Improving Management Strategies for Reduced Freight Costs

by

Amelie Feron

Diplôme d'Ingénieur, Arts et Métiers ParisTech (2021)

Submitted to the Department of Mechanical Engineering
in partial fulfillment of the requirements for the degree of

Master of Engineering in Advanced Manufacturing and Design
at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
September 2021

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Abstract

This thesis deals with two freight problems currently encountered by Waters Corporation, an analytical laboratory instrument company. According to the customer service department, for approximately 40% of the orders, Waters does not charge for shipments in the US, and a portion is done by mistake due to misalignments between databases or due to unnecessary expedited shipments. The company uses several databases for contract management (Lotus Notes) and shipments (SAP). Correcting these misalignments would ensure that Waters does not absorb the freight charges for customers that are supposed to pay for shipping. Moreover, Waters pays for expedited shipping of some orders due to time constraints, stocks out, damaged inbound products or human errors. Therefore, there is a real opportunity for freight savings. This work offers a cost analysis of potential savings and provides some recommendations to reduce the freight costs. In particular, this thesis focuses on misalignments between Lotus Notes and SAP for European customers and on unnecessary expedited shipments from the Global Distribution Center located in Franklin, MA.

Thesis Supervisor: Stephen C. Graves

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Acknowledgments

I would like to take this opportunity to express my special thanks to all the people who contributed, directly or indirectly, to making this project a reality and a success.

I would like to thank Jose Pacheco and Professor David Hardt for making this project possible and putting us in contact with Waters Corporation during this challenging COVID pandemic. It was a great opportunity to gain industry experience. I would like to thank my thesis advisor, Professor Stephen Graves, for his guidance through the project and his helpful advice.

I would like to express my sincere gratitude to Michael Fogwill and Joseph Michienzi for sponsoring our project. I would like to express my special thanks to Craig Bedigian and Mitch Fonda for offering the project, their time, their insights, and advice. I would like to thank Samantha Sorrentino for her patience during the long process of getting the data for us and her help. I would like to thank all Waters' employees who were enthusiastic about providing us with more information about their department such as Patty Butler and Sheila Embree from the Customer Service Department, Kristen Arakelian from the Contracts Management Department, Ron Creasia from the Field Service Support, Ryan Cashman from the Global Distribution Center, and Ethan Peloquin, DJ Halpin and Eric Mammone from the Quality Assurance Team.

I would like to thank my teammate, Jiayue Zhao, for his determination, support and the beneficial brainstorming sessions we had. Thank you to the rest of our cohort: Mingyuan Li, Joyce Tam and Jonathan Williams. This year at MIT with COVID would not have been the same without your

support, your kindness and the great time we shared together. Thank you for this unforgettable experience.

Finally, I would like to thank my parents and my sister who made my journey at MIT possible, for their love and support during the year. Thanks to my family and my friends in France and here at MIT.

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Glossary and abbreviations

Absorbed: The customer does not pay for shipping costs.

LC: Liquid Chromatography

GC: Gas Chromatography

MS: Mass Spectrometry

GDC: Global Distribution Center

Chapter 1
Introduction

1.1 Problem statement

Waters Corporation does business with thousands of customers worldwide. Everyday hundreds of products are shipped domestically and internationally. Currently, the arrangements for a small fraction of these shipments are not aligned with what is reflected in the customer contracts. Most of the time, Waters ships these orders without charging the shipping cost to the customer. According to the customer service team, Waters does not charge for shipping for approximately 40% of the orders in the US, and a portion of this is done by mistake. Hence, we expect that correcting the assignment of shipping charges will save Waters a huge amount of money each year. Therefore, there is an opportunity for freight savings where the customer contracts and the shipping methods do not align.

1.2 Project scope

Waters operates in three different regions: Asia, the Americas, and Europe. In 2019, the contracts information was centralized and managed by the US customer service team. Keeping track of data is a tedious process and considering that Europe recently transferred its contracts to the US, we will focus on analyzing European contracts since the beginning of 2021; we expect that this sample would enable us to identify trends. The execution of this project will involve the study of freight patterns and shipments to specific customers along with the review of customer contracts. After collecting data and analyzing customer contracts, we will check if the shipping method is aligned

with the customer shipping methods in SAP. If there is any difference between the contracts and SAP shipping methods, we will see how to correct the mistakes by checking the contracts and looking for evidence of the root cause. The cause can be human error coming from the customer service or global distribution center team, but it could also be a communication issue between the different software programs used. Finally, if the shipping method is now correct in SAP, we will determine how to prevent a misalignment from happening again in the future. We will also focus on damaged inbound shipments that can extend lead times and be responsible for generating extra shipping costs.

We envision that our investigation on Waters' shipping system will reduce Waters' overall spending on shipping and result in better communication between different departments regarding order generation and placement. A key evaluation metric is to make sure the cost of implementing the recommendations is less than the extra cost of paying for the shipments that should not be paid by Waters.

1.3 Objective

Our objective consists of the following five parts:

1. Pinpoint problems that lead to extra shipping costs.
2. Identify what causes the misalignment between the contracts and SAP and correct it.
3. Understand the root cause and investigate which departments are responsible for the misalignment.
4. Renegotiate terms and conditions with customers that do not pay for freight and should pay for it (also called absorbed customers).

5. Prevent and minimize the number of damaged products received by the global distribution center from other the manufacturing facilities and distribution centers.

Chapter 2

Background

2.1 Waters Corporation

Founded in 1958 by Jim Waters and headquartered in Milford, MA, Waters Corporation is a leading specialty measurement company focused on improving human health and well-being through the development of scientific instruments. Waters is the pioneer of chromatography, mass spectrometry and thermal analysis innovations. These technologies enable Waters to do business in several sectors such as pharmaceutical, chemical, environmental and food industries. Waters is present in 35 countries with 14 manufacturing facilities, enabling it to offer products in more than 100 countries. [1] The company generated US$2.37 billion, with a net income of $522 million in 2020 [2].

In 2020, the sales of liquid chromatography (LC), mass spectrometry (MS) and thermal and mechanical analysis systems were on the order of 100,000 units in the world. In addition to the system sales, more than 50% of Waters' revenues come from consumables, informatics maintenance and services. A significant amount of their revenues is coming from growing markets. The pharmaceutical and biomedical markets represent 64% of total sales, materials science constitutes 16%, and food, environmental and clinical markets accounts for 20% of the business. In terms of sales, Asia, the Americas, and Europe represent respectively 38%, 34% and 28% of total sales, and China accounts for 17%. Waters was impacted by the

COVID-19 pandemic and recorded a decline in sales of 2% in 2020 after a growth of 6% in 2017 [3].

2.2 Waters Products

This aim of this section is to present Waters products that are shipped to customers. Waters' core products include Liquid Chromatography (LC) and Mass Spectrometry (MS) instruments, consumables (CO) and spare parts (WGS). The shipping costs depend on the size and weight of the product shipped, on the distance shipped, on the shipping mode, and, on the currency (Table1).

Table 1: Freight Comparison in Europe

Country (currency)	Product	Shipping cost
UK (GBP)	LC	270
	MS	700
	CO	27
	WGS	27
Switzerland (CHF)	LC	400
	MS	800
	CO	35
	WGS	35
Sweden (SEK)	LC	3150
	MS	7000
	CO	270
Denmark (DKK)	LC	2625
	MS	5600
	CO	225
Norway (NOK)	LC	3000
	MS	7000
	CO	240
	WGS	240
Euro Zone (EUR): Spain, Portugal, Netherlands, Italy, Germany, France, Ireland, Belgium, Austria, Finland	LC	270
	MS	270
	CO	30
	WGS	30

In this table, we present the shipping costs by air for different products and equipment from the European Distribution Center to several European countries. If the product is not available in the European Distribution Center, Waters will do an internal transfer from the Global Distribution Center in the US, without any additional cost for the customer. LC and MS are usually shipped on pallets and represent large shipments with high shipping costs. Except for Denmark, the shipping cost is usually higher for MS than LC devices, since those instruments are roughly the size of a table, shipped from Wexford, Ireland, and more expensive.

2.2.1 Liquid Chromatography (LC)

Liquid chromatography was discovered in the 1900s by a Russian botanist Mikhail Tswett. Two types of chromatography techniques exist: planar or column. In both cases, the sample is dissolved in a solvent before using a chromatographic device. The compounds of the solvent are separated by travelling at different speeds through the device.

High Performance Liquid Chromatography (HPLC) is a technique used to identify and analyze the constituent components of a variety of chemicals and material. HPLC can separate, identify and quantify the compounds in any sample dissolved in a solvent. The solvent is the mobile phase and held in a reservoir. A high-pressure pump generates and measures a specified flow rate of the solvent. An injector injects the sample into the HPLC column. The HPLC column contains a packing material (which is a stationary phase) to carry out the separation of the compounds into individual analytic bands. Those bands (Figure 1) are then detected, a chromatogram is generated, and the different constituents of the sample appear as peaks and can be quantified (Figure 2). High Performance Liquid Chromatography improved the separation power using smaller particle sizes

and allowing pressure around 400 bar to generate the solvent flow. It is used in a wide variety of industries for research and development purposes, quality control or process engineering applications. In the pharmaceutical industry, HPLC enables the scientist to understand diseases, recognize new drugs and assure the purity of pharmaceuticals. In the food and beverage industries, it is used for nutritional labeling and compliance with safety regulations.

The Ultra Performance Liquid Chromatography (UPLC) allows better resolution, speed, and sensitivity with smaller particles in the columns and pressure capability for instrument around 1,000 bars. Research continues on columns using smaller particle sizes and increasing the instrument pressure capability up to 6,800 bars [4]. LC products are manufactured in Milford, Massachusetts, and constitute Waters' core products.

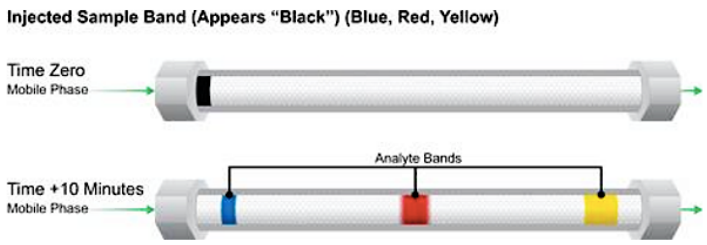

Figure 1: How a chromatography column works - Bands [4]

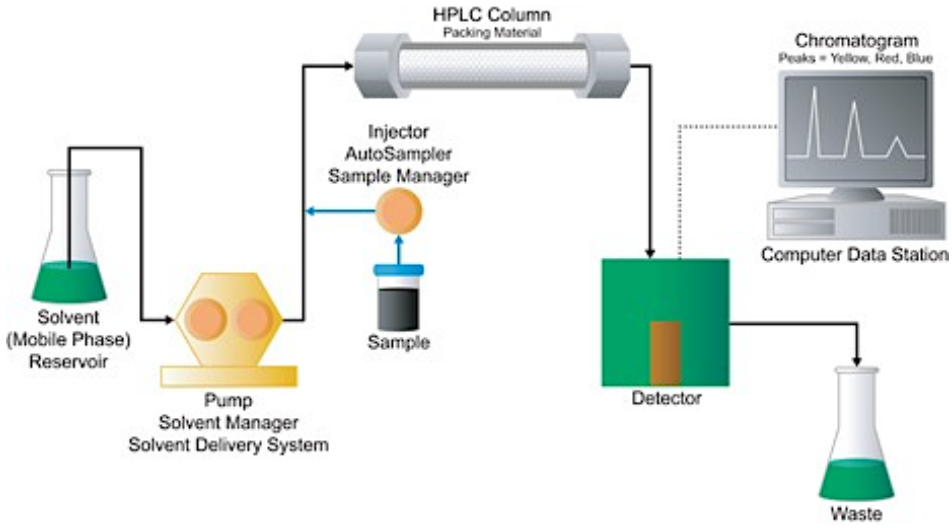

Figure 2: High-Performance Liquid Chromatography [HPLC] System [4]

2.2.2 Mass Spectrometry (MS)

The cathode-ray-tube experiments of J.J Thomson marked the beginning of modern mass spectrometry in 1897 [5]. A mass spectrometer is composed of an ion source, a mass analyzer and a detector operating under high vacuum conditions (Figure 3) [6]. Mass spectrometry is used in chemistry, biochemistry, physics, pharmaceutical industry. Mass spectrometers enable the user to identify and quantify unknown compounds in complex samples and confirm trace components at the lowest possible levels by measuring the mass of every molecule [7]. To do so, the sample is thermally ionized by electric fields or by impacting energetic electrons, ions or photons. Then, a mass analyzer separates the ions by their mass-to-charge ratio (m/z). The lighter ions are more deflected by the magnet than the heavier ones. A detector detects the ions qualitatively and quantitatively by their respective m/z and abundance [6]. The flux of electrically charged ions is converted into a proportional electrical current. A data system reads and converts the electrical current to digital information and displays it as a mass spectrum [7] (Figure 4). Waters' MS units are manufactured in Wilmslow, England, and Wexford, Ireland.

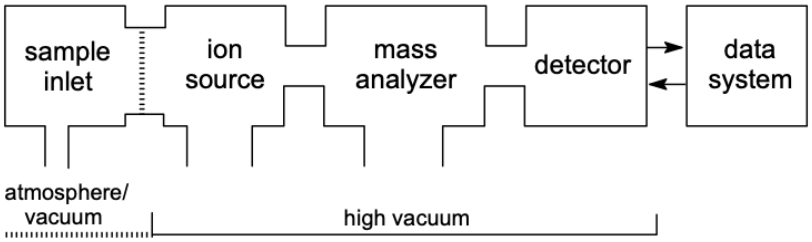

Figure 3: General scheme of a mass spectrometer [6]

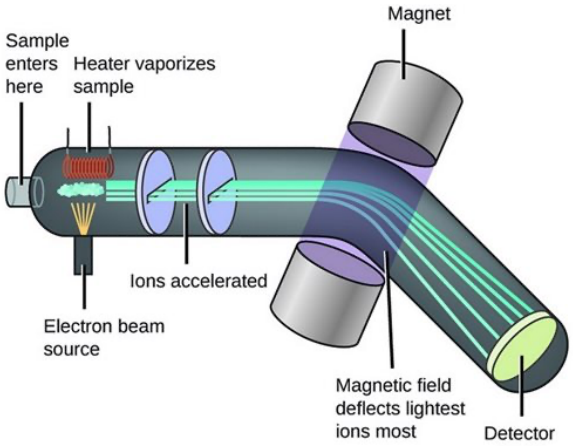

Figure 4: Schematic of Mass Spectrometer [8]

2.2.3 Consumables (CO)

Waters also manufactures consumables products such as chromatography columns for LC; sample preparation tools for LC/MS and GC/MS analysis; analytical standards and reagents to achieve optimal performance and compliance; and vials, plates, and certified containers for sample analysis [9].

2.3 Waters-MIT Collaboration

Waters Corporation and the Master of Engineering in Advanced Manufacturing and Design program have been collaborating since 2013. Each year, a team of students work for Waters

Corporation in different areas such as Product Design, Research and Development, Manufacturing Process Control, Operations Improvement, and Supply Chain. To our knowledge, this is the second project focusing on freight savings. In 2019, a team of students worked on improving the packing strategy for distribution centers to reduce freight costs. This project was carried out at the Global Distribution Center in Franklin, MA [10]. This year's project focuses more on the misalignments between customer contracts and data in SAP software generating unnecessary freight costs than on optimizing the packing strategy itself and on how to prevent unnecessary expedited shipments.

2.4 Waters Global Supply Chain

2.4.1 Customer service department

Whenever the sales team captures a new customer, the sales team passes contact information to the customer service department to create a quote on either Salesforce or Lotus Notes. These are what Waters calls "direct customer orders". The customer service team will set up a customer strategic account in either Lotus Notes or Salesforce (Figure 5) with a blanket sales order (Figure 6) and other additional agreements in addendums. A blanket sales order represents a structure for a long-term agreement between Waters and its customer. When a customer plans to purchase large quantities that must be delivered in several smaller shipments over a certain period of time with a predetermined pricing structure, a blanket order is typically generated.

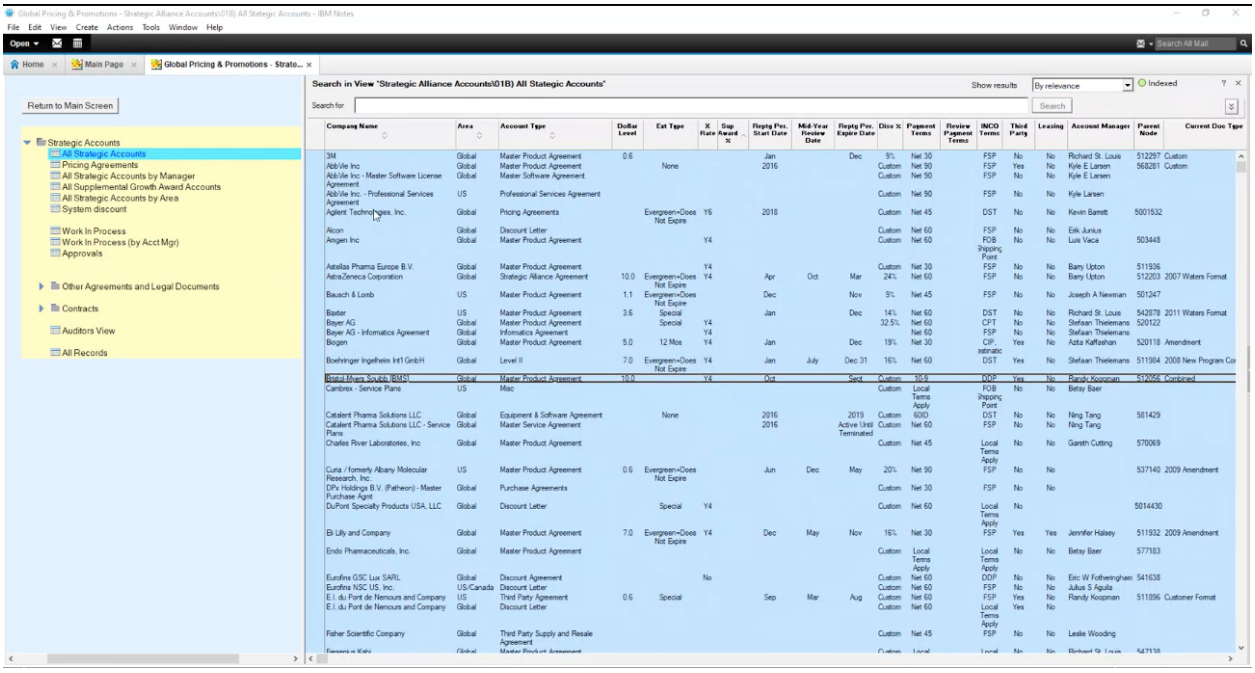

Figure 5: All Strategic Accounts in Lotus Notes

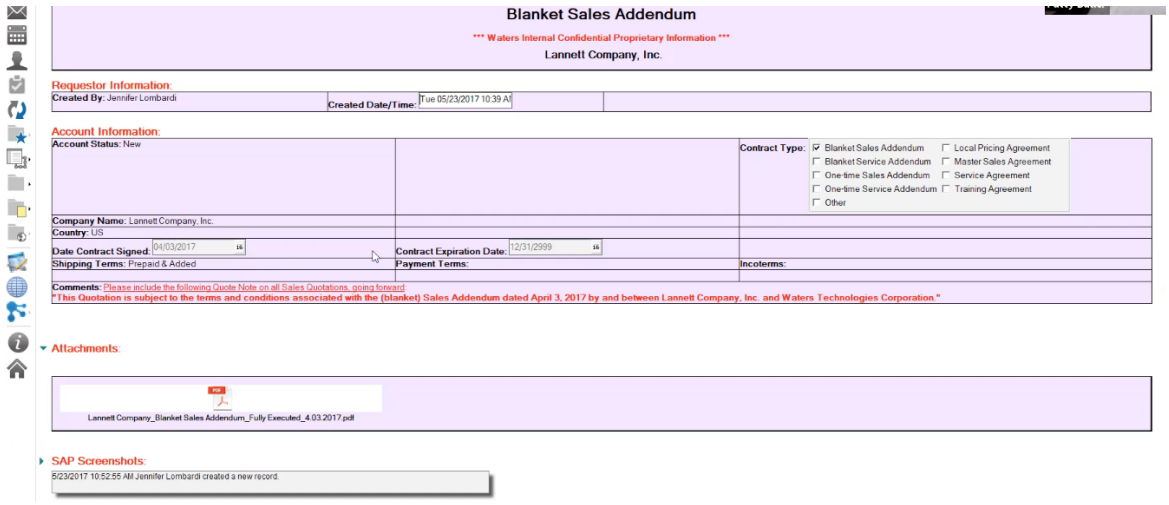

Figure 6: Blanket Sales Addendum

The addendum database gathers sales and service addendums. At Waters, an addendum is a detailed description of changes that have been negotiated after the contract is published (Figure 7). The addendum forms part of the sales contract. It serves as an additional agreement when the customer wants to change the terms and conditions of the contract.

ADDENDUM

THIS ADDENDUM, (hereinafter "Addendum") by and between Waters Technologies Corporation (hereinafter "Waters") and Lannett Company, Inc., including any affiliates (minimum 50% majority-owned) (hereinafter "Buyer"), (both referred to as "Parties"), specifically alters, amends and revises the Waters General Sales Terms and Conditions (the "Waters Terms") in each Waters quotation attached hereto as Exhibit A and made a part of this Addendum ("Quotation"). Each Quotation shall specifically reference this Addendum.

WITNESSETH:

WHEREAS, Buyer and Waters are entering into the Addendum to amend the Waters Terms with respect to the Quotation, attached hereto as Exhibit A;

WHEREAS, the Parties desire to enter into this Addendum in order to give effect to the foregoing.

NOW THEREFORE, in consideration of the mutual promises set forth herein and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the Parties hereto hereby agree as follows:

1. Item 2. Taxes and Payment. In the third sentence, "shipment" shall be deleted and replaced with "receipt of invoice".

2. Item 2. Taxes and Payment. The fourth sentence shall be deleted in its entirety and replaced with the following;

   "An interest charge equal to 1% per month (12% per year) will be added to quotations outstanding beyond 30 days after payment due date."

3. Item 7. Waters Right of Possession. This section shall be deleted in its entirety and replaced with "Intentionally Omitted".

4. Item 12. Governing Law. In the first sentence, "Commonwealth of Massachusetts" is replaced with "State of Delaware".

5. Item 14. Additional Terms and Conditions. This section shall be deleted in its entirety and replaced with the following:

Figure 7: Addendum

To make a shipment for the "direct customer order" requires a purchase order number, and a credit card number for payment.

2.4.2 Distribution Centers

Waters Corporation operates three distribution centers in the world: the Global Distribution Center (GDC) in Franklin, MA, the European Distribution Center (EDC) in the Netherlands, and the Asian Distribution Center (ADC) in Singapore. The Global Distribution Center is the largest and ships products from Massachusetts to the two other distribution centers. This distribution center was initially located in Milford, MA, and relocated in Franklin, MA, in October 2017 to meet the

growing needs of the company. The warehouse is over 56,000 square-foot and contains over 14,000 SKUS of different sizes in over 20,000 separate storage locations (Figure 8).

The GDC receives products five days a week from the manufacturing facilities in the US (Milford, MA) and in Europe (Wexford, Ireland and Wilmslow, UK) and from the contract manufacturer in Singapore. Once the products are received by the GDC, they are inspected and put on shelves, if they are not damaged and depending on their size, waiting for their future shipment (Figures 8&9). The safety stock of the warehouse decreased by 60% in 2021[1] and the planning in manufacturing slowed down due to the COVID pandemic while demand increased.

Figure 8: Global Distribution Center

[1] Personal communication from Waters Warehouse manager July 2021

Figure 9: HPLC Columns on shelves

2.4.3 Field service organization

The customer service department is not the only department that can submit an order. The field service team enters orders when a part installation on a system or a repair is required. The process starts when a customer encounters an issue with their product and calls Waters' experts center. If the customer's issue cannot be solved over the phone, the field service department dispatches a field service specialist to visit the customer and evaluate the issue. Once the specialist evaluates the issue, they will contact the field service support to order parts, which can be done via email, phone call, or online through Lotus Notes or Compass (part of Salesforce Compass System). After the order is placed and service is completed, the specialist writes a field service report to state what was taken from the inventory. They describe in the report whether this customer has a Waters service contract (which entitles them to a service that is covered), if the equipment is under

warranty, or if they are billable. If the customer is billable, the field service logistics group will process the order in SAP and send an invoice to the customer.

When the field engineers order any parts for customers, the logistics group creates the order in SAP, and GDC ships out the order. At this point, the order looks almost exactly the same as other orders placed by the customer service team. The exception is that it is created by a field specialist, and it is considered as a replacement order, and does not require a purchase order number. Waters calls it a "pre-customer order" because they are not dealing directly with the customer. 80% of the time, the customer has a Waters service contract, meaning the field service is covered under their warranty. Then the order is entered as an overnight priority, where GDC uses next-day FedEx priority delivery shipped out at 10:30 p.m. Freight costs are absorbed through the global distribution center's budget.

The field service organization does not place direct orders as the orders are placed by the field specialists. The field service specialists are mainly the customers of the field service organization, but also Waters' employees, so they are not charged for freight. The service specialist does not decide whether or not freight is charged to the customer. The contracts department negotiates the agreements and contract terms. Thus, the field service never enters information in Lotus Notes / Waters service plans. Therefore, no mistake can happen in terms of freight cost during this process.

2.4.4 Relationships between the departments

The sales team initiates the quote through Customer Relationship Management (CRM) for the customer service department. The customer service department deals with presales and quotes while also entering orders into the systems. The field service team works very closely with the

customer service group. The field service organization is also working closely with the global distribution center.

2.5 Waters Customer Master Data

2.5.1 SAP

SAP was founded in 1972 and headquartered in Walldorf, Germany, and was initially named System Analysis Program Development, which was later abbreviated to SAP. SAP is one of the world's leading producers of software for the management of business processes, developing solutions that facilitate effective data processing and information flow across organizations. SAP offers Enterprise Resource Planning (ERP) solutions, which include programs in different business areas, such as procurement, production, materials management, sales, marketing, finance, and human resources. SAP can be used from a specific location or directly from the cloud. SAP helps companies to design their value chain, create forecast and better understand customers' needs by linking operational data on business processes with experience data based on purchase experience or customer feedback for example. SAP software allows companies to better manage their multiple business processes by centralization data management. Therefore, employees can access information from each department. SAP also prevents data duplication which can lead to errors and generates a cost due to storage. Hence, businesses can improve operational efficiency, strengthen customer experiences, and increase productivity and profits. SAP has more than 230 million cloud users, more than 100 solutions covering all business areas, and the largest cloud portfolio compared to other cloud vendors such as Microsoft, Amazon, Salesforce and IBM [11].

Widely used in Waters DCs, the SAP Warehouse Management System (WMS) allows product tracking and stock management. The warehouse system can handle logistical processes efficiently and on schedule. Some general SAP functions include:

- Order creation and verification
- Shipping label generation
- Billing information
- Invoice generation
- Customer master data storage
- Receiving order information quoted on Salesforce

SAP is Waters' financial system and stores every order, invoice, and shipping cost. SAP is downstream of Salesforce and Lotus Notes, as Salesforce feeds SAP with information. There is not a direct feed of information from Lotus Notes to SAP. Rather, Lotus Notes is a static database containing strategic accounts and contracts and is used as a reference when the order entry team creates orders and needs to confirm contract terms.

Central Management Server (CMS)

CMS functions as an interface between content servers and the SAP system. The CMS system database is maintained by the Central Management Server (CMS) and stores the following information:

- User
- Server
- Document
- Configuration

- Authentication [12].

Due to the versatility of SAP, Waters' GDC combines SAP with CMS to centrally manage domestic and international shipments by different carriers.

2.5.2 Salesforce

Founded in 1999, Salesforce is the global leader in Customer Relationship Management (CRM), bringing companies closer to their customer. Salesforce enables companies of multiple sizes and industries to rely on technologies such as cloud, mobile, social internet of things, artificial intelligence, voice and blockchain, to create a full picture of their customers [13].

2.5.3 IBM Notes (formerly Lotus Notes)

IBM Notes, formerly Lotus Notes, is a cooperative client-server software platform. Lotus Notes is the client part of the software platform, while Lotus Domino is the server. IBM Notes is a desktop workflow application providing instant messaging, email, calendars, blogs, personnel directory and forums to organizations [14]. In 2018, IBM Notes got acquired by HLC and became HLC notes. HCL Notes is an email client software. It provides teams with access to email, calendar, and contact management capabilities, and enables a business to integrate social collaboration, messaging, and business applications into a single workspace through Notes. In addition to these functions, Domino Designer and other tools can be used for request approval, workflow and document management [15].

At Waters, all customers' strategic accounts and global contract databases are stored in Lotus Notes. Waters is implementing Compass from Salesforce to replace Lotus Notes as the Customer Relation Management. Lotus Notes is more manual and not as user-friendly as Salesforce which

has much more capability. The sales organization has already transitioned to Salesforce. The field service is still using Lotus Notes but will transition to Salesforce in the near future. However, this is a recent process which started mid-June. The open records that were in Lotus Notes for the US and Europe were migrated from Lotus Notes to Salesforce.

2.5.4 Transition to Salesforce

Waters transitioned from SAP CRM to Salesforce in 2019 to build stronger customer relationships, provide superior service and scale its offerings internationally. Due to the nature of products and services offered, more than half of Waters' employees are in sales and service department, and work closely with customers to establish, calibrate, and deploy technologies in labs worldwide. Therefore, to ensure the products and services reach customers' hands, Waters needed a cloud-based Customer Relationship Management (CRM) to strengthen collaboration globally and scale across offices in 35 countries and 14 manufacturing facilities. Using Salesforce, Waters' employees obtain insights and recommendations based on previously closed contracts and buying trends to better adjust offerings to customers and reduce sales cycles. Salesforce enables employees to better know their customers, to understand their needs and to meet their expectations. Sales representatives are now able to focus more on interacting with customers rather than spending time dealing with their CRM. The adoption of Salesforce was part of Waters' customer-centric culture [16].

2.5.5 Information flow

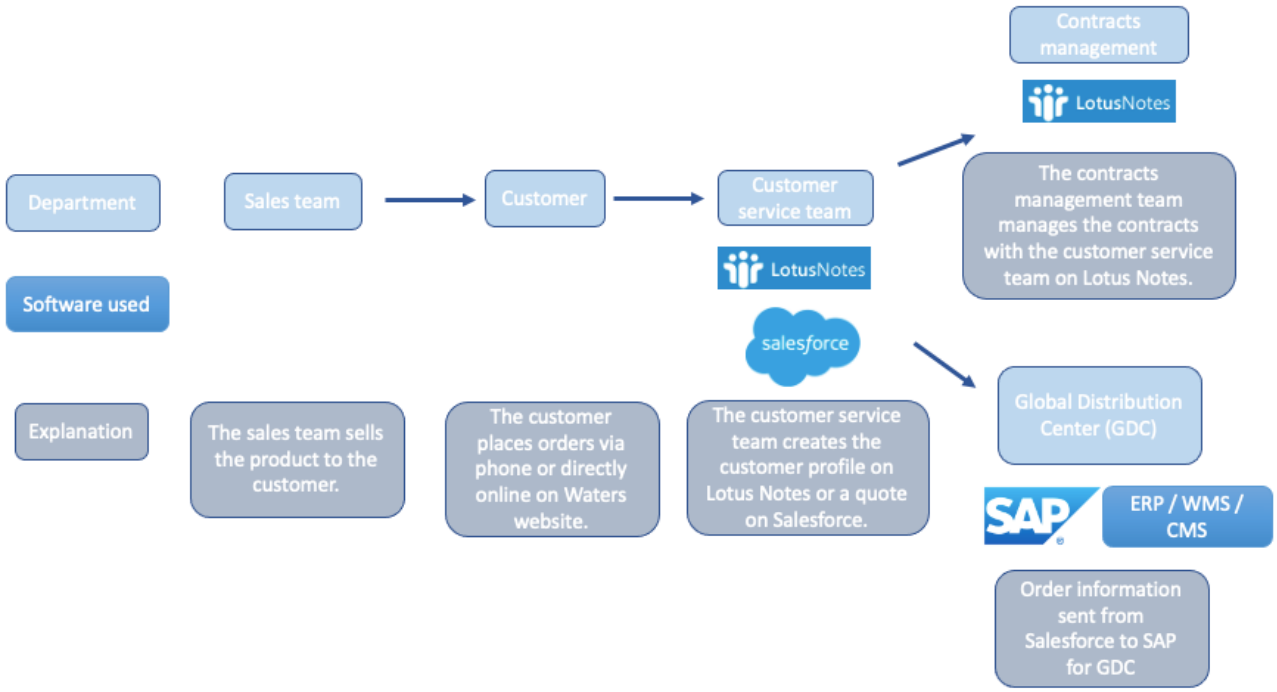

Figure 10: Value stream map of information flow

2.6 Incoterms

When a new contract is negotiated, Incoterms are defined. The International Chamber of Commerce (ICC) was created in 1919 to facilitate international trade. Therefore, ICC published the first Incoterms® rules in 1936 to standardize trade practices around the world. These rules have been updated and developed since then. "Incoterms®" is an acronym standing for international commercial terms and is a trademark of the ICC. Unlike national trade arrangements, Incoterms® regulations are industry standards, fostering clarity and consistency in business. They are the most widely used terms of commerce for the sale of goods around the world. Incoterms® rules specify the obligations of sellers and buyers and smooth the process by stating who is responsible for each step of the transaction. They provide guidance in terms of purchase order

fulfillment, shipment packaging and labeling for freight transport, or preparation of an origin certificate at a port [17] Incoterms part I indicates who is responsible for the product when it leaves the warehouse until it reaches its destination, while Incoterms part II indicates who pays for freight.

2.6.1 Incoterms Part I

For INCO Terms I, the options are CIP, DST, FSP and Local Terms Apply. For the US, Waters only uses FSP or DST.

CIP (Carriage and Insurance Paid) means that the seller is paying for freight and insurance to deliver products at a specified location and to an appointed party. The seller assumes all risk until the products reach the first carrier, then the buyer is responsible for all risks until the place of destination.

DST (Destination based) means that title and risk of loss does not pass until delivered to the customer. Therefore, the seller is responsible for all risks until the customer destination.

FSP (Free on Board Shipping Point) means that the customer is paying for freight once the product leaves the warehouse. The seller is no longer responsible for the product when leaving the shipping dock.

2.6.2 Incoterms Part II

- *Absorbed:* This is a general term describing the situation in which Waters pays for freight charges and the customer does not pay for freight.
- *Absorbed Contracts:* The customer does not pay for the freight because it is written in its contract or the addendum.
- *Absorbed Other:* The freight charge is absorbed due to other reasons.

- *Absorbed Sales:* The freight charge is included in the sales. Therefore, the customers do not need to pay twice.
- *Absorbed Service:* The order is created by a field service team member as a replacement for an existing product. Usually, Waters does not charge for shipping the replacement. The shipping cost is absorbed by the Global Distribution Center.
- *Collect:* The customer is not charged by Waters for freight because the freight charge will get charged to their collection number and the customer will pay directly to the carrier.
- *Freight Included to Destination:* The customer is paying for freight.
- *Prepaid & Added (also indicated by **, ***, ****):* Waters prepays the freight charges and adds them to the invoice. Every region is different regarding how freight charges are added to the invoice. In Europe, it is automated based on the order reason selected on the quote or the carrier on the order if no quote is done. If automated freight does not pull in or the customer needs a customer freight amount, it can be manually added. In the US, the standard conditions are entered into SAP and then, the order entry might adjust them.

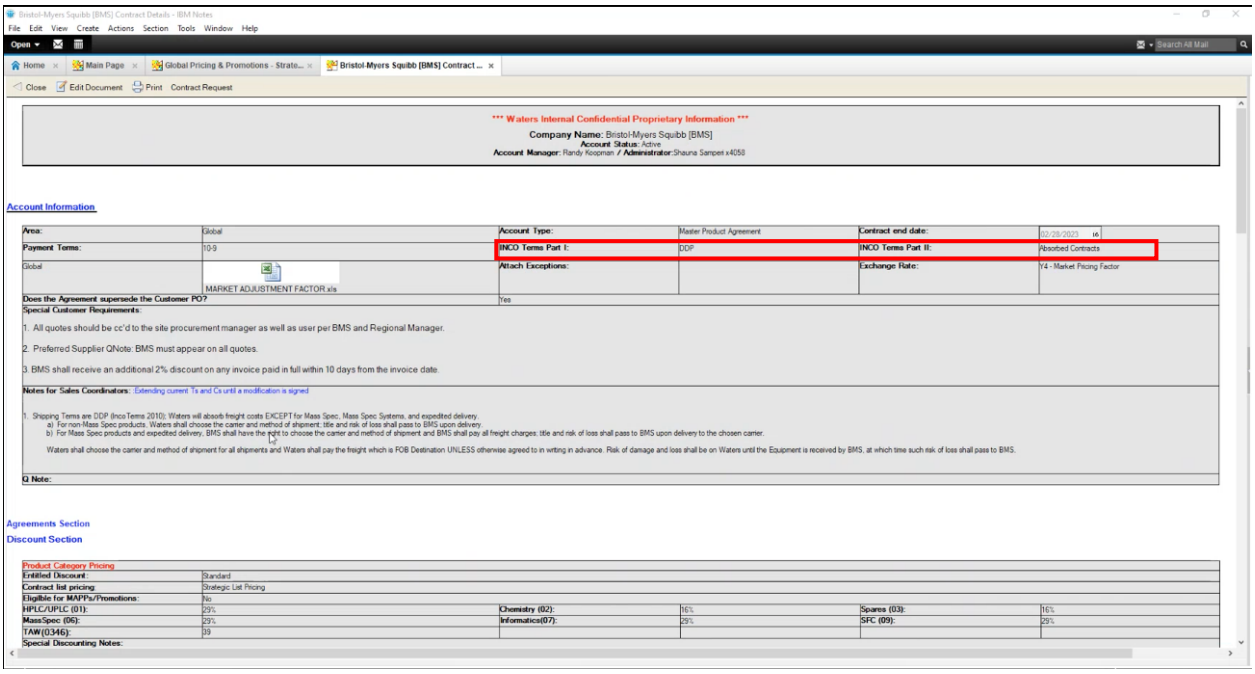

Figure 11: Contract Details – INCO Terms

Chapter 3

Freight current problems

3.1 Misalignments between Lotus Notes and SAP

Some employees at Waters are currently working on a freight savings project, as the company realized that they were wasting a lot of money due to misalignments between Lotus Notes and SAP. The company is absorbing freight for some customers, for which they should not according to the contract terms defined with these customers. This issue is particularly significant as Waters is transitioning from SAP CRM to Salesforce. Therefore, identifying the misalignments and correcting them before transferring the data to Salesforce is a priority. As we saw in Chapter 2 Section 2.5, Lotus Notes is used to store and manage contract terms and customer profiles, while SAP CRM is used at the GDC to prepare deliveries. Waters is also transitioning from Lotus Notes to Outlook for contract management. However, hundreds of data records (strategic accounts and contracts) remain and wait for approval to migrate to Salesforce.

To identify any potential errors between Lotus Notes and SAP, we compared the two databases. We obtained a sample of 71 customers from Lotus Notes. From the sample, we excluded 17 customers because Waters does not do business with them in Europe. We analyzed the 54 customers with which Waters is doing business globally as our analysis focused on European customers and contracts. We found 12 instances of a misalignment between Lotus Notes and SAP (these 12 instances correspond to 10 different customers, because 2 of them belong to the same parent company) (Table 3). According to the contract terms in Lotus Notes, the customers should

pay for freight; however, we found in SAP that in these instances the freight charges were being absorbed depending on the region. To go further with our analysis, we reviewed the contract terms in Lotus Notes (Table 2). In fact, some agreements exist between Waters and a customer for a specific country or region. If the contract terms do not mention an agreement on the freight charges between the customer and Waters, we assumed that the customer should pay for freight, and this mistake should be corrected in SAP (Figure 12). We were then able to calculate any potential savings by analyzing the orders placed by the customer, and, then calculating the corresponding shipping cost depending on the size of the products, the country where it is shipped, and the currency (Chapter 4).

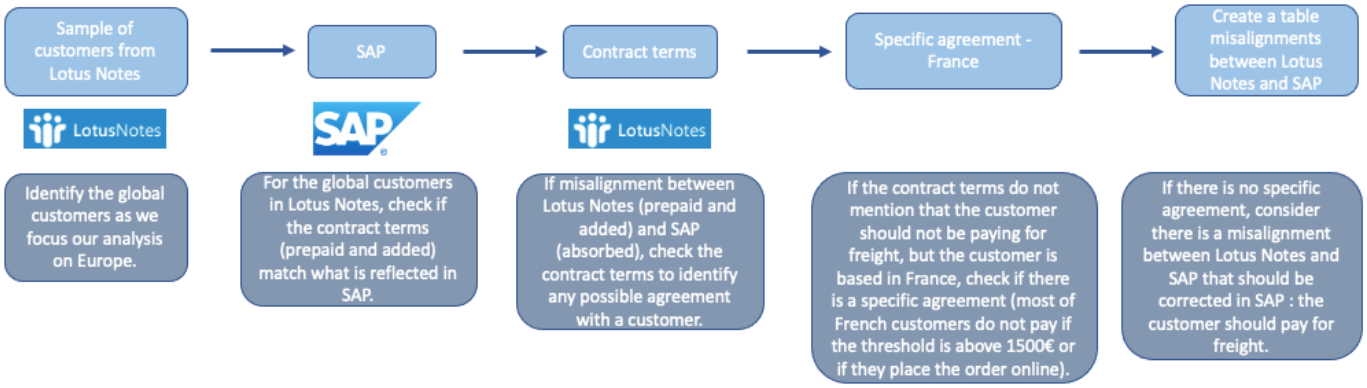

Figure 12: Methodology

Table 2: Contract Terms in Lotus Notes for customers that should pay for freight in Lotus Notes and are absorbed in SAP

Name	Description of Findings	INCO Terms Part I:	INCO Terms Part II:
Company A	**Notes for Sales Coordinators**: In addition to the global contract we have an agreement for Germany (since more that 15 years now) that they do not have to pay any freight charges in Germany. **Also Note: Shipping Terms** are DST because Waters has agreed to procure insurance on behalf of Company A and will work with the carrier for any claims. Sec 2. Delivery Terms: **3.3 Delivery Terms Company A SSA document**:	DST	PREPAID & ADDED

	3.3 Delivery Terms: Delivery Terms will be FOB Waters Shipping Point with Company A paying all applicable shipping charges, which shall include inland freight, airfreight, taxes, licenses, etc. Waters will procure insurance on behalf of Company A to cover the risk of any damaged or lost goods during transit and will facilitate delivery of replacement products as soon as possible after notification of the loss and will coordinate any freight claims with the insurer.		
Company B	As per fully endorsed Company B Discount Agreement states: Delivery: Delivery terms will be DDP, Company B premises, Incoterms 2010 or as otherwise identified on a Waters Quotation issued by an authorized Waters representative. Title and risk of loss shall pass to Company B at delivery to Company B premises. Company B will be responsible for payment of all applicable shipping charges, including, but not limited to, taxes, inland freight, airfreight, insurance, plus any additional and applicable charges, depending on country and product(s) shipped, which shall be prepaid by Waters and added to the applicable Waters Quotation. **As per the IBM Notes**: Requesting approval for purposes of this Discount Agreement received today from Company B. Approval for applicable discounts and DDP payments terms requested for this 3 year term Agreement with option to extend further. Includes 30 day opt out for both parties. Pricing at local list with MAF/USD Zone factor applicable to global accounts, dependent upon currency utilized for payment. Waters standard terms and warranties apply. Pricing and Discounts to be effective within 14 days of today's date = October 28, 2019. Delivery: **Discount Agreement dated July 1st, 2019: Delivery terms will be DDP, Company B premises, Incoterms 2010 or as otherwise identified** on a Waters Quotation issued by an authorized Waters representative. Title and risk of loss shall pass to Company B at delivery to Company B premises. Company B will be responsible for payment of all applicable shipping charges, including, but not limited to, taxes, inland freight, airfreight, insurance, plus any additional and applicable charges, depending on country and product(s) shipped, which shall be prepaid by Waters and added to the applicable Waters Quotation.	DDP	PREPAID & ADDED
Company C	Discount Agreement of 2018 states: Delivery terms will be FOB shipping point or otherwise identified on a Waters Quotation issued by a Waters authorized representative. Identification of the products shall occur when they leave Waters' distribution center at which time title and risk of loss shall pass to Customer. Customer will pay all shipping charges, including, but not limited to, taxes, inland freight, airfreight, insurance, plus any additional and applicable charges, depending on country and product(s) shipped.	FSP	
Company D	No Transportation data nor language found in IBM Notes except for INCO: FSP	FSP	
Company E	No Transportation data nor language found in IBM Notes except for INCO: FSP	FSP	

Company F	Special Customer Requirements: Switzerland: Swiss operations payment terms shall continue to be "0 net 60" and shipping terms shall continue according to Incoterm DDU (Delivery Duty Unpaid -Not Cleared) / Absorbed Freight – as is the current practice between Waters Switzerland and Company F. Company F **INDIA** does NOT follow the Global Contract- they have separate Local Agreements- **INCO TERMS: GLOBAL PURCHASING PROGRAM 11.01.2006 :** DELIVERY AND PAYMENT TERMS: Waters payment terms for all purchases are Net 30 days from date of shipment, unless otherwise expressly agreed to in writing by the parties. Delivery terms shall be Waters shipping point. Identification of the products shall occur when they leave Waters shipping point at which time title and risk of loss shall pass to Company F. Notwithstanding the foregoing, the parties acknowledge and agree that for Swiss operations, payment terms shall continue to be "0 net 60" and shipping terms shall continue according to Incoterm DDU (Delivery Duty Unpaid Not Cleared) as is the current practice between Waters Switzerland and Company F. 5 – Company F will pay all shipping charges, which shall include inland freight, airfreight, insurance plus any additional and applicable charges from the following list, depending on country and product(s) shipped. Taxes Value-Added Taxes Hazardous fees Handling and forwarding Import licenses Customs Clearance Import duties Consular or Legalization fees Certificates of Origin or other certificates Demurrage fees Waters will make reasonable commercial efforts to ship the Goods or provide the Services hereunder in accordance with the delivery date set forth on the Quotation provided, that Waters accepts no liability for any losses or for general, special or consequential damages arising out of delays in delivery.	FSP	
Company G	INCO 1 FSP/INCO 2 PREPAID & ADDED. INCO TERMS. **DISCOUNT AGREEMENT DATED 07/01/2018.** **APPENDIX 2. GLOBAL DISCOUNT PRICING**. Unless otherwise agreed in writing, discount pricing Is based on delivery terms DDP or OAP (INCOTERMS 2010). The time of delivery and delivery address are to be specified in each Purchase Order.	FSP	PREPAID & ADDED
Company H	Contract Terminated	50	
Company I	Company I Orders are originally Net90 and eligible for a 2% additional discount – For ROW Pricing to pull in Price Group NB needs to be added to the order/quote header for this pricing to pull in 3rd Party agreement with Company I is Net 45	FOB SHIPPING POINT	PREPAID & ADDED

Company J	**Notes for Sales Coordinators**: Waters has agreed with Company J to hold 2020 global pricing for them through December 31, 2021. Discount levels will remain the same so net pricing will not change for them. Company J uses the Global Price List and MAF. SAP is set up to reflect this. **INCO TERMS: WATERS ACCESS NETWORK AGREEMENT DATED 03/12/2018 ARTICLE 5- DELIVERY, DELA VS AND INSPECTION** 5.1. Delivery Delivery terms will be CIP (Carriage and Insurance Paid to Supplier Distribution Centre (Incoterms 2010) or as otherwise stated on a Supplier quotation issued by an authorized Supplier representative. Identification of the products shall occur when they leave Suppliers distribution center at which time title and risk of loss shall pass to Company J. Company J will pay all shipping charges, including, but not limited to, taxes, inland freight, airfreight, insurance, plus any additional and applicable charges, depending on country and product(s) shipped.	CIP	PREPAID & ADDED

Even if maintaining the customer master base seems to be the main issue currently encountered, the customer service team is also facing issues identifying customers that are part of the same company and appear under different names on Salesforce. Those customers should be part of the same contract; therefore, the same terms should be applied when charging for freights. The team must ensure if customers are part of the same company by checking the customer number in Salesforce. For example, for Company I, the contract terms should apply to all the subsidiaries of the company. In SAP, we had the different customer names (or each subsidiary of the company) depending on the country, while for Lotus Notes, we had the incoterms associated with the company. The 10 companies from Lotus Notes represents in fact 394 customers in SAP (Table 3).

Table 3: Misalignments between Lotus Notes (Prepaid and Added) and SAP (Absorbed)

From Lotus Notes	**From SAP**		
Company	Sales organization	Customer number	Incoterms (Part 2)
Company A	FR01	0000116549	Absorbed
Company B	FR01	0000111785	Absorbed
	DA01	0000107769	Absorbed
	DA01	0000108120	Absorbed
	DA01	0000108121	Absorbed

	DA01	0000108169	Absorbed
	DA01	0000108170	Absorbed
	SP01	0000275068	Absorbed
Company C	UK01	0000208021	Absorbed
	UK01	0000208027	Absorbed
	UK01	0000208028	Absorbed
	UK01	0000208029	Absorbed
Company D	FR01	0000115502	Absorbed
	FR01	0000115518	Absorbed
	FR01	0000142699	Absorbed
	FR01	0000194435	Absorbed
	FR01	0000751752	Absorbed
	FR01	0000816580	Absorbed
Company E+A21:A95	FR01	0000117280	Absorbed
Company G	DA01	0000108129	Absorbed
	DA01	0000108130	Absorbed
	DA01	0000108131	Absorbed
	DA01	0000108132	Absorbed
	DA01	0000108133	Absorbed
	DA01	0000108134	Absorbed
	DA01	0000108135	Absorbed
	DA01	0000108136	Absorbed
	DA01	0000108137	Absorbed
	DA01	0000108138	Absorbed
	DA01	0000108139	Absorbed
	DA01	0000108140	Absorbed
	DA01	0000108141	Absorbed
	DA01	0000108142	Absorbed
	DA01	0000108262	Absorbed Sales
	DA01	0000108269	Absorbed
	DA01	0000118238	Absorbed
	DA01	0000190164	Absorbed
	DA01	0000192782	Absorbed
	DA01	0000192792	Absorbed
	DA01	0000192852	Absorbed
	DA01	0000192869	Absorbed
	DA01	0000193286	Absorbed
	DA01	0000193703	Absorbed

	DA01	0000193704	Absorbed
	DA01	0000194230	Absorbed
	DA01	0000194238	Absorbed
	DA01	0000194972	Absorbed
	DA01	0000195533	Absorbed
	DA01	0000195804	Absorbed
	DA01	0000195851	Absorbed
	DA01	0000201155	Absorbed
	DA01	0000202001	Absorbed
	DA01	0000203575	Absorbed
	DA01	0000204173	Absorbed
	DA01	0000204809	Absorbed
	DA01	0000205272	Absorbed
	DA01	0000205526	Absorbed
	DA01	0000206454	Absorbed
	DA01	0000208285	Absorbed
	DA01	0000208296	Absorbed
	DA01	0000208339	Absorbed
	DA01	0000208552	Absorbed
	DA01	0000209349	Absorbed
	DA01	0000209959	Absorbed
	DA01	0000209960	Absorbed
	DA01	0000209961	Absorbed
	DA01	0000215596	Absorbed
	DA01	0000217364	Absorbed
	DA01	0000235955	Absorbed
	DA01	0000235956	Absorbed
	DA01	0000235961	Absorbed
	DA01	0000235962	Absorbed
	DA01	0000235963	Absorbed
	DA01	0000235964	Absorbed
	DA01	0000235965	Absorbed
	DA01	0000235966	Absorbed
	DA01	0000235967	Absorbed
	DA01	0000235968	Absorbed
	DA01	0000235969	Absorbed
	DA01	0000235970	Absorbed
	DA01	0000243512	Absorbed
	DA01	0000716851	Absorbed

	DA01	0000716922	Absorbed
	DA01	0000717138	Absorbed
	DA01	0000729109	Absorbed
	DA01	0000729448	Absorbed
	DA01	0000731704	Absorbed
	DA01	0000738399	Absorbed
	DA01	0000739010	Absorbed
	DA01	0000746805	Absorbed
	DA01	0000748115	Absorbed
	DA01	0000750230	Absorbed
	DA01	0000750493	Absorbed
Company H	FR01	0000116108	Absorbed
Company I	FR01	0000115860	Absorbed
	FR01	0000116116	Absorbed
	FR01	0000116340	Absorbed
	FR01	0000116343	Absorbed
	FR01	0000116676	Absorbed
	FR01	0000116678	Absorbed
	FR01	0000116717	Absorbed
	FR01	0000116791	Absorbed
	FR01	0000116880	Absorbed
	FR01	0000116920	Absorbed
	FR01	0000116923	Absorbed
	FR01	0000116947	Absorbed
	FR01	0000116950	Absorbed
	FR01	0000116961	Absorbed
	FR01	0000116979	Absorbed
	FR01	0000116982	Absorbed
	FR01	0000117323	Absorbed
	FR01	0000117331	Absorbed
	FR01	0000117337	Absorbed
	FR01	0000117341	Absorbed
	FR01	0000118071	Absorbed
	FR01	0000118294	Absorbed
	FR01	0000188294	Absorbed
	FR01	0000190448	Absorbed
	FR01	0000194236	Absorbed
	FR01	0000756906	Absorbed
	FR01	0001004017	Absorbed

	GE01	0000116880	Absorbed
	GE01	0000116961	Absorbed
Company J	FR01	0000112181	Absorbed
	FR01	0000115931	Absorbed
	FR01	0000115951	Absorbed
	FR01	0000193411	Absorbed
	FR01	0000212167	Absorbed
	FR01	0000213705	Absorbed
	FR01	0000267422	Absorbed
	GE01	0000120890	Absorbed
	GE01	0000122917	Absorbed
	GE01	0000122918	Absorbed
	GE01	0000122921	Absorbed
	GE01	0000124466	Absorbed
	GE01	0000125317	Absorbed
	GE01	0000125318	Absorbed
	GE01	0000192298	Absorbed
	GE01	0000198649	Absorbed
	GE01	0000226007	Absorbed
	GE01	0000263706	Absorbed
	GE01	0000282715	Absorbed
	BE01	0000101206	Absorbed
	BE01	0000101491	Absorbed
	BE01	0000101505	Absorbed
	BE01	0000101555	Absorbed
	BE01	0000118308	Absorbed
	BE01	0000204312	Absorbed
	BE01	0000229365	Absorbed
	BE01	0000717434	Absorbed
	BE01	0001021219	Absorbed

This table was created after analyzing the contract terms for each company. In Lotus Notes, we found that companies A, B, C, D, E, F, G, H and I should pay for freight, except for Company A in Germany and Company F in Switzerland for which there are specific agreements (Table 2). We did not include in the table above Company A in Germany and Company F in Switzerland because there were no misalignments between their contracts and SAP (they should be absorbed). In SAP,

the customers for companies A, B, C, D, E, F, G, H, I and J were absorbed. If the Incoterms part 2 in Lotus Notes were “prepaid and added”, we considered that this was a mistake in SAP and should be corrected.

Color code for customer number:

Red: the customer should be paying for freight according to the contracts in Lotus Notes (there is therefore a mistake that should be corrected in SAP). This represents 145 customers. These customers did not place orders between January and May 2021. Therefore, we did not focus on them to estimate savings in Chapter 4.

Yellow: These customers (5 in total) should be in red too because there is a misalignment between Lotus Notes and SAP that should be corrected in SAP. They placed orders between January and May 2021 and did not pay for freight while they should have according to their contracts. Therefore, these customers constitute our sample to estimate savings in Chapter 4 (except for customer 0000101505 in clear yellow in Belgium that paid for freight (Table 4) while it is absorbed in SAP – therefore, the mistake might have already been corrected for this customer).

Therefore, the total number of customers that should pay for freight are 150 (red + yellow). Among the 394 customers studied, this represents 38% of misalignments between Lotus Notes and SAP.

For the 6 customers in yellow and yellow clear, Table 4 presents the orders placed by these customers between January and May 2021 and the freight cost charged for each order.

Table 4: Orders placed by absorbed customers in SAP between January and May 2021

Company	Customer number	Country	Document#	Created on	Item Net Value	Freight cost	Curr
Company B	275068	SP	316036728	18/03/2021	590,8	0	EUR
	275068	SP	316038391	18/05/2021	17,25	0	EUR
	275068	SP	316038391	18/05/2021	344	0	EUR
	275068	SP	316038677	27/05/2021	3 159,00	0	EUR
	275068	SP	316038677	27/05/2021	0	0	EUR
Company H	116108	FR	306066936	20/01/2021	1 326,20	0	EUR
	116108	FR	306066936	20/01/2021	663,1	0	EUR
	116108	FR	306067557	01/02/2021	644,65	30	EUR
	116108	FR	306067557	01/02/2021	0	0	EUR
	116108	FR	306067557	01/02/2021	810,35	0	EUR
	116108	FR	306067557	01/02/2021	0	0	EUR
	116108	FR	306068048	10/02/2021	172,29	30	EUR
	116108	FR	306068048	10/02/2021	142,29	0	EUR
	116108	FR	306068049	10/02/2021	1 878,60	0	EUR
	116108	FR	306068049	10/02/2021	316,2	0	EUR
	116108	FR	306068049	10/02/2021	1 878,60	0	EUR
	116108	FR	306068049	10/02/2021	316,2	0	EUR
	116108	FR	306068050	10/02/2021	2 282,85	0	EUR
	116108	FR	306068050	10/02/2021	0	0	EUR
	116108	FR	306068169	12/02/2021	1 719,50	0	EUR
	116108	FR	306068169	12/02/2021	0	0	EUR
	116108	FR	306068169	12/02/2021	760,95	0	EUR
	116108	FR	306068169	12/02/2021	0	0	EUR
	116108	FR	306068169	12/02/2021	1 288,20	0	EUR
	116108	FR	306068169	12/02/2021	0	0	EUR
	116108	FR	306068451	17/02/2021	45,57	0	EUR
	116108	FR	306068514	18/02/2021	45,57	0	EUR
	116108	FR	306068514	18/02/2021	91,14	0	EUR
	116108	FR	306068514	18/02/2021	91,14	0	EUR
	116108	FR	306068580	19/02/2021	45,57	0	EUR
	116108	FR	306068630	22/02/2021	45,57	0	EUR
	116108	FR	306068854	25/02/2021	93	0	EUR
	116108	FR	306068854	25/02/2021	93	0	EUR
	116108	FR	306068975	26/02/2021	98,58	0	EUR
	116108	FR	306068975	26/02/2021	98,58	0	EUR

	116108	FR	306069570	10/03/2021	2 578,30	0	EUR
	116108	FR	306069570	10/03/2021	0	0	EUR
	116108	FR	306069641	11/03/2021	1 153,20	0	EUR
	116108	FR	306069936	17/03/2021	1 413,60	0	EUR
	116108	FR	306070949	01/04/2021	104,4	30	EUR
	116108	FR	306070949	01/04/2021	803,52	0	EUR
	116108	FR	306071100	03/04/2021	1 229,30	0	EUR
	116108	FR	306071100	03/04/2021	0	0	EUR
	116108	FR	306071100	03/04/2021	1 521,90	0	EUR
	116108	FR	306071100	03/04/2021	0	0	EUR
	116108	FR	306071155	07/04/2021	1 229,30	0	EUR
	116108	FR	306071155	07/04/2021	0	0	EUR
	116108	FR	306071405	13/04/2021	1 337,60	0	EUR
	116108	FR	306071405	13/04/2021	0	0	EUR
	116108	FR	306071771	21/04/2021	781,2	0	EUR
	116108	FR	306071771	21/04/2021	550,56	0	EUR
	116108	FR	306072588	06/05/2021	718,2	0	EUR
	116108	FR	306072588	06/05/2021	0	0	EUR
	116108	FR	306072588	06/05/2021	810,35	0	EUR
	116108	FR	306072588	06/05/2021	0	0	EUR
	116108	FR	306072588	06/05/2021	585,2	0	EUR
	116108	FR	306072588	06/05/2021	0	0	EUR
	116108	FR	306072748	11/05/2021	644,1	0	EUR
	116108	FR	306072748	11/05/2021	0	0	EUR
	116108	FR	306072748	11/05/2021	614,65	0	EUR
	116108	FR	306072748	11/05/2021	0	0	EUR
Company G	0000108129	DA	0304037098	05/05/2021	5 892,00	0	DKK
	0000108129	DA	0304037150	05/06/2021	41 664,00	0	DKK
	0000108129	DA	0304037150	05/06/2021	474 123,00	0	DKK
Company I	116923	FR	306066193	05/01/2021	854,79	0	EUR
	116923	FR	306066633	14/01/2021	35 878,08	0	EUR
	116923	FR	306066633	14/01/2021	398,07	0	EUR
	116923	FR	306066633	14/01/2021	2 252,20	0	EUR
	116923	FR	306066830	19/01/2021	1 189,50	0	EUR
	116923	FR	306068183	12/02/2021	686,12	0	EUR
	116923	FR	306068183	11/02/2021	0	50	EUR
	116923	FR	306068183	12/02/2021	0	0	EUR
	116923	FR	306068183	11/02/2021	0	0	EUR
	267422	FR	306069291	04/03/2021	1 952,80	0	EUR

	267422	FR	306069291	04/03/2021	0	0	EUR
	267422	FR	306069291	04/03/2021	0	0	EUR
Company J	101505	BE	302047955	08/01/2021	1 719,60	30	EUR
	101505	BE	302047955	08/01/2021	0	0	EUR
	101505	BE	302047955	08/01/2021	604,8	0	EUR
	101505	BE	302047955	08/01/2021	0	0	EUR

For Company H, the contract was terminated. Customer 116108 paid freight for 3 orders placed (in red Table 4) in February and April but did not pay freight for the 14 other orders placed. Customer 116923 from Company I also paid the shipping cost for one order in February (Table 4) and did not pay the shipping cost for orders placed in January. Therefore, we considered that these are mistakes, and the customers should have been charged for freight for their other orders (Chapter 4).

However, it is crucial to note that 3 customers in the table 4 above are based in France. In France, a lot of exclusions for customers exist. Historically, customers in France did not pay for freight. For the last 2 years, Waters did not charge for freight on online orders to waters.com for France, Spain, Portugal, and Italy to push customers to buy online. When Waters started its freight recovery program, the company wanted to stop offering free freight on waters.com. However, French customers complained and negotiated to continue benefiting from free freight. In the spreadsheet "Listing of specific freight ECOM and threshold if above 1500€ - FR01", we found that customer 116108 (Company H) is not supposed to be charged freight if their order is over 1500€ or if they place the order online (ECOM). Therefore, we removed all the orders above 1500€ for this customer. For orders below 1500€, we checked in the spreadsheet "Europe 2021 YTD F2 Invoices KL" if the PO type was ECOM. None of the orders placed by Patheon between January and May 2021 appear as online orders in this spreadsheet. In Table 5, we focused on the orders placed

between January and May 2021 by customers that belong to Company H to see if there are still misalignments for some orders considering the existing threshold.

Table 5: Comparison between the total net value per order for customer 116108 and the 1500€ threshold for which the customer does not pay freight

Customer number	Country	Document#	Order number	Created on	Item Net Value	Freight cost	Total net value per order	Curr
116108	FR	306066936		20/01/2021	1 326,20	0	1989,3	EUR
116108	FR	306066936		20/01/2021	663,1	0		EUR
116108	FR	306067557		01/02/2021	644,65	30	1455	EUR
116108	FR	306067557		01/02/2021	0	0		EUR
116108	FR	306067557		01/02/2021	810,35	0		EUR
116108	FR	306067557		01/02/2021	0	0		EUR
116108	FR	306068048		10/02/2021	172,29	30	314,58	EUR
116108	FR	306068048		10/02/2021	142,29	0		EUR
116108	FR	306068049		10/02/2021	1 878,60	0	4 389,60	EUR
116108	FR	306068049		10/02/2021	316,2	0		EUR
116108	FR	306068049		10/02/2021	1 878,60	0		EUR
116108	FR	306068049		10/02/2021	316,2	0		EUR
116108	FR	306068050		10/02/2021	2 282,85	0	2282,85	EUR
116108	FR	306068050		10/02/2021	0	0		EUR
116108	FR	306068169		12/02/2021	1 719,50	0	3 768,65	EUR
116108	FR	306068169		12/02/2021	0	0		EUR
116108	FR	306068169		12/02/2021	760,95	0		EUR
116108	FR	306068169		12/02/2021	0	0		EUR
116108	FR	306068169		12/02/2021	1 288,20	0		EUR
116108	FR	306068169		12/02/2021	0	0		EUR
116108	FR	306068451	16235525	17/02/2021	45,57	0	45,57	EUR
116108	FR	306068514	16235525	18/02/2021	45,57	0	227,85	EUR
116108	FR	306068514	16235525	18/02/2021	91,14	0		EUR
116108	FR	306068514	16235525	18/02/2021	91,14	0		EUR
116108	FR	306068580	16235525	19/02/2021	45,57	0	45,57	EUR
116108	FR	306068630	16235525	22/02/2021	45,57	0	45,57	EUR
116108	FR	306068854	16235525	25/02/2021	93	0	186	EUR
116108	FR	306068854	16235525	25/02/2021	93	0		EUR
116108	FR	306068975	16235525	26/02/2021	98,58	0	197,16	EUR
116108	FR	306068975	16235525	26/02/2021	98,58	0		EUR

116108	FR	306069570		10/03/2021	2 578,30	0	2 578,30	EUR
116108	FR	306069570		10/03/2021	0	0		EUR
116108	FR	306069641	16266291	11/03/2021	1 153,20	0	1 153,20	EUR
116108	FR	306069936	16266291	17/03/2021	1 413,60	0	1 413,60	EUR
116108	FR	306070949		01/04/2021	104,4	30	907,92	EUR
116108	FR	306070949		01/04/2021	803,52	0		EUR
116108	FR	306071100		03/04/2021	1 229,30	0	2 751,20	EUR
116108	FR	306071100		03/04/2021	0	0		EUR
116108	FR	306071100		03/04/2021	1 521,90	0		EUR
116108	FR	306071100		03/04/2021	0	0		EUR
116108	FR	306071155	16290983	07/04/2021	1 229,30	0	1 229,30	EUR
116108	FR	306071155	16290983	07/04/2021	0	0		EUR
116108	FR	306071405	16297555	13/04/2021	1 337,60	0	1 337,60	EUR
116108	FR	306071405	16297555	13/04/2021	0	0		EUR
116108	FR	306071771	16306228	21/04/2021	781,2	0	1331,76	EUR
116108	FR	306071771	16306228	21/04/2021	550,56	0		EUR
116108	FR	306072588		06/05/2021	718,2	0	2113,75	EUR
116108	FR	306072588		06/05/2021	0	0		EUR
116108	FR	306072588		06/05/2021	810,35	0		EUR
116108	FR	306072588		06/05/2021	0	0		EUR
116108	FR	306072588		06/05/2021	585,2	0		EUR
116108	FR	306072588		06/05/2021	0	0		EUR
116108	FR	306072748	16326574	11/05/2021	644,1	0	1258,75	EUR
116108	FR	306072748	16326574	11/05/2021	0	0		EUR
116108	FR	306072748	16326574	11/05/2021	614,65	0		EUR
116108	FR	306072748	16326574	11/05/2021	0	0		EUR

In this table, we calculated the net value for each order placed by Company H to compare it to the 1500€ threshold. In the order was above 1500€, there was no mistake, the customer should not pay for freight according to the agreement regarding the threshold. However, the customer should have been charged freight for orders under 1500€. Therefore, we will propose a corrected freight cost for these orders in Chapter 4.

We also found 2 companies for which local terms apply in Lotus Notes and that are absorbed in SAP: Company K and Company L. The contract terms say:

Table 6: Contract terms for Company K and Company L

Company	Description of Findings	INCO Terms Part I:	INCO Terms Part II:
Company K	Notes for Sales Coordinators: Approval for Net 45 Payment Terms for Americas 5.31.2019	LOCAL TERMS APPLY	LOCAL TERMS APPLY
Company L	No other transport language found on IBM Notes.	LOCAL TERMS APPLY	LOCAL TERMS APPLY

Therefore, those companies should also pay for freight while they are absorbed in SAP. We did not consider them for the rest of our analysis (Chapter 4) since we decided to focus on the customers for whom freight should be prepaid and added and were absorbed. As well, we delete from the table the orders for which customers 116923 and 101505 paid for freight.

3.2 Expedited shipments

In this section, we describe the process and the different departments that deal with expedited shipments.

3.2.1 Order Entry Team

The order entry team decides which shipping methods to use based on product availability and lead time. If there is an urgent request made, the order entry team will approve express shipping. Usually, exceptional demand is the reason why the order entry team switches to express shipping. The decision is then sent to the GDC. The GDC usually carries 4-6 weeks of safety stock. If manufacturing is on track, the order entry team only deals with large, unexpected orders. However, it has been different during the pandemic. The safety stock level is currently 40% of the level before pandemic. Therefore, the order entry department is more likely to issue express shipping during the pandemic.

3.2.2 GDC Logistics Pitfalls

In this part, we describe the shipping process at the GDC and the main problems leading to mistakes in shipping methods and unnecessary expedited shipments.

3.2.2.1 GDC Outbound Shipping Process

1. Deliveries are created from Sales Orders in SAP.
2. Once the deliveries are created, they are counted and sorted by the shipping method and placed into respective bins.
3. The Material Handlers take the deliveries, go to the locations specified and proceed to pick the materials required for each delivery. This process applies to all orders (equipment and consumables). If the material that is needed on the delivery is not found in the location specified on the delivery note, the Material Handler fills out a NIL (not in location) form and bring it to the Sr. Inventory Control Specialist to investigate. Once solved, the Sr. Inventory Control Specialist will inform the Material Handler of his findings.
4. When the Material Handler completes the preparation of the delivery, the Material Handler initials in the “Picked By field”.
5. Carts with completed deliveries are brought to the pack bench.
6. Once at the pack bench, the Material Handler proceeds to scan the barcode on the delivery note which represents the Transfer Order that will be verified as picked. This process is done through the Catamaran system which interfaces with SAP.
7. If a picking error is discovered, the Material Handler fills out a Picking Discrepancy form and brings it to the Sr. Inventory Control Specialist to investigate. Once solved, the Sr. Inventory Control Specialist will inform the Material Handler of his findings.

8. When the verification process is complete, an address label which has the Delivery number barcoded on it is printed and placed on the box.
9. The box then goes to the shipping station where it is processed through a system called CMS which interfaces with SAP.
10. The box is placed on the scale, the barcode on the address label is scanned. The information about the shipment is added on the CMS screen. The Material Handler selects the F2 key (meaning that the product has been shipped), the Tracking Labels are generated and placed on the box. The box is placed on a cart which when filled is brought to the dock area to be picked up by the assigned carrier.
11. The delivery is "Post Goods Issued" in the background on SAP which means that the customer is invoiced, and the order is removed from SAP.

From there, a FedEx designated truck based on products and locations brings the products to Expeditors. For shipping freight, it is based on what delivery service time the customers want and their preferred carrier. Some exceptions exist. For example, for shipments over 151 pounds, the customer is not paying for freight. As we saw in step 8, through CMS, a FedEx or UPS label is generated for domestic shipments. Then, CMS will send the information to FedEx that will charge the GDC on a weekly basis. The global distribution center likely incurs all the shipping costs.

3.2.2.2 Low inventory and unpredictability

For some parts there are shortages due to low inventory and caused by slow production. This situation happened at the end of June 2021 (Q2) because the pandemic caused a lot of shortages of 10 to 20 different, high value parts. When a part arrives and several orders are waiting for the same part, the priority is typically given to the most expensive orders, unless there are deals with

the customers. Moreover, the demand exceeded the forecast and since orders are not predictable, this is a source of stress for employees working at the warehouse. They also noticed that orders were shipped later than usual this year because they were waiting on parts generating additional expedited shipments to meet the deadlines.

3.2.2.3 Time constraints and the COVID pandemic

When the GDC does not get an order out in time, they absorb most of the freight costs as compensation for a late shipment, and to maintain good customer relations. A lot of additional costs are generated by time constraints. This problem is more prominent at the ends of quarters (last week of March, June, September, and December). Moreover, the end of the quarter usually coincides with holidays (i.e., 4th of July or Christmas). Many last-minute orders are placed because Waters offers customers discounts to bring in as much revenue before the quarter ends. Some orders are destination based (DST) which means that the customer should receive the product before the deadline while some orders must just leave the distribution center to count as part of Q2. The distribution center must ship these orders in a short amount of time, and therefore uses express shipping methods. Because of this time sensitivity, the team might switch from ground to air shipping. For example, at the end of June 2021 (Q2), there were several express international shipments, which were cost inefficient. The distribution centers in Europe and Asia needed those parts to fulfill the orders before the Q2 deadline. Furthermore, manufacturing production was behind in 2020-2021, especially during the first two weeks of the COVID pandemic, causing even more delayed orders. Employees were required to work overtime, which cost Waters for additional external resources. In the GDC and across the company, a lot of employees were furloughed, which slowed down operations in the company.

3.2.2.4 Incorrect shipping methods

Another issue which generates additional freight costs is that employees can ship the product with the incorrect shipping method. For example, sometimes overnight delivery is used unnecessarily while the product does not need to be at the customer's location for three or four days. Another example is for priority shipments in Massachusetts. Overnight shipping is not required as ground transportation will allow for next day delivery since the Global Distribution Center in located in Franklin, MA. This happens if people are not properly trained and use the most expensive shipping method while they could have used ground transportation. This can be due to errors in SAP or people reading the information incorrectly in SAP. There is a map indicating which shipping method to use depending on the shipping location. Workers are supposed to follow the map, but most workers do not[2]. Waters has trained some workers on choosing the appropriate shipping method, but with around 500 deliveries a day, it is currently not feasible to check if each shipping method is chosen properly.

3.2.2.5 Company dynamic challenges

Another issue is fast-paced dynamic within the company. Workers are moving to different positions and some re-training could be needed to understand the challenges of the new job. This also impacts the cross-collaboration potential across the different departments.

[2] Personal communication from Waters Warehouse manager June 2021

3.2.3 Quality Assurance Team

This section focuses on inbound damaged products received by the Global Distribution Center from Waters' manufacturing facilities and contract suppliers.

3.2.3.1 Damaged inbound products not eligible for outbound shipping

The GDC also receives inbound damaged products more often during the pandemic (10 to 20 per week)[3]. The COVID pandemic and the blockage in the Suez Canal reduced the number of containers available to ship the products by boat. Therefore, more products were shipped by air than usual. There is much more movement when the product is transported by air than boat which explains why there are more damaged products than the previous year. The damaged products are usually instrument more than consumables. The parts are damaged because of two reasons:

1. Waters' logistics providers move shipments as fast as they can without paying attention to them.
2. There is no penalty for damage to parts under $10,000 according to the contract between Waters and the logistic provider.

Sometimes the damage cannot be fixed. In other cases, if the damage can be fixed, the quality manager assigns an associate every week to the GDC warehouse to fix the damaged products. This leads inevitably to a waste of time to understand if the part can be replaced or if the product is completely damaged. This problem can result in lost inventory.

3.2.3.2 Contracts with Logistics Providers

Horizon, a trucking company, and Expeditors, a company that takes the shipments from the airport, encounter the products before they reach the distribution center. Depending on Waters agreement

[3] Personal communication from Waters Quality team July 2021

with those companies, Waters assigns the damage costs to them. In addition, an associate checks damaged products once a week and is paid by the quality cost center budget further inflating costs. A contract between Waters and its two major logistics providers, FedEx and Expeditors, states that for any part value under $10,000, Waters would absorb the cost of any damage. Therefore, if the shipment is only an individual instrument, the net value would be between $2,000 - $3,000. Waters might be able to offset the costs by filing a claim with FedEx or Expeditors, but most of the time the cost goes to Waters.

3.2.3.3 Quality Assurance Team Logistics

The quality assurance team uses a shared smartsheet that helps keep track of the damaged products which come in and out of the global distribution center. Whenever the team identifies any damage, either upon receipt or in the storage location, they enter the damage information on the sheet. When submitting a form, the employee indicates in which distribution center the shipment is received, the part number, the purchase order number, the method of shipping, the origin of the part, the damage type and the location of the damage (Figure 13). They take a picture of the damaged product so that they can evaluate the damage at the Milford manufacturing center, so they are able to get an immediate answer. Depending on the type and the severity of the damage, the quality assurance team decides whether the product can be repackaged and put to stock right away without affecting the shipping schedule, or if it would have to go back to the manufacturing center and be re-tested.

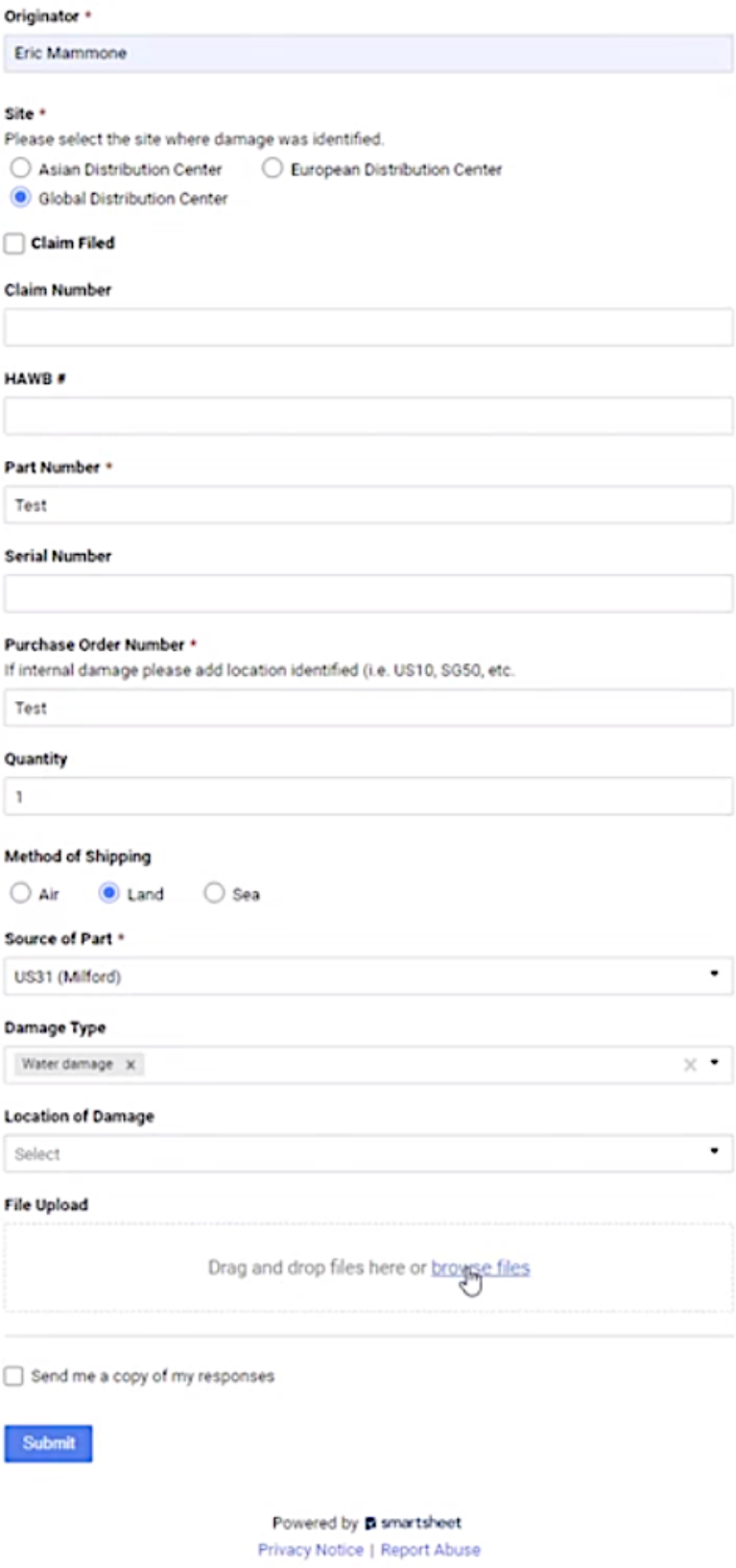

Figure 13: Smartsheet used by the Quality Assurance Team

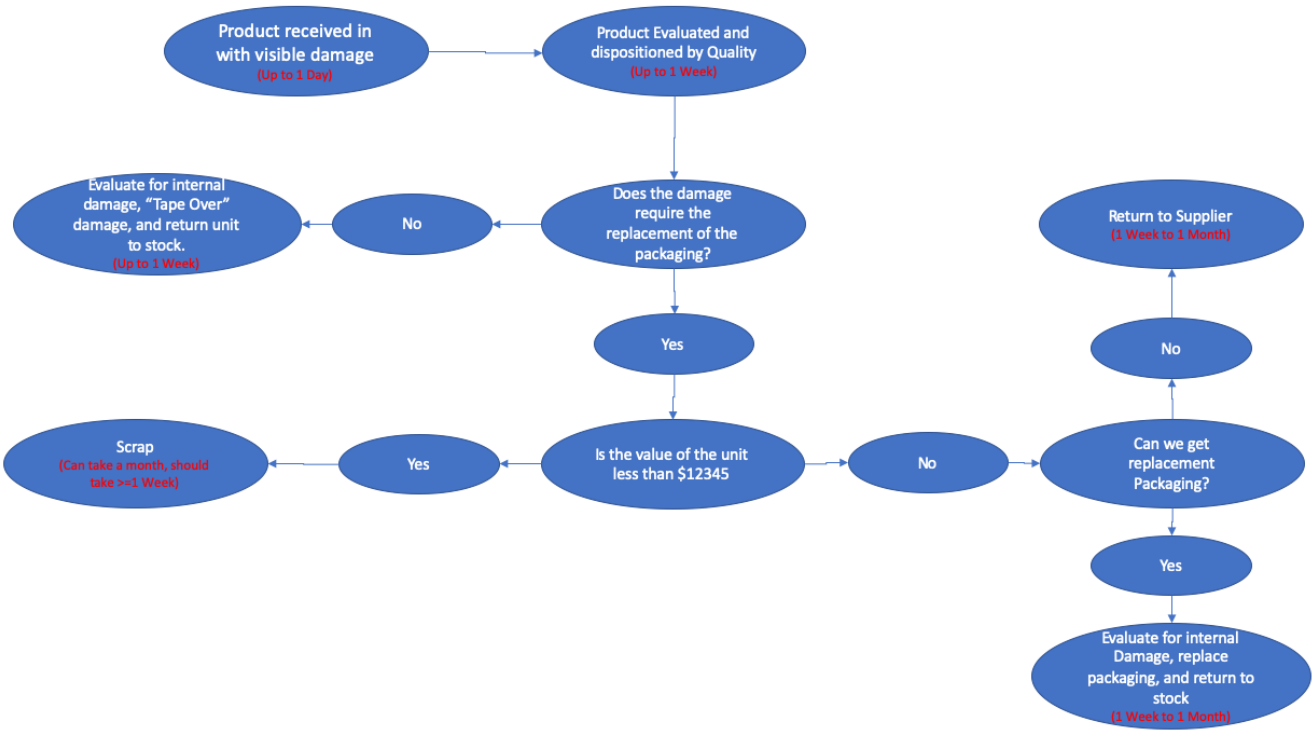

Figure 14: Shipping Damage Flowchart

3.2.3.4 Type of damage and remedy

Package damage

The main damage types encountered (Figure 17) are torn packaging (Figure 15), crushed packaging (Figure 16) and water damage (Figure 16). Most of the time, the team can repackage it within 30 minutes. This does not affect the shipping schedule. However, in other cases, the replacement package is not available because not all products are made in the Milford manufacturing center. It requires additional shipments of packaging material from the European or Asian warehouses. This delays the shipping schedule, and the order entry team might then use express shipping once the product is repackaged to get it delivered on time.

Damage that can be fixed immediately: A forklift will sometimes knock the legs off the pallets that the units come in on. Therefore, the box will not be damaged. Usually if the damage is minor while the unit is on a high-value order, the quality assurance team will quickly fix the issue with a "band-aid" solution, such as taping over the damage. The quality assurance team will also send a planning notice ahead of time so the customer can expect the minor damage on the packaging and be assured that the product has been evaluated. It saves time and avoids potential conflicts.

Figure 15: Torn Packaging

Figure 16: Crushed Packaging

Figure 17: Water Damage

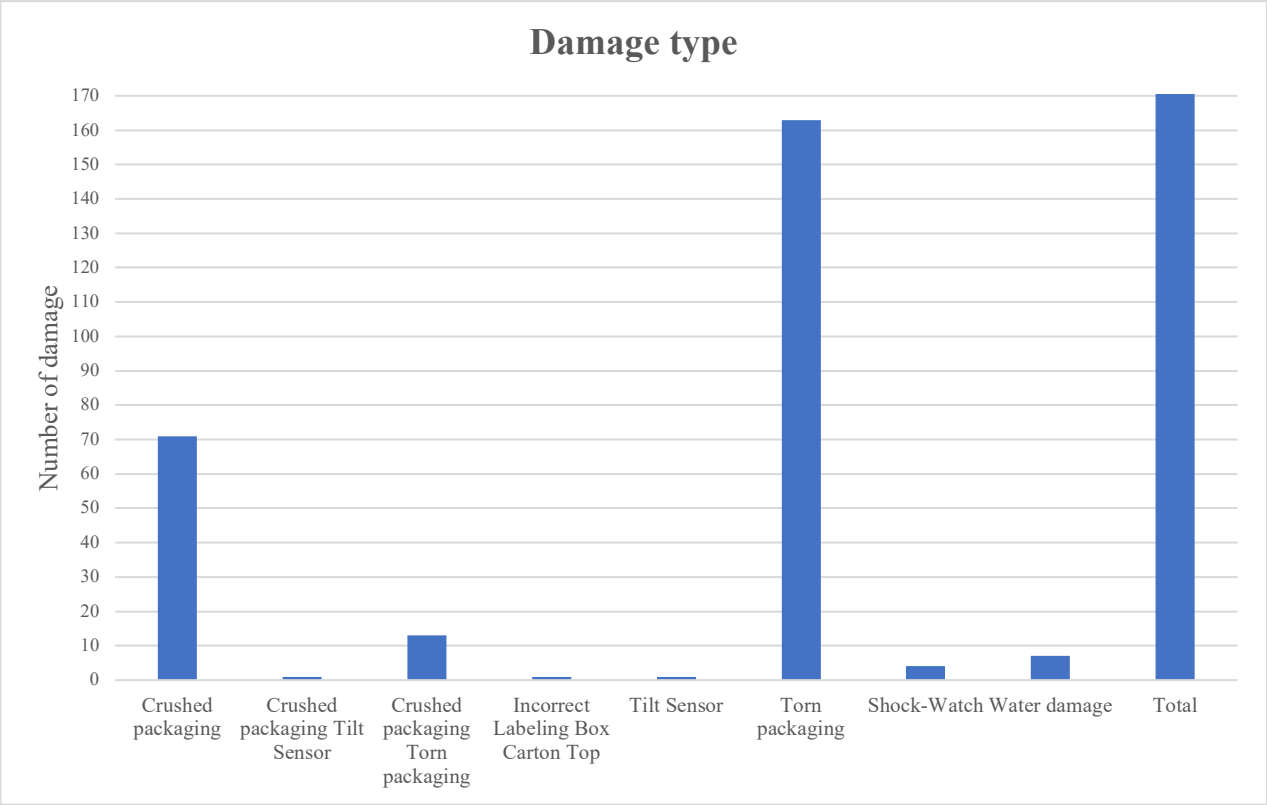

Figure 18: Histogram of damage type – May to July 2021

Customers from the US and Europe can accept minor damage on the package. On the other hand, Asian customers can reject a shipment easily if there is any minor scratch on the package.

Singapore contract manufacturer: A lot of products are designed in Milford, and then Waters sends the design to contract manufacturers in Singapore. If the package from Singapore that is sent to the Global Distribution Center in Franklin is damaged, then they will repair it if they have the packaging material. But if the packing material is not available, they have to wait for it to be produced or order a packing material from the Asian Distribution Center which increases lead time and generates additional costs. The quality assurance team can also rely on local suppliers in the US to manufacture these packages in a few days.

European manufacturer: Products with damaged packages from Europe are usually more challenging because they are not designed in the Milford manufacturing center. Therefore, if a damaged package is received, the team needs to order new packaging material from Europe, which has a longer lead time (1-2 months).

Product damage

Rework: Some damaged products are sent back to the supplier if the quality assurance team does not have the capability of fixing the product onsite.

Scrap: If it is not worth the time and effort to fix the product, the team will throw it away.

Decision-Making Rationale

If the value of the unit is less than $250, it goes to scrap directly, because it is not worth the effort to request new packaging, evaluate, and repackage it.

Origin of damaged products

Most damaged products are coming from the Asian Distribution Center in Singapore (Figure 18). This can be explained by the fact that products will be handled several times before reaching the destination. The product will first be transported from the distribution center to the airport, then loaded onto the plane, taken off the place when reaching the United States (typically in New York), and then carried by truck until Milford.

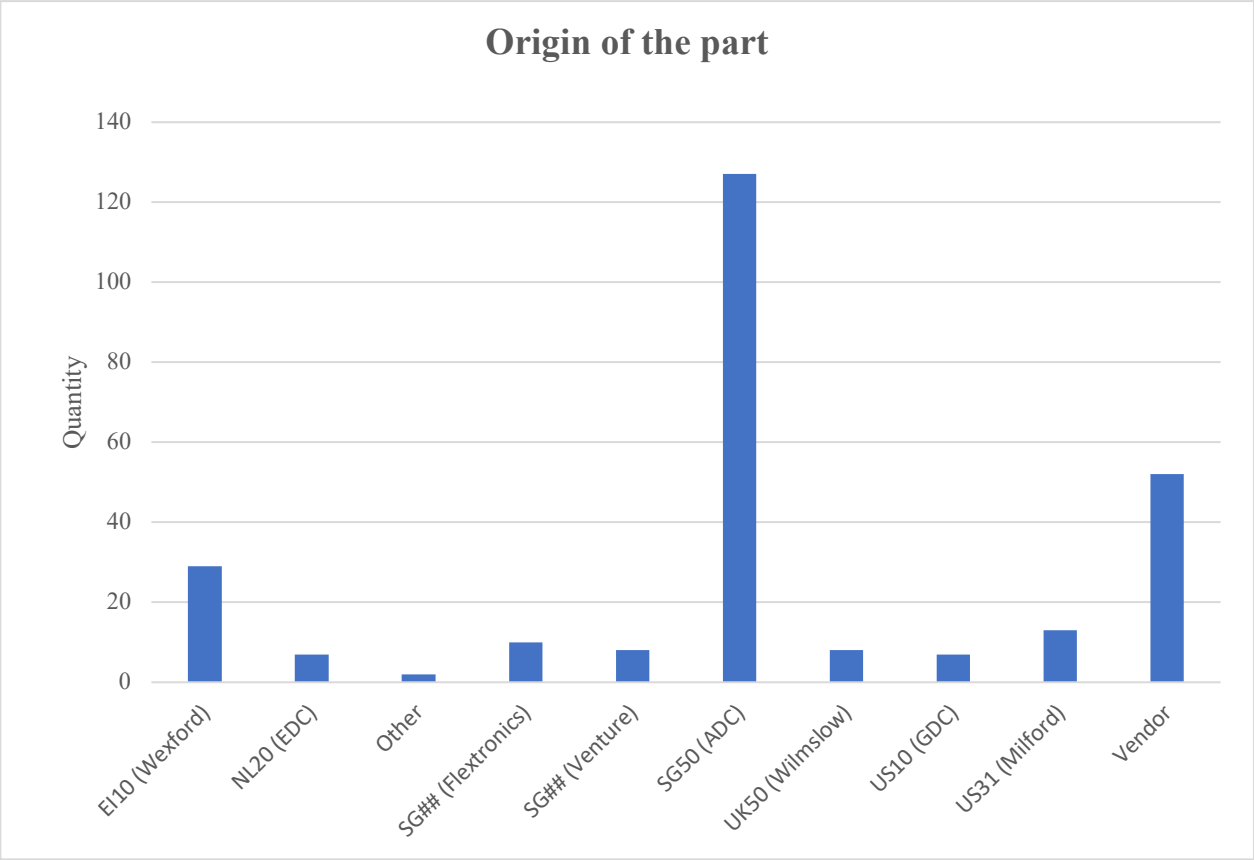

Figure 19: Origin of damaged products – May to July 2021

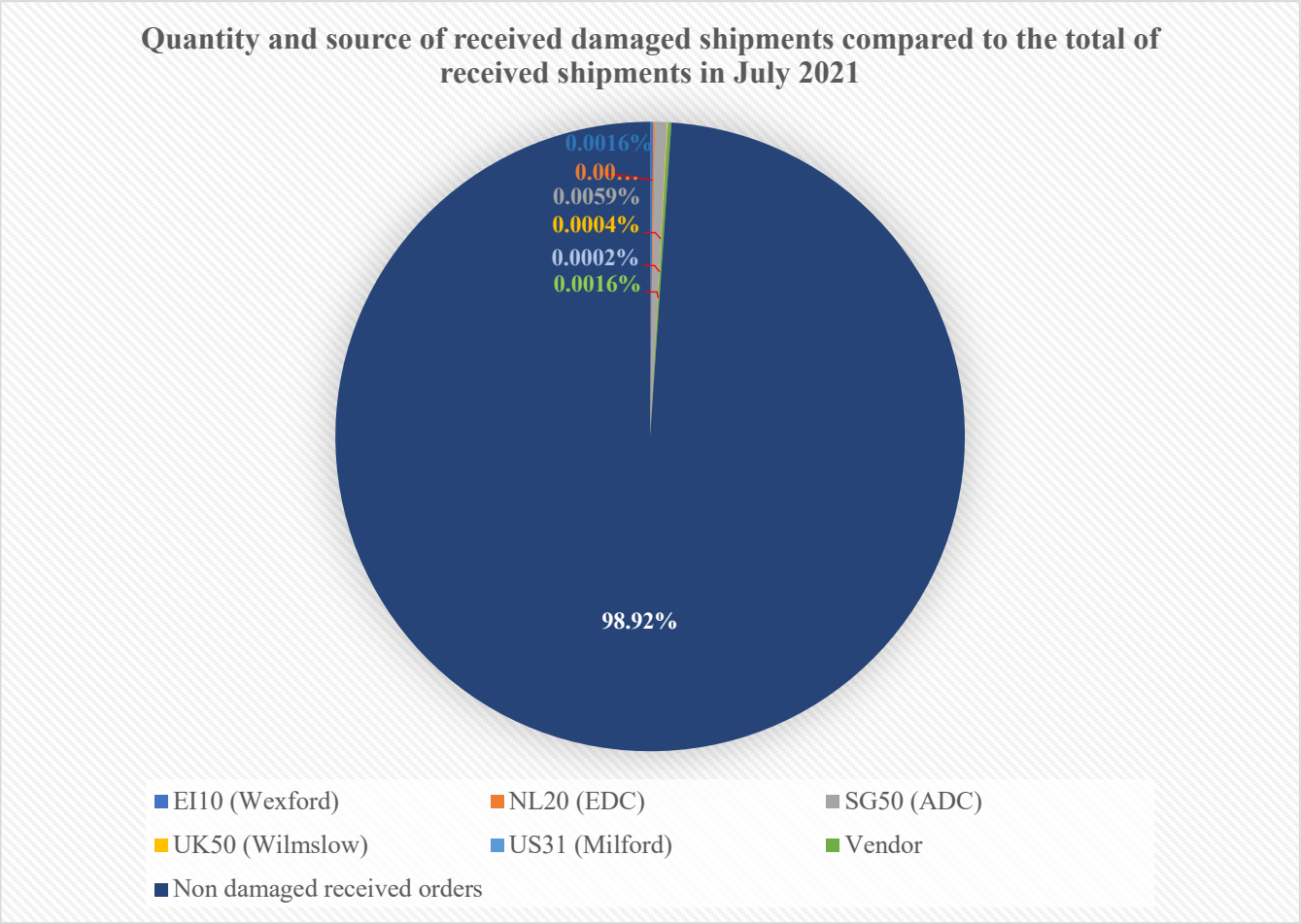

Figure 20: Chart diagram of the number of damaged parts over the total number of parts received in July 2021

2143 shipments were received during the first two weeks of July 2021, with an average of 434 shipments per day. Therefore, as the data have not been published yet, we estimated that the number of received orders at the Global Distribution Center in July 2021 was approximately 9114 (434*21 business days in July 2021). Among them, 47 were damaged, coming from different locations (Figure 20).

Chapter 4

Freight Savings Opportunities

4.1 Correction of misalignments between Lotus Notes and SAP

4.1.1 Quality Assurance Team

To estimate how much can be saved by correcting misalignments between Lotus Notes and SAP, we focused on the orders placed by customers between January and May 2021. This analysis was performed thanks to a spreadsheet with customers' billing documents between January and May 2021 for different countries in Europe. Thanks to the customer numbers, we were able to find 6 customers among the 394 absorbed customers in SAP that placed an order between January and May 2021 (we removed customer 101505 in yellow clear in Table 3 from Table 7 as this customer was charged for freight). Then, we analyzed the detailed orders in SAP to estimate shipping cost depending on the product ordered, since in Europe freight cost depends on the details of the order.

Table 7: Proposed corrected freight table

Company	Customer	Country	Document#	Order	Number of delivery	Created on	Item Net Value	Corrected freight cost	Curr
Company B	275068	SP	316036728	16275954	1	18/03/2021	590,8	30	EUR
	275068	SP	316038391	16333686	1	18/05/2021	17,25	1,43	EUR
	275068	SP	316038391	16333686		18/05/2021	344	28,57	EUR
	275068	SP	316038677	16343809	1	27/05/2021	3 159,00	30	EUR
	275068	SP	316038677	16343809		27/05/2021	0	0	EUR
Company H	116108	FR	306068451	16235525	7	17/02/2021	45,57	12,80	EUR
	116108	FR	306068514	16235525		18/02/2021	45,57	12,80	EUR
	116108	FR	306068514	16235525		18/02/2021	91,14	25,60	EUR
	116108	FR	306068514	16235525		18/02/2021	91,14	25,60	EUR
	116108	FR	306068580	16235525		19/02/2021	45,57	12,80	EUR
	116108	FR	306068630	16235525		22/02/2021	45,57	12,80	EUR

	116108	FR	306068854	16235525		25/02/2021	93	26,12	EUR
	116108	FR	306068854	16235525		25/02/2021	93	26,12	EUR
	116108	FR	306068975	16235525		26/02/2021	98,58	27,69	EUR
	116108	FR	306068975	16235525		26/02/2021	98,58	27,69	EUR
	116108	FR	306069641	16266291	2	11/03/2021	1 153,20	30	EUR
	116108	FR	306069936	16266291		17/03/2021	1 413,60	30	EUR
	116108	FR	306071155	16290983	1	07/04/2021	1 229,30	30	EUR
	116108	FR	306071155	16290983		07/04/2021	0	0	EUR
	116108	FR	306071405	16297555	1	13/04/2021	1 337,60	30	EUR
	116108	FR	306071405	16297555		13/04/2021	0	0	EUR
	116108	FR	306071771	16306228	1	21/04/2021	781,2	17,60	EUR
	116108	FR	306071771	16306228		21/04/2021	550,56	12,40	EUR
	116108	FR	306072748	16326574	1	11/05/2021	644,1	15,35	EUR
	116108	FR	306072748	16326574		11/05/2021	0	0,00	EUR
	116108	FR	306072748	16326574		11/05/2021	614,65	14,65	EUR
	116108	FR	306072748	16326574		11/05/2021	0	0,00	EUR
Company G	0000108129	DA	304037098	16320801	1	05/05/2021	5 892,00	225	DKK
	0000108129	DA	304037150	16323969	0	05/06/2021	41 664,00	0	DKK
	0000108129	DA	304037150	16323969		05/06/2021	474 123,00	0	DKK
Company I	116923	FR	306066193	16196747	1	05/01/2021	854,79	5,69	EUR
	116923	FR	306066633	16196747		14/01/2021	35 878,08	238,76	EUR
	116923	FR	306066633	16196747		14/01/2021	398,07	2,65	EUR
	116923	FR	306066633	16196747		14/01/2021	2 252,20	14,99	EUR
	116923	FR	306066830	16196747		19/01/2021	1 189,50	7,92	EUR
Company J	267422	FR	306069291	16260326	1	04/03/2021	1 952,80	30	EUR
	267422	FR	306069291	16260326		04/03/2021	0	0	EUR
	267422	FR	306069291	16260326		04/03/2021	0	0	EUR
							Total	809,25	EUR

The analysis of the orders showed that customers ordered consumables, except customer 116923 who ordered an LC instrument and consumables.

- For consumables, the shipping cost is 30€ for the Euro Zone and 225 DKK for Denmark, while for a LC device, the shipping cost is 270€ for the Euro Zone.
- For each delivery, the customers pay the shipping costs associated with the products they ordered (i.e. if there are 2 deliveries of consumables, the freight cost is 2*30=60€).

- The freight cost is distributed proportionally between each item of the order (for example, the customer 275068 ordered consumables (order 16333686). Therefore, the freight cost associated is 30€ according to Table 1 and it is distributed among the 2 items in the order).
- For customer 108129, the customer paid for a service contract and services, so there is no shipment associated with the order 16323969.
- For customer 116923, order 16196747, the consumables are shipped on the same pallet than the LC device. Waters only charges freight once per shipment, therefore the shipping cost associated with the order is the shipping cost of a LC device to France i.e. 270€.

We estimated that 809.25€ should have been charged to those customers which represents direct savings for Waters. Therefore, 161.85€ of freight costs should have been charged for each customer per order on average from January to May 2021 (therefore, it would be 161.85€/5 per month). This only considers 5 customers from a total of 150 according to Table 3. Thus, the total savings could be approximately 24,278€ for the 150 customers with which Waters does business in Europe from January to May 2021. This savings was calculating by multiplying the freight cost that should have been charged for each consumer per order on average (161.85€) and the total number of customers (150). In SAP, 2082 European customers appear are absorbed. Based on the percentage of absorbed customers that should pay in our sample, we considered that for 38% of them it is a mistake i.e. 792 customers. Therefore, the estimated total savings after correcting misalignments between Lotus Notes and SAP for Europe is 310,000€ for the year 2021. This savings was calculating by multiplying the freight cost that should have been charged for each consumer per order on average for a month (161.85€/5), the total number of European customers

for who there is potentially a misalignment between Lotus Notes and SAP (792) and the number of months in the year.

4.1.2 Recommendations

We conducted several interviews across different departments to understand the root causes of the misalignments between Lotus Notes and SAP. We believe that the transition from SAP to Salesforce will facilitate the centralization of data, and therefore avoid data duplication. This problem is tricky to address as, for the moment, checking that the data are correctly reflected in Lotus Notes and SAP must be done manually. Therefore, it is a time-consuming process. We recommend creating a job to ensure that the new contracts signed will be up to date in Salesforce. This will save time and money for Waters in the future. We also believe this position would be a great benefit for the company as during our interviews, employees mentioned that keeping track of data was a main problem, and the contracts are not available in a single database. We believe that the most efficient way to solve this issue is to check the contract terms when a customer places an order and to correct any misalignment between Lotus Notes and SAP directly in SAP. Moreover, absorbed customers in SAP that should pay for freight according to their contracts will progressively disappear from the database in SAP when their contracts terminate. When talking with the customer service team, we also noted that customers who appear under different names represent additional constraints. If customers belonging to the same parent company appear under the same name on Lotus Notes, it would be easier to identify the contract terms when an order is placed since contract terms apply to all subsidiaries or divisions of a company. Furthermore, if Waters is the customer's main supplier and there are no other alternatives for them, Waters could renegotiate contract terms with absorbed customers to save more money on freight. Finally, we

believe that there is a communication issue between departments. Several employees are currently working on a freight savings project and several departments are impacted by freight. Creating a single centralized team to gather and report all the information would resolve this problem as each department has a different understanding of the issue.

4.2 Improvement of management practices at the GDC

4.2.1 Damaged products

434 shipments were received on average per business day for the two first weeks of July 2021, which represents 2173 shipments on average received each week. The number of damaged shipments, either packaging materials or products, received in July 2021 was 47. Among them, 2 were returned to the supplier in Wexford and 16 packaging materials were reworked. The 29 other damaged shipments have not been processed as of the week of August 9th, 2021. Among the 29 damaged shipments received 5 are coming from Wexford, 4 from the EDC, 10 from the ADC, 1 from Wilmslow, 1 from Milford and 7 from Vendor.

4.2.2 Package safety stock

For damaged shipments received from Europe, the Global Distribution Center does not have the packaging material to replace any damaged packaging because the Milford manufacturing facility does not produce the same equipment as the European manufacturing facilities. Therefore, if a packaging material must be replaced because it is crushed or damaged by water, the Global Distribution Center must place an order to the European Distribution Center to receive the packaging material. We believe that building a package safety stock will reduce the lead time associated with ordering and waiting for the new packaging material coming from Europe. In

Chapter 3, section 3.2.3.4, 44 damaged packages out of a total of 263 damaged packages were received from Europe between May and July 2021, which represents 16.7% of damaged packages received. Reworking the box or the product in Milford is less expensive than sending back the product to Europe or waiting for new packaging. Moreover, changing the packaging material requires printing a new label. The Global Distribution Center does not have the printer needed to print all the labels. Therefore, they might wait for a label to be shipped from Europe before expediting the shipment.

According to section 4.2.1 and given the lack of data, if we assume that 5 products need to be reworked in Europe out of 47 damaged shipments received, each with a cost of $20,000and if we assume that 5 orders would have to wait for a packaging material or a label coming from Europe, each with a cost of $5000, (including workforce, lead time, shipment from the EDC to the GDC, expedited shipment to the customer), then the cost from these 10 damaged shipments is $125,000€. If we consider that the implications for each of the other 37 damaged shipments is $1,000, then the cost from these damaged shipments is $37,000. Therefore, the total cost for damaged shipments in July 2021 is $162,000. Suppose that we can take some actions to reduce the percentage of damaged shipments by half by increasing the safety stock for packaging material and by using a more robust packaging material for example (4.2.3); then we could save approximately $81,000 per month on damaged shipments i.e. a savings of $972,000 per year.

4.2.3 Stronger packaging material

One way to prevent damaged boxes is to replace cardboard with stronger packaging material, for example, polystyrene (Figure 19). In industry, the packaging material must be shock absorbent, easy to handle, cost-effective and sustainable. Choosing the appropriate packaging material would

reduce the cost associated with breakage, storage, and deterioration. In addition to protecting better the product from mechanical and thermal stresses, and water damage, expanded polystyrene is more ecofriendly than cardboard as it requires 6 times less energy to be produced, pollutes 20 times less water than cardboard, and represents a lower global warming potential [19]. However, expended polystyrene is currently considered non environmentally friendly due to the lack of infrastructures to recycle it, and the majority ends in landfills. An alternative to polystyrene is foam packaging. This material offers enhanced protection during transit and handling and minimizes the number of damaged products returned. Foam also requires less material than polystyrene to be produced. However, specialist facilities are needed to recycle this material. Using recycled foam is an even more ecofriendly solution and can also be recycled again [20].

Figure 21: Example of a polystyrene packaging

4.2.4 Quality Assurance Team spreadsheet

The quality assurance team usually goes to the Global Distribution Center twice a week to analyze damaged inbound shipments even during the pandemic. However, if everything can be updated

quickly and carefully on a spreadsheet, the team can view everything on the desktop, and they can know directly what the problem is and plan ahead. (e.g. Does it need a new package? Does it need rework, or does it go to scrap?). The warehouse workers can also take pictures of the package to make sure the quality assurance team is not blindsided. The warehouse workers enter the damage information on the spreadsheet using a form currently that is only compatible with desktop computers. If the team can facilitate the form on a tablet, the workers can take advantage of the tablet camera to take pictures and scan barcodes. The team is currently working on this project which will optimize the working time of employees. The goal would be to create a standardized spreadsheet/process for all the distribution centers.

Chapter 5

Conclusion and Future Work

5.1 Conclusion

As we saw throughout our work, there is a real opportunity for freight savings at Waters, either on the contract management side or at the Global Distribution Center. We studied two main issues: misalignments between Lotus Notes and SAP leading Waters to absorb shipping costs for some customers, and unnecessary expedited shipments due to time constraints, stocks out, damaged received inbound shipments, or human errors. From correcting the misalignments between Lotus Notes and SAP, we estimate that Waters could save 24,478€ for a sample of 150 customers on freight from January to May 2021. Waters does business with 2082 customers that appear absorbed in SAP. If we consider that there is a 38% chance there is a mistake in SAP and the customers should pay for freight, this represents a total savings of 310,000€ on freight for Europe for the year 2021. By using more robust packaging and increasing packaging safety stock, we estimate that Waters could save $972,000 per year by reducing by half the number of damaged inbound shipments received by the Global Distribution Center. Increasing part availability would also enable the employees to deal better with late orders placed at the end of the quarters. On the management side, we saw that training employees could reduce the number of incorrect shipping methods chosen.

5.2 Challenges

Throughout this work, we try to provide the most accurate estimations of savings Waters can expect from implementing our recommendations. However, this project was carried out during the COVID pandemic and remotely. Therefore, getting access to the data we needed to identify misalignments and perform a cost analysis was a challenge. We did not receive all the data required within our project time constraint. Most of the information provided in this thesis is from our interviews with several Waters employees and our personal interpretation of the problem from what we understood during our interviews and when visiting the Global Distribution Center. My teammate Jiayue Zhao will continue working on this project during Fall 2021. Therefore, we can expect more accurate savings calculations.

5.3 Future work

First of all, the mistakes identified in this thesis should be corrected in SAP. We believe that the team working on correcting misalignments between Lotus Notes and SAP should focus on Waters' main customers as these customers are likely to place orders more frequently. Therefore, any potential errors should be corrected in priority to maximize savings. The same methodology as the one used in this thesis can be used to continue the analysis. Unfortunately, correcting the mistakes by hand is currently the most effective solution, which is not time efficient. A solution to prevent future misalignments between Lotus Notes and Salesforce would be to create a new standardized customer order review process. Orders from different departments can be synchronized on a single platform (such as Salesforce), so there will be no more confusion regarding customer order creation between multiple departments. A new tool to help contract review of shipping methods can also be developed.

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