participants declared that their companies had up to 1000 employees, and 5% affirmed that they had more than 10·000 employees. The highest segment is the one that represents the number of employees up to 100. This one, changed form 65% in 2017 to 60% in 2018, showing a decrease in percentage. According to the

report, the only increase is in the number of vendors who reportedly employ up to 5000 people, from 5% to 10%.

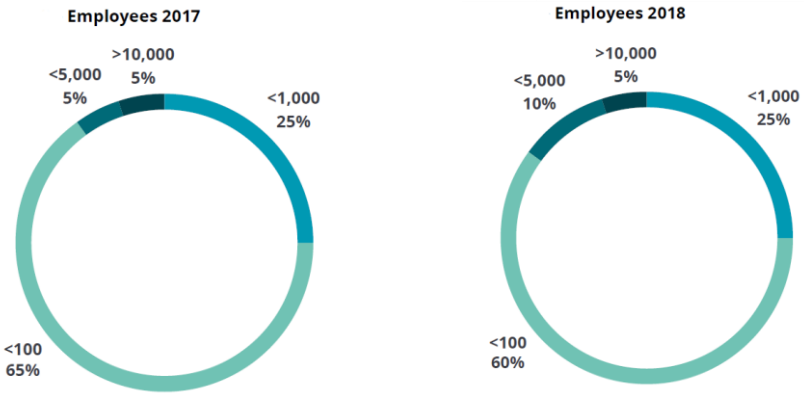

Figure 1.5 Number of employees of TMS companies, 2017 vs 2018 [9]

The survey shows, through the Figure 1.6, the **geographic distribution of TMS vendors** according to their operating regions, sales authority, support resources and server locations. Starting from the *operating regions*, most of the vendors considered in the study are operating in Europe, 90% in Germany and EU (non-Germany) and 85% in Europe (non-EU). None of the vendors are just acting in one region, they are all operating globally, and the majority are operating in more than four regions. One reason for this distribution relates to the international trade volumes. High volumes are generated by Europe, in particular by the China-Europe trade, so it is fundamental for transport logistic companies to have localized operative facility and be present globally. The distribution of the *sales authority* shows that TMS vendors are highly involved in the European market and all of them have a sales authority in Germany. In comparison, *support resources* act more locally, in fact none of the vendors have a supporting function in all regions. In conclusion, looking at the server locations, there is an average of 28% of coverage over all regions and the servers are either located in EU (Germany and non-Germany) and/or in North America.

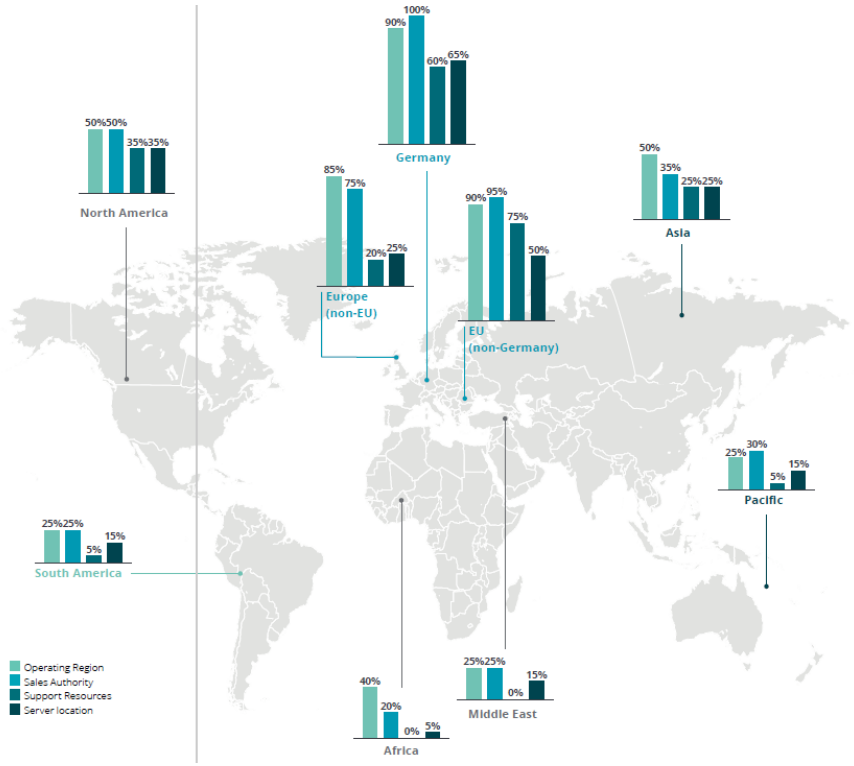

Figure 1.6 Geographic distribution of TMS vendors [9]

Regarding the **products offered by the vendors**, a minority cover customers' need with one product only, 60% have two or three products and 20% of the software providers have developed five or more products. This results in highly specialized solutions for different clients and better business coverage for customers. In particular, the group of vendors with five or more products have customizable solutions and are more likely to get higher revenue. On the other hand, the small number of vendors offering one product only decide to specialize in a specific customer group, maintaining a small number of employees and getting revenue rather small. In a globalized supply chain, the system requires that different currencies and languages are used. So, all providers offer an English version of the tool, and a small number of vendors offer the option to translate the software front end into any language the customer would like. Most of the vendors offer different currencies using conversion table. Finally, all vendors offer standard support channels, like telephone and e-mail service, especially because in most cases user certifications is no longer necessary to use the program. In some cases, vendors offer in-person/on-site support and where no on-site support is available, detailed training is necessary for customers service employees to become experts in the tool.

According to the survey, the vast majority of the selected vendors offer **key functions** according to Deloitte's TMS Business Architecture Framework. Going deeply into detail, in the *preparation module* only about half of the companies analyzed have dedicated sales and marketing, procurement, and sourcing functions while approximately three-quarters of the selected providers have an offering and order management available in their product portfolio. In the *finalization module* more than three-quarters of all selected providers have a billing function and offer proof of delivery while more than half of them have finance and accounting, claim management, internal activity, monthly/year end statement functions. Lastly, looking at the cross-cutting function module, most of vendors offer a comprehensive stack. Almost all of them have interface management, reporting and monitoring, and master data management functions. More than half have administration, account management, and cash flow management functions available for their customers.

The demand of the transport logistic industry consists of a multi-device solution, so TMS products need the ability to support a **device**. In fact, looking at the survey, about 90% of the vendor solutions are applicable for tablets and 80% for smartphones. This is an important aspect in order to smoother the interaction with the user and more specifically with the truck driver. Some vendors exploit the use of smartphones and tables with apps for transport controlling and tour evaluation, for order management and for loading activities. Regarding the software environments of TMSs, 70% of vendors are able to use SAP, 45% Oracle, 30% MS Dynamics and 15% Salesforce. Concerning future-oriented technologies, 50% of the providers are investing in Internet of Things and robotic process automation. Moreover, TMS vendors are using cloud technologies that are seen as high-value future possibility.

There is no TMS covering all the requirements of the different businesses, at least providers can take into consideration different target groups and offer different modules for them. The result of the study shown that TMS providers adapt to different market needs and target customers and have different levels of maturity in terms of the individual modules. Therefore, in order to properly serve business

needs, each company has to assess itself individually, finding its potential for improvement in a structure and efficient way to generate greater business value.

[9]

2 The project proposal in the AS IS Verallia situation

This chapter gives a general overview of who the Verallia company is and then delineates the perimeter in which the Easy Go transportation digitalization project operates. The company's current situation in each affected process is then analyzed to understand what are the critical points that will underlie the Easy Go project.

2.1 The Verallia company

Verallia is the European leader and the world's third largest producer of glass packaging for beverages and food products. It is a global reference point in the supply of bottles for wine, sparkling wine, spirits and food jars. They operate in 12 countries with 34 glass plants, 3 decoration plants, 5 technical centers and 8 cullet (glassware) processing centers. They manufacture 17 billion glass bottles and jars each year to supply 10·000 companies, from local family producers to major international brands.

With a global turnover of around 3.4 billion euros in 2022, Verallia supplies innovative, customized packaging solutions with a precise eco-sustainable connotation. It is able to offer long-run and small-batch items, moreover it has a line of standard premium Selective Line items to differentiate its customers' high-quality products.

The company wants to redefine the way glass is manufactured, reused and recycled, to make it the most sustainable packaging material in the world. Sustainability and innovation are their main values and every year they invest huge resources in research and development to ensure the best environmental performance and reduce CO_2 emissions as much as possible by increasing the average rate of recycled glass used in production. In fact, what distinguishes Verallia is the coherence and concreteness with which they are operating so that the values of naturalness, wholesomeness, reusability and infinite recycling of glass are expressed at the highest level in the characteristics of hollow glass for packaging.

Verallia operates in Italy through 6 factories in which glass jars and bottles for food are designed and manufactured, employing over 1·300 people. Furthermore, Verallia is the 100% owner of the two Ecoglass plants, the largest post-use glass processing centers in the country. It has integrated the commitment to spread glass recycling within its corporate mission and founded, in joint venture with two other glass packaging protagonists, a third post-use processing center in Frosinone under the name of Vetreco. This, together with the two Ecoglass centers, represents an undisputed excellence in the sector because the two plants allow glass to be separated by color, guaranteeing higher percentages of recycled glass even for the lighter colors.

Some of the milestones that have marked company's 200 years of **history** are shown in Figure 2.1:

Figure 2.1 The history of Verallia [10]

The **values** of Verallia are:

- *Care for customers*. Every day the teams work in order to anticipate the customer needs and to meet the customer expectations in terms of design, quality and logistical service.

- *Respect for people, laws and the environment*. All partners, agents, consultants, subcontractors and suppliers, are responsible for respecting this value in each country where the Group operates.

- *Empowerment and accountability*. Verallia wants to develop an entrepreneurial spirit in which the Group encourages all of its employees to take initiatives supporting the expression, sharing and respect of each other's opinions.

- *Teamwork*. They believe in transversal teamwork for the collective success of the Group independently of the organizational structure (interdepartmental, inter-plants, etc.).

In 2020, Verallia launched its **purpose**, which is the deepest goal that drives their business and objectives. It describes why the company exists, the value Verallia carries in the world, how they do it and how each of all the employees contributes. Their purpose can be explained through the points in Figure 2.2:

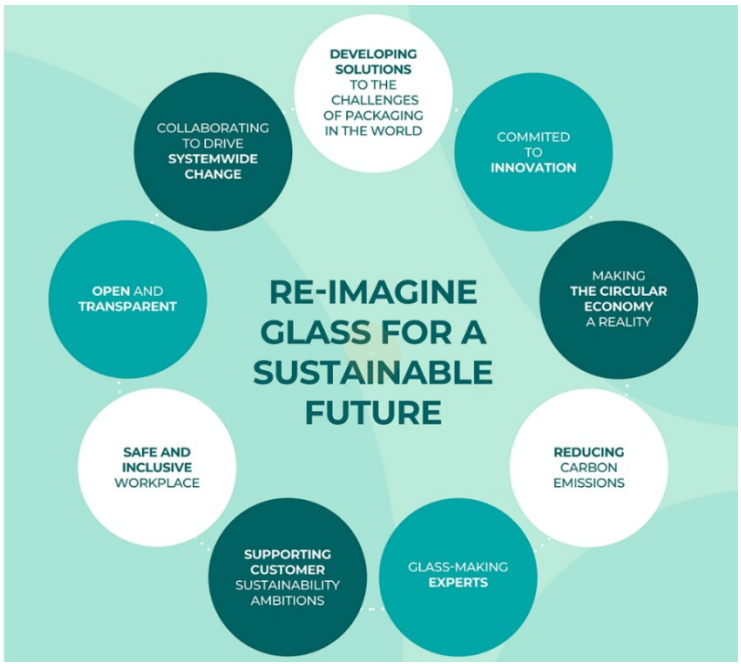

Figure 2.2 The purpose of Verallia [11]

1. *Developing solutions to the challenges of packaging in the world*. At Verallia, the purpose is to re-imagine glass for a sustainable future because the waste generated by people every day, stance an unprecedented challenge for the world. As one of the leading glass packaging manufacturers in the world, Verallia has a major role to play in accelerating the transition to sustainable packaging.

2. *Committed to innovation*. They want to redefine how glass is produced, reused and recycled, to make it the world's most sustainable packaging material.

3. *Making the circular economy of packaging in the world*. Their business model is characterized by recycling and reuse but to make glass fully sustainable they need to do more. In order to make circular economy a reality, they act beyond the business to strengthen recycling systems and encourage reuse.

4. *Reducing carbon emissions*. Verallia is innovating to significantly improve the performance on CO_2 emissions to contribute towards a carbon neutral system. These innovations involve the energy consumption in furnaces, the use of raw materials and cullet, the design and transport of products.

5. *Glass-making experts*. In the company, they are experts at designing, producing and recycling glass. They provide healthy, attractive, and sustainable packaging solutions to more than 10·000 businesses around the world – from the local family-run producers to the large multinational household brands.

6. *Supporting customer sustainability ambitions*. Across the world, they manufacture and recycle locally, very closely to customers, which means that they are well placed to solving challenges of clients, every single day.

7. *Safe and inclusive workplace*. Excellent service means working closely with customers in order to create the solutions that help them reduce environmental impact and meet changing consumer expectations.

8. *Open and transparent*. The foundation on which they build on is the openness about the progress they are making and the challenges they are facing. Thus, for people to continue to face new challenges, Verallia must be a safe and inclusive workplace.

9. *Collaborating to drive system-wide change*. Progress will be made by defining clear targets and working in common cause with customers, suppliers, peers, and other partners across the value chain to develop new healthy and sustainable solutions for all. This is how they make an effort to improve the packaging industry and set out on this exciting journey to re-imagine glass.

[12], [13]

2.2 "Easy Go" project proposal

According to Verallia's values and purpose, in the Supply Chain area of the company there are some projects with a perspective of continuous improvement and innovation of which one is the "Easy Go" project. The last mentioned is a corporate project that is born with the idea of digitalizing the shipping process of finished goods. The team is made up by business sponsors (group SC director and each region SC director), the business project manager (SC process improvement manager of the group), country project managers (logistic managers of each country with their collaborators) and the central IT referent (IT SC & logistic project manager) coming from 5 countries (France, Italy, Spain, LATAM, Germany).

The objective of "Easy Go" project is to review the shipping process of finished products in order to standardize and digitalize it. With the implementation of a more efficient process, the company expects to reduce waste time, diminish and finally eliminate the use of paper, increase safety in the stock to provide a better service to customers.

The **main points** that guide the entire project are:

- *Standardization*. The aim is to reach a standardized shipping process in all the plants. Moreover, the final goal is to provide and capture the same information at the same time and apply same quality controls.

- *Safety*. To increase safety, the company wants to reduce truck driver's trip, avoid useless forklift movement and find a systematic way to communicate and validate the safety rule.

- *Waste and efficiency*. One of the main focuses is reducing IN/OUT time in order to load more trucks and reduce queues. In order to do this, it's important to delete non-added value tasks and kill wasted time for an efficient loading. In turn, also the customer service will increase.

- *KPI*. The information captured into the system need to be standardized in order to monitor and report the KPIs in a meaningful way.

The **perimeter** of the project is divided into 5 sub-processes:

1. *Booking*: this phase is made up by the transport allocation and the slot reservation. The carrier has to book the time slot for the loading through a digital platform.

2. *Arrival*: this process regards all operations of managing the arrival of the truck in our sites like the registration at the front office and the parking management. The idea of this project is to automate all the possible activities in order to avoid wasted time and reduce the truck drivers' movements even by foot.

3. *Loading*: it refers to the physical loading operation including preparation and execution. This one is the core phase in which we want to improve the process form the communication of the loading area to the truck drivers until the truck is fully loaded. Moreover, the idea is to create a digital tool that serves as yard management cockpit.

4. *Completion/Departure*: this phase manages the departure of the trucks from our sites, so the latest activities done within the plant before the trucks leave.

It includes the loading checking, the delivery of the documentation to the drivers and the shipment start capture. Moreover, this step is strictly connected to another project of the company called "Sixfold" that wants to truck the shipments from plants to customers.

5. *Documentation*: this process concerns the generation of all the documentation needed for the loading activity and for the transport of the finished goods. In this case the final goal is to reduce the use of paper and to avoid bottlenecks at the front-office.

2.3 Analysis of the actual Verallia situation

The following paragraphs analyze the actual situation of the Verallia company in the Italian plant of Lonigo (VI). This plant is the referent for the country of Italy, and it acts as the pilot for the implementation of the project in this state. Before entering in the detail of each shipping operation, in the following scheme, Figure 2.3, it's shown a schematic overview of the entire flow of shipping activities done in the plant.

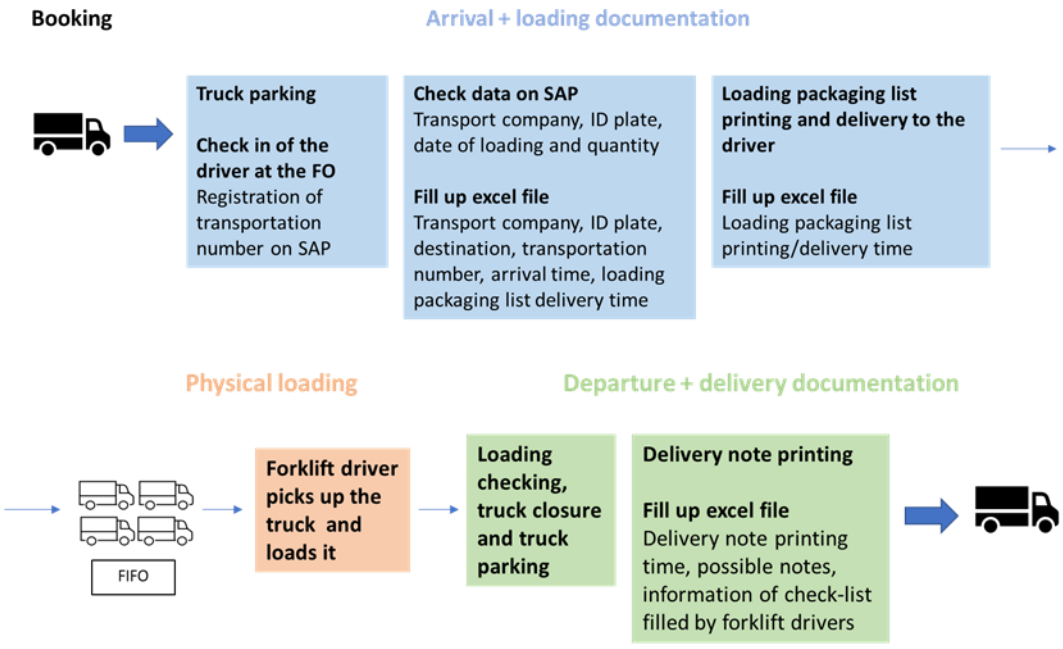

Figure 2.3 Schematic overview of the shipping process activities [14]

2.3.1 The booking process

In this project the booking process is considered as the activity of allocating the shipments to the carriers and booking the time slot for the loading. Regarding such activities, for the past few years, Verallia has been using a portal called "Transporeon".

Transporeon presents itself as: "*Transporeon's Transportation Management Platform empowers shippers, forwarders, carriers and retailers to move, manage and monitor freight in a world in motion. Transporeon lives, breathes, and dreams transportation and logistics. Our Transportation Management Platform powers the most experienced network of shippers, forwarders, carriers, retailers, and load recipients in the world. With our Application Hubs you can digitalize your end-to-end transportation management processes — from procurement to settlement — and everything in between.*" [15]

The platform was born in 2000 with the simple purpose to connect shippers and carriers while now it changes into "*bringing transportation in sync with the word*" [15], focusing on digitalizing and transforming transportation for all. Today, platform's innovation and strategy are driven by three main principles:

1. *Automation*. Transporeon continuously adds smart automation into the platform to help users get better answers faster. The aim is to move collecting data from the transactions executed to start generating transactions from the data available.

2. *Real-Time Insights*. The ability to make the right decisions at the right time having the right insights permits a better control that is at the heart of optimization. For example, Transporeon gives the visibility into CO_2 emissions, access to spot rates, an overview of capacity or simple ETAs (estimated time allocations) for transport.

3. *Collaboration*. Transporeon wants to improve operational efficiencies for processing around dock scheduling, freight matching, settlement actions and others through the collaboration.

Transporeon joined the Trimble family in 2023. Trimble is an industrial technology company that is transforming the way the world works. They deliver technologies in positioning, modelling, connectivity and data analytics that connect the digital and physical worlds to improve productivity, quality, safety, transparency and sustainability. [16]

The following map, Figure 2.4, illustrates how the **booking process** is done in Verallia using the Transporeon platform.

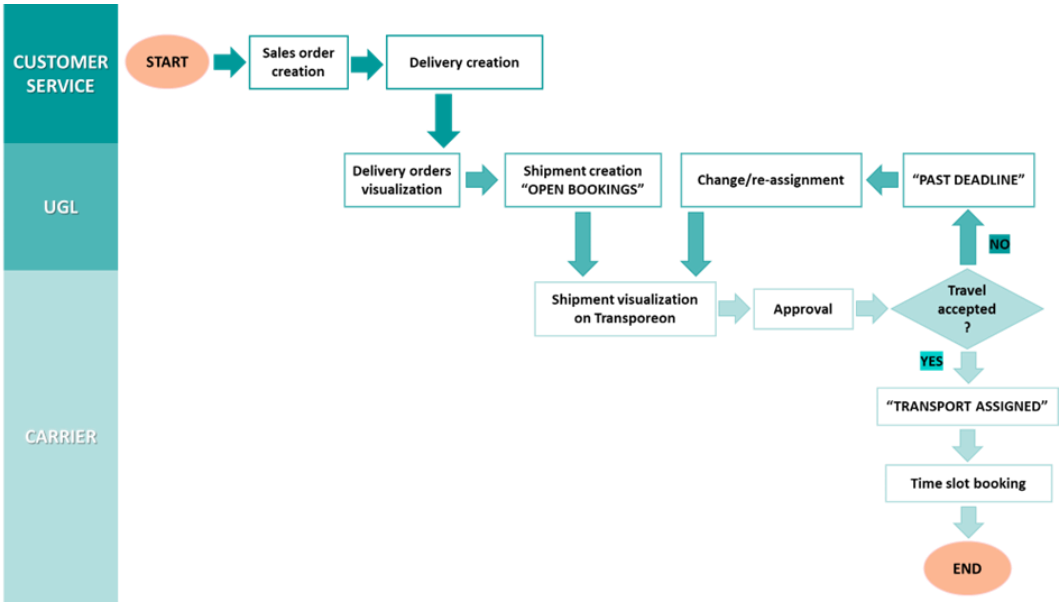

Figure 2.4 Swimlane map of the "AS IS" booking process done in Verallia [14]

The customer service is the first function involved in this process. It is the responsible of creating the sales order and the respective delivery on the ERP of the company (SAP). Then, there is UGL (the logistics management office, in Italian "ufficio gestione logistica") that is the central office appointed to organize the trips for the carriers. Finally, there is the carrier that has to accept the trip organized by UGL and book the time slot for the loading. Let's see the process in detail:

1. At the root of the booking process there are the activities carried out by the customer service function. This is where sales orders and their respective delivery are created in SAP. In other words, having direct contact with customers, this function can create the delivery schedule within the company ERP. Each of these deliveries is characterized by basic

information that identifies it, such as: place of departure of the goods; code of the warehouse where the goods to be shipped are located; place of destination of the goods; commercial document number; type and quantity of the goods to be shipped; date of delivery of the goods; definition and details of the goods; shipping conditions.

2. All orders entered by customer service are then visible on the SAP management system. From here, the UGL office can apply filters to view the delivery schedule from the various hubs and based on the different delivery dates, figure out how to arrange trips. All the delivery information that is entered into SAP helps in creating a trip and must be considered. For example, loading and delivery locations define the carrier and routes while quantities define the type of vehicles. Based on this data, again through a SAP operation, UGL creates trips that are automatically displayed on the Transporeon platform in the "OPEN BOOKING" section.

3. The created shipment that UGL displays in its "open booking" section on Transporeon is also automatically visible to the carrier who has 2 hours to accept the request. If it is accepted within the time limit, UGL will display the transport in the "TRANSPORT ASSIGNED" section and the carrier will see the transport number. On the other hand, if the request is not accepted within the time limit, UGL will display it in "PAST DEADLINE" and can change or reassign the shipment. Once the transport is assigned to the carrier, this one must book on the platform the time slot of his arrival until 18:00 o'clock, 1 working day preceding the loading day. If the carrier needs to change the time slot, he can modify it until 10:00 o'clock of the loading day.

At the end of the process all the bookings are visible on the "Time Slot Management" section of Transporeon, Figure 2.5. This table is accessible on the platform to UGL office, Front Office of the different plants and carriers. Filtering by plant and date it is possible to see all the bookings for the different time slots with their information:

- The red light (truck not yet arrived), blue (truck arrived – start loading phase), green (truck left).
- The code “9xxxxxx” indicates the transport number needed to receive the loading packaging list.
- The details (carrier, driver cell phone number, license plate number, shipment type, driver name).

Moreover, the time slots are adaptable according to the necessity of each plant. In the case of Lonigo, actually there are 60 places available for the booking and time slots are about 60 minutes subdivided as following:

- 8:00-9:00, 9:00-10:00→ 8 places available per hour.
- 10:00-11:00, 11:00-12:00, 13:00-14:00, 14:00-15:00→ 10 places available per hour.
- 15:00-16:00, 16:00-17:00→ 8 places available per hour.

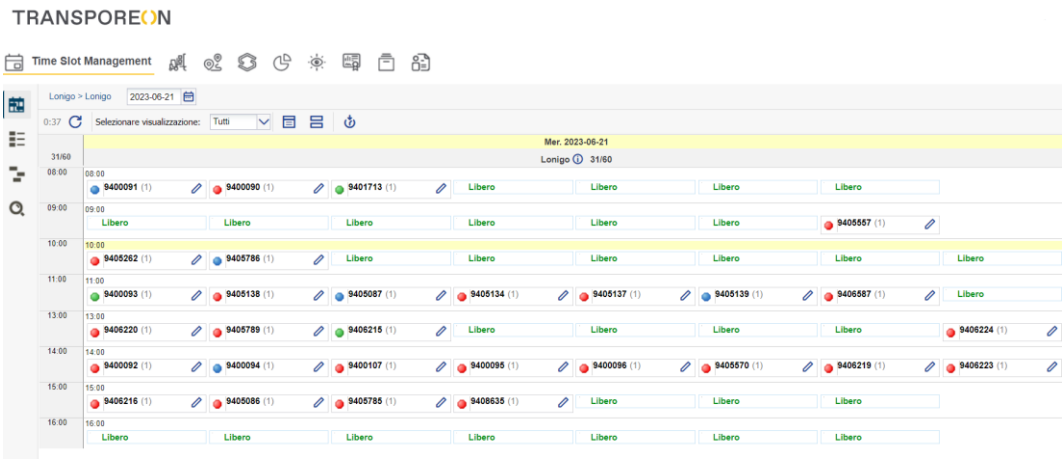

Figure 2.5 Time Slot Management: loading schedule [17]

In the Time Slot Management section there is also an overview of the last 3 months in which there are all the bookings with related information. In this case, the trips are not displayed in the table of the time slots but are listed in a unique page grouped by status (green, red, blue). These data don’t create a complete database of all the trips arrived at each plant, but they can be useful. For example, it is possible to see in the current date how many trucks booked are arrived (green light status), how many are not arrived (red light status) and how many are yet inside the plant (blue light). The same operation can be done in a specific day belonging to the last 3

months. In general, all data, including data prior to 3 months are stored in the "Analytics" section of the platform accessible only to the logistic management office.

In addition to the features already described, Transporeon offers a wide range of tools among which "Rate Management" for the trip-carrier assignment activity stands out. It is given that, when UGL creates trips, it makes a study based on some criteria (e.g., price/km, reliability, volumes) to associate the trip with the carrier. Therefore, most of the time, dealing with usual destinations, freight and customers, this association is done manually when creating the trip on SAP. In other words, UGL already knows which is the most suitable carrier to propose the trip to, so the request on the platform will be sent only to him. But when this association is not so trivial, "Transporeon Rate Management" is a valuable aid and UGL lets the platform suggest him the best carrier for the trip. This tool brings order to transportation rate structures, regardless of data complexity or the number of logistics contracts managed worldwide. Its benefits are:

- *Full transparency*. It means having quick access to one centralized database in which are contained all freight rates and contracts.

- *Optimized process*. The inquiry process is optimized and there is a fast output of requested rates. Additionally, to find the best carrier with a right cost, rate query engine takes into account multiple parameters (e.g., multiple currencies, surcharges, volumetric conversion).

- *Fully customizable*. The system is very flexible and permits to use fully customizable rate tables.

- *Transparent and compliant*. There is full control and traceability over any changes to rates and table structures. Moreover, Single Sign-On using enterprise credentials ensures user access is actively controlled and secure.

- *Fully integrated*. The aim is to create a fully integrated process for assign transports and managing rates throughout the organization. Interface capabilities supporting third party integrations and ERP systems enable

smooth implementation within the existing IT landscape. Flexibility of handling existing data is increased with easy Excel/CSV upload/download functionality. [18]

2.3.2 The arrival process

The map below, Figure 2.6, explains how the **arrival process** takes place at Verallia in the plant of Lonigo.

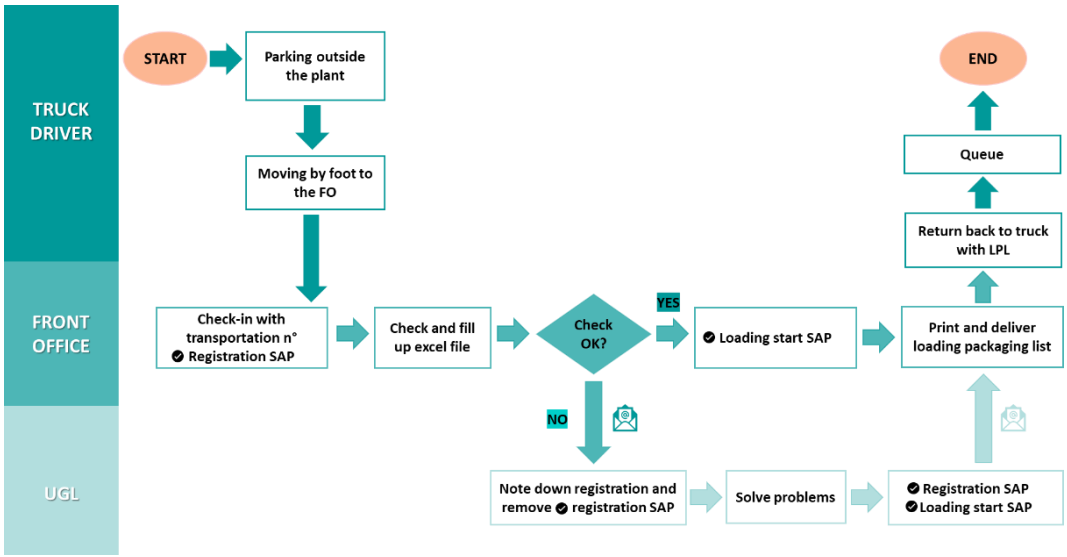

Figure 2.6 Swimlane map of the "AS IS" arrival process of Verallia [14]

The main characters of the arrival process are the truck driver, the front office and the logistics management office (UGL). Let's look at the process in each step:

1. When the truck arrives at the plant for loading products, it parks in the parking lot outside of the gate and then, the truck driver has to move by foot at the Front Office. In the case of Lonigo the parking is located about 200m from the Front Office, visible in Figure 2.7, and walking this distance takes about 3 minutes.

Figure 2.7 Distance between Parking and Front Office on the Map [19]

2. Once the truck driver is arrived at the at the Front Office, he has to communicate his transport number so that the FO can enter it into SAP. This transport number is the code 9xxxxxx generated automatically and progressively by SAP when UGL creates and saves the trip. Through it the Front Office can access to the information of the trip (e.g., vector, type of truck) and the loading packaging list. At this point the FO executes 3 main activities, shown in Figure 2.8: put the tick on "Registration" on SAP to track the driver's arrival time at the office; check that carrier, type of truck, ID plate are consistent with the truck arrived; fill up an excel file with the main information.

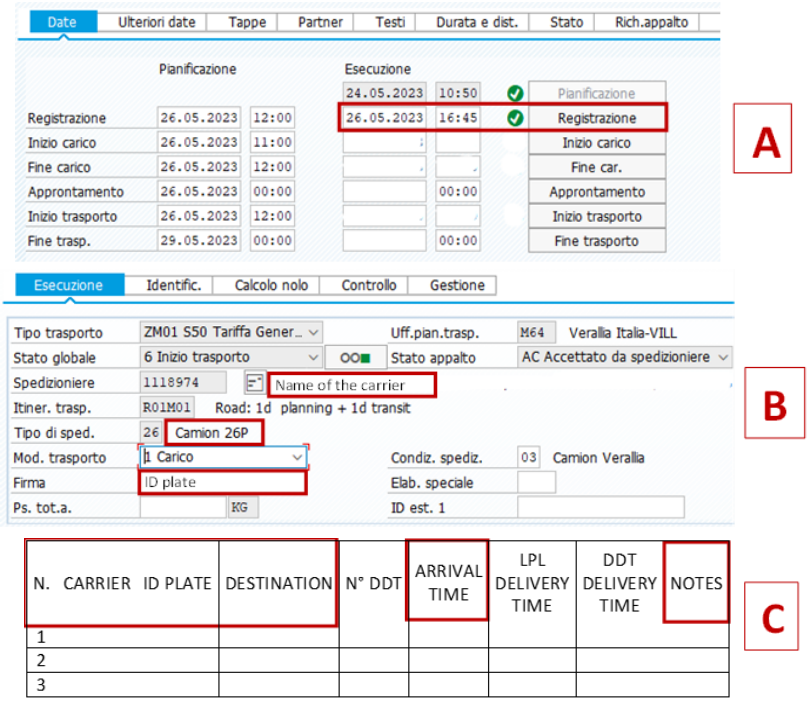

Figure 2.8 Main activities done by the FO in the arrival process [20]

If it is all OK, the FO put the tick on “Loading start” on SAP and print the loading packaging list. In this case the time of Registration and the time of Loading start are the same or very similar like in Figure 2.9.

Figure 2.9 Timing visualization on SAP of a case of an arrival without problems [20]

If problems are found during the inspection, the Front Office should contact UGL by email in order to solve them.

3. *UGL* participates in arrival process activities if the FO finds problems during checks on SAP. For example, if the license plate or truck type is wrong, only UGL can make these changes. The FO communicates the issue found by email, then the proper procedure to resolve it is as follows: UGL takes note of the Registration time put by the FO on SAP; it removes the tick and makes the required changes; it reinserts the Registration tick with the actual time that was noted; it puts the tick on Loading start; it sends an email to the FO of successful change. In this case the time of Registration and the time of Loading start are different, like in Figure 2.10, and the gap between the two can be approximated by the time taken to solve the problem.

Figure 2.10 Timing visualization on SAP of a case of an arrival with problems [20]

With both the Registration flag and Loading start flag, the FO can print the loading packaging list and write a sequential number on it indicating the order in which the truck arrived and also the order in which it is to be loaded, in accordance with FIFO logic. At the same time SAP create the number of DDT that is printed on the loading packaging list and will be also printed on the transport document. Moreover, the Registration time and Start Loading time collected in SAP are automatically communicated to Transporeon that saves these times in the status of the shipment. Finally, with the loading packaging list in hand, the driver can return to the truck and get in the queue.

2.3.3 The loading process

The following schema, Figure 2.11, shows how the **loading process** happens in Verallia.

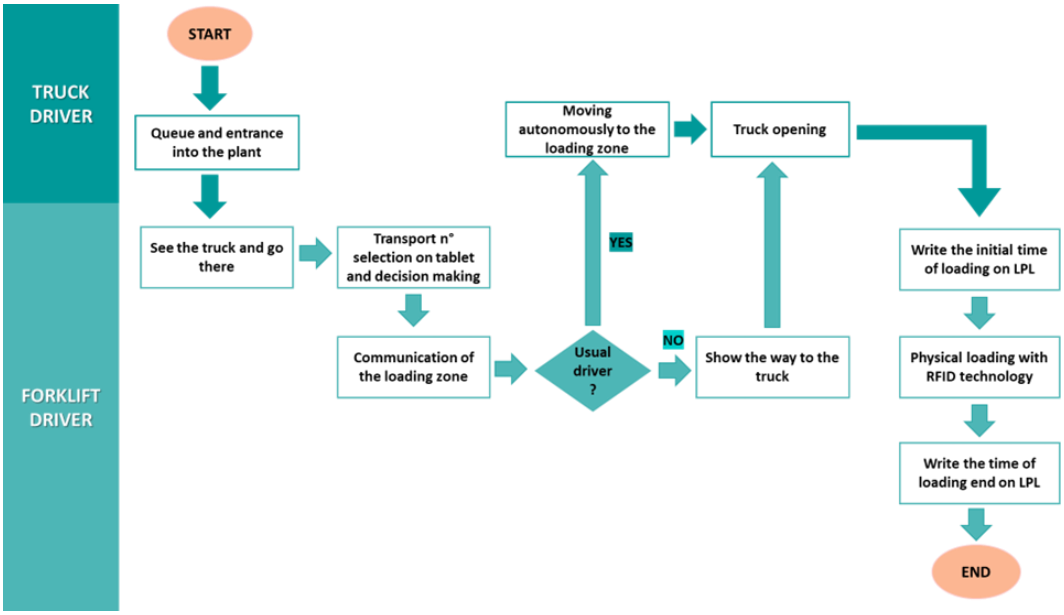

Figure 2.11 Swimlane map of the "AS IS" loading process of Verallia [14]

The loading process is the beating heart of the entire finished product delivery process. In fact, the end customers who demand the required products in the stipulated time, quality and quantity also depend on it. These activities are executed by two main actors that are the truck driver and the forklift driver. In particular, at the Lonigo plant, each forklift is equipped with a tablet designed to read the label of pallets with RFID technology. This capability allows each pallet to be tracked

from its birth to its shipment. In addition, this technology, which is fully integrated with the company's management system, helps in guarantee the complete correspondence between the physical stock and its virtual image on SAP.

The loading process involves the following stages:

1. The truck driver gets in queue outside the gate until one of the two areas inside the gate becomes free. Once inside the plant, he waits for a forklift driver to see him in the STOP area, highlighted in Figure 2.12.

2. When the forklift driver physically sees the truck, he reaches for it and asks the driver for the transport number printed on the loading packaging list to access the desired shipment on his tablet. In fact, when in the arrival process the FO flags on “Registration” and “Loading start” on SAP, the transfer order is automatically sent to the “Shipment” section in the forklift driver’s tablet. Here there is a list of all the trucks (in the format “ID PLATE – N° OF TRANSPORT”) that need to be loaded and already have the loading packaging list on hand. Selected the right shipment, the forklift driver can see where the finished product to be loaded are ubicated in the warehouse. The shipping policy adopted by the company is "FIFO tranche" so they ship the product to the customer by tranches of increasing production. This is the general indication, then there may be special cases for each customer. In any case, given specific directives to the forklift driver, then he will be the one who has to identify the hold from which to take the material.

3. At this point the forklift driver communicates the loading area to the truck driver: if the trucker knows where to go, he goes there autonomously, otherwise the forklift driver leads the way by having the truck follow him. After reaching the loading zone, the truck driver opens the tarps and removes the slats to prepare the truck for loading. Then the forklift driver writes the initial time of loading on the loading packaging list and can start the physical activities: the forklifts are able to pick 3 pallets at a time and each forking is read by the RFID system and counted by the tablet. At the end of loading, if all the pallets have been loaded and scanned correctly, the

counter will be zero and the forklift driver can close the activity on the tablet. Lastly, the forklift driver notes the time of loading end on the loading packaging list.

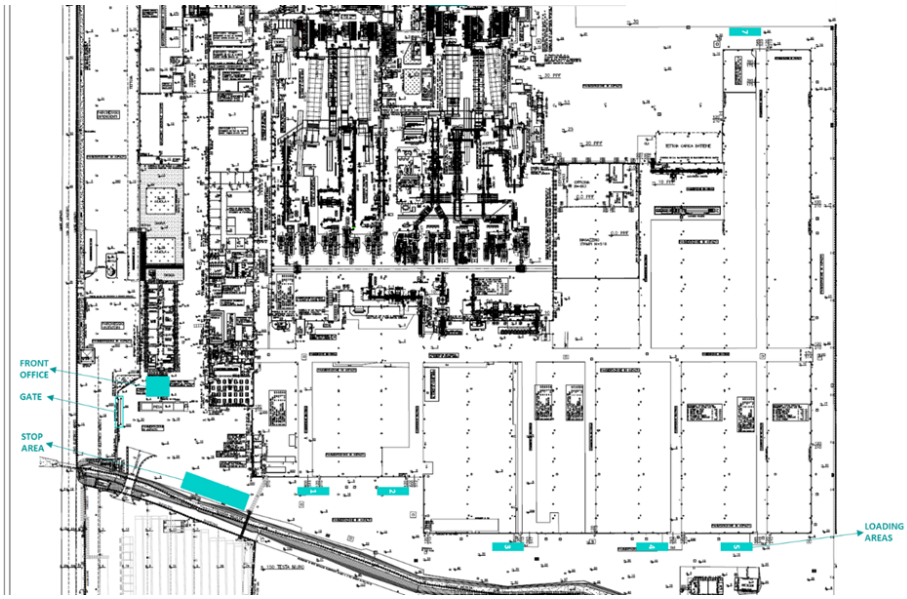

Figure 2.12 Map of the Lonigo plant with a zoom on gate, stop area and loading areas [14]

2.3.4 The completion and departure process

The chart hereafter, Figure 2.13, explains the **completion and departure process** done in the Lonigo plant of Verallia.

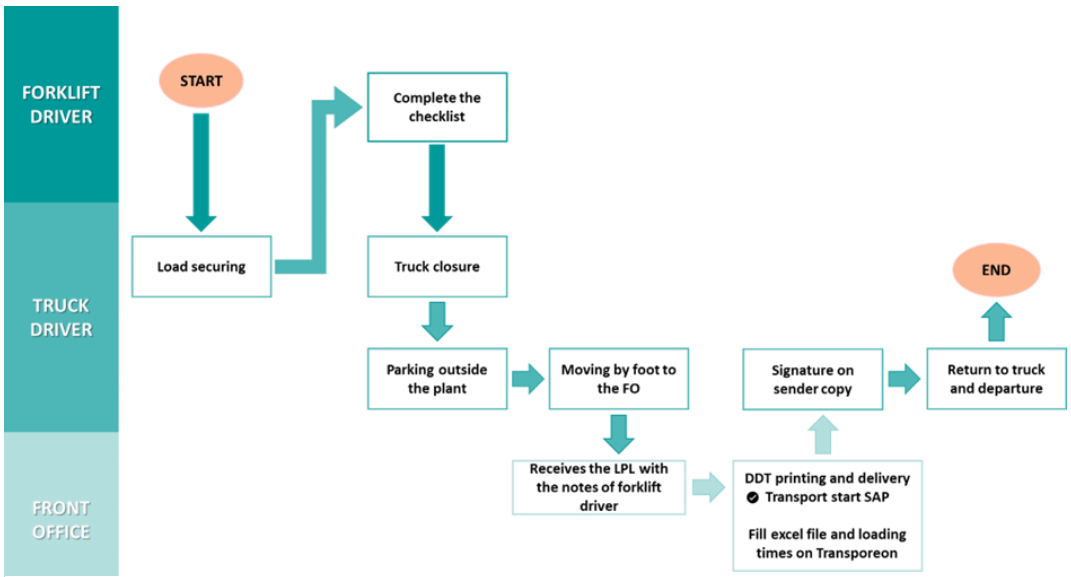

Figure 2.13 Swimlane map of the "AS IS" completion and departure process of Verallia [14]

Once the truck is fully loaded it starts the completion process in which the actors are the truck driver, the forklift driver and the front office.

1. Firstly, in the loading area, the truck driver secures the load for the transport according to the standard of the company: straps and appropriate angles properly arranged in order to make the load well stable without damaging the packaging and containers.

2. Secondly, the forklift driver has to complete a checklist on the loading packaging list to witness the securing of the goods. This checklist is stamped by the front office on the printed loading packaging list and looks as in Figure 2.14:

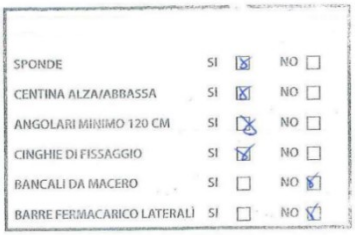

Figure 2.14 Checklist stamp on the loading packaging list [14]

3. Once the load is ok, the truck driver can completely close the truck with the tarps and leave the loading zone to reach the parking outside the plant. Here he has to return back to the front office by traveling the same route he previously took to register.

4. The front office receives the noted loading packaging list by the truck driver and executes the dedicated transaction on SAP to print the DDT (transport document, in Italian “documento di trasporto”). With the RFID technology all the pallet scanned and loaded are automatically visible on SAP, so on the DDT it will be printed: the code of the product loaded; the product description; the quantity and the production batch. The printing time of the transport document is automatically saved with the flag on SAP as the shipment start time, like in Figure 2.15.

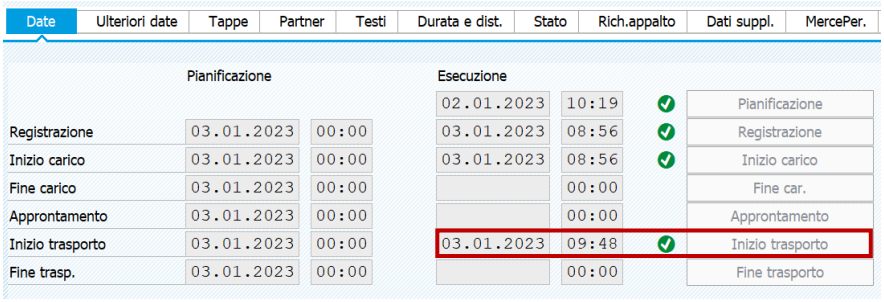

Figure 2.15 Automatic flag on the shipment start time when the DDT is printed [20]

Then the FO gives the sender copy to the truck driver for the signature. In the meantime, it uses the information noted on the loading packaging list to fill the excel file and the loading time on Transporeon. On the same excel file used during the arrival process, the Front Office has to complete with "yes" or "no" the information regarding the securing of goods, as in Table 2.1.

Table 2.1 Checklist done by the forklift drivers filled by FO on the excel file [14]

SIDEBOARD	HIGH/LOW RIB	ANGULARS (>120cm)	FASTENING STRAPS	PULPING PALLETS	SIDE LOAD SECURING BARS
Y	Y	Y	Y	N	Y

Finally, the FO has to fill in Transporeon the Loading start time and the Loading end time noted by the forklift driver on the loading packaging list, as in Figure 2.16.

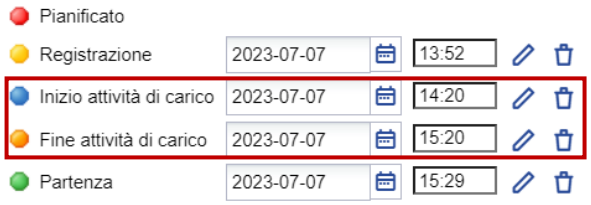

Figure 2.16 Start and end loading time modified by the FO on Transporeon [17]

5. In conclusion there are the last steps of the departure process. Once the truck driver signed the sender copy, he gives it back to the FO and keeps with him the other copies for the shipment. Then he can come back to the truck in the parking and start the trip.

2.3.5 The documentation process

Considering the whole shipping process made up by the activities just described, there are 2 main documents that are currently printed by the Front Office: the loading packaging list (LPL) and the transport document (DDT).

The first document printed, in single copy, is the **loading packaging list** that is required for the loading activity. This document contains the following information:

Supplier side:

- order number;
- date and time of LPL printing;
- DDT number;
- shipping conditions;
- division in which the shipment is made;
- date and time of loading;
- gross and net weight of the order.

Customer side:

- customer code;
- customer's address;
- commodity destination code and its address.

Carrier side:

- transport number;
- license plate of the vehicle;
- carrier information (name, code, address).

In addition, there is a section devoted to any comments to be made at the time of loading (e.g., the customer requests a maximum of two production batches).

The second half of the page is dedicated to the *forklift driver* and contains:

- product code and its description;

- quantity of pallets to be shipped;
- batches and locations where the goods to be shipped are stocked;
- checklist stamp;
- space to note loading times;
- space for forklift driver signature.

As we have seen, this document is used by the forklift driver during the loading phase and then by the front office during the completion process.

The other document printed by the front office before the departure of the goods, is the **transport document (DDT)**. Four copies of this are printed: one for the shipper, one for the customer, 2 for the carrier (one is for the eventual sub-carrier). The document must contain some mandatory information such as:

- date;
- sequential number;
- generalities of the parties involved in the transaction. In particular, the firm, name or company name, residence or domicile of the transferor and transferee must be indicated. The issuer must also indicate the VAT number. In addition, the details of the third party, if any, entrusted with the transport must be indicated on the document, giving the data of the entrusted company (not, however, of the individual who physically performs the transport). If more than one carrier is involved in the transport on the entire route, at least the particulars of the first person in charge of the transport must be indicated, who is not, however, required to make further annotations;
- description of the nature, quality and quantity of the goods. Thanks to RFID technology, all identifying matrices of each pallet loaded on the truck are also specified.

In addition, the company has also added other fields such as: any comment/instruction statements, generalities of the company that loaded the goods, annotations at unloading.

One of the 4 copies of the DDT, the sender's copy, is signed by the truck driver before the truck departs and will be filed for 10 years in the company, along with

the relevant loading packaging list. The other 3 copies are left to the driver for transportation and delivery to the customer.

For international travel, in addition to the DDT, the **CMR** is also used. The CMR document, or international waybill, is a genuine contract governing the international transportation of goods by road, and, at both the national and EU level, a CMR signed by the sender, carrier and consignee is the "master proof" to attest receipt of the goods. Although, in its absence, any other alternative means of proof, including the DDT, may also be considered valid. Again, there are 4 copies of the document that are usually carried directly by the truck driver. In particular, there are 24 sections to fill such as: data of sender and consignee, delivery of the goods, sender's instructions, data of carrier and successive carriers, signature of sender/carrier and many others. All these data are filled in by hand by the FO before the departure.

[14]

2.4 Critical issues and starting points for improvement

Having analyzed the company's current situation by mapping each sub-process involved in the entire shipping process, the major critical issues are identified, which will be the starting points for improvement. They are discussed below one by one following the logical order of activities from the booking process to the departure process.

In the **booking process**, each carrier can book truck loading within 60-minute time slots. Therefore, the booking time is not specific but rather each truck can arrive at any time within the booked slot. This situation, on one hand grants flexibility to carriers to deal with any unforeseen events along the road, but on the other hand doesn't guarantee maximum efficiency in loading activities. In addition, by interviewing the Front Office and randomly monitoring the arrival status of trucks on Transporeon, it appears that most don't respect the arrival time slot, showing up early or late. Given this situation, the order in which trucks are loaded follows FIFO logic despite the reservation times on Transporeon. Therefore, the critical issue that can be found is the non-respect of carriers' booking times and on the other hand a lack of prioritization by Verallia for trucks arriving on time.

In the **arrival process** there is a clear waste of time when the truck driver has to walk the distance between the parking and the FO twice. In addition to the actual time it takes to walk that distance, which approximates to about 3 minutes, there is also the time it takes to get in and out of the truck, albeit short. Secondly, during the eventual problem-solving process by UGL, the risk of data loss is high. Besides being a complex process, the correct resolution procedure is not always followed. For example, to speed up the process, the FO may decide not to put the flag on Registration when the driver shows up and directly notify UGL of the problem to be solved. In that case, UGL can resolve problems as soon as possible by skipping the activities of noting registration time, removing the flag, and re-entering the actual registration time. If, as in the example, the correct problem-solving procedure is not applied, the actual registration time is lost in SAP.

In the Table 2.2 below, it's shown an analysis of the comparison between the data in SAP and the data in the excel file filled in by the FO. The study is done considering 130 transports to customers in a sample month.

Table 2.2 Data comparison of registration and LPL between SAP and the manual excel file [14], [20]

TRANSPORT N°	CARRIER NAME	SAP REGISTRATION	EXCEL REGISTRATION	Δ REGISTRATION	MEANINGFUL DIFFERENCE	SAP LPL	EXCEL LPL	Δ LPL	MEANINGFUL DIFFERENCE
9231643	Carrier 1	11:35	11:24	00:11	Yes	11:37	11:38	00:01	No
9231588	Carrier 2	09:39	09:39	00:00	No	09:39	09:39	00:00	No
9233642	Carrier 3	11:10	11:10	00:00	No	11:10	11:10	00:00	No
9236724	Carrier 4	09:24	09:18	00:06	Yes	09:24	09:24	00:00	No
9238232	Carrier 5	08:07	08:00	00:07	Yes	08:07	08:07	00:00	No
				.....					
9237257	Carrier 126	13:42	13:33	00:09	Yes	13:45	14:15	00:30	Yes
9245474	Carrier 127	10:59	11:00	00:01	No	10:59	11:00	00:01	No
9244523	Carrier 128	07:55	09:23	01:28	Yes	07:55	09:23	01:28	Yes
9254646	Carrier 129	09:03	12:16	03:13	Yes	09:03	12:16	03:13	Yes
9255916	Carrier 130	16:15	16:16	00:01	No	16:15	16:16	00:01	No

The comparison between registration time on SAP and excel shows a data discrepancy of 42%. The cases identified are as follows:

1. *Registration time on SAP < excel registration time*. In this case, it is possible that UGL resolved issues before the truck arrived by putting the flag on the Registration after the change was made.

2. *Registration time excel < registration time on SAP*. This is the most frequent case where the driver shows up at the FO but, due to problems, must wait

for the loading packaging list. These situations occur when FO and UGL resolve issues found at registration without following the correct procedure. The actual registration time is written on excel but not updated in SAP which will record the end time of problem resolution as the registration time. For example, the 9237257 transport is registered by the Front Office at 13:33 but on SAP at 13:42. The Δ of 9 minutes represents the time used by UGL to solve the problem of the LPL.

The difference between the two registration times is classified as significant if it exceeds 5 minutes. This assumption was made to consider a reasonable time margin for the completion of manual operations performed by the Front Office. For example, the 9255916 transport is registered at 16:15 on SAP and 16:16 on excel. This Δ of 1 minute is acceptable for the performance of manual tasks performed by the front office, so it's not considered as a meaningful discrepancy.

Finally, when the loading packaging list is printed, this time is recorded in SAP with a flag on Loading Start. This can be considered as another critical issue since SAP does not record the actual time of start of loading, but only the time when the LPL is printed, which doesn't consider the time taken by the driver to return to the truck, get in queue, and finally be loaded. Recall that the actual data of loading is written down in the printed LPL and manually inserted in Transporeon.

Looking at the previous analysis (Table 2.2), there are some cases in which the LTL time on SAP is minor than the excel LPL time. These cases are uncommon and occur when the FO prints the LTL before the driver arrives. It can happen when it is known that SAP will not work for some hours due to upgrades or due to other scheduled events such as a power outage.

In the **loading process**, the first loss of time consists of the truck waiting for the forklift driver. This activity not only results in longer time, but it is also inefficient because the forklift driver has to repeatedly look and reach the STOP point where the trucks are waiting. In addition, decision-making regarding the location from which to pick up the goods is also attributed to the forklift drivers in order to tell the truck where to stand. Another possible critical issue can be attributed to the

manual process of writing down the start and end times of loading: since this is an activity performed by the operators, possible forgetfulness or adjustments cannot be ruled out.

In the **completion process** there is again the loss of time of the driver's walk from the parking to the front office. Later, when the DDT is issued, SAP records the time with a flag on "Transportation start". Again, this is a critical issue since the recorded time doesn't correspond to the actual departure of the truck from the plant but only to the printing of the transport document. In addition, this document can be printed by the FO before the driver physically shows up: with RFID technology, it is possible to see with a transaction on SAP which pallets have already been scanned by the forklift driver who is performing the loading. When the FO displays all loaded pallets, it can decide to anticipate the printing of the DDT before the driver actually arrives at the office. This decision can be made to speed up activities but, in that case, the actual time of document delivery to the driver is lost in SAP.

Comparing the data saved in SAP and those on the excel file for a sample month, the following analysis emerges. The study is done considering 130 transports to customers in a sample month and some of these data are shown in Table 2.3.

Table 2.3 Data comparison of DDT delivery between SAP and the manual excel file [14], [20]

TRANSPORT N°	CARRIER NAME	SAP DDT	EXCEL DDT	Δ DDT	MEANINGFUL DIFFERENCE
9231643	Carrier 1	12:19	12:19	00:00	No
9232391	Carrier 2	09:18	09:18	00:00	No
9231588	Carrier 3	10:43	10:43	00:00	No
9237767	Carrier 4	09:33	09:43	00:10	Yes
9236724	Carrier 5	10:19	10:19	00:00	No
			.....		
9239471	Carrier 126	17:19	11:25	05:54	Yes
9240477	Carrier 127	09:56	09:56	00:00	No
9241487	Carrier 128	10:59	10:59	00:00	No
9242046	Carrier 129	13:07	13:07	00:00	No
9241491	Carrier 130	13:12	13:32	00:20	Yes

The analysis shows a 26% discrepancy between data on SAP and data on excel. The situations may be as follows:

1. *DDT printing on SAP < excel DDT printing time*. It happens when the Front Office decide to print the DDT in advance. For example, in the 9237767

transport the DDT was printed at 9:33, probably when the FO saw all the pallets scanned and loaded with the RFID, and then delivered at 9:43 as noted on the excel file.

2. *Excel DDT printing time < DDT printing on SAP*. In exceptional cases, it may happen that the transport document is not printed when the truck departs. For example, due to SAP problems or power outage the DDT will be printed as soon as possible.

Another possible starting point for improvement in the completion phase is the manual input of the start and end time of the physical loading done by the FO. In addition to being an automatable activity, data are recorded on Transporeon but not transferred to SAP. Thus, the monitoring of actual loading time is poor and ineffective.

Analyzed these 4 processes, it can be deduced that a strong critical issue concerns data dispersion. The following situation results from the study conducted:

- *Excel file*. Here the FO manually writes down the actual data of: transport information; registration time; LPL print time; DDT print time; notes; forklift driver checklist.

- *SAP*. Here are collected the registration, loading start, and transport start times referring to when the respective flag is given to SAP. The registration and loading start flags are entered manually by the FO or UGL. The transport start flag is automatically entered by the system when the DDT is printed. If the ticks are entered correctly and consistently the data should match with the excel file, but, as we analyzed earlier, there are possible discrepancies.

- *Transporeon*. This is where the actual start and end load data are manually edited. In addition, all data remains on the platform and are not transferred to the company's ERP.

Regarding the **documentation process**, the ultimate goal is to digitalize the LPL for internal operations and the DDT for transportation. Therefore, the major critical

issues are the creation of a digital loading packaging list that is functional and complete with all useful information for loading, and a DDT that complies with legislative guidelines. In addition, all these digital documents will have to integrate with the company's current management system.

The following scheme, Figure 2.17, summarizes all the main critical issues found.

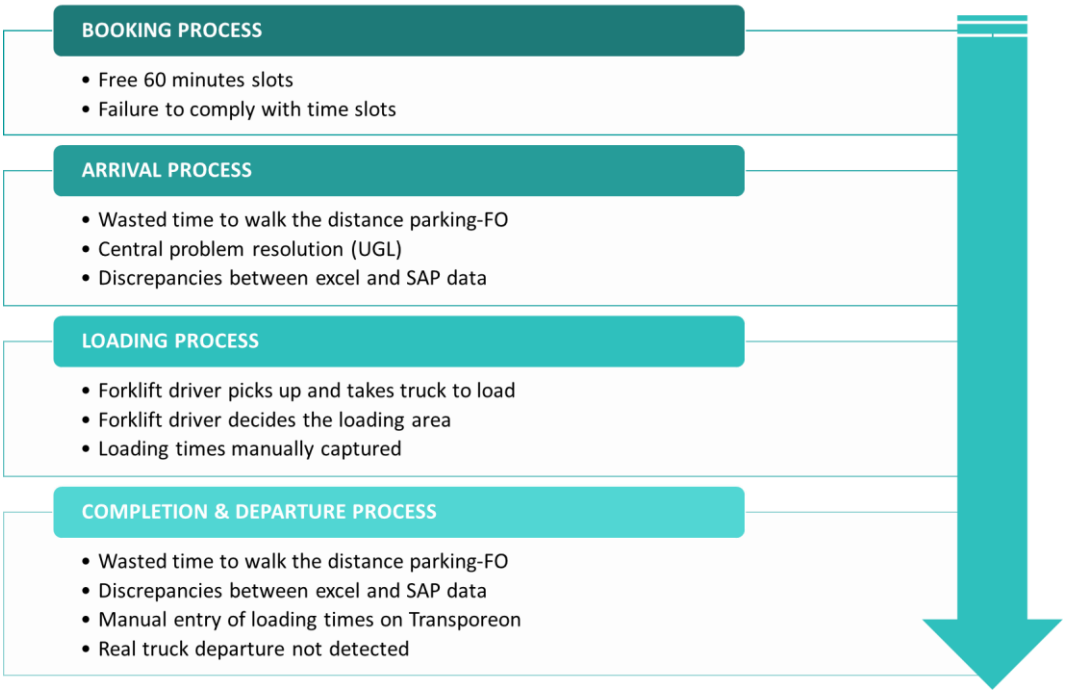

Figure 2.17 Scheme of the main critical issues along the analyzed process [14]

3 The Easy Go project

This chapter explains the "Easy Go" project regarding the shipping process standardization and digitalization of Verallia. Starting from the critical issues outlined in the previous chapter, common solutions are articulated for all plants around the world, while keeping a critical eye on the Lonigo plant. Finally, new tools for improving, achieving, and monitoring the future shipping process are discussed.

3.1 The new shipping process

The Easy Go project proposes a new shipping process that aims to reduce wasted time, solve problems encountered in the arrival phase, decrease manual tasks, and automatically capture the correct data in real time. The ultimate goal is to implement a standard, digital shipping process in all plants worldwide.

The proposed new shipping process is depicted in its macro view in Figure 3.1 and is illustrated below.

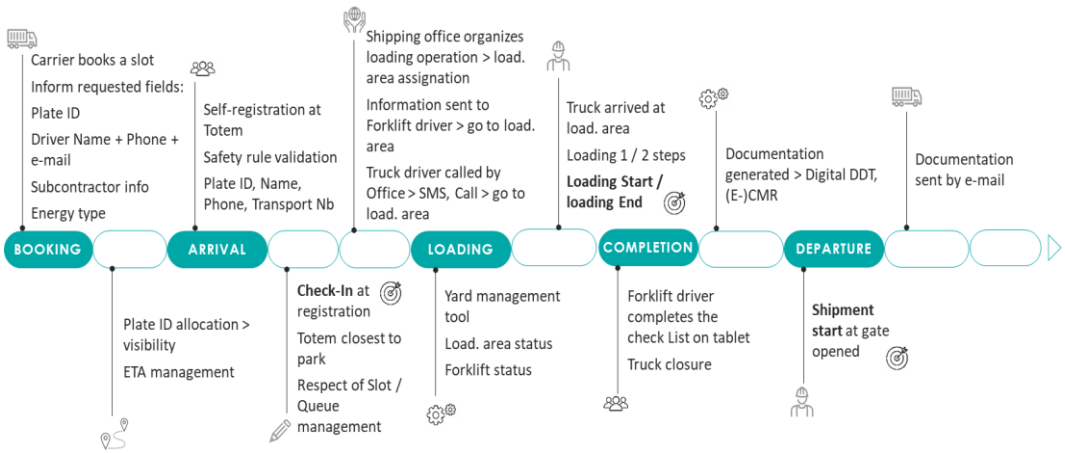

Figure 3.1 Macro view of the new shipping process proposed in the Easy Go project [14]

The skeleton of the process consisting of the booking, arrival, loading, completion and departure steps remains the same but the way in which the activities are carried out changes. Let's see this new process step by step:

1. *Booking*. In the booking phase, carriers use the Transporeon platform to book the time slot for loading. As seen in the previous chapter, this activity is already done but with little adherence to the arrival time by carriers. In order to incentivize adherence to the time slot each plant will need to implement rules for loading trucks, rewarding those that are on time. For example, the Lonigo plant plans to reduce the time slots from 60 minutes to 45 minutes by decreasing the drivers' discretion. It is important that carriers respect the booking time as much as possible since this is the starting point of the whole process on which its success will depend. In addition, during the booking phase the carrier must necessarily enter:

    - Date & Time for the Slot;
    - Plate ID of the truck used for the transport;
    - Driver's Name + Driver's Phone Number + Carrier's e-mail;
    - Subcontractor's name + address;
    - Energy type for the road.

    To make a full booking, the carrier must also allocate the vehicle's license plate in order to track it before arrival at the plant, during loading, and during the delivery trip to the customer. This topic is discussed in the Sixfold project, which is intersected with the Easy Go project toward the creation of a comprehensive transportation management system.

2. *Arrival*. In the arrival phase, the truck driver arrives at the parking lot and finds a totem for self-registration. This device will be placed in a designated area as close as possible to the parking lot and outside the gate so as to decrease driver travel as much as possible. Through this totem, the driver will register with name, phone number, license plate, and transport number without having to physically go to the Front Office. In addition, when registering, the driver is asked to read the safety instructions that must be

adopted inside the plant. In this way, before entering the gate, the driver can arrange to wear the required personal protective equipment. Finally, the driver waits in the parking lot until the FO notifies him that he can enter for loading.

3. *Loading*. The allocation of the loading area is decided by the FO who has to communicate it to the truck driver via phone and to the forklift driver directly on his tablet. In this way, the truck can independently go to the loading area and the forklift driver does not have to continuously check the STOP area. All the operations will be kept under control by a yard management tool that shows the loading status of each truck arrived and the forklift driver situation. About the physical loading, if it is possible, it can be considered the two steps loading with the picking and then the loading activity.

4. *Completion and departure*. After the physical loading the truck driver secures the load and close the tarps. During this operation the forklift driver controls the activities and complete the checklist no longer on the loading packaging list but on his tablet. In addition, when the Front Office creates the transport document on SAP a specific code is automatically sent to the driver that will identify him at the exit. At the gate, in fact, there will be another Totem in which to enter the identification code to have the bars opened. Only at this point the transport documents are sent to the relevant parties.

3.2 Solutions and tools

3.2.1 Self-registration totem

The first tool identified for the arrival process is a Totem or Kiosk for the self-registration of truck drivers. This instrument can be positioned near the parking lot where trucks arrive and permits to avoid useless movements by foot from the parking to the Front Office. Moreover, with this digital tool that is connected to the ERP and TMS system of the company, the aim is to automatically solve at least the

simplest problems observed in the arrival phase without contacting the logistic management office. For example, if the Plate ID registered during the booking phase is not the same inserted in the Totem by the truck driver the system can correct it automatically while keeping trace of this change.

The expectation for the application is to be composed by different screens and fields to get the exhaustive information from the truck driver. Firstly, the driver can select his preferred language to register, as in Figure 3.2. Given the presence of multiple carriers and sub-carriers with foreign drivers, it is important to ensure that requests and information are clear and understandable to all.

Figure 3.2 Representation of the Totem for the self-registration with a zoom on the first language screen [14]

Secondly, the truck driver has to validate the safety rules of the plant depicted in Figure 3.3. Of course, before entering in the plant he must equipped himself in the proper way and know how to behave.

Figure 3.3 Second screen of the Totem with the safety rules to be validated [14]

Thirdly, the truck driver has to fill in a questionnaire, like the one in Figure 3.4, with the following information:

- driver's name;
- driver's phone number, used by the FO to contact the truck driver when it's time to load and for send him the documents. In addition, there is the possibility to add another field where to insert the e-mail to which the documents can be sent;
- transport number, to identify the shipment already created on SAP and Transporeon;
- plate ID, to check if it matches the one already registered in the booking process and if it's necessary to automatically correct it;
- container ID for export;
- subcontractor name and address.

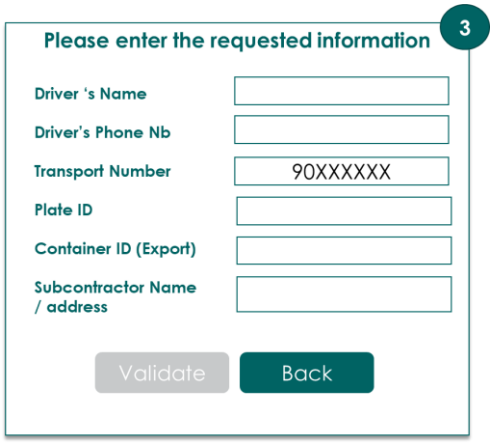

Figure 3.4 Third screen of the Totem with the questionnaire to fill in by the truck driver in at the arrival phase [14]

Finally, the last screen is the loading confirmation, Figure 3.5, in which the truck driver has to check if all the data are correct. If the registration process is successful, the driver can go to the truck and wait for instructions via phone from the Front Office. On the other hand, if there are any problems during registration that the system cannot automatically resolve the driver must contact the Front Office.

Figure 3.5 Fourth screen of the Totem with the loading confirmation [14]

Regarding the device, it must be greater than 21" in size, be tactile and robust, have Wi-Fi connection that connects to the Verallia network and must comply with computer security standards. Furthermore, given the outdoor location of the parking, a small protected area should be created in which to place the device.

3.2.2 Yard management cockpit

The second proposed tool is a yard management cockpit aimed at the Front Office to organize loading operations and keep monitored all process steps. This tool will allow to manage the queue of trucks, the loading operation in the different loading areas, the management of the resources such as forklifts and drivers. The information contained in this cockpit needs to be easily accessible and updated in real time, according to the truck statuses. For that, it may need to be connected with the ERP System (SAP) and TMS system (Transporeon).

A representation of what this dashboard might look like is shown in the Figure 3.6. On the right there are 3 spaces containing a summary of the meaningful numbers. Firstly, there are the present number of trucks inside the plant and the number of trucks registered and physically in the parking. Secondly, there is a chart with all the forklifts currently interested in the loading activities (the red ones) and the others potentially free (the green ones). Finally, there are 4 fields regarding:

- *Loading scheduled*. The number of loadings scheduled on Transporeon for the current day.
- *Loading executed*. The current number of trucks loaded.

- *Remaining workload*. The percentage of work to be done calculated with the ratio between the loading executed and the loading scheduled.
- *Slot used*. The percentage of slot booked calculated with the ratio between the loading scheduled and the total number of slots made available by the plant in a day.

In the middle of the dashboard there are three speedometers:

1. *IN/OUT*. It is the time measured from the arrival of the truck, thus from registration at the Totem, to departure. The desired IN/OUT time of the company is about 1 hour so the needle can move along the following categories: IN/OUT < 15’ = NA because is an unreal situation; 15’< IN/OUT < 30’ = excellent; 45’ < IN/OUT < 60’ = good; IN/OUT > 60’ = exceed.

2. *Slot adherence*. It is the correspondence between the booking time and the arrival time. The company leaves a flexibility of about 45 minutes within which the truck can arrive, so it expects most of them to arrive in the slots provided. The percentage is considered "average" only above 70%. For “excellent” results, a slot adherence rate above 90% is expected.

3. *Loading execution*. It is the time needed for the physical loading of the truck, so it is calculated from the first pallet loaded by the forklift on the truck until the last one. The target time is about 25’, so the categories “excellent” and “good” are between 15’ and 30’, outside there are “NA” and “exceed”.

On the left there is a table with the list of all the plant’s loading areas and their status:

- in green the free areas;
- in light blue the areas where the truck is about to place or is preparing for loading operations;
- in blue the area in which there is already a truck in the loading phase;
- in orange the areas in which there is the truck loaded in the completion phase;

- in red the non-usable area.

Moreover, for the areas already occupied, the third column displays the ID plate and transport number of the trucks assigned to that loading zone. The last column of the table is dedicated to the shipment registrations of the trucks arrived in which there are the ID plates of:

- the ones that are in the parking waiting for an allocation, in yellow;
- the ones that are going from the parking to the loading area or preparing for the loading activity, in light blue;
- the ones that are loading, in blue;
- the ones that are in the completion phase, in orange.

This side of the dashboard is designed to be interactive and allow the Front Office to associate each truck to its loading area by simply dragging the license plate to the desired location when the truck can enter for loading.

In this new process, the choice of loading areas and pallets to be picked is determined by the Front Office and no longer by the forklift drivers who will receive instructions directly on their tablets. These decisions will be made based on the location of the goods in the warehouse, visible on SAP, and following the company's "FIFO tranche" shipping policy. In addition, truck entry order is also managed by the Front Office, which is responsible for rewarding carriers who arrive on time. If the booked loading slot is not met, the Front Office has to manage the queue by following certain guidelines such as:

- if the truck arrives late it must wait for the first free loading slot.
- if the truck arrives early, it can enter only if the loading zone and forklift drivers are available. Otherwise, it waits for the slot it had reserved for.

In light of this, it is clear that the Front Office becomes the brain of this new shipping process.

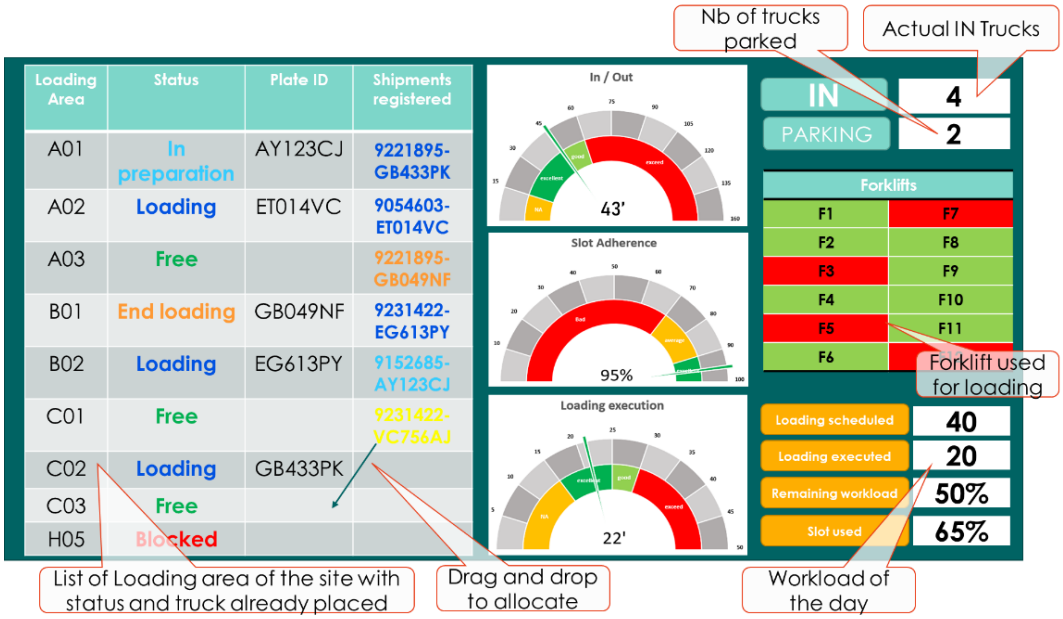

Figure 3.6 Representation of the "Yard management cockpit" tool [14]

At an operational level, when the driver registers at the totem his ID plate and transport number appear in the "Shipments registered" list on the FO dashboard. At that point, the Front Office enters the transport on SAP and performs the operations to create the loading packaging list specifying the locations from which to pick up the pallets and the loading zone. Eventually, without printing the loading packaging list, the load order is transmitted to the forklift driver's tablet on the Pallet Tracking System. Immediately thereafter, the Front Office drags and drops the subject transport to the selected loading location in the dashboard table. Contextually, an SMS is automatically sent to the driver with the loading location to which he should go.

3.2.3 Loading situation for forklift drivers

In the new process, the forklift driver won't pick up anymore the trucks at the entrance, they will go directly to the loading area to proceed the truck loading. To give them autonomy, it's necessary to provide some additional information in Pallet Tracking System than the simple list of trucks in the format "N° OF TRANSPORT – ID PLATE". In the following Figure 3.7 it is shown how it's possible to integrate such system with useful and visual information.

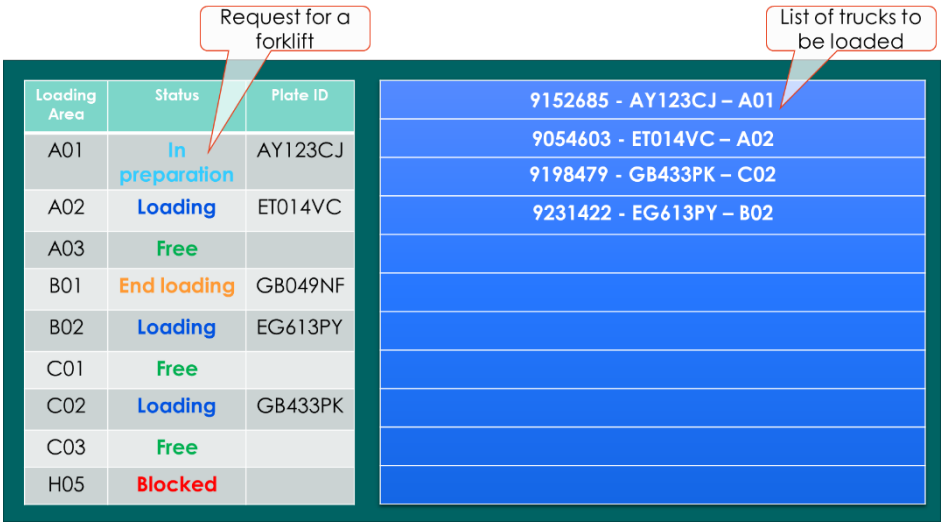

Figure 3.7 New visualization in the Pallet Tracking System for the shipping operations [14]

This will be the screen of the forklift driver's tablet when it is in the shipping app. On the right there is the list of the trucks with their transport number and associated loading zone while on the left it's displayed the table of loading areas with their statuses to provide a global view about the loading to be done. This visualization is connected to the activities performed by the front office on SAP and on the interactive dashboard: when the loading packaging list is processed, the freight appears in the right-hand list, and immediately thereafter, when the front office drags and drops the ID plate in the loading zone, the left-hand table is also updated.

When the status is "in preparation" it means that the truck it's coming in the associated loading zone, and it's requested a forklift driver for the loading activity. So, the forklift driver goes to the designated loading area where the truck will also independently arrive. While the driver prepares the truck for loading, the forklift driver checks that it is suitable for loading (e.g., views that the loading floor is flat and completely clear). Once the preparation is complete, the forklift driver accesses the transport on the tablet and begins loading operations. Let's look at the steps in detail:

1. Within the shipping app, the forklift driver displays the screen as in Figure 3.7. Having read the truck's license plate, he identifies the freight on the right-hand list and selects it.

2. Within the transport it will display the product to be loaded and the location, chosen by the Front Office, from which to pick up the pallets. This location will consistently be the closest to the loading zone where the truck has been allocated. At this point the forklift driver can proceed with the physical loading operations by scanning all the pallets he picks up and loads on the truck from the selected ubication.

3. Once all pallets have been scanned, the forklift driver closes the loading operation, and the loading request will disappear from the list. At the same time, the status of the loading area is also updated and will change from "Loading" to "End Loading" symbolizing that the physical loading is finished and that it is moving into the completion phase.

The process just described is the 1-step truck loading (picking and loading in one movement) that is adopted in most plants in Italy including Lonigo. However, there is also another loading mode, carried out for example in some French plants that involves 2-steps, first picking and then loading. In this case, pallets are moved closer together in a special area near the loading zone before the truck physically arrives. This operation is accompanied by a picking order that must be transmitted to the Pallet Tracking System of the forklifts. Picking orders are also handled by the Front Office and can be issued before the truck arrives or at the same time as the truck arrives depending on the availability of free areas and forklifts. For example, if truck A is being loaded in area A01 and another truck B is waiting to load in the same area a free forklift driver can perform the picking operations for truck B. In this way, when it is truck B's turn, the materials to be shipped will be ready in the immediate proximity of the loading area.

When performed, the picking activity is separated from the loading one and its steps are as follows:

1. Within the picking app in the Pallet Tracking System there is a list of picking requests associated with the transport number and the area where the loading operations will be performed.

2. Within a request it's possible to see the detail of the item, the location from which to pick it, and the future loading area. At this point the forklift driver performs the picking by scanning all the pallets and bringing them closer to the loading area.

3. When the picking is finished, the forklift driver closes the task on the tablet and the picking request disappears from the list.

4. Subsequent operations will be performed at the loading time by an available forklift driver. From here the procedure is the same as the 1-step process with the difference that the pallets will be in the designated area near the loading zone and not in the warehouse ubication. Then once entered in the transport in question it's possible to see a list of all the pallets, like in Figure 3.8, that have already been scanned previously in the picking process.

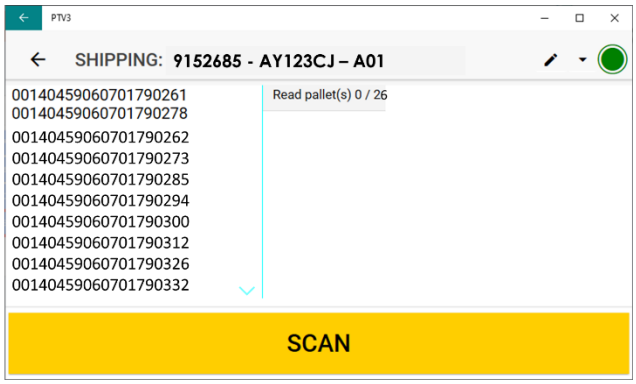

Figure 3.8 Transport visualization in Pallet Tracking System when pallets have already been picked up [14]

5. The pallets are scanned again by the forklift driver performing the loading operation. When the operation is completed, the load request disappears, and the dashboard table is updated as seen above.

3.2.4 Truck completion step

In the shipping process, a new subprocess is implemented to manage the completion phase and ensure that everything is done to close the truck and allow it to depart. There are two distinct completion steps that are carried out by two different actors:

1. *Completion of loading to close the truck*. The forklift driver carries out the completion within a new Pallet Tracking Application. This will be launched directly at the end of the loading, or it could be integrated as the last step within the loading application.

2. *Completion in SAP for truck departure documents*. The Front Office performs the completion on SAP to generate the transport document and to trigger the good issue.

At an operational level, the completion phase begins as soon as the forklift driver finishes loading the pallets onto the truck. At that point the driver must secure the load according to the standard using straps and angles. Normally the forklift driver who has finished the load should stay and supervise this activity, in fact the pallet tracking system immediately launches the new completion app in which there is a list of all shipments to be closed. However, if for some reason the completion is done by another forklift driver, the system gives the option to exit the app leaving the shipment to be completed on the list. In the next Figure 3.9 there is a visual schema of the steps just explained.

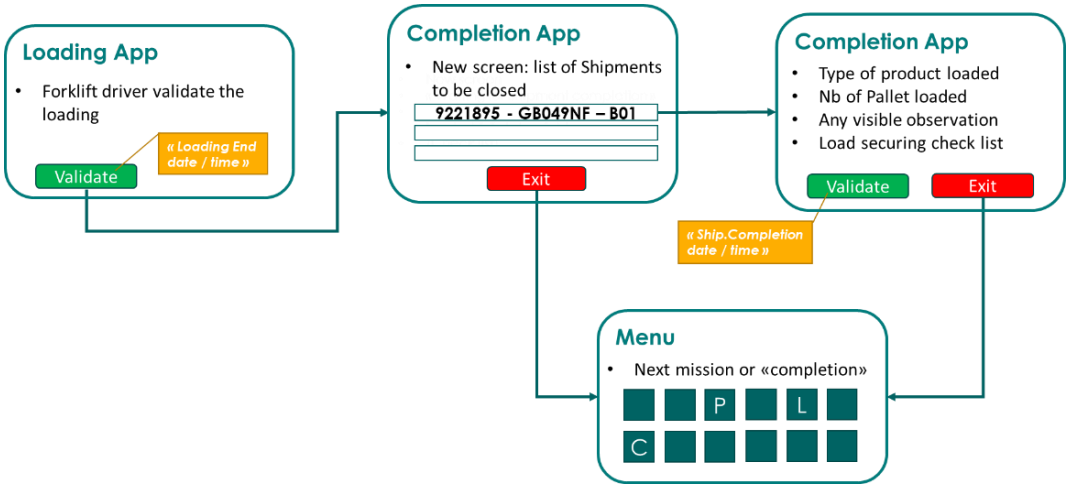

Figure 3.9 New completion App in the Pallet Tracking System [14]

Selecting the transport to be completed opens a new screen where there will be:

- a report of the loaded pallets;
- a free notes field where the forklift driver can write down any observations he feels are important about the load;

- the checklist on securing the load (sideboard, high/low rib, angular, fastening straps, pulping pallets, side load securing bars);
- the validation button that replaces the forklift driver's paper signature on the loading packaging list.

When the forklift driver validates the end of the completion the shipment to be closed disappears from the app list and the Front Office is notified. In this way the FO knows that it can proceed with the completion operations on SAP to issue the transport document which will not be printed. When the document is issued, the system creates an identification code associated to the specific transport that is sent by SMS to the driver. In the meantime, the driver can close the truck tarps and leave the loading position.

For the departure phase, the proposed tool is another totem near the gate that can be accessed by standing in the truck. Inside this totem the driver has to enter the code that he received via SMS which will trigger:

- the opening of the gate;
- the sending of the transport document to the driver by SMS and to carrier, customer and company by e-mail;
- the take on responsibility of the trip by the carrier in question.

At this point the control dashboard updates as below:

- the status of the loading zone changes from "End loading" in orange to "Free" in green;
- the transport number and license plate disappear from the list of "Shipments registered";
- the number of "IN" trucks decreases by 1.

The completion process just described is important for quality control of the loaded goods and to ensure that the securing systems are properly placed. Currently these activities are carried out by forklift drivers or dedicated operators but, thinking ahead to the future the idea is to make them fully automated. To do this, the

installation of ad hoc cameras capable of autonomously performing quality control and securing systems has been discussed.

3.2.5 Digitalization of documents

Nowadays, digitalization of transport documents is a very sensitive and heartfelt topic. The main objectives are to remove the paper but also to win efficiency in the sharing of information between the carrier, the customer and Verallia about the deliveries. More in detail:

- Verallia aims to stop the paper printing and save time for the shipping office. In addition, they continuously want to increase the safety in their sites so removing the driver trips by foot is another goal.
- Verallia wants to provide accurate information to the customer: examples of important data to include in the documents are batch number, SSCC code, type of products and quantity.
- The company would like to inform the customer about the delivery at the truck departure.

As discussed in the previous chapter (section 2.3.5), the two documents used for transportation are the DDT and the CMR. Starting from the DDT, it's a document that the company needs to generate at the completion of the truck because is mainly useful for customers to check the goods during the receiving process. In addition, the issuance of the DDT is mandatory in the case of shipment of goods with deferred invoice issuance. Thus, being in the compulsory case, the DDT cannot be replaced by any other document. Regarding the form, the DDT can be either paper or digital as long as it contains the mandatory information already mentioned in section 2.3.5. In the case of a digital DDT, however, the electronic transmission must take place by the day on which the delivery of the goods begins. Expectation of Verallia is to stop the printing of this document, creating a digital PDF and to send it directly to all concerned recipients by e-mail. [14]

On the other hand, the CRM is the international waybill, an official document recognized by various countries. While in Italy this document is used only for exports, in other countries, such as France, it is also used for national travel together

with the delivery note. The digitalization of this document has been a topic discussed for years in fact, e-CMR is an electronic waybill system that is becoming increasingly popular within the European market. It is not a simple replacement of paper documents with digital PDFs but a digitalization that goes one step further. As the e-CMR is an electronic system, its use facilitates procedures by making documents always available online, increasing the transparency, traceability, and quality of the logistics supply chain.

The e-CMR is the road waybill but in electronic format, drafted to prove both that the goods have been taken over and their status by the carrier. This document is based on the CMR (Convention des Marchandises par Route), a convention stipulated in Geneva on May 19, 1956 to regulate certain aspects of international road transport. Since 2008, the possibility of drafting a delivery note electronically has been introduced, and as early as 2019 it had eleven adhering countries. Today it includes every state in Europe, Morocco, Tunisia, some Central Asian countries, and parts of the Middle East. In particular, Italy has included within the PNRR business supports aimed at the creation of "sustainable mobility infrastructure," which includes precisely the stable adoption of e-CMR by 2024.

With e-CMR, operations such as data communication, signing for receipt or delivery, and shipment tracking can be encapsulated in a simple digital file that is always available and retrievable. In addition, as a result of e-CMR, all paper documents produced would be eliminated, reducing the environmental impact of transportation. The absence of the paper document allows the company a reduction in filing costs, a limitation of human error (forgotten documents, illegible handwriting) making the whole process smarter. In addition, with e-CMR it is possible to automatically produce a document in multiple languages, without the need for extra translation costs, facilitating traffic with all countries. [21]

To get a clearer view of the benefits, a direct comparison between the features of CMR and e-CMR is shown in Figure 3.10.

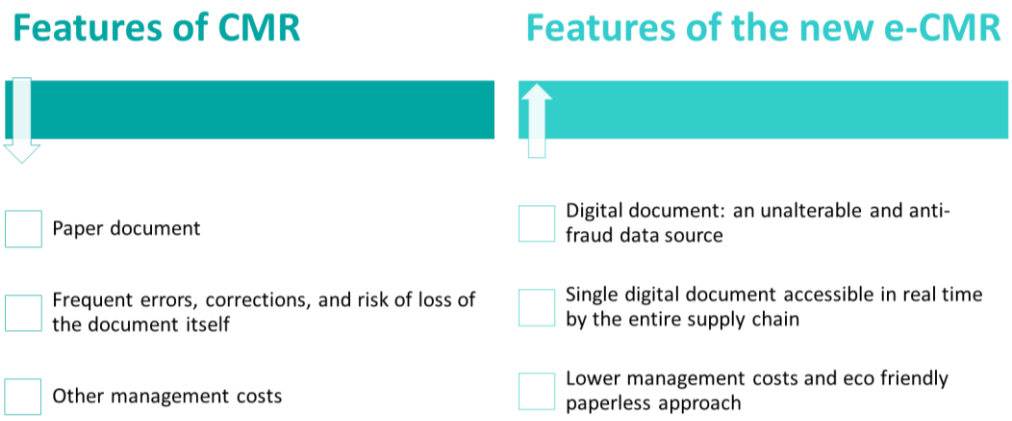

Figure 3.10 Comparison between CMR and e-CMR [21]

The company's partner Transporeon has developed a solution that manages e-CMR. A business review is underway to study their solution and obtain a business proposal for using this feature. Anyway, the solution proposed in their fact sheet works as follows:

1. Shipper indicates that e-CMR can be issued. The system generates a PDF version of the e-CMR without signatures after the vehicle allocation and transmits it to both the shipper and the carrier.

2. Using the Transporeon app on a mobile device the driver signs the e-CMR (sign on glass) and gets the signature of the shipper when loading the products. When the driver submits the loading status with the relevant signatures, a second version of the e-CMR is created and transmitted in real time to the shipper (and the carrier).

3. In case of police or administrative checks during the transport, the driver always has access to the latest e-CMR in the Transporeon App.

4. After the arrival of the trucks at the customer, the driver obtains the recipient’s signature and submits the status for unloading.

5. With the unloading status, the third and final version of the e-CMR is transmitted to the shipper (and carrier) in real time with the signatures of the shipper, driver and goods recipient and, if necessary, comments by the

driver. If an e-mail address of the final customer is stored, he will receive the final e-CMR via e-mail. [22]

In Figure 3.11 there is a schematic representation of the steps just explained.

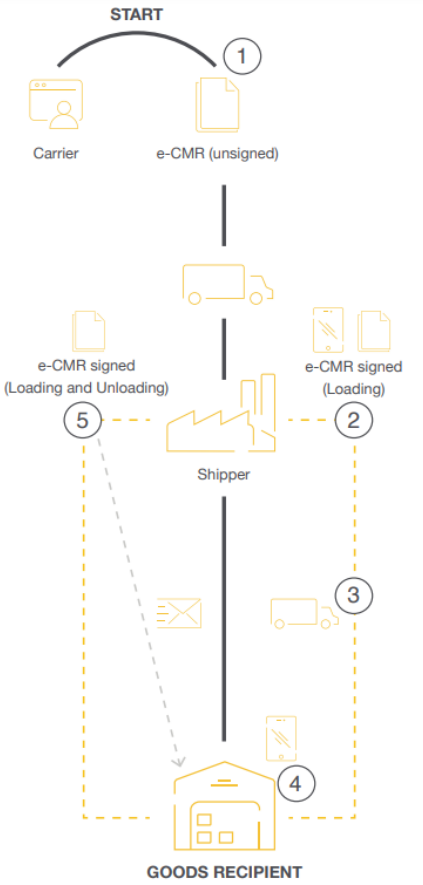

Figure 3.11 How it works the e-CMR Transporeon solution [22]

Currently, the technologies proposed for digitalizing the CMR are the most advanced, but building on this, studies are underway to develop a similar system for the digital DDT as well. Overall, the adoption of these new documents would mark a real change and an important step toward "true digitalization."

3.3 Monitoring & reporting – KPIs

In order to track, report and monitor this new process, several measurement points have been decided to characterize the salient activities throughout the process. These measurements refer to specific times captured automatically during different stages of the process:

1. *Check-in*. When the driver registers at the totem by entering his data, the so-called check-in time is automatically captured.

2. *Loading start*. When the forklift driver starts loading activities by scanning the first pallets using the application on his tablet, the loading start time is automatically acquired.

3. *Loading end*. When the forklift driver finishes the loading activities by closing the operation on the Pallet Tracking System, the loading end time is automatically captured.

4. *Shipment completion*. When the forklift driver validates the completion operation on the tablet app, the completion time is recorded.

5. *Shipment start*. When the code for opening the outgoing gate is entered, the shipment start time is automatically recorded.

6. *Shipment end*. This is the arrival time of the load to the end customer. This can be captured if the truck is tracked during the journey to its destination (Sixfold project, section 3.4).

All these times captured by the different devices should be automatically saved to SAP and Transporeon in real time and without differences. In this way, all systems are synchronized and consistent. Figure 3.12 shows the specific fields of TMS and ERP that will be filled by the captured real-time data.

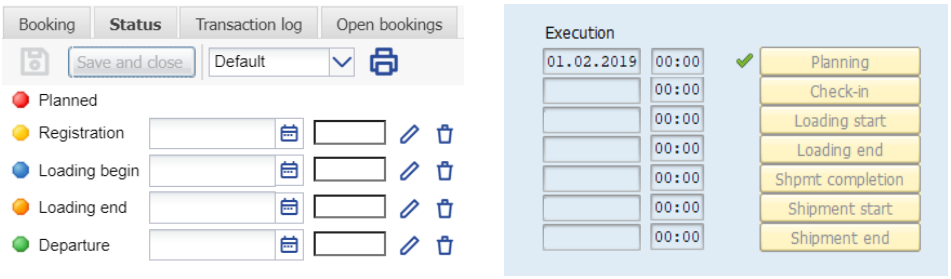

Figure 3.12 Empty fields to be filled by real time data in Transporeon and SAP [17], [20]

Given these captured times, the same KPIs were agreed upon for all plants in the company. Figure 3.13 shows a timeline in which the performance indicators are placed.

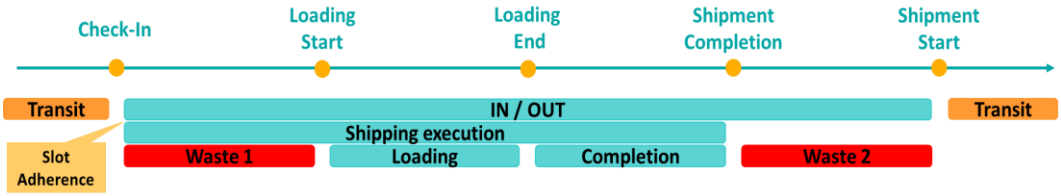

Figure 3.13 Timeline of the process activities with the identified KPIs [14]

The KPIs identified are as follows:

1. *Slot adherence*. It is the correspondence between booking time and arrival time. When the truck does not arrive in the booked time slot in the Time Slot Management section of Transporeon, a "delay of X minutes" message automatically comes out on the transport in object.

2. *IN/OUT*. This indicator considers the entire process carried out in the plant, from the time of check-in at the totem until the truck leaves the gate.

3. *Shipping execution*. This is the time between check-in and completion of the shipment, so from the driver's arrival until the load is secured. It does not consider the time taken by the driver to close the truck and go to the exit gate.

4. *Waste 1*. The time between check-in and start of loading can be calculated to understand the waiting and preparation time for the loading activities.

5. *Loading execution*. It is the actual time used by the forklift driver to load the goods onto the truck, starting from the captured time of loading start to the loading end.

6. *Waste 2*. There is an interval of time between the completion and departure phases when the driver closes the truck and heads for the exit.

The idea is to combine all these KPIs into a single dashboard to be added to an existing dedicated section of the company's Qlik. Figure 3.14 shows for illustrative purposes what this dashboard of KPIs would look like.

Figure 3.14 Dashboard of KPIs to add in Qlik [14]

3.4 The Sixfold project

This section is devoted to the Sixfold project dealing with the tracking of trucks along their route. Even this project is "a piece of the puzzle" aimed at building a complete transportation management system in all its parts. Furthermore, it is related to the departure phase of the Easy Go project because, if applied, it can capture the Shipment end time.

Sixfold is the provider of the Real-time Visibility function in the Transporeon platform, which enables tracking of shipments and sharing of ETAs (estimated time allocations) with customers. Visibility Hub is a way to maintain control of transports by offering real-time visibility of shipments in transit. At the heart of Visibility Hub is a powerful AI engine that processes GPS data creating accurate ETAs for all modes and types of transportation. In addition, the processed data is natively integrated into all Transporeon products.

Overall, Visibility Hub offers many benefits including the following:

- *Increased efficiency*. Visibility Hub simplifies processes and reduces costs for all stakeholders. Shippers and carriers benefit from accurate real-time

predictions, leading to fewer check calls and enabling them to focus on exception management. So, it is possible to make informed decisions about the most efficient and convenient routes and times to deliver goods to their destination.

- *Improved customer service*. End customers gain full visibility into incoming shipments, allowing them to plan their processes accordingly. In fact, providing customers with accurate and up-to-date information on the location of their goods will improve customer satisfaction and reduce the number of inquiries.

- *Collaboration with subcontractors*. Visibility Hub enables better collaboration with subcontracting partners to smoothly submit freight orders and/or receive tracking information from partner trucks.

- *Increased safety and security*. Visibility helps ensure the safety of transported goods by providing real-time alerts in case of accidents or other deviations from the plan.

- *Improved data quality*. Intelligent algorithms clean and process incoming raw data automatically and return the most accurate ETA in the market, helping to provide customers with best-in-class visibility services.

- *Platform advantage*. Connection to the Transporeon transportation management platform makes it easy to expand business. Connections to new customers and logistics partners are facilitated without having to integrate new systems.

In Visibility Hub there are several ways to provide real-time monitoring. The most important thing is to receive a GPS signal from the moving object to be tracked such as a truck, trailer, or driver's mobile phone.

If a connection to a GPS platform is not possible, GPS data can also be provided via Transporeon mobile app. In this case, a smartphone with an available mobile data connection is needed and driver involvement is required. However, the real-

time visibility results achievable with this method are lower than those obtained with connection to GPS provider. The advantages of the latter are:

- No dependence on cell phones with good Internet reception.
- No interaction with the driver is required. All that is required is the assignment of a license plate.
- On average, better real-time visibility service can be provided to customers.

Therefore, in the long run, it is recommended to introduce GPS equipment in the truck fleet to achieve higher quality results. Visibility Hub has established interfaces with over 90% of all GPS providers, in fact activating the connection between the two can be done quickly and easily.

Once vehicles are connected from the telematics provider platform to the Visibility Hub, the vehicles must be assigned to transport. This step is critical because it associates the transport with the license plate of the truck that will carry it out. In Figure 3.15, it is explained through a diagram that before the transport begins, the truck must be allocated, and consent must be given for data sharing. In addition to these two prerequisites, to have real-time visibility of the truck, other data sharing criteria must also be met, which are discussed below.

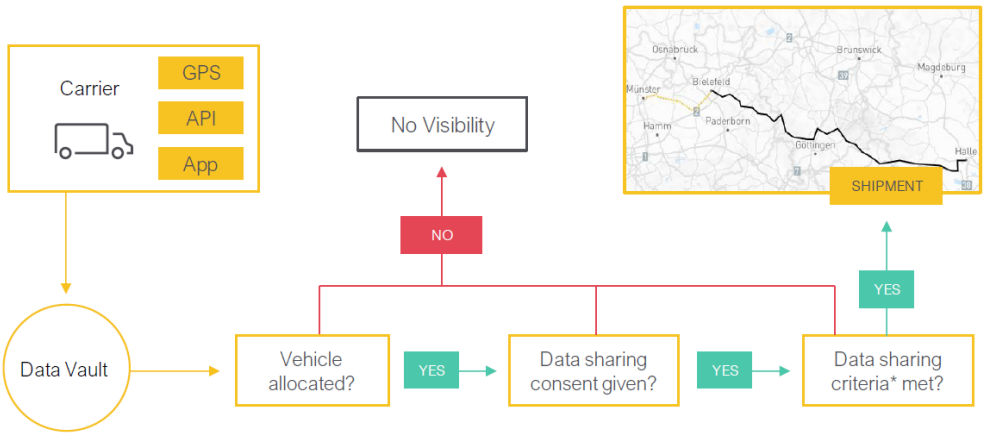

Figure 3.15 Prerequisites to be met before the shipment to have visibility during transport [14]

Let's look in detail the different phases of a shipment and their visibility status through the Figure 3.16.

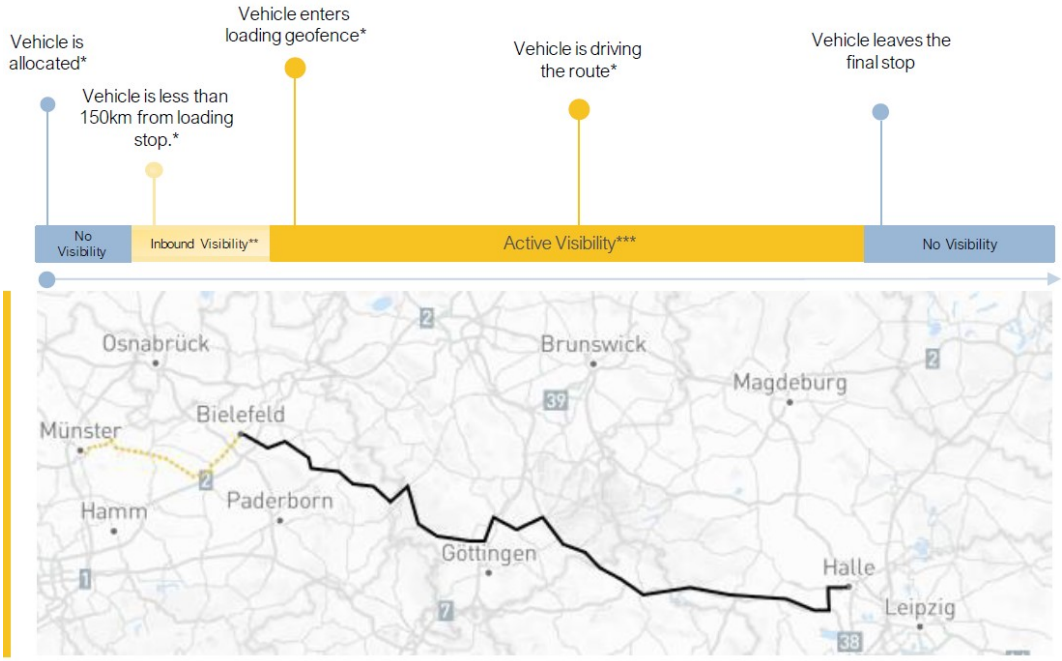

Figure 3.16 Phases of a typical shipment with their visibility status [14]

1. The vehicle is not yet on the road, or it is more than 150 km from the loading stop. In this case the license plate of the truck should be allocated to the transport but there is *not yet visibility*.

2. The vehicle is less than 150 km from loading stop. In this case there is the "*Inbound Visibility*" in which ETA and delay status is displayed on Transporeon, but no truck is shown on the map. This information is useful to inform loading place about the truck arrival.

3. The vehicle enters the loading geofence. Geofences, figure 3.17, are a virtual boundary of a geographic location (address) that are used to determine arrival and departure times of a vehicle. When the truck stops within the geofence for at least 5 minutes, the system considers it to be arrived at the planned address. Doing so, the system is able to recognize when the truck is in the warehouse for the loading activities and when it's arrived at the final customer for unloading. In this case there is the "*Active Visibility*" in which ETA and delay status are available on the Visibility Hub and the location of the vehicle is shown on the map.

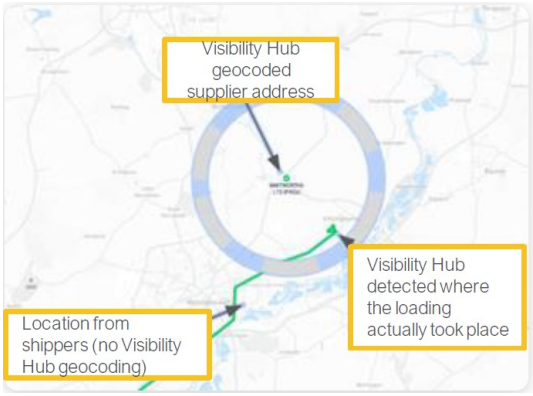

Figure 3.17 Virtual boundary of a geographic location called “geofences” [14]

4. Vehicle leaves the final stop. Visibility Hub breaks displaying truck when all stops of the transport are visited either via GPS monitoring or other methods.

Visibility Hub makes sure that shipment data is always valid and that shipments are correctly monitored. The data are improved by cleansing, rejecting or ignoring:

- GPS outliers;
- faulty timestamps;
- broken addresses;
- wrong stop order;
- etc.

To detect events and calculate ETAs 3rd party data, like weather or traffic data, is used. Historical and anonymized data from past deliveries helps Visibility Hub to learn from the past and provide the best visibility service in the market. Additionally, many smart features, such as "Smart Geofences" helps in get more accurate arrival times, by learning where the vehicles stop and dynamically adapt the geofence to that.

Finally, data privacy is an important issue for carriers. Sixfold strives to be a qualified, compliant and secure provider. In fact, vehicle location and status are displayed in Sixfold only if data sharing has been enabled, and truck location will

only be visible to the shipper while an assigned transport is in progress. There are cases in which tracking is cancelled because of safety nets:

- *Stops not visited.* In these cases, there are safety mechanisms in place, that stop data sharing after 24 hours normally. The timeframe is longer for long distance transports because the system calculates the time, when visibility should be stopped relative to the current delay and ETA. At the latest, 4 days after the planned end of the shipment, visibility will be stopped.

- *Incorrect data*. These are cases in which the master data is incorrect, no GPS signals are received or truck deviates far from the expected route. Moreover, tracking will not even start if the necessary data sharing criteria is not met (e.g. wrong truck allocated that is nowhere near the loading station at the expected time).

[14], [23], [24]

4 Expected consequences of the Easy Go implementation

This chapter aims to expose the most important consequences that arise from the implementation of the Easy Go project. First, the direct effects on the shipping process are explained with a detail on the comparison between current and future times acquired along the process. Then the project is analyzed in its entirety with the SWOT technique. Finally, the topic of change that affects the company and all its partners in the application of Easy Go and Sixfold is discussed.

4.1 Direct effects on the process

The second chapter discussed the current situation with its critical issues. On the other hand, the third chapter described the proposed new digitalized shipping process. Now a direct comparison can be made between the critical issues found in the existing process and the proposed solutions. In the diagram in Figure 4.1, all the problems of the "AS IS" situation are listed on the left, while on the right there are the project resolution ideas for the "TO BE" situation.

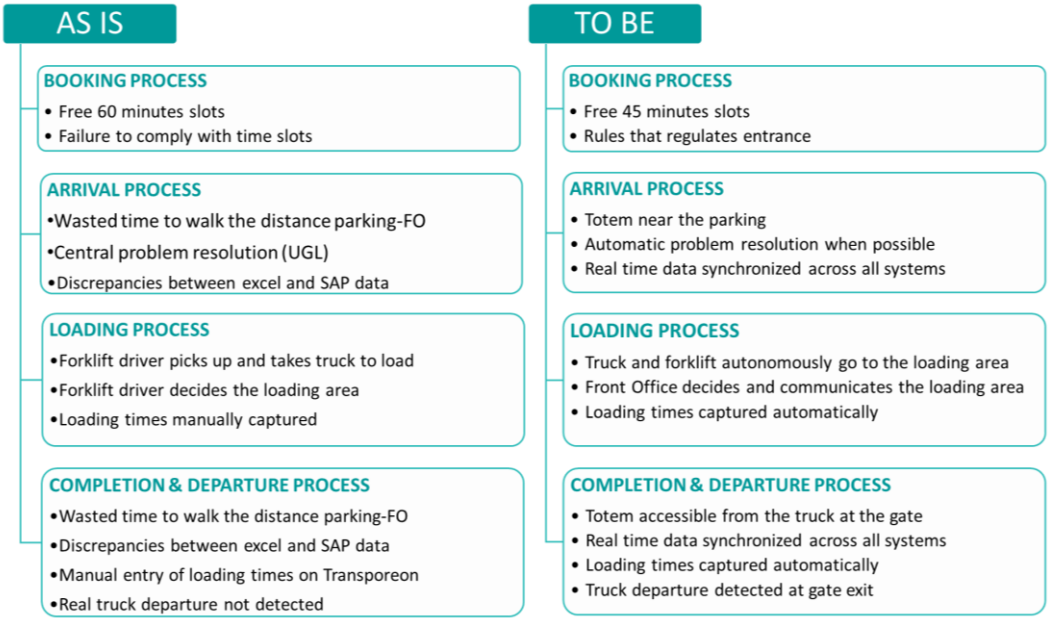

Figure 4.1 Direct comparison between the criticalities of the AS IS process and the solutions of the TO BE process [14]

Also in this case, we analyze the comparison through the stages of the process:

1. *Booking process*. Currently, the main problem related to the booking process is the driver's failure to meet the arrival time at the load. To counter this, booking time slots in Transporeon will be reduced from 60 minutes to 45 minutes to leave less discretion to drivers. This countermeasure alone, however, is not enough in fact, to regulate truck entry, FIFO logic will no longer be followed but rewarding rules for on-time carriers will be put into practice. In order to do so, the company will have to communicate the new stricter rules to the carriers in order to succeed in enforcing arrival times at the plant. In addition, carriers will be required at the booking stage to fill in all required data as accurately as possible before the truck arrives. Finally, for maximum results the carrier will be required to allocate the truck's license plate for tracking purposes.

2. *Arrival process*. The first problem encountered in the arrival process is the distance between the parking lot and the Front Office that drivers must travel. Many plants, such as the one in Lonigo, have the parking lot outside the plant therefore drivers have to walk a pedestrian distance along the road to get to the Front Office for registration and then return to their truck. The proposed solution in the new digitalized process involves installing a totem near the parking lot that would allow drivers to register themselves without moving too far. Second, currently there are various problems that are encountered during registration: in all these cases the Front Office contacts UGL for their resolution. To avoid these cases as much as possible, the goal would be to create the transport on ERP and TMS, correct and complete in every part, before the truck arrives. If this is not the case, the proposed solution is to let the system automatically correct the simplest issues (e.g., license plate correction) and to create a procedure that automatically contacts Front Office and UGL to resolve the more complex ones. Finally, the registration time that is currently written on an excel file and entered manually on SAP will be recorded automatically by the system when the driver's data is entered on the Totem. If there are changes to be made or

problems to be solved, the goal is to track and record all movements made and transmit to SAP and Transporeon the actual registration time, corresponding to the driver's arrival at the Totem.

3. *Loading process*. In the actual loading process, forklift drivers check if there is the presence of trucks in the STOP area, then decide the loading area and if necessary, accompany the driver there. This procedure is inefficient and results in wasted time for the forklift driver who has to physically travel distances to reach the truck in the STOP area and then go to the loading area. An average time of 7 minutes was estimated to perform these trips. The proposed solution in the new process is to centralize loading area decisions to the Front Office, which will also be responsible for managing truck entries into the plant. In this way, forklift drivers will no longer have to physically go to the truck but will be notified directly on their tablet when the truck is about to arrive at the chosen loading area. To allow drivers to independently go to the loading areas, signage must be clear and updated. Therefore, each plant will be required to equip itself with:

    - building signage and vertical directional signage for the building (Figure 4.2);
    - horizontal signage of the loading area;
    - site map at the entrance and in the parking area.

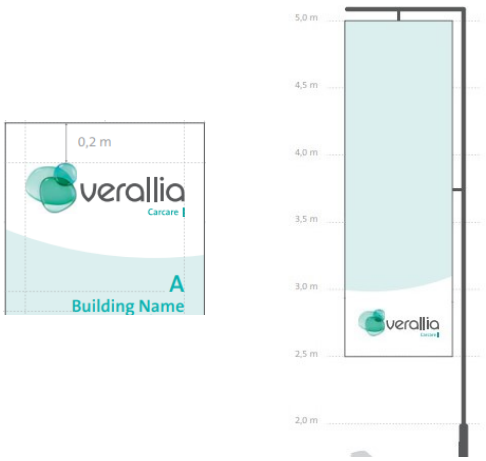

Figure 4.2 Building signage and vertical directional signage for Verallia plants [14]

In addition, other modes of optional signage may include:

- colored paint lines to reach different buildings;
- colored lines for the exit route.

Finally, the loading times that are currently written by the forklift driver on the loading packaging list will be captured automatically by the Pallet Tracking System at the beginning and end of loading.

4. *Completion and departure process*. At the current completion stage, the forklift driver checks the load securing and completes by hand the checklist on the loading packaging list. In the new process presented, this activity is digitalized within a new App in the Pallet Tracking System. In this way, the completion time, which is not tracked in the current process, is also automatically captured. After completion, the driver must receive the transport document: in the current situation, the driver leaves the plant to park the loaded truck and walks back to the Front Office again to sign and collect the DDT. In addition, SAP captures the truck's departure time when printing the transport document, which, however, does not correspond to the actual departure time. The proposed solution for this last step is the installation of a truck-accessible Totem positioned at the exit gate. Through this Totem, the driver will have to enter an identification code that will act as proof of taking charge of the transport, it will also cause the bars to open, and the system will automatically capture the truck's exit time. This time will then be transmitted to SAP and Transporeon so that all systems are aligned in real time.

In conclusion, with the implementation of the Easy Go project, the company expects to solve the major critical issues found in the current shipping process. Thus, at the process level, the plants expect a decrease the total IN/OUT time due to the digitalization of activities and elimination of wasted time. To mention some numbers, based on the new process for the Lonigo plant, the following time savings can be added up:

- about 3 minutes to walk to the front office for the registration step;

- about 3 minutes to walk back to the truck with the loading packaging list in hand;
- about 7 minutes for the activity performed by the forklift driver to pick up the truck and take it to the loading area;
- about 3 minutes to walk to the front office to receive the transport document;
- about 3 minutes to walk back to the truck with the transport document in hand.

So:

$$Saved\ time = 3 + 3 + 7 + 3 + 3 = 19\ minutes$$

But we have to consider that the time taken by the driver to reach the Front Office for the registration phase and the final time to walk back to the truck with the DDT in hand are not currently considered within the IN/OUT calculation. Therefore, the reduction in IN/OUT time will be visible but not in its entirety. Other minutes that can be considered in the "saved time" are:

- waiting time for loading (currently average 25-35') reduced if there is slot-adherence;
- time to issue the transport document (about 2 minutes), which in the new process will be issued during the completion phase while the truck is preparing for departure;
- the time taken by the driver to get off and back on the truck during the departure phase that will be avoided thanks to the Totem accessible from the truck.

In addition to the time savings achievable during the process, the company expects to simplify manual activities as much as possible by achieving greater efficiency in the process itself and moving toward a “true digitalization”.

4.2 "AS IS" times captured VS "TO BE" times captured

In order to track and evaluate the process in all its parts, it is necessary to collect as much data, in our case times, as possible. At the same time, in order to make accurate studies based on such data, it is necessary for them to be as real as possible. In fact, one of the goals of the new shipping process is to capture real-time data and align them across all platforms in the system. Let's look in detail all the times captured in the new process, compared with those captured in the current situation (Table 4.1).

Table 4.1 Comparison between "AS IS" time captured and "TO BE" time captured [14]

TIMES TO CAPTURE	"AS IS"	"TO BE"
CHECK-IN	Manual flag on SAP Excel file	Automatically captured by the Totem
LOADING START	Manual flag on SAP with LPL printing Handwritten on LPL Manually entered on Transporeon	Automatically captured by the Pallet Tracking System in the Loading App
LOADING END	Handwritten on LPL Manually entered on Transporeon	Automatically captured by the Pallet Tracking System in the Loading App
SHIPMENT COMPLETION	Not captured ✕	Automatically captured by the Pallet Tracking System in the Completion App
SHIPMENT START	Automatic flag on SAP with DDT printing	Automatically captured by the Totem positioned at the gate
SHIPMENT END	Not captured ✕	Automatically captured with the Sixfold project

1. *Check-in*. The so-called "check in" time is the driver's registration time. Thus, in the ideal situation it should be as close as possible to the time when the driver arrives at the plant for the loading activities. Currently, this time is written on an excel file and manually entered into SAP when the driver shows up at the Front Office. The result is that the time taken by the driver to arrive at the Front Office is not taken into account. In addition, as we saw in section 2.4, the data can be "distorted" when the correct procedure for troubleshooting is not followed. On the other hand, in the new process the

registration time is automatically captured by the Totem when the driver enters his data. In this way, the time is more accurate because the driver after parking will take only a few seconds to reach the Totem, moreover if there should be any problems, the system will still keep the first registration time in storage.

2. *Loading start*. The loading start time is the time that corresponds to the first pallets loaded onto the truck. Currently this time is written on the loading packaging list by the forklift driver when he starts operations and then manually entered by the Front Office on Transporeon. However, on SAP in the "Loading start" field there is the time the loading packaging list is printed which, for obvious reasons, does not correspond with the actual start of loading. From this, it results that the data saved on Transporeon and SAP are not equivalent. In addition, for the calculation of KPIs, the company relies only on SAP data, and thus the loading start time entered on Transporeon is lost. The new process aims to resolve all these issues by avoiding the printing of the LPL and recording the actual load start time automatically when the Pallet Tracking System detects the first scanned pallets of the load. Finally, this data is transmitted to all necessary systems, including Transporeon and SAP.

3. *Loading end*. The loading end time corresponds to the instant when the last pallet is loaded onto the truck. The current situation is similar to the one just described for the loading start time, in fact this time is manually written by the forklift driver on the loading packaging list and then manually entered on Transporeon. As before, this data is lost because the analysis is not done with Transporeon data but with SAP data. In addition, this time is not entered into SAP in any way. Therefore, in the new process the goal is to capture the loading end data in real time with the Pallet Tracking System and save it on SAP and on all the other systems.

4. *Shipment completion*. Shipment completion occurs when the forklift driver has finished his control activities and can leave the loading area. At that time, the load is completely over the truck secured and ready for departure,

and the driver only needs to close the truck. Currently this time is not captured in any way, in fact even in the "Shipment completion" field of SAP no time is entered. Therefore, in the new shipping process is introduced capturing also this time through a new completion App in the Pallet Tracking System. In fact, the forklift driver who performs the checks on securing the goods will have to validate the completion in the new App, which will automatically record the time of completion of the shipment. Finally, the data will be shared in real time with other systems.

5. *Shipment start*. The shipment start time corresponds to the instant in which the truck leaves the plant and begins transportation to the customer. In the current situation, once the truck is closed, the driver parks the truck and walks back to the Front Office to receive the transport document. When the DDT is printed, the "Shipment start" time is automatically recorded on SAP, but this does not correspond with the actual departure of the truck. This is because the driver after picking up the document takes additional minutes to walk back to the truck and leave and as seen in section 2.4, the data can be "distorted" if the document is printed early. In the new process, this time will be captured when the driver enters his ID code to have the exit bars open, so the data will match the actual truck leaving the plant. In addition, to have an optimal result, the Sixfold project should be applied, which with GPS technology tracks the truck once it leaves the plant.

6. *Shipment end*. The end time of transportation is the time when the truck arrives at the end customer. Currently this data is not captured within the system. In this case, the proposal is to apply the Sixfold project, which would be able to track the vehicle and capture the final time of arrival automatically.

All of this data is used to calculate the KPIs seen in section 3.3. Most are currently calculated with data captured in the "AS IS" process, but, as just described, many of these times are not accurate or do not reflect reality. By implementing the Easy Go project, the company expects to capture all the necessary data as closely as possible to reality by being able to monitor the entire shipping process. With the

proposed new tools and having alignment of information between all systems (i.e., SAP, Transporeon, Pallet Tracking System, FO Dashboard, Totem), the expectation is to have more visibility of ongoing, already performed and future activities. In addition, there is an expectation of a decrease in the time of most KPIs (i.e., IN/OUT, Shipping Execution, Waste 1, Waste 2) due to the elimination of waste activities (see section 4.1). Finally, by recording all movements and monitoring all timelines more accurately, problems will be identified and clustered more specifically, allowing them to be solved in a targeted manner and opening up new opportunities for continuous improvement projects.

4.3 The SWOT analysis of the Easy Go Project

To focus on all the crucial points of the Easy Go project, the company resorted to SWOT analysis, whose matrix consists of 4 pillars that help to make an accurate analysis of the project:

1. *strengths*: the upper left quadrant with the project's strengths;
2. *weaknesses*: the upper right quadrant with the project's weaknesses;
3. *opportunities*: the lower left quadrant with the new opportunities to be seized with the implementation of the project;
4. *threats*: the lower right quadrant with the external threats to project implementation.

Let's now analyze the project through these 4 pillars (representation in Figure 4.3).

The greatest **strength** of the project is to digitalize flows and processes, not only to keep up with the times, but especially to improve all the activities carried out and benefit from all the consequences of such innovation. In fact, thanks to digitalization, it is possible to optimize the paths that are taken by various actors in the plant to ship finished products, also increasing safety within the plant. For example, the driver's walking paths are reduced as much as possible thanks to the installation of the totem near the parking lot and the one accessible from the truck at the exit gate. Or even the forklift driver who no longer has to physically pick up the truck and take it to the loading zone. Another point in favor of the project is the possibility of achieving greater efficiency in logistics activities and productivity

since, by optimizing the execution time of activities, a greater demand for loads per day could be met. Moreover, the installation of totems makes it possible to digitalize registration and departure operations autonomously and easily, thanks also to the multi-language option. Together with the totems and the other devices used in the digitalized process, data are captured in real time to reflect reality as much as possible and then are immediately aligned across all systems. All this allows for better visibility of the process. Another strength is the centralization of decisions at the FO regarding loading areas. This change is considered a strategic strength to have warehouse management optimization. In fact, the goal is to achieve a single view of the warehouse, preventing forklift drivers from choosing to pick goods from one hold rather than another based on their work style or any other preference. This centralization decision could also result in a new goods stowage policy in which high-rotating products prefer holds close to loading zones while low-rotating products prefer warehouse areas further away from loading zones. Last but not least, digitalization is intended to eliminate printed paper, moving permanently to a solution with reduced environmental impact.

One of the goals of the Easy Go project is to standardize the shipping process for all of the company's plants. A **weakness** in achieving this goal is the difference there is among all the plants. For example, the parking lot for arriving trucks is not always outside the plant as in the case of Lonigo but may be inside the plant. In addition, there are cases where the janitor's quarter and Front Office are located in two different offices and the driver has to reach both places for arrival registration operations. Therefore, the solution proposed in the Easy Go project offers a standard guideline for all but needs to be adapted for each plant. Second, the change from the current process to a digitalized one needs the training of all employees involved in the operations. In particular, the actors most involved in the use of the new devices are the driver and the forklift driver: for the driver, training is needed on the use of Totems, for the forklift driver on the use of the new Apps on the Pallet Tracking System. Regarding the Front Office, training is needed on the use of the yard management dashboard and the new procedures to be followed. Moreover, becoming the "brain" of all operations will need to receive support not only in the use of the new technologies adopted but also in the strategic choices it will face. In

addition to the actors who actually carry out the activities in the shipping operations, the Verallia staff involved in the process must also receive training on the new flows (e.g.: UGL, customer service, logistics managers and logistics technicians, warehouse managers). Finally, in order to achieve results from the implementation of the project, strong cooperation with the external transporters to whom the company relies on is necessary. Greater compliance with booking schedules and adaptation to the digitalization of processes are expected from them. In fact, the rules to be adopted by Verallia will reward transporters who arrive on time at the expense of those who arrive late and/or early. This aspect could be a weakness in cases where the availability time of the transport is given to be known shortly in advance (e.g.: small or poorly structured carriers, carrier that relies on a sub-carrier).

In addition to the direct benefits to be gained from the Easy Go project, new **opportunities** for improvement also open up with its implementation. First, the flows that take place in each plant are not only those related to finished products but there are also those of raw materials and packaging returns. Extending digitalization to these flows as well can be a good opportunity to monitor and track them. Furthermore, to have a comprehensive view of everyone within the plant, the flow of visitors or customers could also be digitalized. In this way, all entrances within the establishment could be managed and monitored from Digital Totems. Second, another opportunity may relate to the implementation of a warehouse management system that would be facilitated by digitalization and would integrate seamlessly with the transportation management system. Third, Verallia also has many external warehouses where finished product unloading and loading operations are performed. These flows could also be digitalized with an adaptation of the Easy Go project specifically for external warehouses. Finally, an additional opportunity is to update the customer on the status of the incoming truck: the departure of the truck from the plant can be communicated through an email when the digital transport document is generated, moreover, with digitalization, the use of the Sixfold project, through which company and transporter can track the vehicle as it travels, is also encouraged.

In order to do a complete analysis of the project, possible external **threats** to its implementation must also be considered. Relying on devices and technologies, possible crashes of the access management software and problems with the connection must be taken into account. In fact, if there is a network failure the registration to the Totem at the parking lot and the code entry in the Totem at the exit of the plant would give problems not allowing the operation of the activities. Another critical system is that of the forklift drivers, in fact the Pallet Tracking System is crucial for all loading operations and data acquisition: a malfunction of the system could put the new digitalized process in pain. Regarding drivers, on the other hand, a specific requirement to be able to implement the project is the possession of a smartphone on which to receive loading instructions, exit identification code and digital transport document. Thus, not possessing the smartphone that can be used on the job is a threat to be considered. Finally, the transport document is currently used by customers in paper format when the goods are received to make checks on what has arrived and proceed to unloading. Some customers may be reluctant to the digital document, and in case they want it in paper format, they would have to equip themselves to print it on their own.

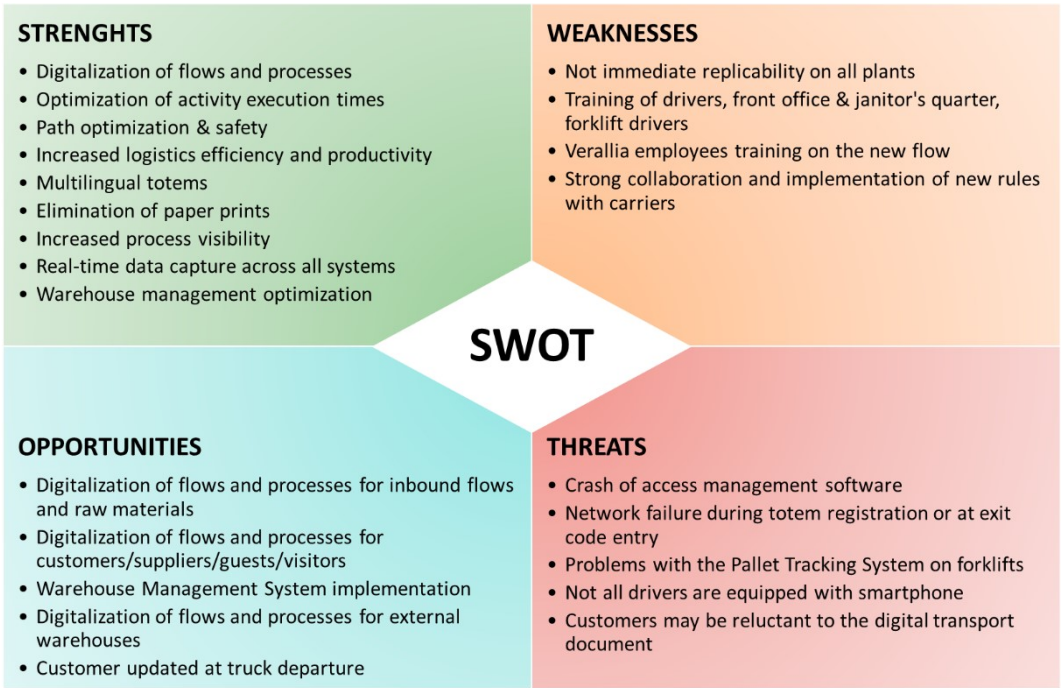

Figure 4.3 SWOT analysis of the Easy Go project [14]

4.4 The theme of digital transformation and change for Verallia and its partners

Easy Go and Sixfold are projects that lie within the world of digital transformation, which in turn is a subset of business transformation. According to SAP, the definition of digital transformation is the following:

"*Digital transformation involves integrating digital technologies and solutions into every area of a business. This is as much a cultural change as a technological one as it requires organizations to make fundamental shifts in the ways they operate and how they deliver customer experiences and benefits. Digital solutions also help to augment the workforce and can lead to business process and business model transformation.*" [25]

Therefore, any transformation project should consider these three areas:

1. *Business process transformation*. To meet business objectives, cope with competitors and customer demands, workflows are changed and adapted through process automation. Underlying all change there is business transformation, which supports process changes and incorporates digital transformation.

2. *Business model transformation*. This refers to changing traditional business models through digital transformation. While process transformation focuses on workflows, business model transformation points to the way value is delivered.

3. *Organizational and cultural transformation*. An important aspect in order to be successful with a digital transformation is alignment with corporate culture and values. In addition, in order to succeed in organizational transformation, the focus should be on collaboration and open dialogue to clearly indicate the consequences of digital transformation on roles and workflows. [25]

Although digitalization can offer many benefits, there are a number of risks that can block the success of a business digitalization project. The main causes of failure are as follows:

- *Lack of an overall strategy*. For digital transformation to be successful, it is necessary for the company to have a comprehensive, orchestrated and organized strategy that ensures an overall vision. All projects must be aligned with that strategy, which is responsible for prioritizing and directing people, employees and collaborators.

- *Difficulties in implementation*. Digitalization can be difficult for the company to implement because major changes to business processes are required. For this reason, it is essential to rely on partners who have the necessary knowledge and experience in the relevant field.

- *People's resistance to change*. This issue is one of the most common reasons why projects fail in digitalization projects. There are various reasons why people, employees, and collaborators resist change, but whatever the reason, it is important that there is training and support throughout the transition process. This allows employees to understand what is happening and why by providing the tools needed for the new environment. Finally, incentives can also be offered for those who support the change.

- *Unclear goals and unrealistic expectations*. The first thing the organization must understand is what it wants to achieve from the digitalization project because only by having a clear goal realistic expectations can be developed.

- *The role of management in the success of a digital project*. In these digitalization projects, management can play an important role, working closely with all departments and providing the appropriate support and resources to carry out the work effectively. [26]

With these theoretical pills in mind, the topics of digital transformation and the one of change for the company, customers and carriers is now discussed.

First, the project team identified final goals and expectations both at the company level and specific to each country (Table 4.2). This activity, carried out at the very beginning of project development, underpins all others since key objectives that will guide the entire project are established. As seen in section 2.2, the cornerstones are standardization, safety, waste & efficiency, and KPIs, which we find in the category column in Table 4.2. Note that in Table 4.2, Germany is not present as it was added to the working group later. In addition, the company-level objectives encapsulate all the objectives of the different countries, most of which are common.

Table 4.2 Identification of clear and common objectives before the project development [14]

Objectives

BU	Description	Category
Corporate	Shipping process standardization	standardization
	Operation time capture in the ERP for monitoring and KPIs	KPI
	Improve safety by reducing useless trip for Driver, forklifts + Safety validation	Safety
	Optimize forklift use by deletion of non-added value task (pick the trucks)	Waste reduction
	Increase nb of truck loading by killing waste time and optimize operation time	Waste reduction
France	Reduction of the truck drivers' movements on the plants => Improvement of safety	Safety
	Reduction of 5 FTE administrative from logistic external providers on the VF perimeter	Resource
	Reduction of 5 drivers from logistic external providers on the VF perimeter	Resource
	Reduction of the In and Out time	Efficiency
	Standardization of the process in all the plant	standardization
	Decrease the nb of operations with no value added	Waste reduction
	All this will provide a reduction of FTE from logistic sub-contractors	Resource
Iberia	Reduction of the IN/OUT time (currently 48 % Trucks IN/OUT > 60 min)	Efficiency
	Carry out Improvement projects in MD (Q1) & AZ (pending for budget allocation)	Efficiency
	Standardization of the measuring and the reporting of the IN/OUT for all plants	KPI
Italy	Reduction of the IN/OUT time	Efficiency
	Accurate information given to truck driver	standardization
	Process standardization in all plants	standardization
	Safety improvement (Safety validation)	Safety
LATAM	Improve safety by reducing useless trip for driver and forklift	Safety
	Standardization of the measuring and the reporting of the IN/OUT for all plants	KPI
	Improvements on operations planning	Efficiency
	Process and operations digitalization	standardization
	Implementing new tools for operations (e.g. automatic truck photography)	standardization

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It can be said that this working approach is conducive to the implementation of a digitalization project because having common goals for all plants in the company is a good starting point. In addition, during the development of the Easy Go project, and also the Sixfold project, the company relied on partners who are experts in the field (i.e., Transporeon who is already one of their partners and other partners working with Transporeon).

Regarding customers and their attitude to the change, the customer service function surveyed about 70 customers to understand their position regarding the digital

transport document. From that survey, it was found that more than half of the customers would accept the digital version of the document as long as there is the same information on it as the paper document currently used: those unloading goods should be able to compare the physical product on the truck and the one on the transport document. Those who have presented perplexities, on the other hand, believe that the paper document is essential for several reasons. Some customers do not have direct connections with their warehouses or do not have printing capabilities so it would be difficult for them to receive the transport document via e-mail and then transmit it or give it printed to the person who actually unloads the goods. Other customers, on the other hand, prefer the paper transport document because they require that at the time of unloading, in addition to the signature of the one who unloads, the company's stamp should also be affixed. In light of this, the overall picture from the perspective of "change & customers" is quite positive. However, in order to have the change accepted by all customers, it is necessary to find a system of authentication for product acceptance, possibility of entering reservations in case of nonconforming product, and a way of sharing the document between the carrier customer and Verallia.

Regarding carriers, on the other hand, the issue is very sensitive as the company has relationships with a wide mix of carriers of which some in turn hire sub-carriers. The fact is that in the current situation, many carriers are unable to meet booking schedules despite booking themselves on Transporeon platform. This may happen because, at the moment, no rewarding or penalizing rules for access to the plant are applied. Or some carriers who then rely on sub-carriers do not give notice of the arrival time to be met. What is certain, is that the importance of arrival time is not recognized by carriers with the proper importance. Another much-discussed topic with carriers playing a major role is that of traceability with the Sixfold project. In this case, currently only 23% of the transporters that Verallia relies on have adhered to and are properly executing the procedure for tracking vehicles. This is a clear sign of resistance to change where carriers prefer not to be tracked with GPS, not only because they do not want to apply themselves in the plate allocation procedures but probably also because of a backward mentality.

In conclusion, to cope with changes due to the implementation of projects such as Easy Go and Sixfold that seek digital transformation, the company intends to adopt a policy of gradual change. This means that, the implementation of the projects should take place first in the pilot plants in steps so that it integrates seamlessly with the current process and replaces it gradually. In addition, trusted customers and carriers who are proactive to change will be chosen to begin the full implementation of the projects in all its parts. For example, the Sixfold project could be adopted first by all Verallia trucks. Whereas, for the digital document, it could start with the digitalization of the sender's document and then test the digital document with some customers until the complete digitalization.

Conclusion

In the paper, it was attempted to present a project for digitalizing the shipping process characterized by new tools and technologies that can serve as a standard guideline for all Verallia company plants. Among the various projects aimed at achieving digital transformation, the Easy Go project, which is intertwined with the Sixfold project, was most developed. The main goals that the company expects to achieve with the digitalization of the shipping process can be summarized in the following points:

1. find a standard guideline for the shipping process for all plants;
2. increase safety in the plants by reducing unnecessary movements as much as possible;
3. reduce wasted time by allowing greater efficiency and increased daily throughput;
4. create a system that captures data in real time allowing the correct KPIs to be calculated and strategic decisions to be made.

Given these objectives and considering the implementation of the project it emerges that in the *short term*, by adopting a gradual change policy, the company expects to partially achieve these goals. Presumably, the arrival and loading steps will be implemented first, leaving the implementation of digital documentation for last. In this case, it is expected to eliminate the driver's pedestrian path from the parking lot to the front office for the registration step (about 6 minutes) and the forklift pickup activity (about 7 minutes). The direct consequences will be decreased IN/OUT time, increased safety and real-time data capture from registration to load completion. Thus, the goals would be partially achieved as there remains room for improvement due to the implementation of the last steps of completion and departure.

On the other hand, in the *long term*, the company expects to achieve all goals and have a transportation management system that includes the following interconnected sections:

1. *Transporeon platform for booking carriers*. This is already used by the company, but in the future perspective it is expected to receive more accurate and complete bookings of all necessary information from carriers. In addition, the goal is to leverage this platform to regulate the arrival of trucks at the plant, so rules to enforce arrival times with respect to booking and also to convey to carriers the importance of punctuality will be key.

2. *Loading tools*. With the implementation of Easy Go it is expected the installation a Totem for self-registration and one at the exit for authentication and bar opening. In addition, it is proposed to create a yard management cockpit for the Front Office and to integrate the Pallet Tracking System with picking-loading-completion apps. All implementations will be done on an ad hoc basis for the plant and will need to integrate with the company's current systems (i.e., SAP, Transporeon, Pallet Tracking System). A supplier working with Transporeon is currently being evaluated.

3. *Sixfold on Transporeon to track trucks*. It is expected to track most vehicles via GPS and to be able to see their status via the "Visibility" section on Transporeon.

As for the current status of the project, the study and process development phase of the pilot plants has been completed and a meeting has already been held with a supplier to purchase the new devices and implement the whole system. The payback and budget, on the other hand, are still being worked out and need to be completed by each plant and the Central IT & Central Business, respectively. The next step will be the submission of the complete project to the Verallia board to receive investment approval.

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