



Internal Warehouse Management System in Tabaqueira (Philip Morris International)

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Master dissertation

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“I consider myself neither poet, composer or musician. These are merely tools used by sensitive men to carve out a piece of beauty or truth that they hope may lead to peace and salvation.”

- Gil Scott-Heron

Abstract

Objective of the Study

The aim of this project is to assess if it is worthy, both in terms of figures and features, to deploy a new Warehouse Management System (WMS) for the different warehouses within Tabaqueira, a Philip Morris International (PMI) affiliate. Furthermore, is planned that this dissertation will give an added insight to the management team in 2012, corresponding to the cessation of the Logistics Service Provider contract, who owns the present WMS.

Methodology

The methodology followed is based entirely on two major pillars, a qualitative and a quantitative analysis. The first one embodies the physical and system requirements for the warehouses, namely Leaf, Direct Materials, Technical Materials, Semi-finished products and Finished Goods, enabling also a better perception of the entire workflow. Moreover, the different system options were analyzed by their ability to provide new technological features. Secondly, the quantitative breakdown on the whole reflects the overall cost of each option, taking into account their CAPEX and expenses, if that same alternative was deployed in Tabaqueira. For a better grasp of what is available on the market, it was issued a request for information, by the use of email or conference calls, in order to know what is currently being used in PMI affiliates, mainly in the West European Cluster.

Findings and Conclusions

The need for building up a consistent recommendation, having in mind a long-term commitment, leads to a complex decision with a wide approach. On one hand, some advantages are clear when choosing a best-of-breed system, namely innovative functionalities and increased flexibility, while being capable of adding value to the Supply Chain. On the other hand, the in-house PMI solution LES, which is still on development, is projected to be able to match every warehouse demand at a fraction of the cost needed for a best-of-breed platform; the obvious drawback here is the hazard this solution carries about the uncertainty of its capabilities, which could be damaging to the organization. However, when comparing both tools with the current one from the LSP, it simply comes down to strategy. Is the management team willing to invest in a project with such a long payback period and an attached risk label?

Key Words:

Supply Chain Management, Warehouse Management, Warehouse Management Systems, information systems, Logistics, consumer product goods, tobacco, Tabaqueira, Philip Morris International

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Acronyms

3PL	Third-party Logistics
AE	Expedition Warehouse (<i>Armazém de Expedição</i>)
APA	Finished Goods Warehouse (<i>Armazém de Produtos Acabados</i>)
ASRS	Automated storage and retrieval system
BBS	Basic Blended Strip
bio	Thousand million units
CAPEX	Capital Expenditure
CF	Cut Filler
DAA	Accompanying administrative document (<i>Documento Administrativo de Acompanhamento</i>)
DIC	Document for Introduction to Consumption (<i>Documento de Introdução ao Consumo</i>)
DN	Delivery Note
EMEA	Europe, Middle East and Africa
ERP	Enterprise Resource Planning
FEFO	First Expired, First Out
FG	Finished Goods
GI	Goods Issue
GR	Goods Receipt
IM	Inventory Management
ITSC	Information Technology Service Center
LES	Logistics Execution System
LSP	Logistics Service Provider
MES	Manufacturing Execution System
PGI	Product Goods Issue
PGR	Product Goods Receipt
PMH	Philip Morris Holland
PMI	Philip Morris International
PMPL	Philip Morris Poland
PMU	Philip Morris Ukraine
pp	Pallet Places
QI	Quality Inspection
RF	Radio Frequency
RFI	Request for information
SKU	Stock-Keeping Unit

STO	Storage Transfer Order
TP	Transfer Posting
TPM	Third-party Manufacturers
VAO	Value Added Offer
WCS	Warehouse Control System
WMS	Warehouse Management System
MRP	Material Requirement Planning

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1 Introduction

This project aims to be a master dissertation within the Master in Industrial Engineering and Management at University of Porto, Faculty of Engineering, with the support of Philip Morris International.

1.1 Company presentation

This study is made to address a need from the Supply Chain department of Tabaqueira, Philip Morris International's affiliate in Portugal, which is the largest tobacco company in the country (Philip Morris International). It was founded back in 1927 by the business man Alfredo da Silva; nonetheless, in the aftermath of April 1974 political amends, it was nationalized and merged with INTAR, an industry competitor, two years later.

In the early 1980s, PMI and Tabaqueira established a joint venture with the latter beginning the license manufacturing of *Marlboro*. Some years after, in 1996, a consortium composed by PMI and other companies acquired the Portuguese company, by settling gradually not only the new vision and mission, but also a new business model, called *Tolling Model*. In terms of company structure, Tabaqueira is divided into Tabaqueira EIT and Tabaqueira II, the first being dedicated to the production of tobacco products and the latter specialized in Buy and Sell for the domestic market.

According to recent figures (Philip Morris International), PMI has grown steadily throughout the years and currently is the leading international tobacco company outside People's Republic of China, with products sold in approximately 160 countries; in addition, it owns seven of the top fifteen brands worldwide. Likewise at a national level, Tabaqueira holds the majority of the cigarette market share with both inter- and national brands, like *Marlboro*, *L&M* or *Chesterfield* and *SG* or *Português*.

1.2 Industry background and business model

Even though the tobacco leaf was used since the 16th century, the tobacco industry only advanced at an exponential growth in the twentieth with the advent of the big corporations, largely British and American. Management-wise, the strategy of these companies was made at three levels:

1. Vertical Integration – Since the tobacco leaf is the most expensive raw material in the process - and being the variability in crop quality a major concern of the company, which in turn does reflect in the final product safety and consumer perception - the tobacco companies have control, with some exceptions, of most of the supply chain. This ranges from the tobacco crops, passing by the cure of the tobacco leaf and its subsequent blending and flavoring, as well as with the manufacturing of non-tobacco materials, e.g. filter rods, and the inevitable finished tobacco product, e.g. cigarette. In one hand, the

company gets efficiency by incorporating companies in the upstream value chain. On the other hand, since the crop does not depend on a third-party, the sensitive topic of brand integrity becomes sole possession of the company.

2. Horizontal Integration – As with what happens in other businesses, the enterprises are quite fond of mergers and acquisitions. These days, there are a handful of major tobacco players in the world, which in turn grew by incorporating brands and making joint ventures to manufacture other with smaller ones. A practical example is Philip Morris International, which acquired the *L&M* and *Chesterfield* brands, the second and third most sold cigarette brands in the group and presently, well positioned in the markets worldwide.
3. Tobacco products portfolio – Even though the most sought tobacco product is the cigarette, there are some niches that for cultural reasons have a considerable market share. One example is *Snus*, which is sold in Norway and Sweden, but it is banned in the remaining European Union. In Indonesia, the major smoked form of cigarette is the *Kretek*, containing a blend mostly made with tobacco and cloves. Nonetheless, it is necessary to keep in mind that some companies which manufacture these products were acquired by Philip Morris International as well.

1.3 The Project

The current project pretends to address a current need from the management team in order to support their decision concerning the LSP contract; this agreement is expected to cease by September 2012. At the present, the LSP is responsible for the warehousing operations. This includes not only the material handling between warehouses and/or production, but also managing the transactions at WMS level. This proves to be the setback for Tabaqueira, since the system is owned by the LSP. Therefore, the purpose of this project is to analyze the company requirements in terms of logistic flows, both at physic and system levels, which are needed to properly operate the company's different warehouses. Additionally, it is desirable to know what different solutions are available, and what each one of those offers. Obviously, this comprises a quantitative and qualitative analysis, backed up by a final recommendation.

1.4 Methodology

In order to reach a consistent recommendation, the methodology applied to the project followed a step by step evolution, where each layer is needed for the next one. The steps are shown below:

1. Analyzing requirements using Business Process Modeling, for a given type of product, e.g. Finished Goods, map the logistical flows within the different warehouses at system and physical levels;
2. Evaluation of different solutions used on PMI European Affiliates, based on interviews and case studies;
3. Comparison of different platforms at two levels:
 - a. Qualitative – breakdown of needed features, plus analysis on the main benefits and drawbacks, together with a Risk Assessment;
 - b. Quantitative – Cost, projected savings, and projected payback period;
4. Giving a final recommendation to the company.

2 State of art in Warehouse Management

2.1 Activities in Warehouse Management

Typically, warehousing activities are responsible for supporting critical activities like Sales, Distribution and Manufacturing and its proper execution also provides a better feedback for the Purchasing department. Among other, these include (Berg, 2007):

- Putaway – Directs the operator to a valid storage location;
- Allocation – Reserves inventory for picking, taking into account different placing strategies, e.g. FEFO
- Work Scheduling – Manages tasks and directs them to operators via RF terminals
- Picking – Order validation by item scanning
- Consolidation – Building and handling pallet units for shipping
- Kitting – Building kits from different items.
- Shipping – Managing inventory loads to send to different locations
- Cross-docking – Transfers the goods directly, or via an intermediate storage, to the shipping dock

For a better understanding, the following diagrams explain the classic operating sequence in a distribution center. Also, check (Ghiani, Laporte, & Musmanno, 2003) and (Berg, 2007)

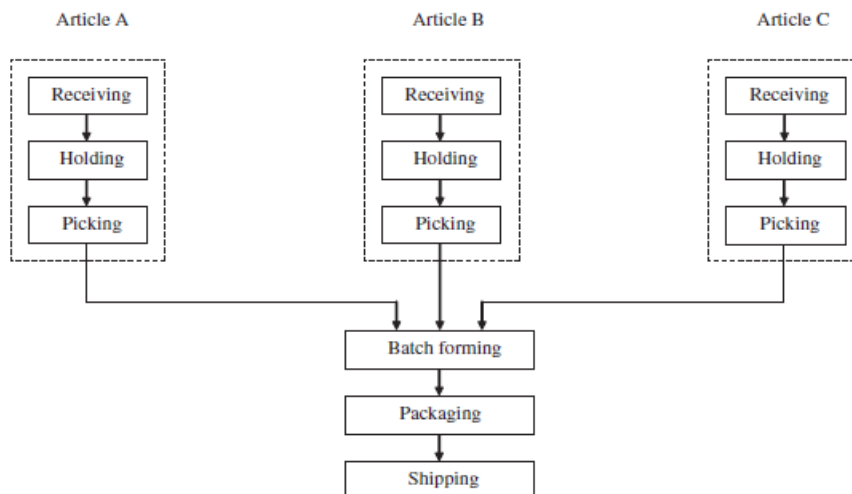


Figure 1 - The flow of items through a typical warehouse (Ghiani, Laporte, & Musmanno, 2003)

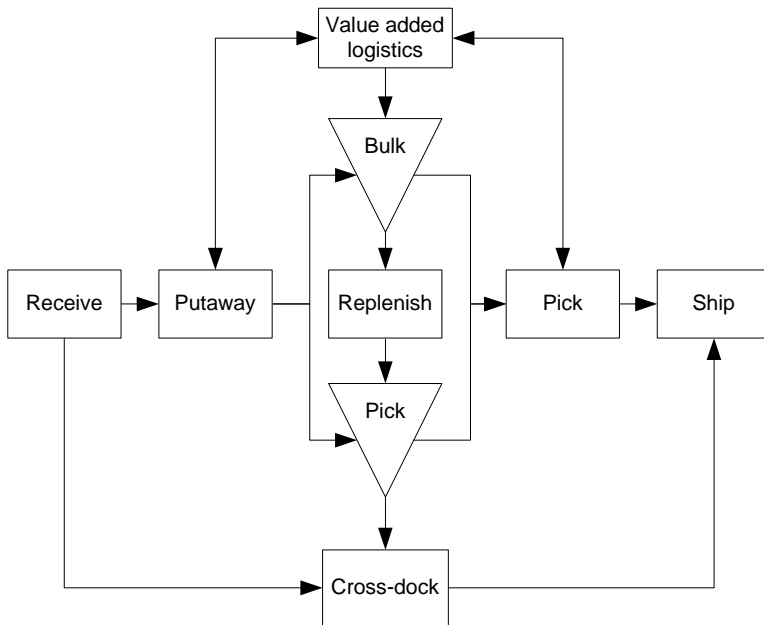


Figure 2 - Activities and flows in the distribution center (Berg, 2007)

2.2 The importance of a WMS in operations

The primary purpose of a Warehouse Management System is to timely and efficiently answer to all requests by optimizing goods and workers movement inside the warehouse, in order to support all core services of a company. These connections are listed below:

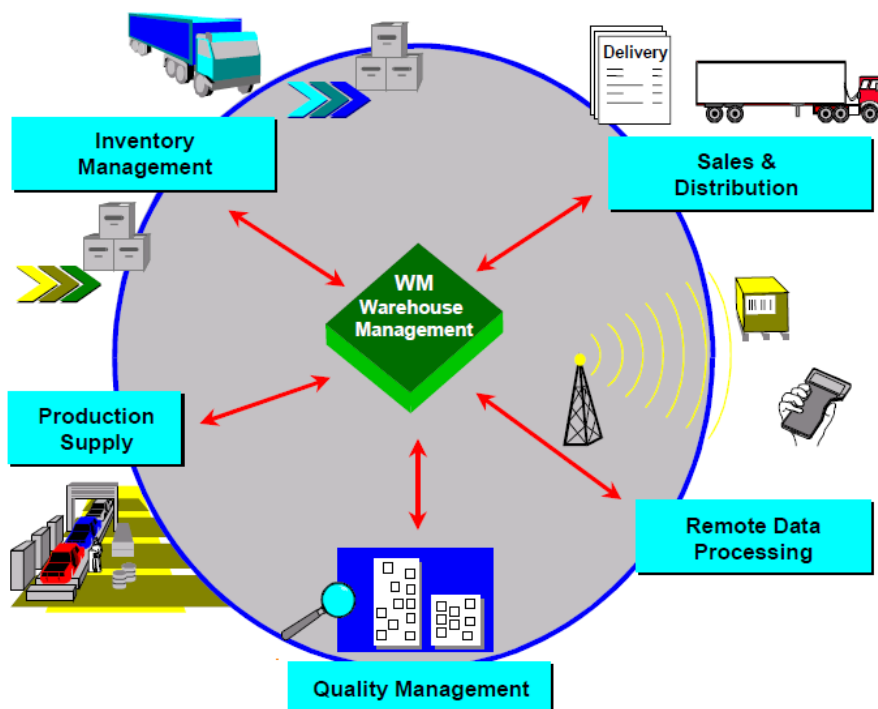


Figure 3 – Supporting other activities with WMS (SAP AG, 2001)

To start with, it is necessary to establish the difference between Inventory Management and Warehouse Management. The first is a common tool found in ERP, which can handle up to storage location level. In practical terms, it only provides information on the stock quantities at storage location level in the form of quantity totals (Figure 4), like the locations in Tabaqueira, found in ANNEX A: Storage Locations within the ERP, for example. Moreover, it also means the software user is only capable to determine in which complex is a certain item, and he does not have a clue about which is its real location. However, each storage location can be configured for a single type of storage type, e.g. high-rack storage.

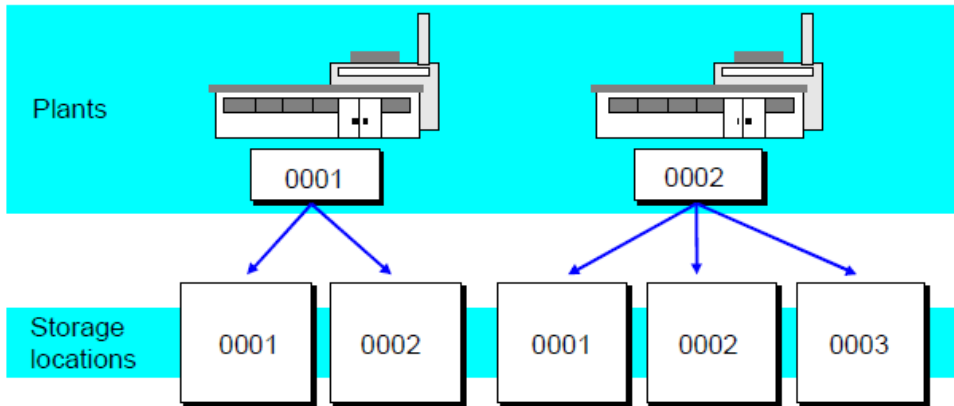


Figure 4 - Storage location level within IM (SAP AG, 2001)

On the other hand, a WMS manages information on all materials up to storage bin level, which is exemplified on Figure 5. Likewise, via interface, when allocating a set of storage bins to a storage type still allows one to know stock quantities of a given item when necessary by simply using Inventory Management. For further knowledge about storage definitions, see (SAP AG, 2001)

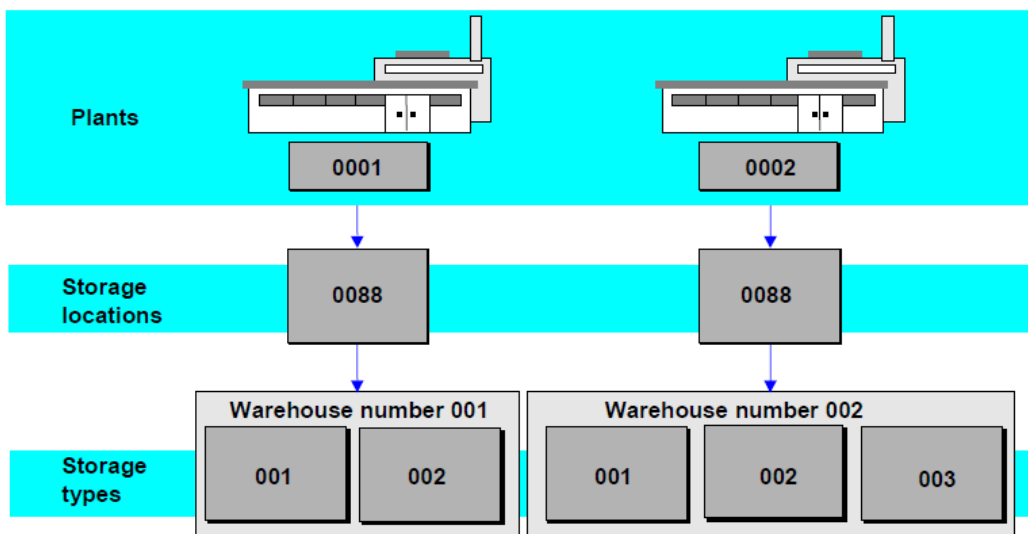


Figure 5 – Storage type detail with WMS (SAP AG, 2001)

Like aforementioned with Activities in Warehouse Management, a system to manage warehouses follows the same pattern. (Bowersox, Closs, & Cooper, 2002). A known basic activity for a WMS is the coordination of orders via discrete selection and wave selection. While the first reflects a given customer’s priority with a specific work duty, in the second, wave picking can be done simply by assigning workers to a given area of the warehouse or by planning around specific shipments. Furthermore, WMS also enables other advances features specialized in optimizing labor, the warehouse itself, with picking, storage and putaway strategies, or value-added services like product customization or kitting. In the following list it is possible to see the integration between WMS functionalities and other related systems:

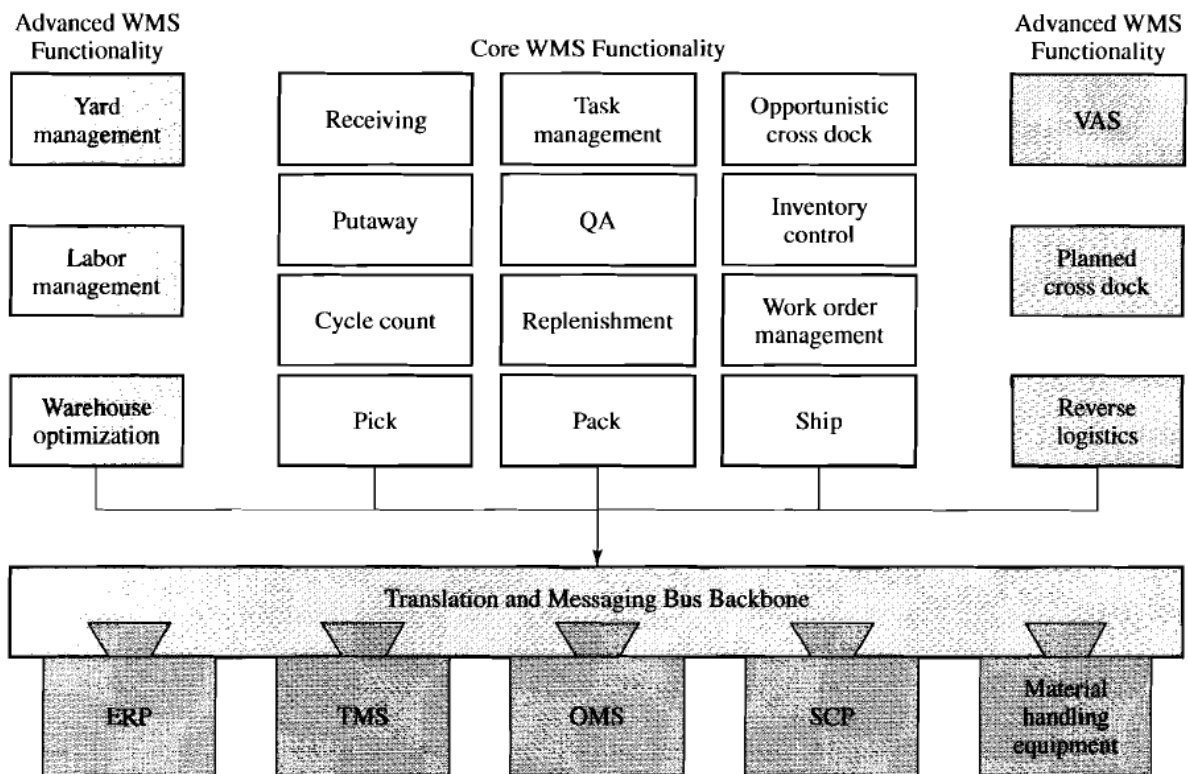


Figure 6 - Typical warehouse management system (Bowersox, Closs, & Cooper, 2002)

For a big perspective on the correlations between system elements, within the ERP for example, it is possible to know in which warehouse and in which storage location is a given item. Nonetheless, the WMS achieves a bigger depth, as it is possible to know what is stored in a given storage bin and how much is stored there. To conclude, the relations between elements of a physical warehouse are depicted subsequently:

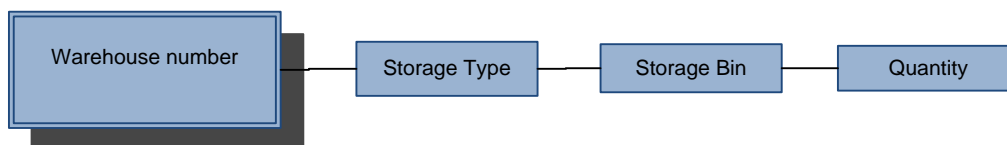


Figure 7 - Warehouse system structure

2.3 Best of breed vs. embedded systems

Currently, there are two big groups of vendors, the ones who develop embedded systems, like ERP with WMS modules and the so-called best-of-breed systems (Young, 2009). The second allows more and more advanced functionalities such as Transportation Management Systems and on a regular basis, can match atypical business requirements right away. On the other hand, the main advantage of embedded WMS is the seamless integration with the ERP. Globally and with the aim of choosing a new project, both platforms need to be assessed on features and economic levels before jumping into any conclusion.

2.4 Make vs. Buy systems

Some decades ago, the big corporations started to develop their own legacy platforms, but due to increasing costs and limited flexibility the trend started to switch to commercial packages (Young, 2009).

The main advantages are typically:

- The vendors are specialized in the system and have high budgets dedicated to Research and Development, thus being able to present compelling packages, both economically viable and feature rich. Moreover, the initial vendor expenses are leveraged throughout many clients, thus lowering the initial acquisition cost for the company (Frazelle, 2001);
- Full-time dedication to the software. Often in companies, time tends to be spent in many projects and it reflects in system efficiency.

On the other hand, in-house systems provide (Frazelle, 2001):

- The adaptation of world-class operational guidelines for a given business;
- Cheaper maintenance and support and greater flexibility for system changes when compared to commercial solutions if, and only if, the supporting personnel are highly competent.

In the end, the decision depends on the owner. Is he willing to improve the in-house system and to keep the software support?

3 The problem and its milieu

As aforesaid, the current project pretends to tackle an existing need from the company's management team in order to support their decision concerning the WMS part of the LSP contract; this agreement is expected to terminate by September 2012; in these circumstances, the importance of the context is significant. Hence, the problems turn out to be without doubt influenced by the operations background, namely the impact of the Logistics Service Provider, the specific business model and the current state of internal processes. As such, before going straight to the solution proposal, the impact of these factors is analyzed underneath.

3.1 The Manufacturing Model

In the current PMI operations landscape throughout the West European Cluster factories, Tabaqueira follows a manufacturing model called *Tolling Model*. This way of manufacture affects the way the information systems landscape is arranged, mainly at the ERP level. The Tolling Model is depicted under.

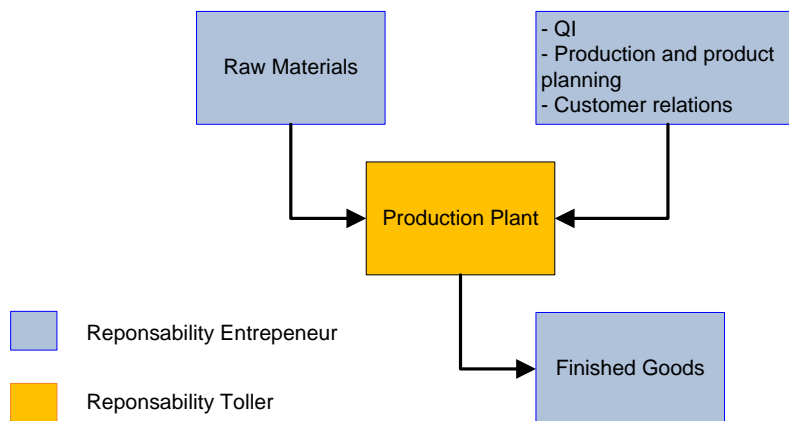


Figure 8 - The Tolling Model

As the Toller entity, Tabaqueira EIT receives the raw materials, namely the tobacco leaf and direct materials from Philip Morris International Management (PMIM). To sum up, the Tolling Model represents a form of limited risk manufacturing. While from the Supply Chain standpoint it does not raise any problem whatsoever - the major hitch found here is how the

different information systems are organized in different tiers in order to match the different requirements from the material logistic flows. The following topic answers this question.

3.2 The Systems Landscape

Back in 2007, PMIM decided to set up a unique ERP system to all Western European Affiliates in order to cope with the Tolling Model. To the Portuguese affiliate, it meant they were going to change from a local to a remote and global system. As portrayed with the diagram in ANNEX B: Operations Systems Landscape, the WMS would operate directly with the ERP, but as a general rule by changing to a global platform it was needed to build a new data warehouse to operate as a buffer for the transactions sent from the local WMS. This local interface, called Delta, has the responsibility to briefly store information from any local system and then upload it to the global ERP, both being located in Switzerland. Consequently, for any given WMS solution and any other operation information system, it is mandatory to configure the interface with the ERP.

3.3 The Logistics Service Provider

In Tabaqueira, the LSP is responsible for the entire warehousing operations, reaching various storage facilities, namely Leaf, which is held in an external warehouse, Semi Finished Products, Direct Materials, Finished Goods and Technical Materials, i.e. Spare Parts.

The LSP manages these activities in accordance with the company's guidelines and orders. In order to achieve this, they handle the warehouse management via WMS to ensure the correct handling and storage of complex items. For instance, just for DIM, there are around 700 active SKU out of a possible 2000. Additionally, in accordance with their duties, they are also the owners of the WMS, named X, built on a G operating system. The scope of this system is listed in the diagram below:

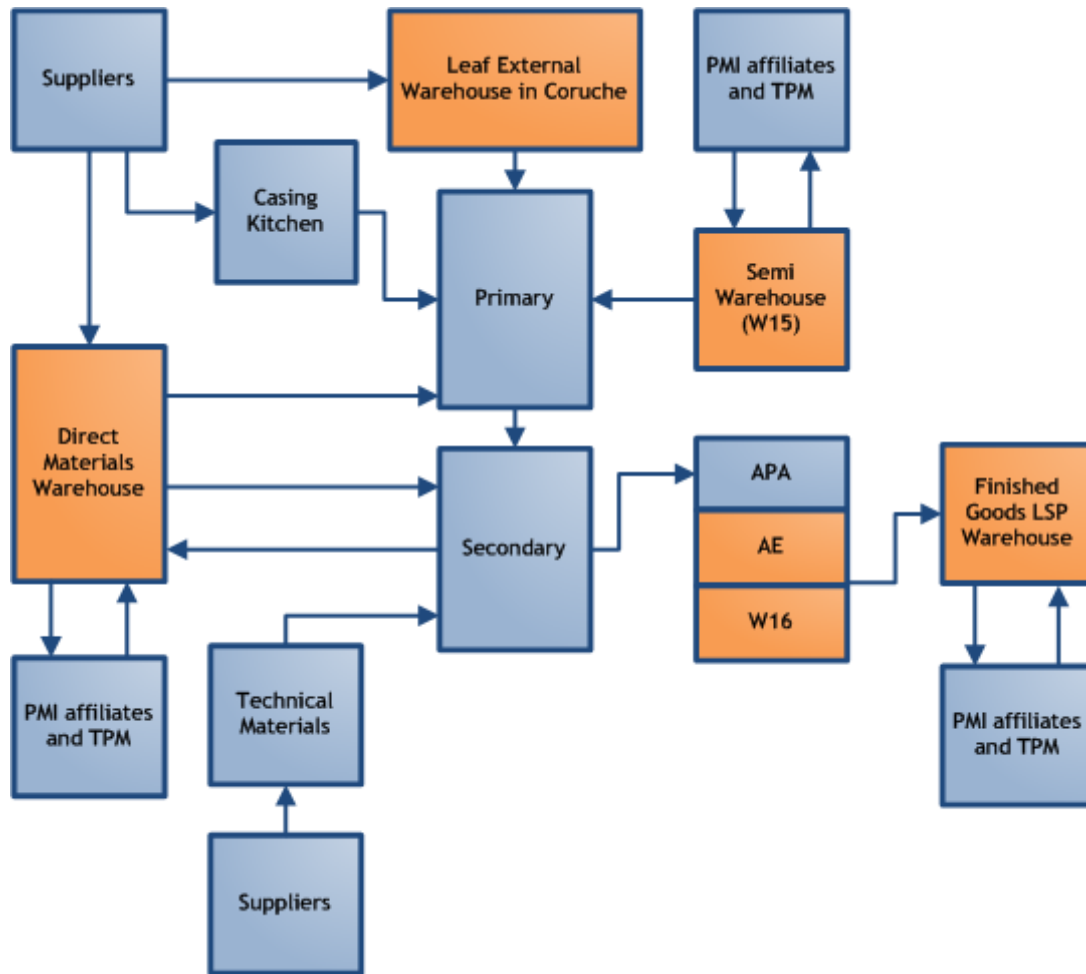


Figure 9 - Scope of LSP system (colored orange) in the whole operations

One of the main issues that warehousing management outsourcing creates is the inability for Tabaqueira to trace an item directly in the respective storage bin. In practical terms, the company looks at inventory information like a black box; it only knows the storage location, not the item's real location inside a given warehouse, i.e. its storage bin. When in need to trace a specific item for perform a quality inspection, for example, Tabaqueira contacts the LSP, which in turn will check where the item is, generating an added work for both parties. Nonetheless, as with any contracted company, the current contract ceases on September 2012, with a possible renewal option.

3.4 The assessment

In this context, taking into account the need of a long-term and strategic solution for the warehouse management system, together with the cessation of LSP contract in the upcoming years, Tabaqueira launched a project to assess the current system and what could be the best platform to replace it. In order to do so, different PMI affiliate solutions were analyzed, mainly because they are already ready or, on the other hand, since there have been efforts on developing a unique PMI solution, which according to the group's expectations should be ready to implement in the near future, covering all warehousing necessities.

4 Internal Warehouse Management System Assessment

In order to tackle the problem properly, it is necessary to know the big picture about processes in the company, whether they are at a system level or purely physical. Starting by the latter, the following table depicts the warehouse organization within the company:

Table 1 - Warehouses within Tabaqueira

<i>Type of warehouse</i>	<i>Warehouse</i>	<i>Storage Type</i>
Leaf	Coruche (external)	Floor and pallet rack
Direct Materials	9 warehouses	Pallet rack
Semi	W15	Floor
Finished Goods	AE	Floor
	APA	Automatic Storage and Retrieval System
	W16	Pallet rack
Technical Materials	APR	Pallet rack and automatic carrousel

It is worthy to note W16 is divided in multiple areas, where each area has a different purpose, due to customs rules and regulations. For a proper understanding, the ANNEX C: Warehouse 16 map, depicts the given warehouse.

4.1 Warehouse flow mapping and the LSP WMS

In the current project, there is a need to check what is used amongst PMI affiliates and validate if their own platforms could be used in Tabaqueira. However, in order to do a proper analysis, it is necessary to fully understand the system requirements in terms of materials and information flow throughout the warehouses. Thus, this can be reached by using one typical tool such as Business Process Modeling (Havey, 2005) which allows one to assess requirements at different levels with more than one entity involved. In this case, , the flow of three different materials was analyzed taking into account their complexity and impact on the operations, specifically DIM, Semi and FG, taking into account the two flow levels, physical and information, together with more than one entity, Tabaqueira, the LSP and in some cases, Efacec. Nonetheless, regarding the other warehouses, Leaf and TM were not managed by X. Please note, all Storage Locations are described in ANNEX A: Storage Locations within the ERP.

4.1.1 Direct Materials

When it comes to DIM, on total there are 7 associated sub-processes:

- Supply/Inbound;
- Replenishment to Primary
- Replenishment to Secondary;
- Export;
- Destruction;
- Quality Inspection.
- Return to supplier.

For each one, there is a diagram to exemplify how the material and information are handled.

4.1.1.1 Inbound

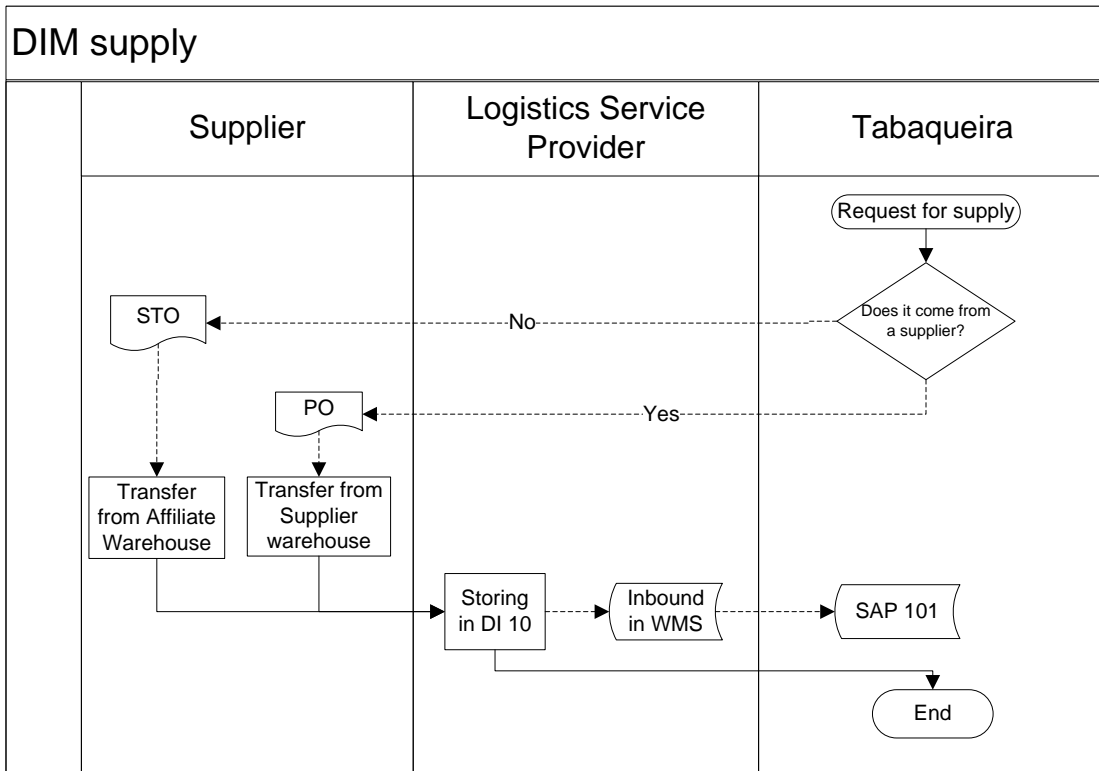


Figure 10 - DIM inbound, from supplier or affiliate

The process starts with the request of replenishment via MRP and then depending from the source, a supplier or an affiliate, can be issued a Purchase Order or a Stock Transfer Order, respectively. Afterward, it is stored in DI10 and the LSP does the Putaway. Consequentially, it enters the WMS and the inventory is added in the ERP.

4.1.1.2 DIM replenishment process for Primary

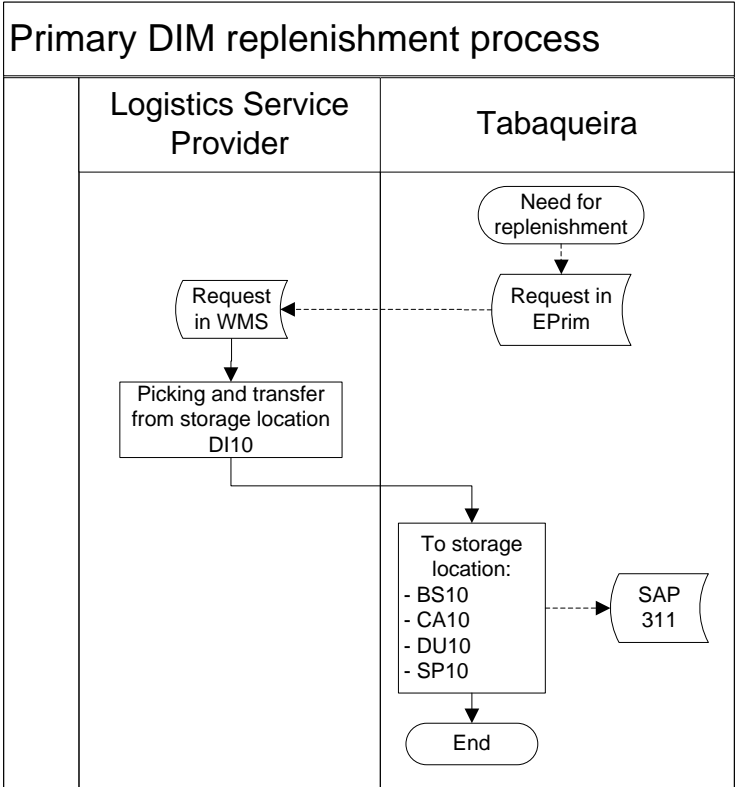


Figure 11 - DIM replenishment process for Primary

The process starts with a replenishment order from the Primary, via ePrim and is communicated to the LSP via Delta interface; typically, there can be transferred items such as boxes or adhesives. Then, the LSP proceeds to pick from storage location DI10 and delivers it to BS10, CA10, DU10 or SP10, depending on the destination.

4.1.1.3 DIM replenishment to Secondary

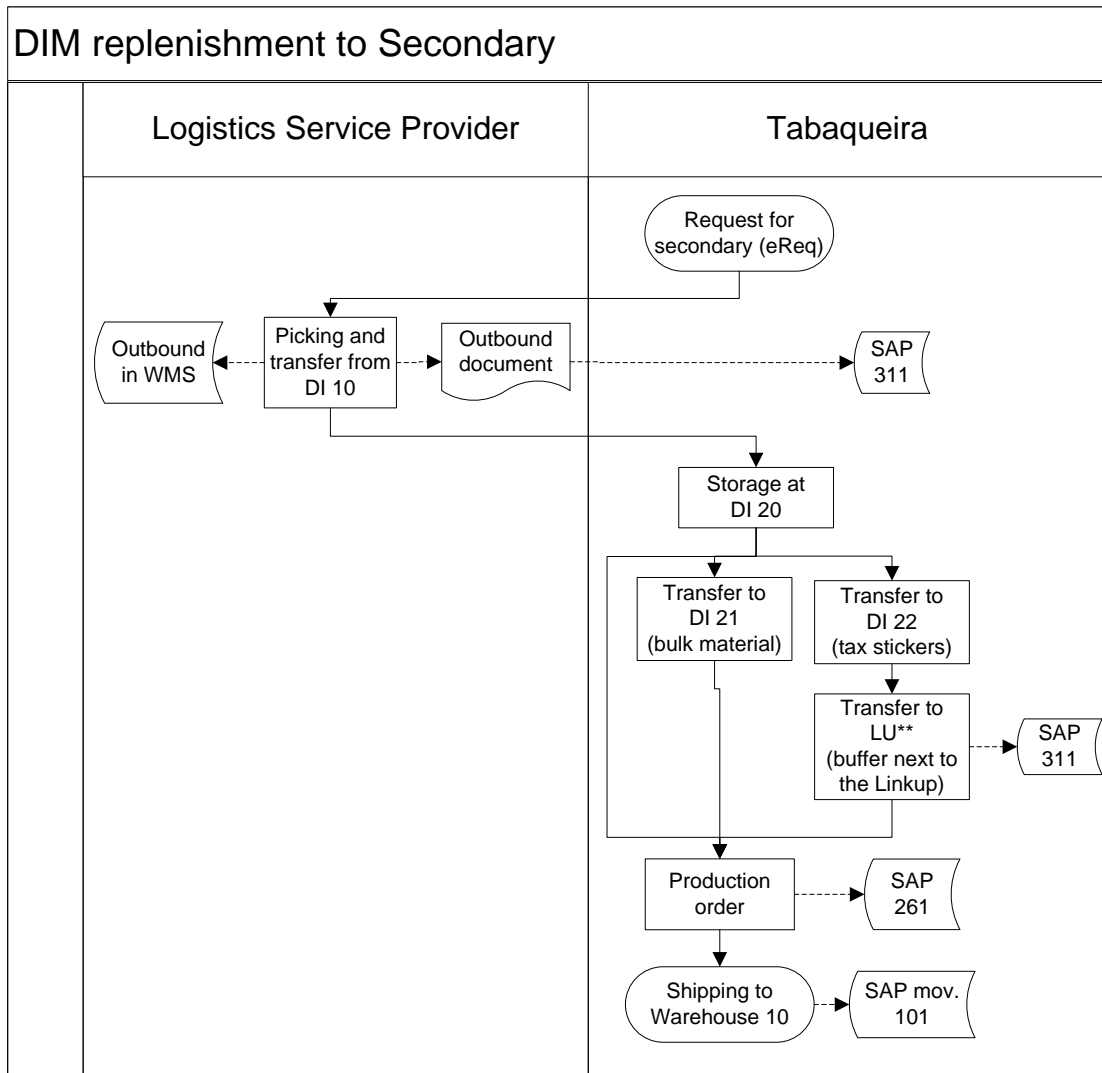


Figure 12 - DIM replenishment process to Secondary

The process starts with a replenishment order from the Secondary, via eReq and is communicated to the LSP X system via Delta interface; typically, there can be transferred items such as polypropylene or aluminum foil. Then, the LSP proceeds to pick from storage location DI10 and delivers it to DI20. From that point on, Tabaqueira owns the process and transfers it to DI21, DI22 or directly to the Linkup, for the tax stickers. However, while the latter is discounted automatically when it is moved to the linkup, via a SAP movement 311, the others are discounted via Backflush, i.e. only when the good production is registered; the ERP updates the inventory in DI21 and DI22, via movement 261.

4.1.1.4 Quality Inspection process applied to DIM

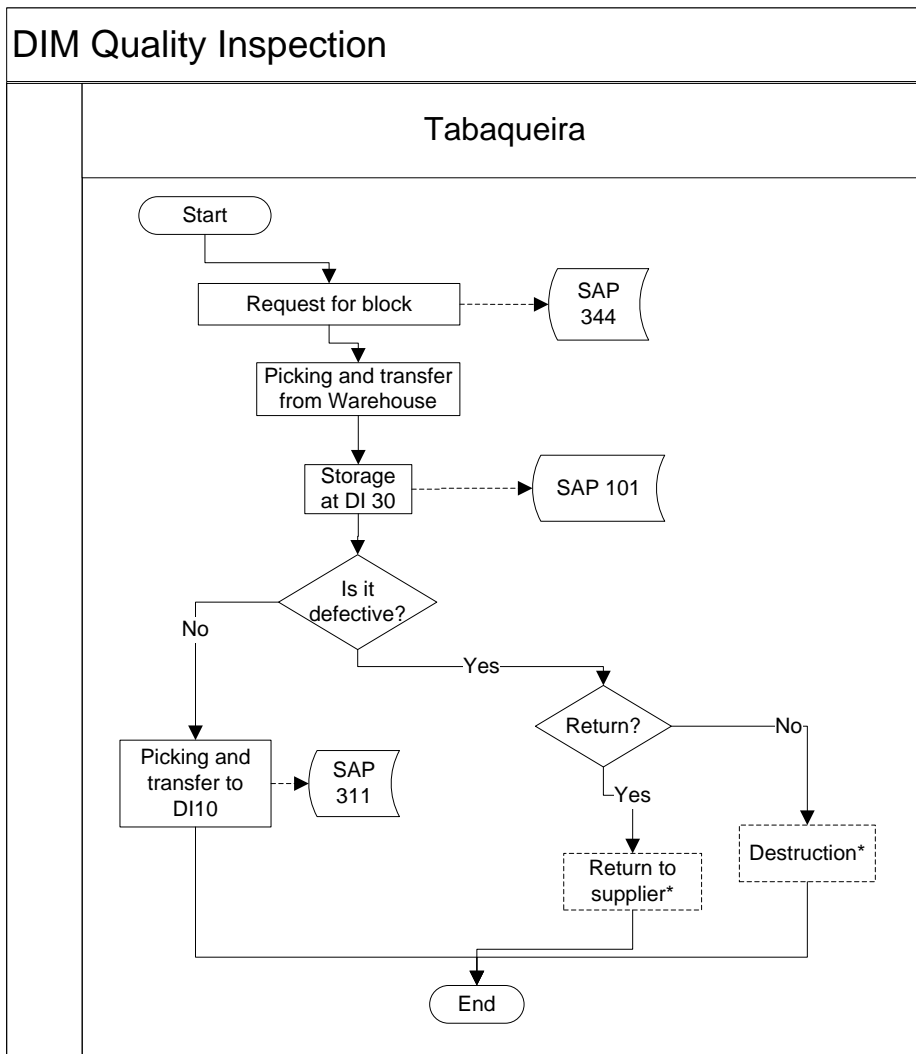


Figure 13 - DIM Quality Inspection process

In this process, for the purpose of Quality Inspection, according to internal guidelines, it is mandatory to change material status before changing its location, as expressed in Figure 30. Hereafter, it is moved to Storage Location DI30 with the SAP movement 101; then followed by a quality inspection which, in turn, determines where should the item go. In this point, there are three options:

1. Not defective, returns to DI10, by using SAP movement 311;
2. Defective, thus returning to supplier. This micro-process is depicted in Figure 14 with more detail;
3. Defective, but since it does not represent a significant value for the supplier, the item is subject to destruction. This micro-process is also drawn in Figure 16.

4.1.1.5 Returning DIM to suppliers

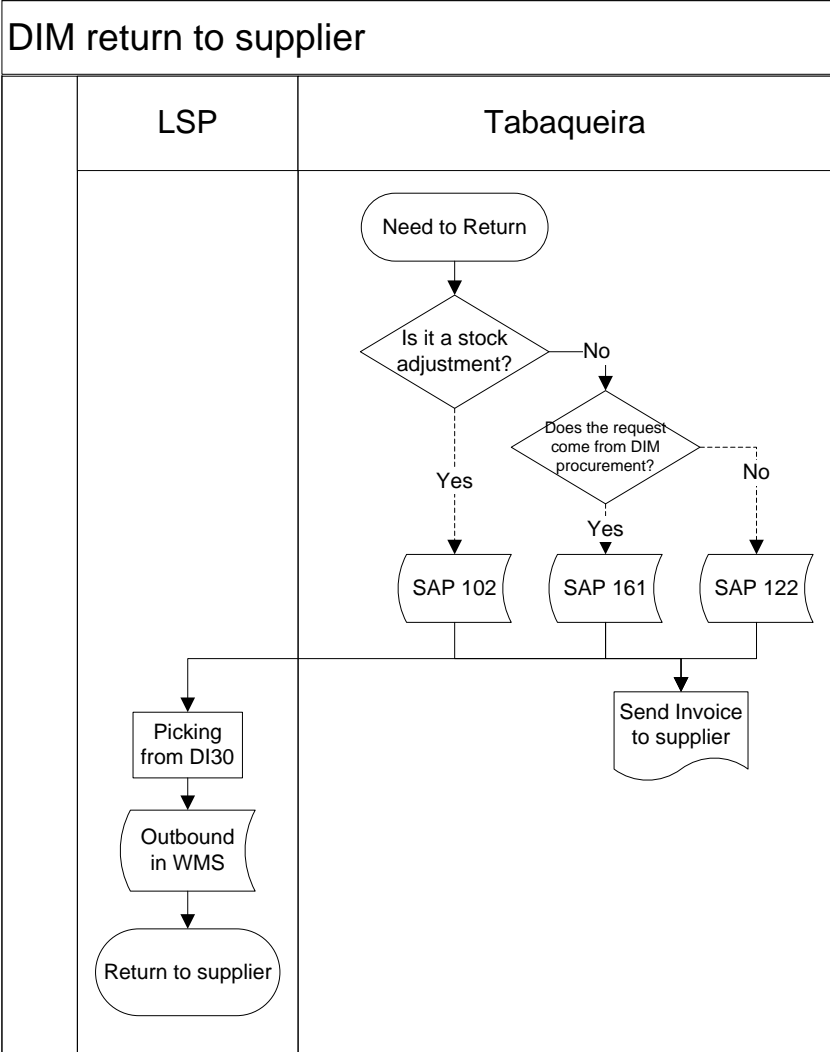
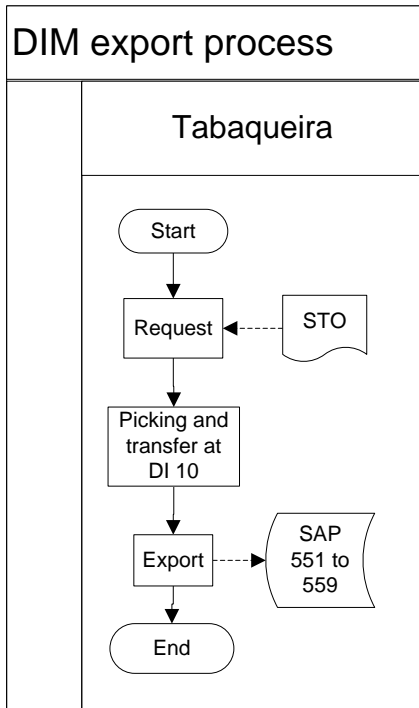


Figure 14 - DIM Return to suppliers

When returning DIM to the supplier, there are three methodologies available for doing so. The first is by adjusting the stock, via SAP movement 102; after this, it depends on who does the request; if it is done by DIM Procurement, it is a movement 161, otherwise, it is simply a 122. Finally, the LSP does the picking, the WMS outbound movement and the return to supplier.

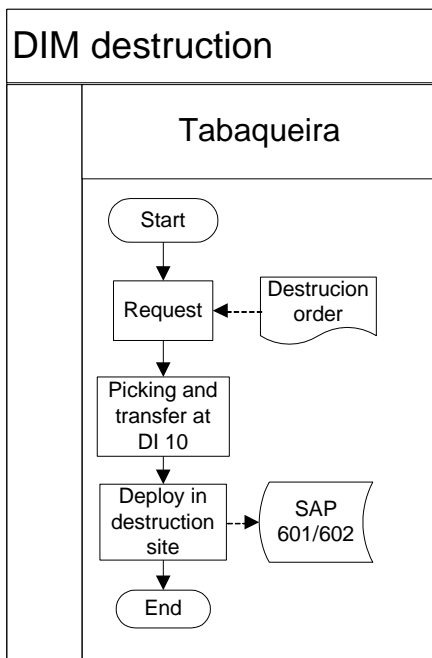
4.1.1.6 *Export process for DIM*



The process starts with a request made by an affiliate or from a TPM. Henceforward, the item is subjected to picking and shipping directly from DI10, via SAP movement ranging from 551 to 559.

Figure 15 - DIM export

4.1.1.7 *Destruction of DIM*



For destruction purposes, the request sent from MQA generates a picking list for the LSP which in turn updates the WMS and the ERP, with SAP movement 601 or 602.

Figure 16 - DIM destruction

4.1.2 Semi-finished products

The Semi-finished Products are materials resultant mainly from the Primary process, including which is the case for BBS, ET, Tobacco Rods, Cut Filler or Stems. On the other hand, the Ripper Shorts have their origin on the Secondary which, in turn, will be reintroduced in the Primary process. Finally, all of them have defined logistic procedures, namely:

- Inbound from production;
- Import/Export;
- Replenishment to production.

Hereafter, each of those was analyzed and the logistic process can be found under.

4.1.2.1 Inbound from Production

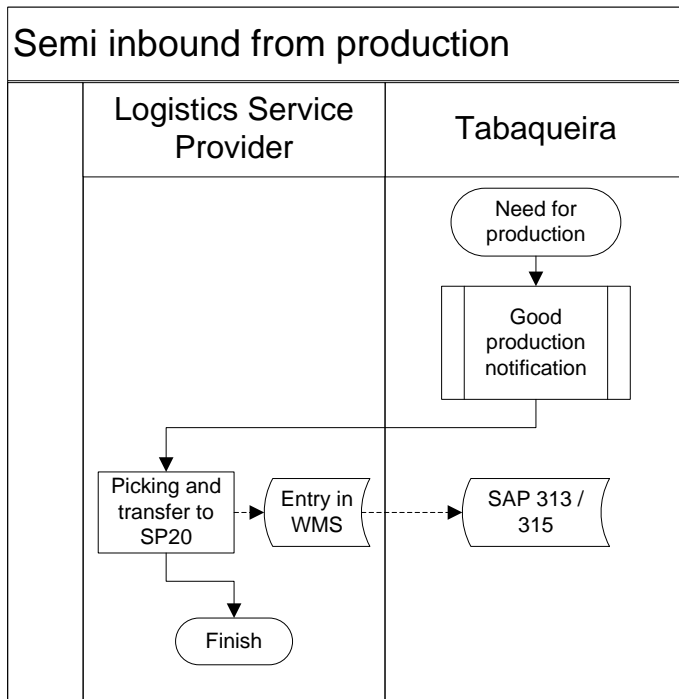


Figure 17 - Inbound from Production applied to Semi

After good production, the LSP proceeds to pick the material and consequentially transfer to storage location SP20; hence also validating the entry in their WMS, which enters the ERP with a movement 313/315, via Delta.

4.1.2.2 Export

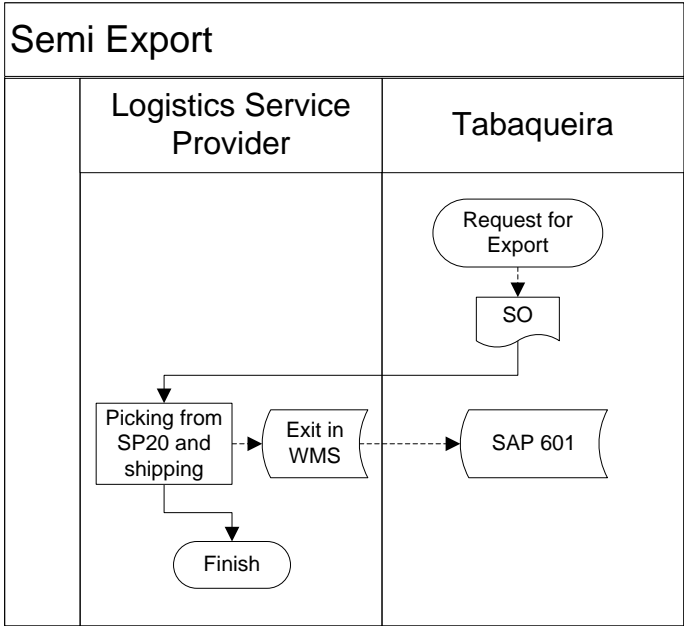


Figure 18 - Export of Semi-finished Products

When it comes for exporting Semi, the process is initiated by a Sales Order, followed by the picking from SP20 and shipping; this activity triggers an exit in the WMS and consequentially a SAP movement 601.

4.1.2.3 Import

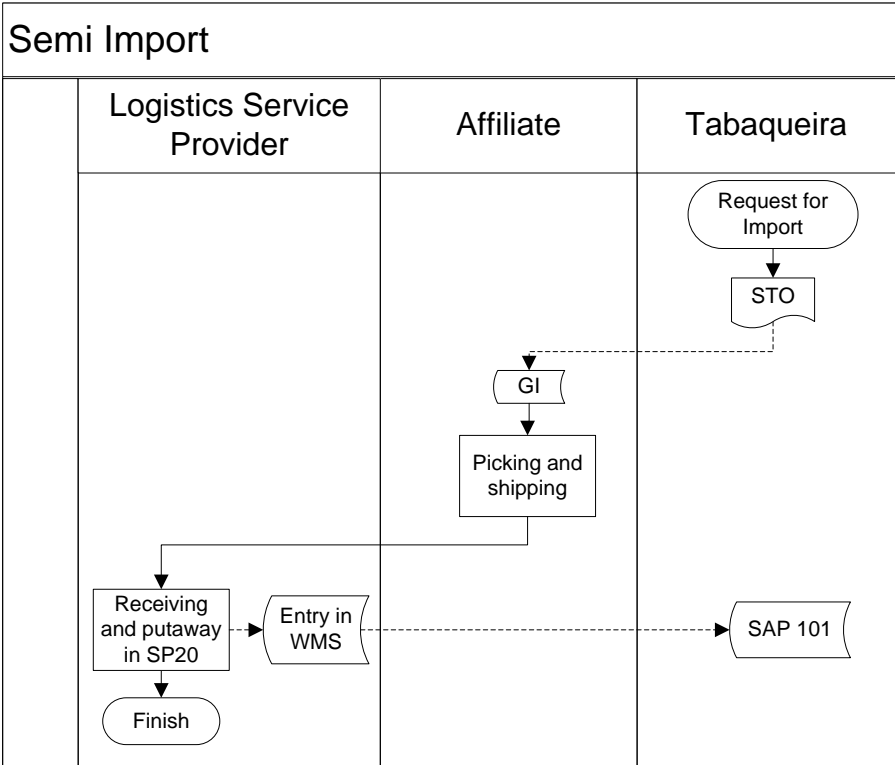


Figure 19 - Semi import

For importing Semi-finished Products, which is a process applicable to ET and CF, it is mandatory for the company to issue a STO to an affiliate or TPM. The process continues when they proceed to the Goods Issue and subsequent shipping to Tabaqueira’s facilities. After arrival, the LSP proceeds to store it in SP20 while adding the shipment in the WMS and the usual movement 101 in SAP, by the use of Delta interface.

4.1.2.4 Replenishment to production

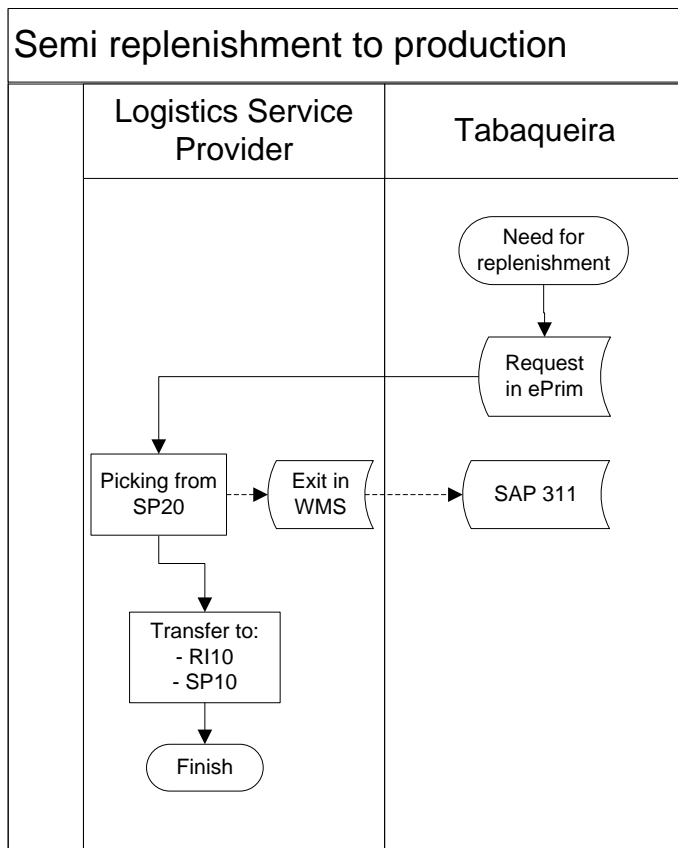


Figure 20 - Replenishment of Semi-finished Products to production

In this case, there is a request made in ePrim which in turn is sent to the LSP. The latter proceeds with the picking from SP20 and posterior transfer to SP10 for all materials, except the Ripper Shorts, which are transferred to RI10. In the mean time, the exit in WMS together with SAP movement 311 is executed, thus finishing the process.

4.1.3 Finished Goods

Drawn below, there are several associated processes which can be performed to FG, namely:

- Import or Export;
- Handling from production to shipment of Foreign or Domestic FG;
- Changing customs material status from bounded to unbounded;
- Destruction;
- Return to supplier or to the factory.

4.1.3.1 Outbound of Domestic Finished Goods, from PT01/FG10 to PT10/FG25

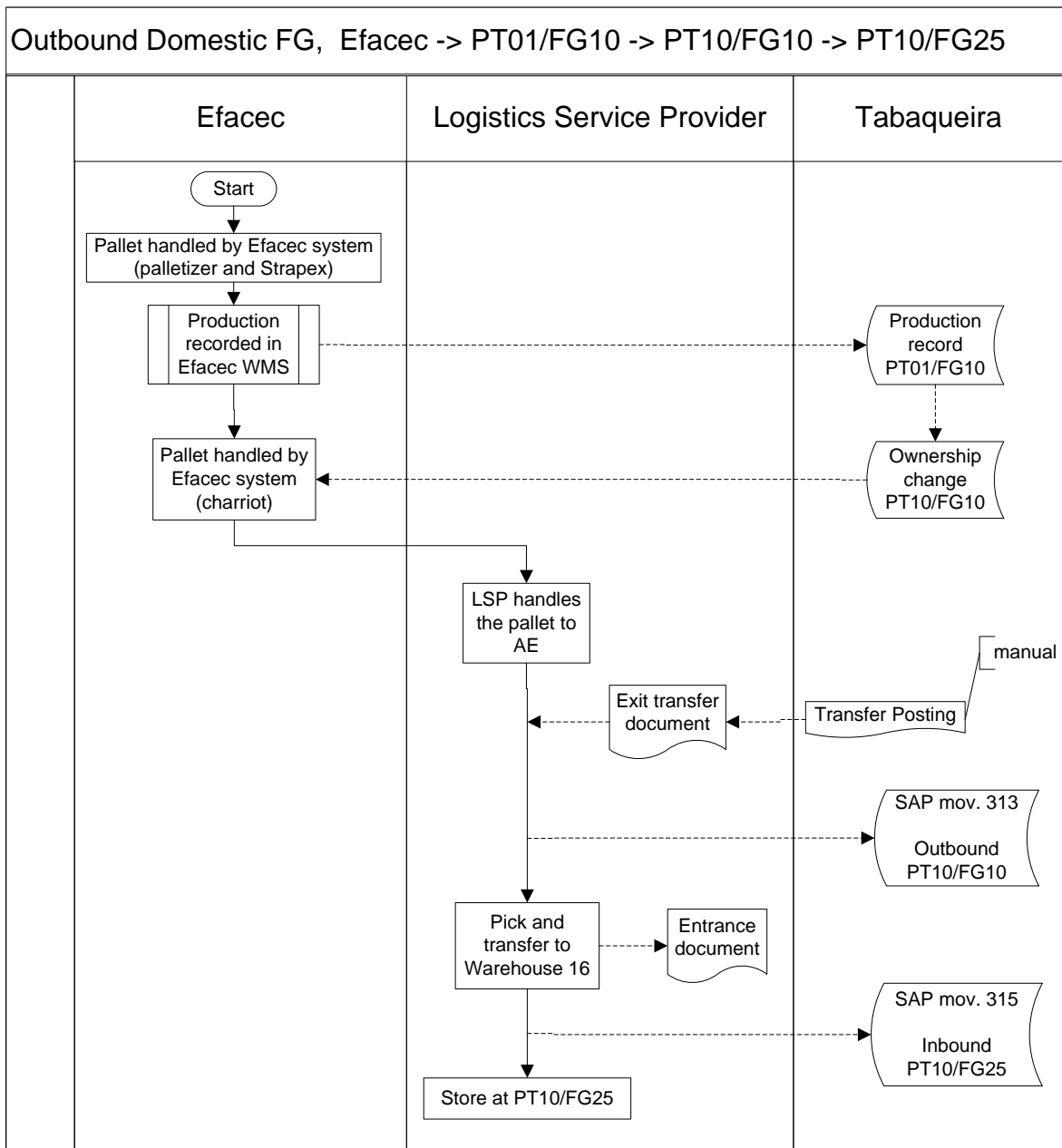


Figure 21 - Outbound DOM FG, from PT01/FG10 to PT10/FG25

The Domestic Outbound flow of FG starts with the palletization and the strapping of the full pallet. After it, the good production is recorded in the Efacec WMS, which in turn leads to production record in SAP at the plant PT01, storage location FG10. Automatically, since the goods are destined to the domestic market, there is an ownership change from PT01, Tabaqueira EIT, to PT10, Tabaqueira II. Henceforward, the goods are in sole possession of the Buy and Sell division, but kept under Tabaqueira EIT warehouses. Back to the physical flow, the pallet moves through the *charriot* system, which consists of a series of automated guided vehicles, and reaches the AE. Furthermore, there is a exit document from the LSP backed up by a Transfer Posting and subsequent SAP movement 313. When it reaches the warehouse 16, there is an entrance document waiting and the inbound is validated using SAP movement 315. At this point, the active storage location is FG25.

4.1.3.2 Outbound of Domestic Finished Goods, from PT10/FG25 to PT10/FG20

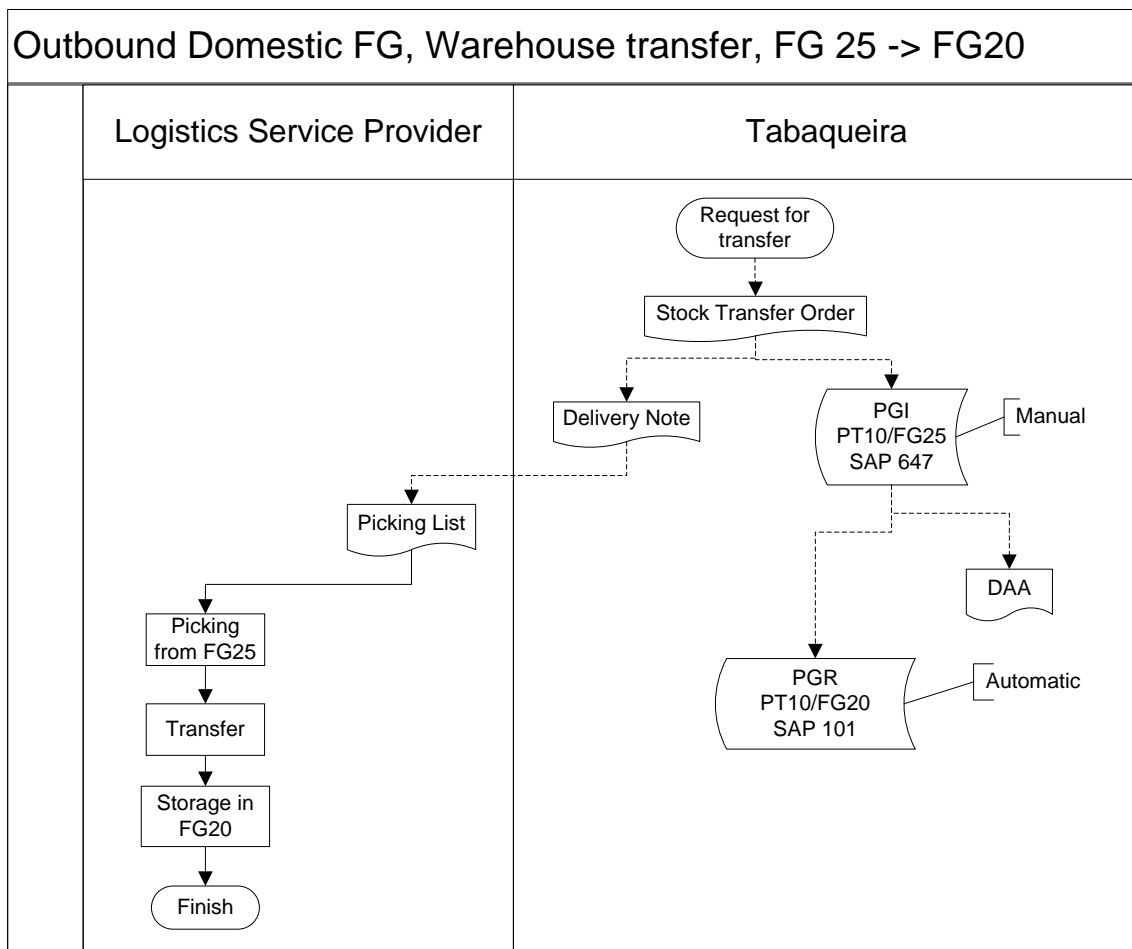


Figure 22 - Outbound for Domestic FG in PT10, from FG25 to FG20

In this process, the trigger is the Stock Transfer Order, which in turn leads to a delivery note, addressed to the LSP and an internal ERP transaction, with a PGI in PT10, FG25 and a PGR in FG20, analogous to their physical flows. Please note, after the PGI, a DAA is sent, corresponding to the approval from the customs.

4.1.3.3 Outbound of Domestic Finished Goods, from PT10/FG20 to PT11/FG30

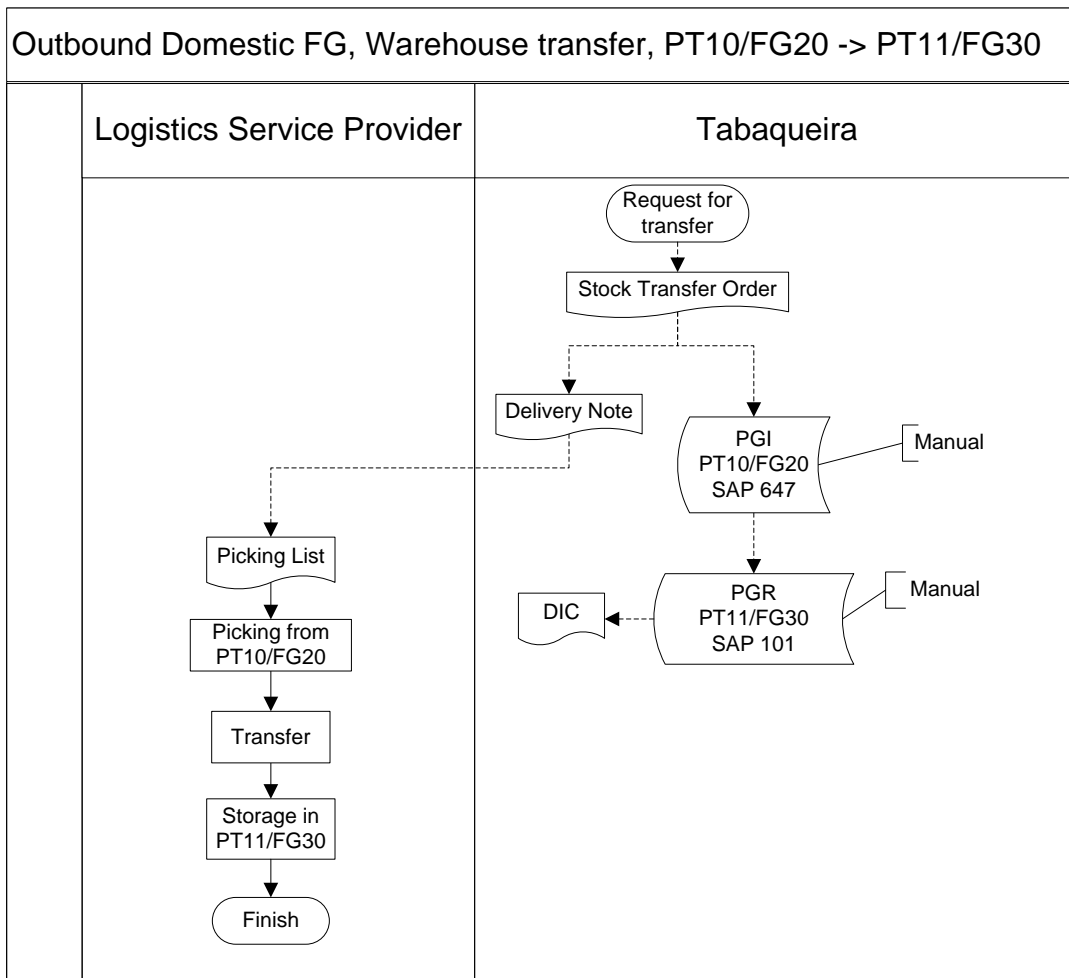


Figure 23 - Domestic FG transfer from PT10/FG20 to PT11/FG30

Meanwhile, this unbounding process is similar to the movement from PT10/FG25 to FG20, starting by a STO which, on one hand, triggers a DN and their respective logistic activities, while on the other hand, there is PGI from PT10/FG20 and a PGR to PT11/FG30. The latter activates a DIC, preparing the FG to consumption.

4.1.3.4 Outbound of Domestic Finished Goods, from PT11/FG30 to expedition

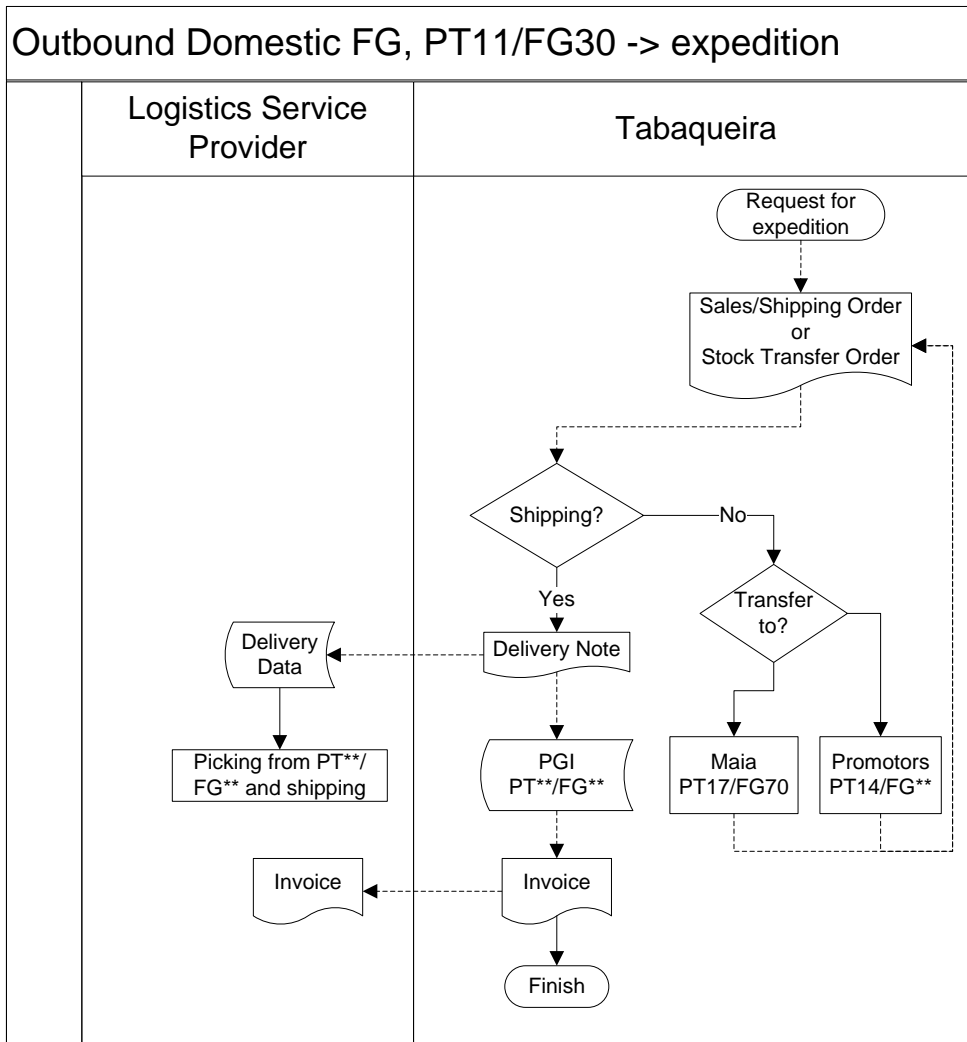


Figure 24 - Domestic FG, from PT11/FG30 to shipping

When there is a request for expedition, it must be done through a Sales/Shipping Order, if it the request comes from a customer or by the means of a STO, if the plan is to transfer the FG to Maia warehouse or to a Promoter. The first triggers a DN which in turn initiates a PGI, which can be from W16, Maia or any Promoter.

4.1.3.5 Outbound of Export Finished Goods, from production to shipping

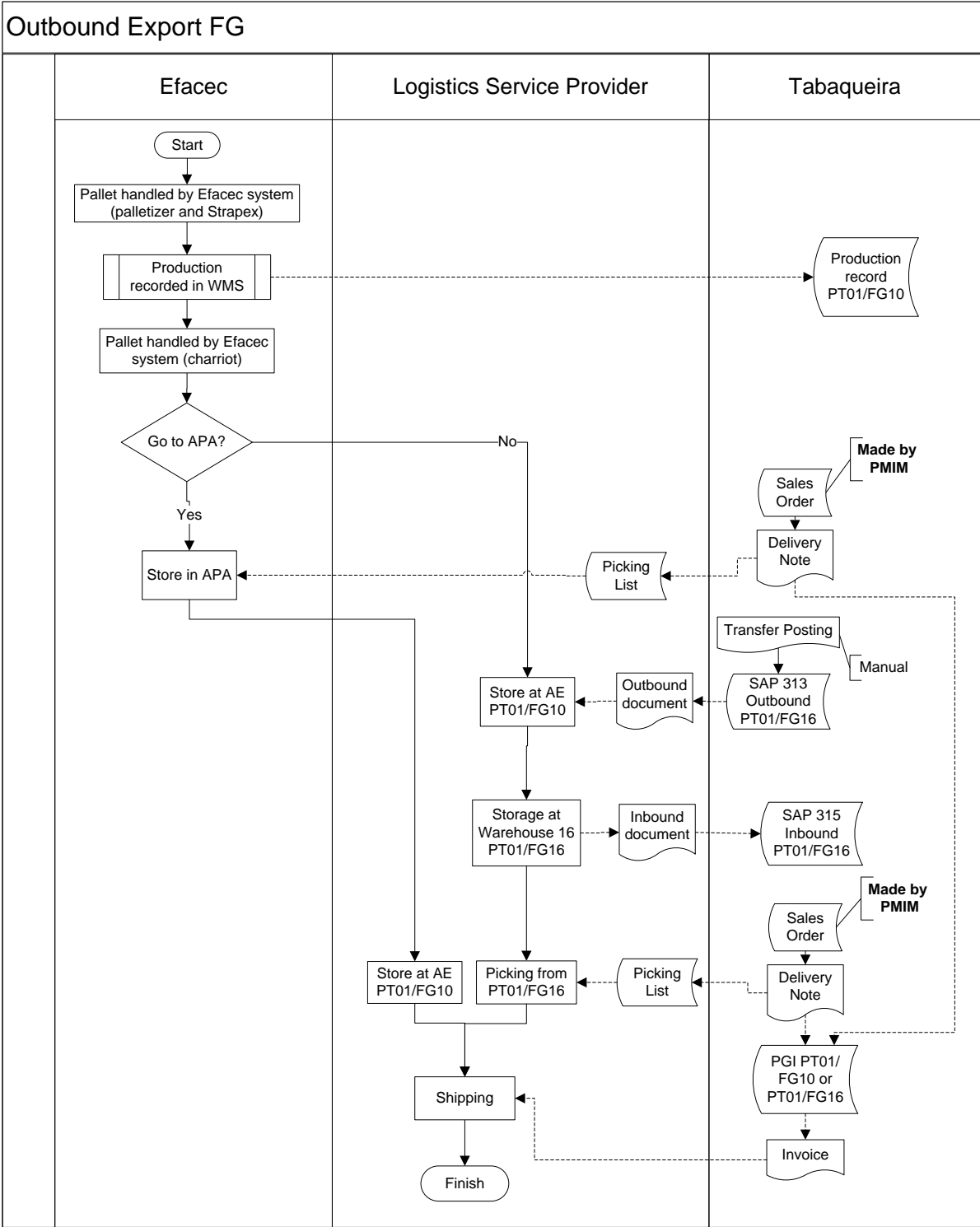


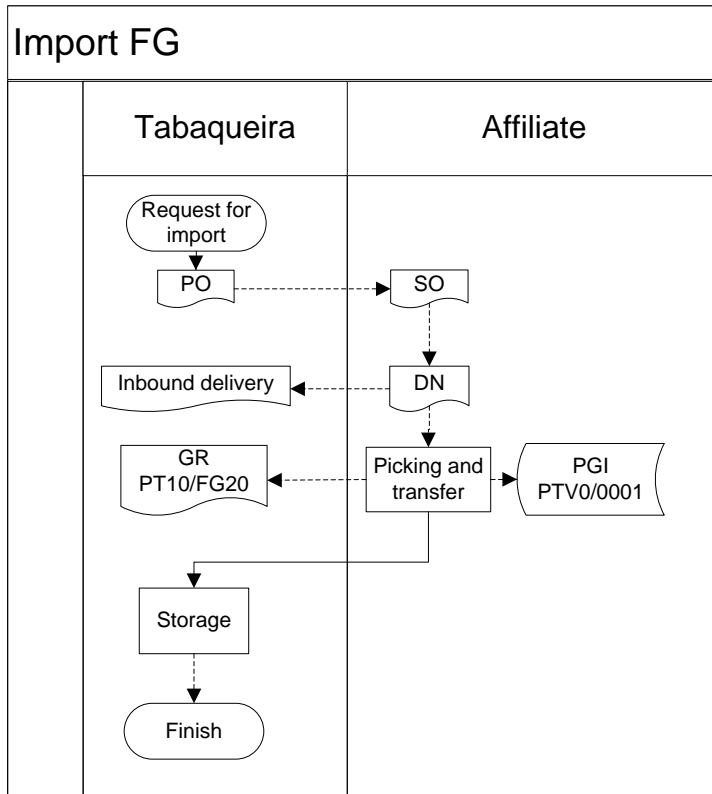
Figure 25 - Export process of FG

The process starts with the production record in SAP and in Efacec WMS, followed by a decision point. Here, depending on the destination, the FG can be stored in APA or taken to AE. If the FG are going to be transferred from APA, the exit is triggered by issuing a Sales Order, DN and Picking List. Finally, the FG are going to be stored temporarily in AE, before shipping. Contrariwise, if they are taken to AE at first, it is simply because they are going to be moved to W16 by the use of a Transfer Posting, SAP movement 313 and an outbound

document sent to the LSP. The inbound in W16 is made with an inbound document as well, followed by a movement 315. Likewise, in order to do the picking, the SO is issued together with DN and a Picking List.

From both warehouses, the shipping is triggered by a PGI together with an invoice, finishing the process.

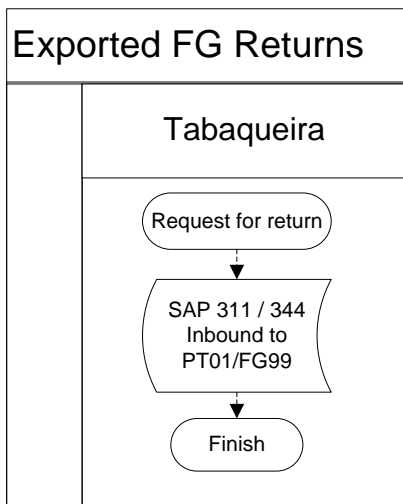
4.1.3.6 Importing Finished Goods



When importing goods, the process starts when the PO is launched by Tabaqueira, triggering a SO by the affiliate which, in turn, leads to a DN, together with an inbound delivery document for Tabaqueira. When doing the pick and subsequent transfer, there is also a PGI and PGR involved, behind the shipment reception.

Figure 26 - FG Imports

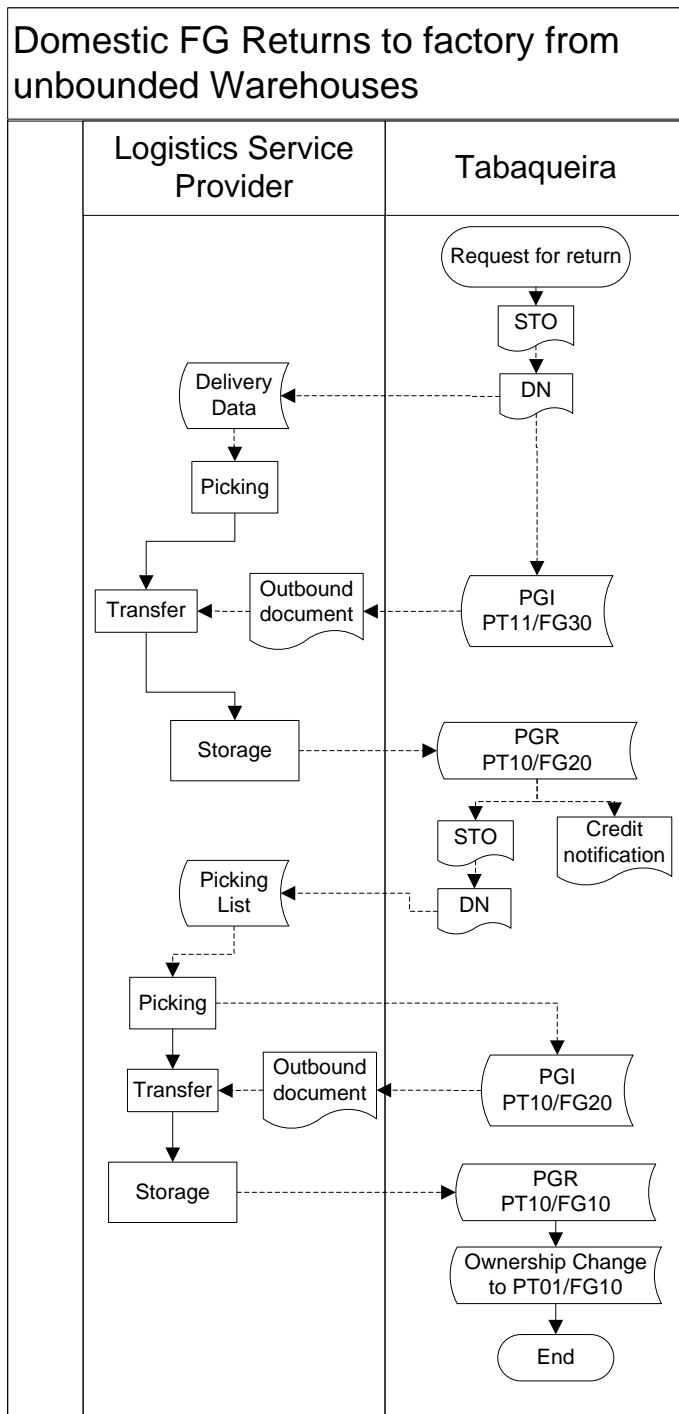
4.1.3.7 FG returns from foreign markets



For returning Exported FG to Tabaqueira, the process starts with a request from the customer, triggering an inbound to location PT01/FG99, specific for quality assessments. The inbound of the material is done manually since the LSP does not have a well defined procedure to be done. When in need for a QI, the process is described in Figure 30.

Figure 27 - Exported FG returns

4.1.3.8 Domestic FG Returns from unbounded warehouses



The process starts when there is a request to return back a given quantity of FG, using a STO, which launches a DN, the latter being transmitted to the LSP and to the ERP via PGI.

After the receiving of this product there is a PGR, which indicates the FG is back to plant PT10, storage location FG20, reversing the customs procedures. The latter is done by creating a credit notification given the fact the taxes were paid, when the item left the location FG20.

Likewise, the process repeats itself in order to reach FG10. At that time, when going back to Secondary, the process ends when the owner changes from PT10, Tabaqueira Buy and Sell to PT01, Tabaqueira EIT.

Figure 28 - Domestic FG returns from unbounded warehouses to Secondary

4.1.3.9 FG returns from domestic and foreign customers

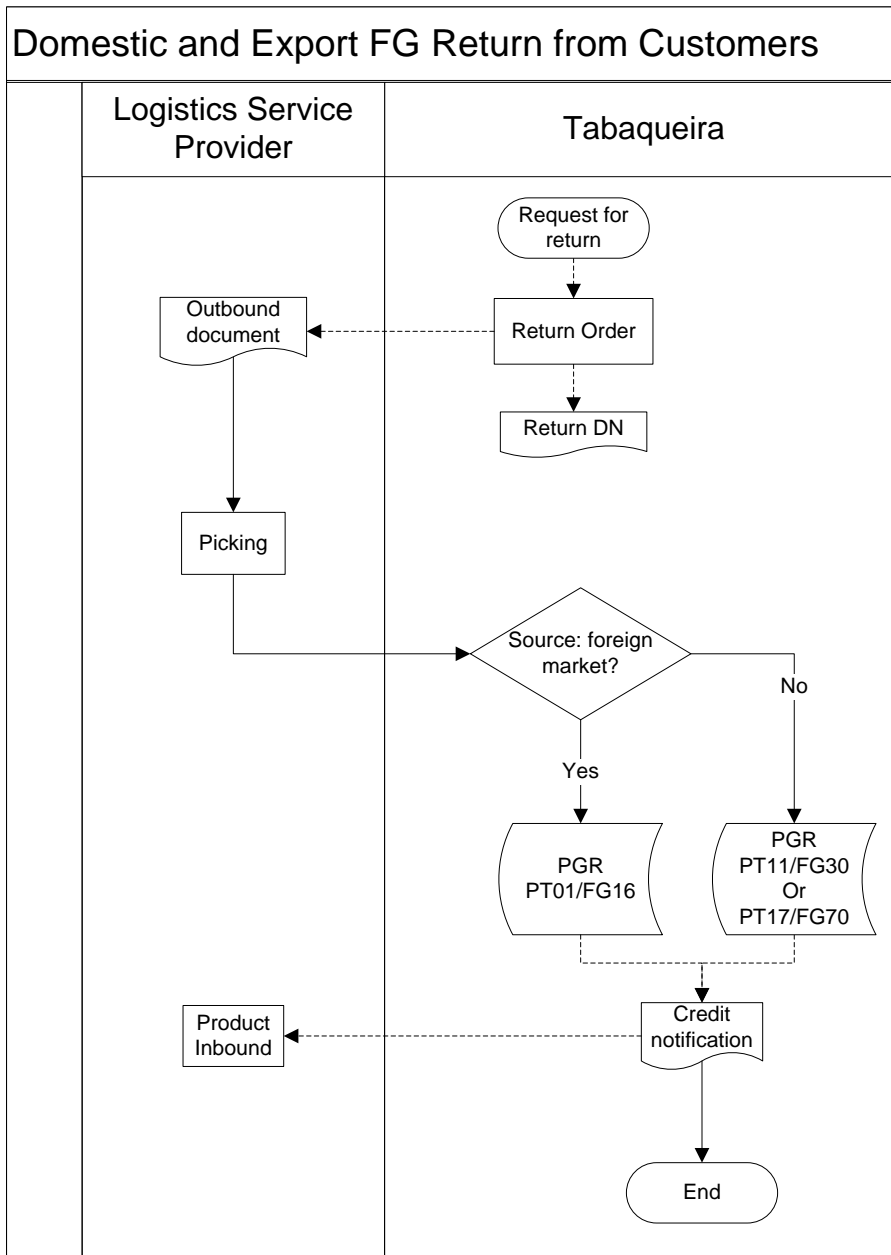


Figure 29 - FG returns from domestic and foreign customers

This process initiates when there is a request from a given customer, by returning the DN back to Tabaqueira. After the product arrives, the LSP proceeds with the picking and, depending on the source, the product can go to PT01/FG16, PT11/FG30 or PT17/FG70, if it comes from other country, from domestic routed to Albarraque warehouse or domestic headed to Maia warehouse, respectively. Furthermore, the material status has to be taken under consideration, like described in Figure 30.

4.1.4 Material Status

Before transferring any material to other areas from and to QI, each item status should be updated in order to comply with PMI internal guidelines; the different material statuses are listed below:

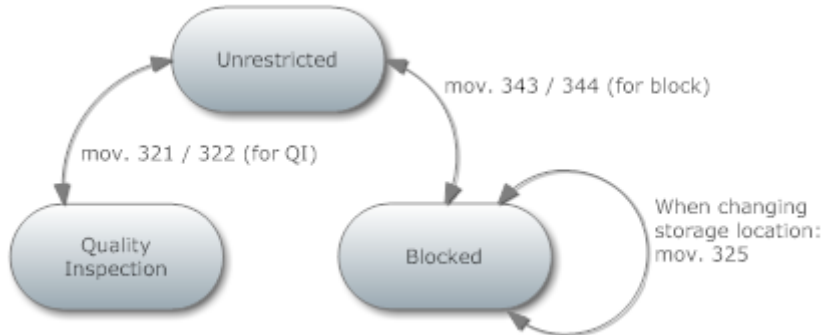


Figure 30 - Material statuses

As a standard procedure, when a new item arrives to the facility, it comes with QI status. After inspection, and if the material is ok, it is given the status of unrestricted for further uses, such as storage or production replenishment. On the other hand, the blocked status is used when the item is waiting for a decision from the supervisor, hence it cannot be used for production

4.1.5 The current WMS

At a physical and system level it was elaborated a list of functions and tasks, suitable to check what is done currently within the warehouses. After thorough analysis, it is worthy to note the present X WMS is capable of handling all requirements, as it is possible to see in ANNEX D:

Warehouse checklist for LSP WMS, physical processing and ANNEX E: Warehouse checklist for LSP WMS, system processing.

Moreover, and in terms of systems integration, the WMS in FG warehouse connects with the ERP at the top level, with the MES for interfacing with production and with the Efacec WMS in the high-bay warehouse which interfaces with the WCS tier.

On the other hand, the DIM WMS connects with MES for replenishment to primary and secondary and with the ERP at the top level for warehouse operations planning. Overall, the LSP WMS, covering DIM, Semi and FG, has 28 concurrent users. The following diagram sums up the system connections.

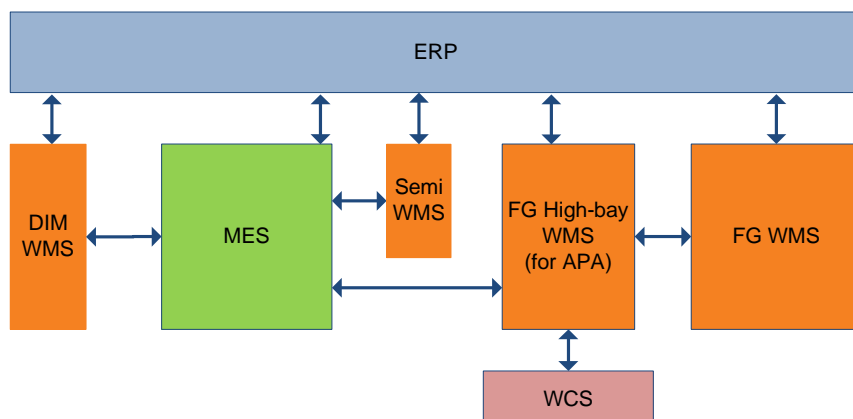


Figure 31 - Operations System interfaces

4.2 PMI European Assessment

After checking the process requirements for a possible deployment of a new WMS, it is time to look around and see what do the other PMI European affiliates have and check if it would be possible to implement a similar system within the company. At first glance, the obvious choices are the fellow affiliates who changed their system recently and the ones who have the biggest cigarette output which, in turn, indicates a high level of complexity. Every factory will be assessed by their physical prowess and complexity and thus analyzed individually. The list ranges from the Netherlands to Poland and Ukraine.

4.2.1 Bergen op Zoom, Netherlands (PMH)

The Bergen op Zoom factory is located south of the Netherlands and has by far, the biggest cigarette output in the entire PMI universe. The analysis of warehouses and systems can be found next.

4.2.1.1 Warehouses

In terms of warehousing type, PMH is the most complex situation. They have two high-bay ASRS for Finished Goods plus one for Direct Materials. Moreover, it is worth to mention they have one dedicated cargo train rail for in- and outbound purposes. The specifications are summarized below.

Table 2 - Bergen op Zoom warehousing characteristics

<i>Type of material</i>	<i>Type of parameters</i>	<i>Information</i>
DIM	Number of warehouses	1
	Type of storage	High-bay
	Capacity (in pp):	11 000
Semi	Number of warehouses	1
	Type of storage	Pallet rack
	Capacity (in pp):	8 300
FG	Number of warehouses	2
	Type of storage	High-bay
	Capacity (in pp):	24 000

4.2.1.2 System

The Bergen op Zoom factory is renowned inside Philip Morris for having a highly customized with both WMS and WCS functions; this system encompasses three modules, one for each group of items, namely Semi Finished Products, Finished Goods and Direct Materials. However, since 2009, they have been running a project to replace the management and

control systems. While the latter is not relevant for Tabaqueira's short-term ambitions, the WMS proxy should be analyzed thoroughly; for PMH, the goal is to fully replace the old and customized M, for a new R platform, a well sold platform in the EMEA region which in addition stands for a best-of-breed solution.

Going back to issues found for the M platform, PMH appoints four main reasons for it, namely:

1. Obsolete platform hardware technology and operating system; these technologies are up to 25 years old;
2. Lack of technical support at an increased cost;
3. The business needs require an increasing functionality which cannot be addressed properly with M due to the nature of the application, complex and inflexible, i.e. it is necessary to program directly on around one million and a half coding lines;
4. Having an unique module for handling WMS and WCS simultaneously does not cope with the current strategy of having individual packages for each function.

On the other side, besides the typical full-time support, R offers features like:

Table 3 - List of R WMS features

Workforce Management	Yard Management
Single scan ASN receiving	Cross Docking
Comprehensive Work Order Management	Multiple Wave Strategies
Task Optimization	Value Added Services
Supplier Recall	Activity Billing
Customs & Excise Solution	Web Visibility
Event Management	RF and Voice direct tasking
Mobile Resource Management	RFID

Even though some elements are not used nowadays, if the future business needs request their application, R would allow an easy deployment but, on the other hand, the existence of unnecessary features forces the adopters to pay a premium on the final package price.

4.2.1.3 Cost drivers in the project

Based on the data provided by PMH, the planned investment is dependent on the parameters:

- Number of concurrent users/licenses;
- Development and implementation costs, which are proportional to the consultants workload.

4.2.2 Krakow, Poland

In terms of size, the Krakow factory is larger than Tabaqueira, although it does not reach the levels of Bergen op Zoom factory.

4.2.2.1 Warehouses

Table 4 - Krakow warehousing characteristics

Type of warehouse	Parameter	Information
Leaf	Number of warehouses	1
	Type of warehouse	Storage racks
	Capacity	1.2 bio cigarettes (equivalent to circa 3200 pp)
Semi	Number of warehouses	2 (one CF, one Filter rods)
	Type of storage	Floor
	Capacity	1.6 bio cigarettes (equivalent to circa 4200 pp)
DIM	Number of warehouses	1
	Type of storage	High-bay storage
	Capacity	1.6 bio cigarettes (equivalent to circa 4200 pp)

4.2.2.2 System

In the midst of last decade, PMPL decided to replace their former WMS with a newer S system, due to changes in the PMI ERP.

4.2.2.3 Cost drivers in the project

Based on the data provided by PMPL, the following cost drivers were considered:

- Number of concurrent users/licenses;
- Development and implementation costs, which are proportional to the consultants workload.

4.2.3 LES (PMU)

LES is a project currently under development inside PMI, planned to provide an universal WMS for any given affiliate. While currently its scope only reaches DIM replenishment to Secondary, it is foreseen to grow to a standard system, similar to any other modules in the market. Noticeably, the main advantage is easily explained by its motto “Develop once, deploy many”; in this case, the first real application is being done at the Kharkiv factory in Ukraine.

Since 2009, LES started to be developed in cooperation with the company A, thus can be placed in the highly customized WMS category. While its main objective now is to make the bridge between Logistics and the Production environment, via the Secondary replenishment of DIM, its gradual development to other warehouses should be able to handle properly the business requirements, especially when it comes to picking rules such as FEFO or put away procedures based on stock turnover.

4.2.3.1 Cost drivers in the project

According to a recent study, the cost of implementing LES within Tabaqueira is solely dependent on two factors, namely the factory size - small, medium or big - which account for the deployment cost and the number of linkups, i.e. the number of production cells. For example, the set of maker and packer forms one cell, whereas in the filter making department the number of linkups corresponds to the number of machines manufacturing filter rods. On the other hand, the number of linkups defines the number of licenses needed.

It is noteworthy that since the current scope only covers DIM replenishment, in the future there will not be any extra fees applicable in the CAPEX. That means only the expenses will grow as the deployment and expansion of the WMS goes further on.

4.2.4 Overall perspective

In order to get the big picture on the different opportunities, it is necessary first to question, “Do we want an internal/own system?” If so, it is possible to choose from three different vendors; however, due to PMI guidelines, if there is any WMS replacements, they should include LES in the project. That being said, we come up with R+LES, S+LES or only LES. Moreover, only the individual solutions were considered, since it would be extremely difficult to reach accurate figures due to the youth of LES project.

On the other hand, if the company decides to keep an external system, it is possible to choose whether to stay with the current LSP one or change to a new one, which would result in a change of LSP as well.

To sum up, the next diagram depicts the aforementioned approaches:

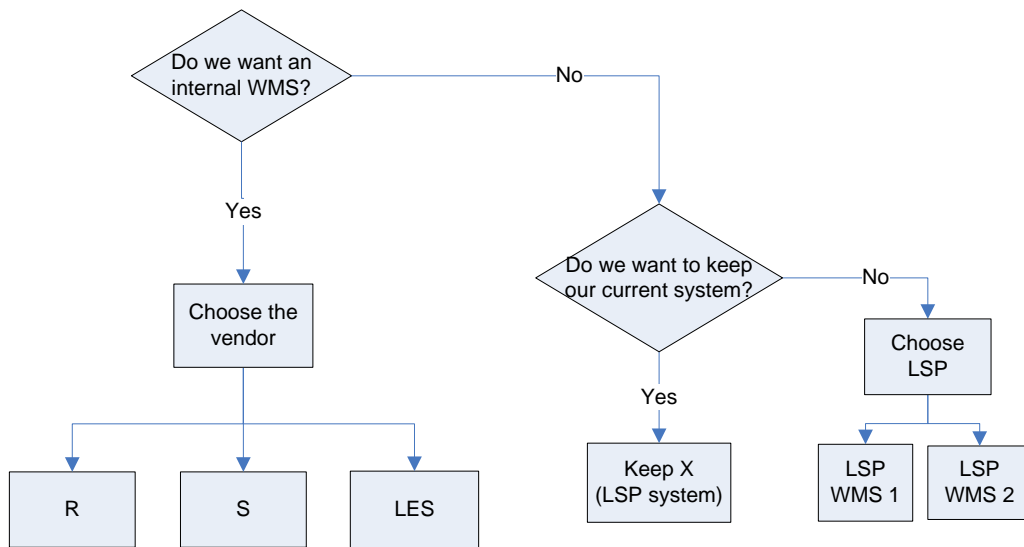


Figure 32 - WMS decision tree

4.3 Comparison

4.3.1 Quantitative analysis

After the requirements assessment, it is necessary to evaluate what are the values behind each feasible solution. This includes what is the price of a given platform, what is needed to support it and what savings can be taken out of it. Moreover, since the project involves a substantial amount of money, it is necessary to know from a financial standpoint, via capital budgeting, if this investment is worth a shot. In order to accomplish so, the estimative was based on internal case studies (Philip Morris International).

4.3.1.1 Savings

At first glance, the most obvious expenditure when benefiting from an internal WMS is the savings which come from the IT costs included in the LSP contract. Furthermore, by cutting with the outsourced system it is feasible to increase the savings, which correspond to the IS headcount.

As abovementioned, one of the benefits from having an internal system is that it allows one to handle all the necessary procedures for a given micro-process, e.g. FG blocking, to a single Tabaqueira entity, whereas using a non-owned system triggers a series of communications amongst company and LSP entities, thus constituting an extra saving. This also enters the overall savings which are estimated at € 160 000.

4.3.1.2 Cost

Table 5 - Total project cost for different platforms

	Project R	Project S	Project LES
Deployment/Development	€ 774 900	€ 691 016	€ 413 200
Licensing	€ 159 580	€ 141 057	€ 105 555
Total	€ 934 480	€ 832 073	€ 518 755

Table 6 - Maintenance and support costs for the different platforms

	Project R	Project S	Project LES
Maintenance and support cost	€ 32 874	€ 31 032	€ 21 180

4.3.1.3 Capital Budgeting

Some KPI were calculated with the purpose of properly analyze the different projects, based on capital budgeting (Brealey, Myers, & Allen, 2007). It is worth to mention that the next indicators were made taking into account a study with a ten year span.

- Net Present Value;
- Internal Rate of Return;
- Payback Period.

The following list pretends to represent all findings about the aforementioned indicators.

Table 7 – Financial criteria to evaluate the three projects

	Project R	Project S	Project LES
Net Present Value (in € '000)	(88)	8	327
Internal Rate of Return (in %)	2.7	5.2	17.5
Payback Period (in years)	11.5	9.8	5.2

When reviewing the values from table 7, LES is the obvious choice when looking at figures. It offers the best Net Present Value, Internal Rate of Return and lower Payback Period. It is worthy to know however, that Project R is not profitable after ten years running, due to its negative NPV.

4.3.2 Qualitative analysis

4.3.2.1 Risk Assessment

The risk assessment was made with the aim of forecast what could happen if a new system was installed and its results are displayed next:

Table 8 - Risk Analysis on a new WMS¹

<i>Description Of Risk</i>	<i>Probability of Failure</i>	<i>Impact on Project</i>	<i>Contingency</i>
Scope of the project increases	M	H	<ul style="list-style-type: none"> Ensure tight project scope management with formal approvals by the business owners (Governance, Sponsors, Steering Committee)
Requirements change too often	M	H	<ul style="list-style-type: none"> Have a clear and communicated change management process in place and ensure all changes are approved by the Steering Committee
Resource not available and fully dedicated to the project	M	M	<ul style="list-style-type: none"> Free up other staff from the company or increase vendor's presence in the project
Delays of other projects, e.g. MES or SCIPIO, or configuration freezes caused by this project	H	M	<ul style="list-style-type: none"> Tight relationship with MES and SCIPIO, planning of all P1 integration activities and updates with sufficient contingency
Key users from business are not available in required period (user-acceptance testing, key-user and end-user training)	L	H	<ul style="list-style-type: none"> Get acceptance from project sponsor for the project schedule in advance If key user becomes unavailable, replacement must be provided from business. However, it will impact project budget (additional training) and schedule (delay until new member is on boarded)
Business requests scope change after completing <i>Blueprint</i> phase	H	M	<ul style="list-style-type: none"> Clearly communicate to the business (on management level) that new requirements may not be added after <i>Blueprint</i> phase. All parties representing inter-connected business processes need to be involved in the <i>Blueprint</i> phase so that all the requirements / constraints are taken into

¹ Rating: L = Low; M = Medium; H = High.

			<p>account</p> <ul style="list-style-type: none"> • If scope change happens after <i>Blueprint</i> phase, it should be managed with <i>Change Request</i> procedure and be subject to project management approval
Long system response times which may be caused by improper WMS platform sizing or network constraints (interface to P1 ERP system)	L	M	<ul style="list-style-type: none"> • Sizing should be confirmed with the system supplier and network requirements should be checked with the ITSC organization
Shift of shutdown periods impact the project planning	L	M	<ul style="list-style-type: none"> • Shift and shortening is a Steering Committee decision • Fix the <i>no production</i> periods for committed project work • Contract considerations
Conflicting activities during shutdown periods	M	H	<ul style="list-style-type: none"> • Determine pre-shutdown activities • Extensive testing upfront
Planned activities in shutdown period are not finished in time	M	H	<ul style="list-style-type: none"> • Extensive testing upfront • Activate business continuity plans • Create fall back scenario's • Mobilize enough resources during PGL
Instable WMS solution after go-live	L	H	<ul style="list-style-type: none"> • Project Approach (Semi first) • Cutover planning • Extensive testing upfront • Activate business continuity plans • Create fall back scenario's • Mobilize enough resources during go-live • Work out business contingency scenarios

4.3.2.2 Pros and Cons

4.3.2.2.1 Project R

Pros:

- Tabaqueira no longer dependent on the LSP System;
- Better inventory tracking inside the facilities for Semi;
- Increased security against theft for Semi;

- Increased accuracy and efficiency of material consumption if Item scanning is applied;
- Less time spent in communications between entities for blocking items or for the Ripping process;
- Features ready to deploy (RFID, voice direct tasking, etc.);
- R is one of the most sold WMS in the EMEA region.

Cons:

- Payback Period \approx 12 years;
- WMS deployment will certainly force factory stoppages during or before go-live;
- System instability after go-live;
- The advantages brought by the new system may not be enough for the associated payback period;
- Training for employees needed;
- In the future, PMIM current guidelines may turn LES into mandatory;
- An increase in the untapped capabilities on scope and features of LES might overcome S solution in the long run.

4.3.2.2.2 Project S

Pros:

- Tabaqueira no longer dependent on the LSP System;
- Better inventory tracking inside the facilities for Semi's;
- Increased security against theft for Semi's;
- Increased accuracy and efficiency of material consumption if item scanning is applied;
- Less time spent in communications between agents for blocking items or for the Ripping process;
- Flexibility to implement new features;
- The interface redesign will be simpler, i.e. between the ERP and the WMS;
- The integration cost will probably be less when comparing to the other vendor platforms;
- There is already some experience with this WMS platform, when it was used in DIM warehouse.

Cons:

- Payback Period \approx 10 years;
- WMS deployment will certainly force factory stoppages during or before go-live;

- System instability after go-live;
- Advantages of the new WMS are not so big when compared to the existent one when combining with a long Payback Period;
- Training for employees needed, although it should be less extensive when compared to the other solutions, since the company had this system for DIM;
- It is not the state of art in current WMS.

4.3.2.2.3 Project LES

Pros:

- Tabaqueira no longer dependent on the LSP System;
- Better inventory tracking inside the facilities for Semi's;
- Increased security against theft for Semi's;
- Increased accuracy and efficiency of material consumption if Item scanning is applied;
- Less time spent in communications between agents for Blocking items or for the Ripping process;
- Possibility to implement new features;
- Customized solution provides better grip to its users and should be better easier to operate, in terms of user-friendliness;
- Possibility to create synergies with other PMI affiliates who share the same LES platform.

Cons:

- Payback Period \approx 5 years;
- WMS deployment will certainly force factory stoppages during or before go-live;
- System instability after go-live;
- The advantages brought by the new system may not be enough for the associated payback period;
- Development of the final product could take years;
- Training for employees needed;
- Right now it has a limited scope, since only covers DIM buffer for replenishment to production.
- Currently, LES is promising but might be a flop when it is finished, due to its scope, features and reliability.

4.3.2.2.4 X WMS

Pros:

- Capital expenditure = 0;
- Currently, the system covers all warehouse needs;
- There is room to further development inside the LSP WMS.

Cons:

- Strategically, the fact the LSP owns the WMS makes Tabaqueira with less room to maneuver for the next contract;
- It is not the state of art for WMS;
- Presently, Tabaqueira is depending on someone else to do their job;
- The future LSP agreement might harm Tabaqueira in the upcoming negotiations (expected to happen in September 2012).

4.3.3 *Critical Success Factors*

If the company decides to move on to an internal WMS, the following aspects would affect directly the outcome of the project:

- Clear ownership of project and business processes;
- The acceptance of changes in business processes as a result of implementing an as much as possible standard Warehouse management solution (standard WMS package and standard PMI solution);
- The integration between the various systems (SAP P1 , Efacec WMS, WCS, MES, ...);
- The level of creativity and innovation in determining the final requirements;
- Strong key user involvement in participating in usability and design activities;
- Strong key user involvement in establishing user requirements in usability and design activities;
- Acceptance of the new software solutions by the users;
- Tight Project Management and Scope Control;
- Quality of training to be delivered;
- Quality of testing to be executed;
- Effectiveness of tracking and tracing for FG, DIM and Semi within the company;
- Controlled utilization of warehouse space.

4.4 Recommendation

After a thorough analysis on pros and cons of each system/opportunity, is it agreeable that Tabaqueira should not change the active LSP WMS in the near future for the following reasons:

1. Project R and S have long Payback Periods and, feature-wise, do not offer a clear advantage when compared to the current LSP system, especially given the price;
2. LES, as a cheaper option is not yet a full-fledged WMS, but according to its NPV has a chance of adding value within six years. Nonetheless, it is necessary to bear in mind there will be only a marginal increase in efficiency and most of all, the implementation of a project which is only in a pilot phase represents a huge risk in two ways. First, by allocating extra resources in terms of capital or headcount, if Tabaqueira decides to be a pioneer among all the affiliates may as well destroy all financial advantages right away. Second, after the deployment of the WMS, the system might not meet the initial expectations and/or become a real problem for the company, needing constant allocation of money and time just to meet basic requirements and functionalities.

For this reason, Tabaqueira should wait a couple of years to realize what are the real capabilities of LES as a complete WMS and when could the system be ready to implement, taking into account time lost in pilot projects and real-life testing. To sum up, in the long-term perspective, the addition of an owned WMS should represent a competitive advantage to the Supply Chain if, and only if, risks are minimized and the critical success factors are met.

5 Conclusion

Approach and Objectives

After a thorough analysis on the requirements and current capabilities of the LSP WMS, the conclusion is straightforward. If there are no root changes in business process, the system is capable of handling novelties without too much ruckus due to the high level of flexibility, as told by the LSP. Therefore, if suddenly Tabaqueira decides to move on for a new technology, this will be quickly adapted without abnormally increasing costs.

Furthermore, mixed with the advantages and disadvantages of each new system, is it agreeable that Tabaqueira should not change the active LSP WMS in the near future for the following reasons:

1. Project R and S have long Payback Periods and do not offer a clear advantage over the old system;
2. LES, as a cheaper option is not yet a full-fledged WMS, and it lacks reliability because it is still a pilot project.

Consequently Tabaqueira should wait a couple of years to realize two things:

- What is LES capable of;
- When the system is ready for deployment.

Finally, from a strategy perspective, the addition of an owned WMS should represent a competitive advantage to the Supply Chain if:

- Risks are properly covered;
- Critical success factors are assured.

For the purpose of an academic dissertation, the boundaries between standard business practices and the academic background were well respected, i.e. even though the practical knowledge attained during the whole project was the main topic of this work, the theoretical fundamentals were taken into account, via Business Process Modeling Notation (section 4.1) or Capital Budgeting (section 4.3.1.3), for example.

Work to be done

Moving on, the next step in this assessment is to evaluate the impact of the current Delta interface on the operations side, on one hand, while on the other is to assess what does it represent for the information systems department. Afterwards, it is recommendable to issue a RFI to vendors with the aim of getting the real figures, not estimations based on other case studies. After this, it could be possible to start thinking on a real system by 2015, when LES

will possibly be mature enough to withstand everyday chores so that is possible to compare between fully developed WMS. Nowadays, it is possible to ask if the management team is willing to pay today or tomorrow for system independence.

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ANNEX A: Storage Locations within the ERP**Plant PT01 – Tabaqueira EIT (Toller)**

<i>Storage Location</i>	<i>Description</i>
BS10	BBS
CA10	Casing Kitchen
CF10	Cut Filler
DI10	DIM Albarraque
DI20	DIM Secondary
DI21	DIM Bulk Material
DI22	DIM Tax Stickers
DI30	DIM Returns
DI99	DIM Off-site
DU10	Dust
FG10	FG Production
FG16	FG Warehouse
FG99	FG Rework
FI10	Filter Making
LU**	Link-up number **
RI10	Ripper Shorts
SP10	Semi FG Packing
SP20	Tobacco Semi
ST10	Stems

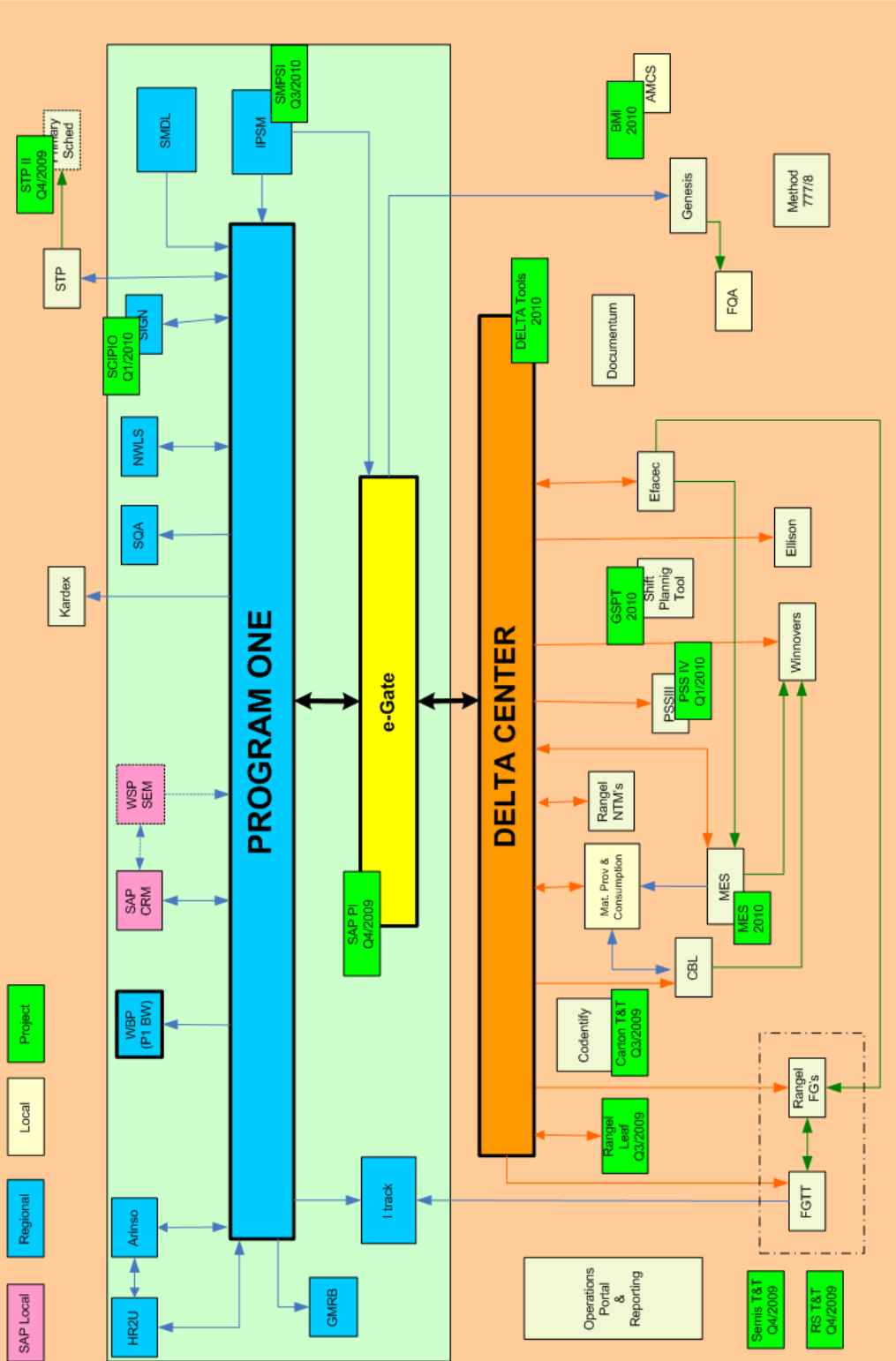
Plant PT10 - Tabaqueira Buy and Sell (bounded)

<i>Storage Location</i>	<i>Description</i>
FG10	FG Domestic
FG20	FG Exped/Imp
FG25	FG Domestic Extra

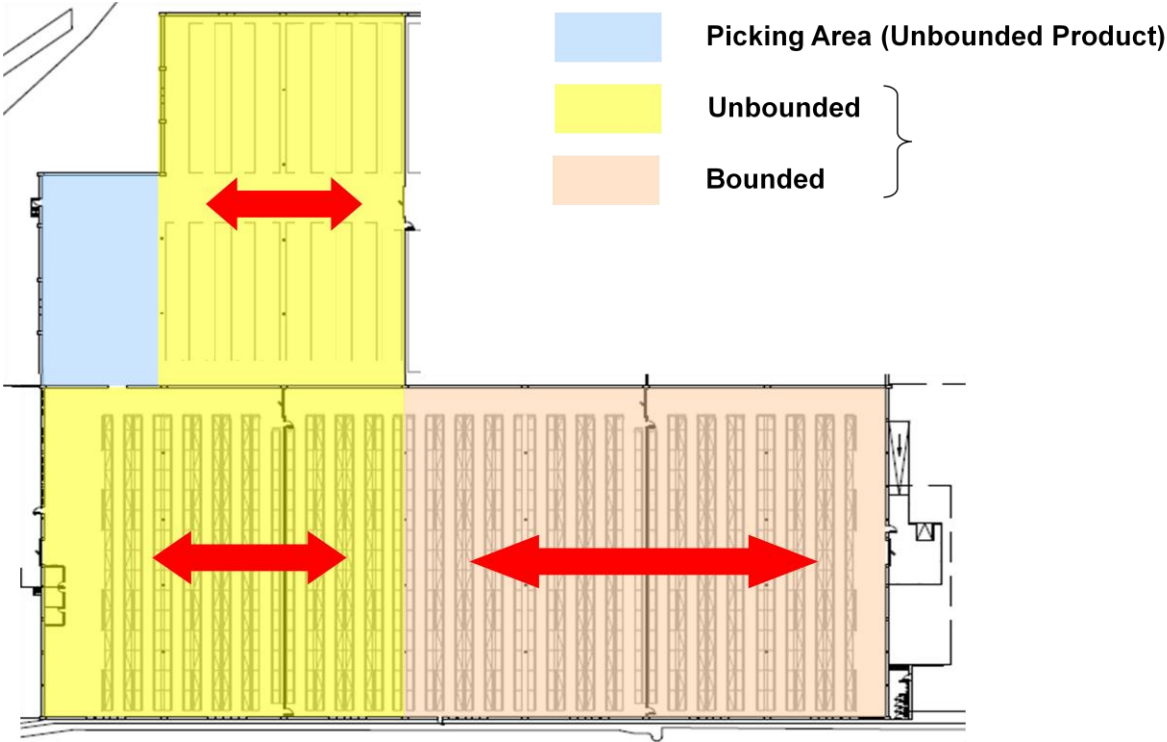
Plant PT11 - Tabaqueira Buy and Sell (unbounded)

<i>Storage Location</i>	<i>Description</i>
FG30	FG Available

ANNEX B: Operations Systems Landscape



ANNEX C: Warehouse 16 map



ANNEX D: Warehouse checklist for LSP WMS, physical processing

Process	Materials				
	Tobacco	SF Tobacco	DIM	Technical Materials	Finished Goods
Receipt to the Receiving Area and put away to the Warehouse	x	x	x	x	x
Picking customs cleared goods from the bonded section and put away to the Warehouse					x
Automated generation of replenishment requirements for DIM Staging Area			x		
Picking goods from the Warehouse and put away for staging	x	x	x	x	x
Control staging time					
Picking from the Staging Area and put away to the Kitting Area			x		
Unpacking handling units in the Kitting Area and kit-car composition			x		
Picking from the Kitting Area and put away to the Machine Buffer					
Material issue to production					
Automated generation of replenishment requirements for Primary In-Feed Area	x				
Picking from the Warehouse and put away to Primary Buffer	x				

Process	Materials				
	Tobacco	SF Tobacco	DIM	Technical Materials	Finished Goods
Goods receipt from the production process and put away to the Warehouse	x	x	x	x	x
Picking from one location and put away to another location within the Warehouse	x	x	x	x	x
Return of material from production process to the Warehouse	x		x		x
Picking goods from the Warehouse and put away to the Shipping Area	x	x	x	x	x
Picking goods from Shipping Area, unpacking and loading into truck	x	x	x	x	x
Determine put away location (different strategies)	x	x	x	x	x
Determine picking location	x	x	x	x	x
Physical inventory count	x	x	x	x	x
Reporting	x	x	x	x	x
FEFO control	x	x	x	x	x
Expiration date control			x	x	x
Quality status control	x	x	x	x	x
Guiding test pallet to production			x		
Material status change			x	x	x
Material scrapping	x	x	x	x	x
Material issue to maintenance order (PM)				x	
Return of a material from maintenance order (PM)				x	

ANNEX E: Warehouse checklist for LSP WMS, system processing

Main Process	Sub-process	Leaf	Semi-Finished	DIM	Technical Materials	Finished Goods
Inbound	Transfer posting IM			x	x	x
	Create inbound delivery	x		x	x	x
	Create transfer order	x		x	x	x
	Confirm transfer order	x		x	x	x
	Packing	x		x	x	x
	Post Goods Receipts	x		x	x	x
	Delivery exchange between ERP-WM	x		x		x
	Difference clearing					
	Create inbound delivery for Purchase order	x		x		x
Outbound	Outbound delivery processing	x		x	x	x
	Delivery exchange between ERP-WM	x		x		x
	Group outbound deliveries					x
	Create transfer order	x		x		x
	Confirm transfer order	x		x		x
	Create handling units (packing)					
	Post Goods Issue	x		x		x

Main Process	Sub-process	Leaf	Semi-Finished	DIM	Technical Materials	Finished Goods
Production	Calculate replenishment for production					
	Create inbound delivery for production					
	Create stock transfer					
	Post stock transfer					
	Create transfer order for replenishment Conditioning					
	Pack handling unit (kitting)					
	Transfer posting					
	Create transfer order for supply prod line					
	Post Goods Issue					
	Confirm transfer order					
Shipping	Create handling units for outbound deliveries	x		x	x	x
	Create outbound shipment	x		x	x	x
	Execute loading	x		x	x	x
Storage	Put away	x		x	x	x
	Picking	x		x	x	x
	Depalletizing	x		x	x	x
	Replenishment			x		x
	Storage unit management	x		x	x	x
Internal warehouse	Internal movements	x		x	x	x
	Inventory control (counting)	x		x	x	x
	Reporting (production date, stock, history)	x		x	x	x
	Radio Frequency			x		x
Label printing	Pallet and/or shipping case label generation & print			x		x