Inbound Incoterm Conversion

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ABSTRACT

Most organizations spend significant time on improving the processes and systems related to outbound movement of goods, i.e., cargo moving from the production site to customers. This focus often ignores the other aspect of the supply chain, namely inbound cargo movement, which refers to the shipments coming from the suppliers to either the purchasing organization or the production site of the organization. This capstone project investigates the various material buying arrangements (which primarily differ in operational setup and risk) that the buying entity will take on. This capstone project focuses on a selected group of twelve products from two suppliers with different characteristics such as origin, volume, price, supplier relationship, etc. Total logistics costs including the transport cost, purchase cost, and inventory costs are calculated. Risk is also included per incoterm option to give an overview for business managers on how to approach the buying decisions. In general, if the company would like to convert from C&D to E&F incoterms, it would mean that the buying organization is taking more risk upon itself and hence needs to have a solid operational setup (inhouse or outsourced) to manage the ownership responsibilities that come with changing incoterms. The end result is a matrix of selected scenarios which will allow the buyer to understand the risk associated with each incoterm under a set of conditions and the expected cost difference. The section ends up with opportunities that might be presented if the organization starts buying more under E&F incoterms instead of C&D incoterms along with the potential risk rating under each scenario

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1 BACKGROUND

1.1 Sponsor Company Background

The sponsoring company (XYZ) is a global industrial manufacturing organization which was founded in 1998 when two European electrical engineering companies merged. XYZ currently has over 130,000 employees across these 4 business lines:

- Product Line 1
- Product Line 2
- Product Line 3
- Product Line 4

Our capstone project is sponsored by the Product Line 1 business and focuses on the inbound flows from suppliers into the ZYX Factory, which manufactures low voltage AC drives and drive modules. The Product Line 1 is comprised of following business units:

- Drives as seen in Figure 1
- Motors & Generators as seen in Figure 2

Drives

Figure 1 - Drives

Motors and Generators

Figure 2 - Motors & Generators

This ZYX site as seen in figure 4 is one of 11 global manufacturing locations as seen in figure 3 that has delivered over 10 million drives since the business inception. Some of the product examples from the drive unit:

- Variable speed drives: Low voltage AC drives, motion control drives, medium voltage drives, power controllers, etc.
- Traction converters: e-Bus drivetrain packages, Diesel-electric propulsion, Multi-system and hybrid applications
- Softstarters - PSTX range of motion control and protection, PSE range for application
- Wind converters – full power converters, doubly fed converters, low voltage utility scale wind turbine converters etc.

Figure 3 - Drives Global Network

Number of employees: **1200**

Focus
- Low voltage AC drives and drives modules

Functions
- Sales and marketing
- Engineering and assembly
- R&D
- Sourcing
- Service Hub
- Training

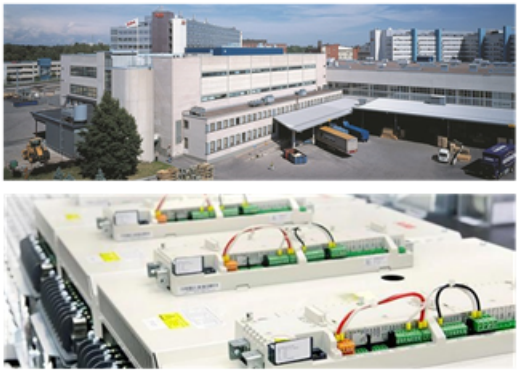


Figure 4 – ZYX Drives Factory

1.2 Introduction to the selected suppliers

Supplier A is the world market leader in the field of transducer manufacturing. These transducers as seen in figure 5 are used to measure electrical parameters. With production locations in Beijing (China), Geneva (Switzerland), Tokyo (Japan) and in Sofia (Bulgaria), Supplier A has the reputation for developing innovative products in the vast area of industrial applications such as

- Power supplies for industries
- AC/DC converters
- Variable speed motor drives

For the purpose of this capstone project, we will focus on shipments originating from the Supplier A plants in Beijing and Sofia.

Figure 5 Voltage Transducers produced by Supplier A

Transducer size as pictured is around 56 mm in length

Suppler B is a global electronic component manufacturer developing solutions for customers in automotive electronics, industrial electronics and consumer electronics. Supplier B has over 24,000 employees and 20+ design and production locations, Supplier B generated $1.79 Billion in 2018 sales. The diverse range of Supplier B products include capacitors, inductors, piezo, protection devices and sensor systems as seen in figure 6.

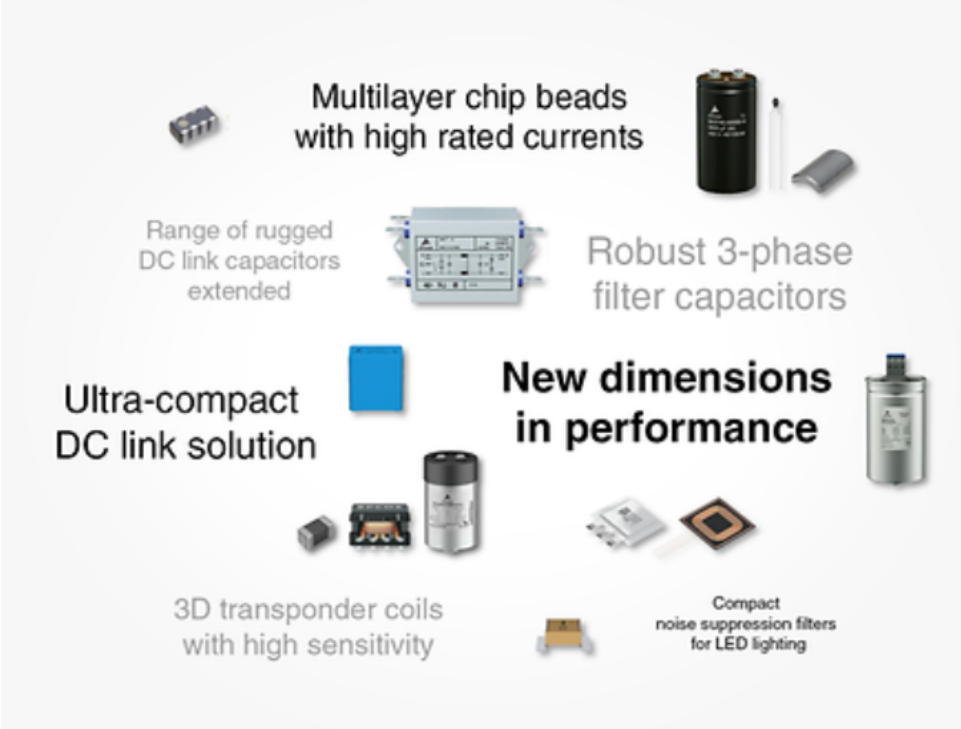


Figure 6 Supplier B Product Portfolio

2 INTRODUCTION TO THE PROBLEM

Current procurement strategy directs suppliers to buy mostly on C or D incoterms thereby giving more control to the suppliers on transport spend as well as shipper choice. This strategy coupled with the lack of a transport management system presents unique challenges to the buyer in terms of poor visibility of shipment status and less control on carrier selection by the supplier making achieving operational excellence increasingly challenging. Our theory and research evaluated the impact of using E&F incoterms compared to C&D incoterms on the overall logistics cost and risk for the company.

The general argument for choosing E&F incoterms are that the company will also gain higher visibility of inbound shipments in the process resulting in better production planning and hence lower networking capital tied up in the inventory. However, this would depend on how the operational setup for buying on E&F incoterm is existing within the company. For example, if the company starts buying on E&F incoterm but still does not have the operational infrastructure in terms of systems and the manpower, the expected benefits will not fully materialize.

This capstone project focuses on the inbound freight flow from suppliers to XYZ's production sites. Currently, XYZ has very limited visibility of these incoming goods as most shipments are booked by the suppliers directly. The suppliers book the freight on their own or with XYZ freight carrier account numbers depending upon the incoterms being used. Most of these freight bookings are unplanned and result in many operational issues. The main issue is that the suppliers include higher transport costs due to the limited freight consolidation opportunities. The production sites also have limited visibility of the shipment's arrival status.

This uncertain arrival time drives higher safety stock levels at the XYZ production sites. The freight booking can also result in a shipment where the supplier declares the goods incorrectly and did not consider the impact of tax treaties and trade agreements that result in a higher total cost. Another potential inbound

freight problem could be the limited understanding of transit time variability, which also results in higher safety stocks, thus keeping working capital locked up longer.

Considering all these challenges, XYZ Management has requested an analytical model to help management understand the impact of choosing E or F Incoterms vs. C or D Incoterms regarding the total logistics cost vs. risk. Some of the factors to consider in the model are duties, taxes, material cost, supplier location, transport mode, lead time variability, inventory and demand variability. XYZ would also like to test this model at a pilot site.

Incoterms are a set of commercial trade terms established by the ICC (International Chamber of Commerce). The first version was published in 1936 and the most recent version is from 2010 as seen in figure 7 with a revision due in 2020. Incoterms consist of a three-letter term used to define the risks, costs, and obligations involved in a commercial trade of goods. Incoterms provide a framework of who pays for what and where the responsibility of goods changes from seller to the buyer in the shipment process.

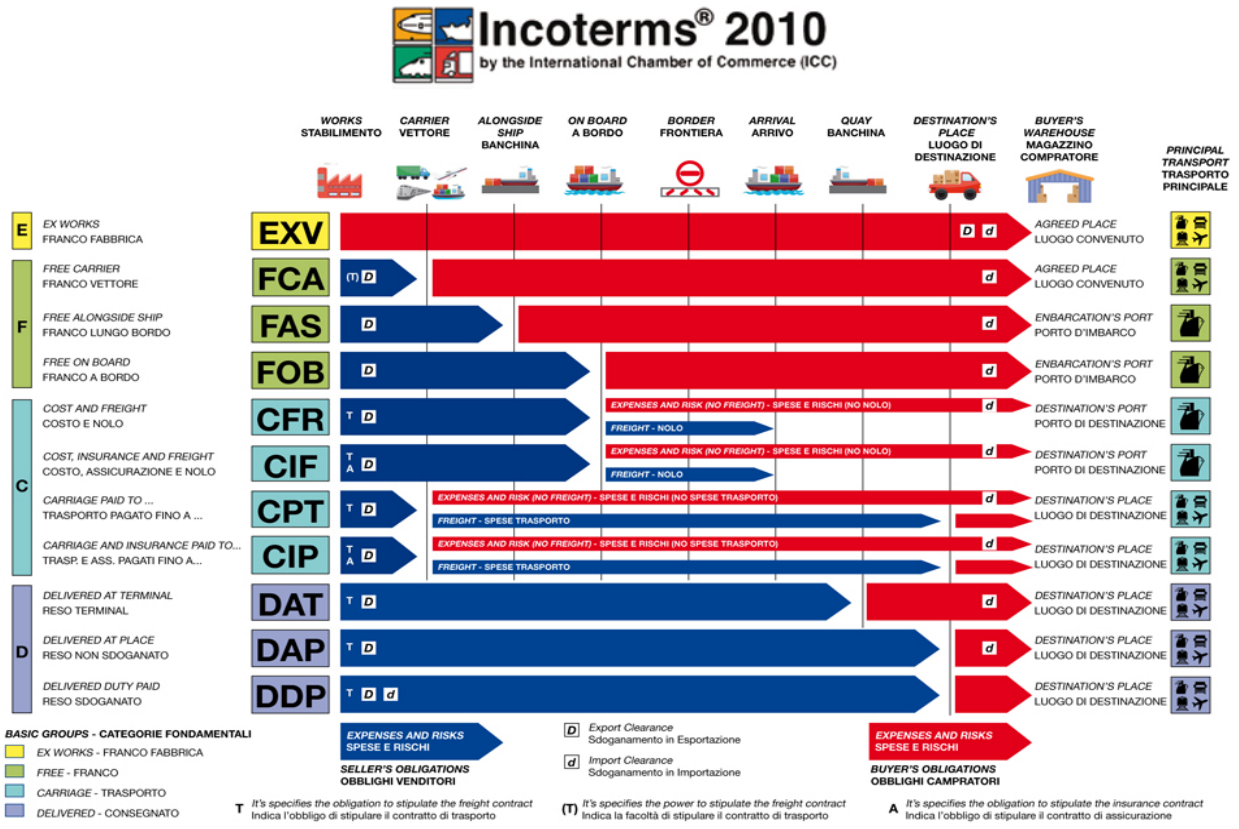


Figure 7 – Incoterms 2010 Chart (Source: https://iccwbo.org)

For the purpose of this capstone project we refer to Incoterms in two groups. The first group is classified as “E & F type Incoterms”. The first group contains the one E type, known as ExWorks or EXW, and the three F types (FCA, FAS, and FOB). We group these E & F types together as meaning the buyer will arrange freight and assume responsibility for the goods at the seller’s plant or port.

The second group consists of “C & D Type Incoterms”. This second group contains the four kinds of C types (CPT, CIP, CFR, CIF) plus the 3 varieties of D types (DAT, DAP, DDP). There are many variables involved with these types pertaining to insurance and carriage charges. We combine these types of C & D Incoterms based on the seller paying for the transportation. The seller will also be responsible for the goods to be delivered to the buyers named place, port, or vessel.

XYZ's Drive factory has inbound deliveries arriving from around the globe. Many of these inbounds arrive as being purchased with C/D type Incoterms using XYZ freight accounts. XYZ suffers from this because of the lack of shipment and arrival visibility and inflated shipping expenses. These inflated shipping charges increase overall total cost and reduce profitability. This lack of arrival visibility also creates a need to have increased safety stock because of the uncertain lead times relating to these purchases. Another problem is that the suppliers are using the XYZ carrier account numbers but instead of using optimized service with proper planning, the suppliers often book expensive services to make up for delays. There is no incentive or pressure on the supplier to use the cheapest or least cost service.

We believe these problems can be managed better by migrating these C/D type Incoterm purchases to E/F type Incoterm inbounds. Our hypothesis will be tested by creating a procurement template that can be used to evaluate the total logistics cost and risk for each incoterm. We will do this by focusing on the total logistics cost to the company and increasing inbound visibility regarding time of arrival for production planning purposes. This research will involve inbound data from selected vendors and selected products from these vendors to the XYZ plant to provide a detailed analysis of potential risks and total logistics costs under various incoterm Scenarios.

3 LITERATURE REVIEW

3.1 Importance of Inbound Logistics

The emphasis on “outbound logistics” while studying distribution as a supply chain function has resulted in limited focus on the research in the area of “inbound logistics”. However, this started to change in the 1980’s when the concept of “integrated logistics” gained traction and inbound logistics became an integral part of the overall physical distribution management (Coyle, Novack, Gibson & Bardi 2011). Inbound logistics is responsible for nearly 40% of the annual freight spend in an organization and can create significant value not only in terms of reduced cost but also improved operations. The authors of this capstone have decided to explore this opportunity by understanding various risks, benefits and total logistics costs associated with different incoterms.

3.2 Benefits of Actively Managing Inbound

Felicio & Sharma (2018) provided evidence of inbound cost savings by consolidating inbound loads with outbound loads. This consolidation will reduce the number of empty miles incurred when these carriers leave the test facility to the next pickup location. This savings would be achieved in better negotiated rates with the inbound carriers as it would provide them with better equipment utilization. This opportunity to save cost on truck freight would be easier to engage in if the company is managing the Inbound process. The managed inbound process would have better visibility of arrival times and could pair the inbound trucks with outbound loads.

Sterling Commerce’s 2010 white paper included multiple case studies on inbound management. They noted that these companies below saved costs by taking control of inbound logistics and utilizing a transportation management system (TMS).

John Deere	5% transportation cost savings in the first year
HJ Heinz	10% transportation costs
True Value	20% reduction in lead times
Tractor Supply	$500,000 in transportation costs
Walmart / Best Buy	Hundreds of Millions $ in transportation costs saved

The TMS involved lead time reduction and decreases in lead time variability, end to end visibility of the entire order, management by exception, improved efficiency in the receiving process, and improved manufacturing processes.

3.3 Benefits of using E/F incoterms

Andersson (2013) examined a purchasing issue regarding taking ownership of goods as late as possible and converting F incoterms to C/D type incoterms. This was done in effort to reduce the amount of capital tied up regarding the purchased goods. Although this capital expense is factored into the true total cost of goods it was not determined to be a large enough factor to justify a C/D incoterm buying strategy. This example supports our theory that from a total cost perspective buying on E/F type incoterms will outweigh other factors. This includes Andersson's example where the company wants to take ownership of the goods as late as possible to avoid putting inventory on the books.

Kaye's web article from 2012 on using incoterms to simplify global sourcing also recommends using F type Incoterms specifically to have greater control of the inbound and to gain better trackability (Kaye 2012).

Our proposition of buying on E/F type incoterms when possible is further strengthened by Kumar's 2010 study of investigating the effects of migrating purchases to F type incoterms. This gives the buyer greater control over the logistical routing of the goods and the main carriage costs. Kumar also makes the point

of possible lower duties, fewer exams, and fewer custom delays if the importer has an established presence created from the volume of making these import arrangements (Kumar, 2010).

Andersson (2013) detailed the analysis of an F vs C/D Incoterm purchase regarding total cost. We seek to combine the total cost analysis with our company-driven metric of inbound visibility.

This will provide a best-case procurement scenario for our selected business unit. However, there can be significant problems in getting traders to change routines to a more appropriate and correct use of incoterms. Our procurement template will be a targeting tool to effectively overcome the hard-to- change patterns that may be ingrained in the current procurement strategy. We will examine total cost analysis regarding imports using E/F incoterms instead of C/D type incoterms to support our procurement template.

More accurate inbound arrival dates will also help the company reduce safety stock levels. Christopher (2008) presents the idea that safety stock levels can be greatly reduced if lead time is more predictable and shorter in duration for the demand production changes that always occur. This shorter lead time or faster material flow response is often part of the procurement decision that is combined with product price (Christopher, 2008). Woxenius (2006) lists this transit or lead time as one of three time elements to consider in procurement decisions, others could be the timing of the actual delivery and the frequency of the delivery.

3.4 Risk Management

Our research identified the risks involved with actively managing the inbound freight process but also provide the business manager with actions they can take to reduce or mitigate these risks. Christopher & Peck (2004) identified five types of risk involved with global sourcing.

- Supply Risk

- Process Risk
- Control Risk
- Demand Risk
- Environmental Risk

Although all types of risk are important to evaluate; we will focus on the risk to supply as this is related to the internal supply chain. The supply risk will focus on possible supply disruptions and unreliable suppliers. Christopher, Mena, Khan, & Yurt's research paper from 2011 concluded the following four strategies to combat global sourcing risks:

- Network Re-Engineering
- Collaboration between Global Sourcing Parties
- Agility
- Creating a Global Sourcing Risk Management Culture

These goals are also related in that better collaboration will lead to better agility. Christopher et al. also interviewed managers in a variety of industries about the concern of global sourcing risk and what mitigration processes were currently in place to gauge the risk management culture. The managers agreed that these were important and made a point to designate resources to establish them (Christopher et al. 2011). We will also interview operational personnel within XYZ for our research project to obtain costs, validate data, and inquire on risk mitigation policies.

3.5 Lead Time Variability and its impact on the overall logistics costs

Variation of the inbound transit times affects operational costs mainly by requiring higher levels of safety stock. Safety stock is extra inventory that is kept on hand to act as a buffer against unplanned delays in the delivery of new material and increased demand that might occur before additional material can be

sourced. Our project goal is to understand the differences in total logistics cost and risks associated with various incoterms on inbound shipments. This goal will also help us to understand whether an E&F incoterm would result in more accurate arrival dates to plan inventory levels better and reduce the overall logistical costs. The best opportunity to reduce inventory including safety stock is via high inbound reliability and higher frequency of deliveries (Harrison & Fichtinger 2013).

3.6 Importance of total logistics costs while making purchasing decisions

Mae & Ohno (2012) described how making changes in the product lead time can affect the production schedule and inventory ownership. These changes can exemplify the siloed department effect in that one area may reap savings but overall the total cost and efficiency for the company is sacrificed (Lysons & Farrington, 2007). Our goal to provide management with a procurement template for making the best decisions including incoterms is centered around reducing this referenced silo effect and illuminating stale buyer habits that do not focus on total cost to the company. It is important to differentiate between price and total cost. The latter consists of freight, inventory, obsolescence, duties, taxes, and other possible risks (Bowersox, Closs, & Cooper 2010). The lowest landed or total cost to the company is the desired procurement goal and this lowest cost may be presented when the goods are picked up at the supplier's mill or production location (van Weele, 2010). The buyer must possess the logistical expertise and scale to move the goods efficiently. This optimal total cost structure will be achieved by utilizing E & F type incoterms (van Weele, 2010) supported by a strong operational backbone.

3.7 Implementation of Inbound Logistics

This capstone project will evaluate impact of using various incoterms and help develop an enhanced procurement strategy considering total logistics costs and risk elements. We will first evaluate current

inbound methods then suggest new options for minimizing total cost and maximizing inventory fill rates with data analysis. Kahl's 2006 thesis on the Eastman Kodak Company implemented a similar strategy after achieving stakeholder buy-in and successful testing (Kahl 2006).

4 DATA & METHODOLOGY

To manage a complex project such as this, it is important to follow a structured approach which the main stakeholders from sponsor company are familiar with. The process displayed in figure 8 details the steps followed in the project methodology which is a standard in the XYZ organization.

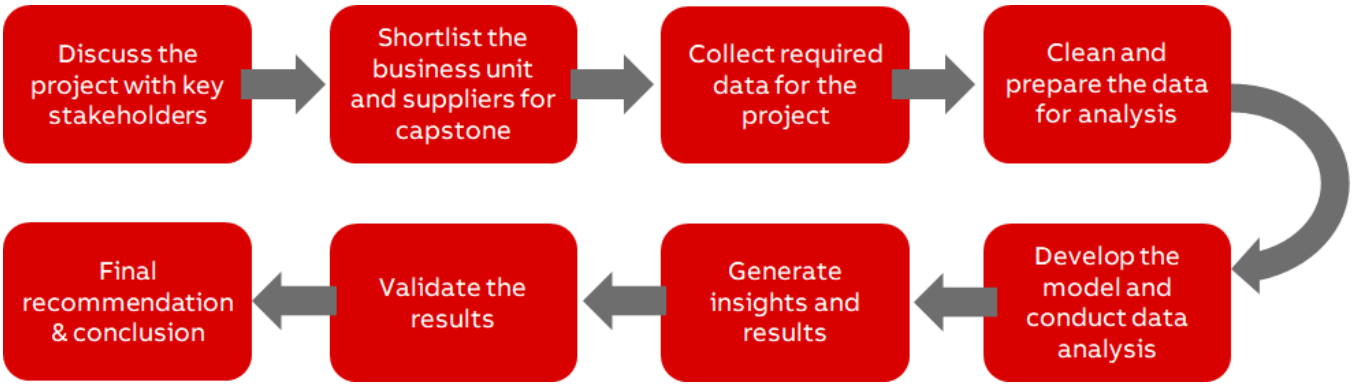


Figure 8 Overall Project Methodology

4.1 Discuss the project with key stakeholders (Project Initiation)

Our project has been discussed with the XYZ's business operations leadership, who clearly see the importance of evaluating opportunities within inbound logistics management. The management is looking for a broad scope in terms of the number of sites, products, suppliers and the expected output from the study. However, after consideration, it was decided to focus on the following project objective:

- *Develop a model which can evaluate the cost and risk impact of using various incoterms on different product categories. Project will focus on selected set of 12 products from 2 suppliers.*

4.2 Shortlist the business unit, products and suppliers for capstone (Project Scoping)

The project team started working with the XYZ global category management team and the business head of operations from the drives business line to review various products and suppliers.

The following set of criteria were considered while creating a shortlist of the suppliers and products for our final capstone analysis:

- What kind of relationship exists between the company and its suppliers? Are the suppliers willing to run a limited scope pilot to test the validity of results?
- Can the representatives from the drives business line invest time and effort during the project to help collect the data, validate the data analysis assumptions, review the draft reports and select few scenarios for pilot setup?
- What are the expectations in terms of timelines from the business managers to complete the project?
- Where are the suppliers based? Preference would be given to suppliers which are shipping products from multiple locations and different transport modes such as ocean, rail and air. This would allow the analytical model to be tested for various scenarios
- What kind of products are preferred for the capstone analysis? Preference matrix to shortlist the products for analysis is provided below in figure 9.

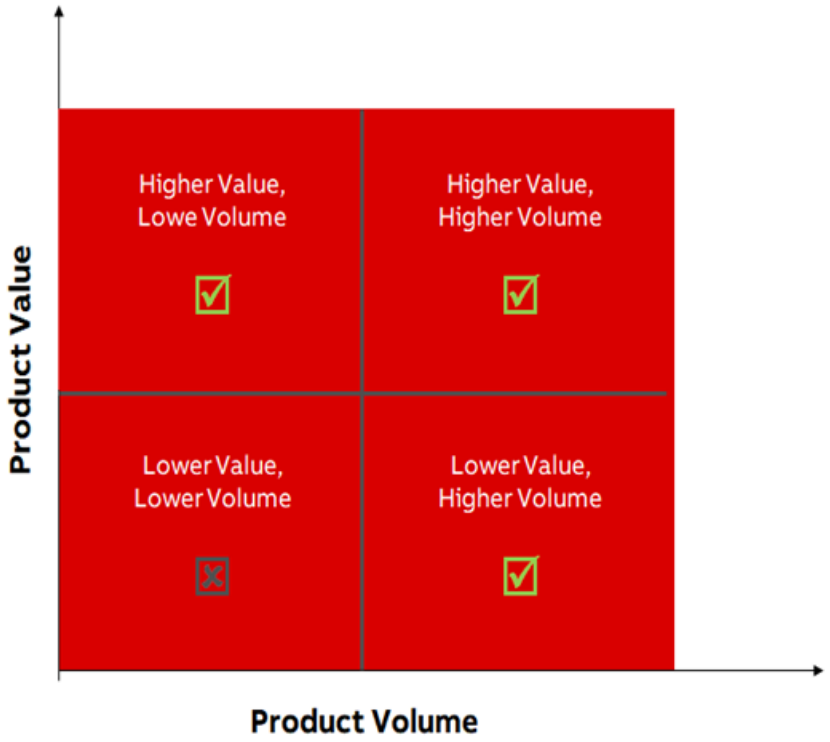


Figure 9 Preference Matrix

- Is there any strategic business reason for which the category managers would like to continue with the suppliers on C&D terms instead of E&F? For e.g. in case of few products originating from Mexico, the buyers prefer to use Delivery incoterms such as DAP or DDP since there is always a major risk of theft during transit and its easier for buyers to let the supplier manage that risks and costs.
- How much of the spend on a product is under E&F incoterms vs C/D incoterms? Products having higher spend under C&D should be preferred for the capstone analysis
- What is the forecasted spend with these suppliers? Is it expected to increase or decrease going further?
- Is the supplier strategic in nature or is it more a transactional supplier?

Based on above criteria, the spend data for various suppliers to the Drives business line was downloaded and analyzed. The total spend volume by dollar value for the XYZ Product Line 1 business was $500 MM

during 2018. The purchase data was also analyzed at the incoterm level as well and the results are shown in figure 10:

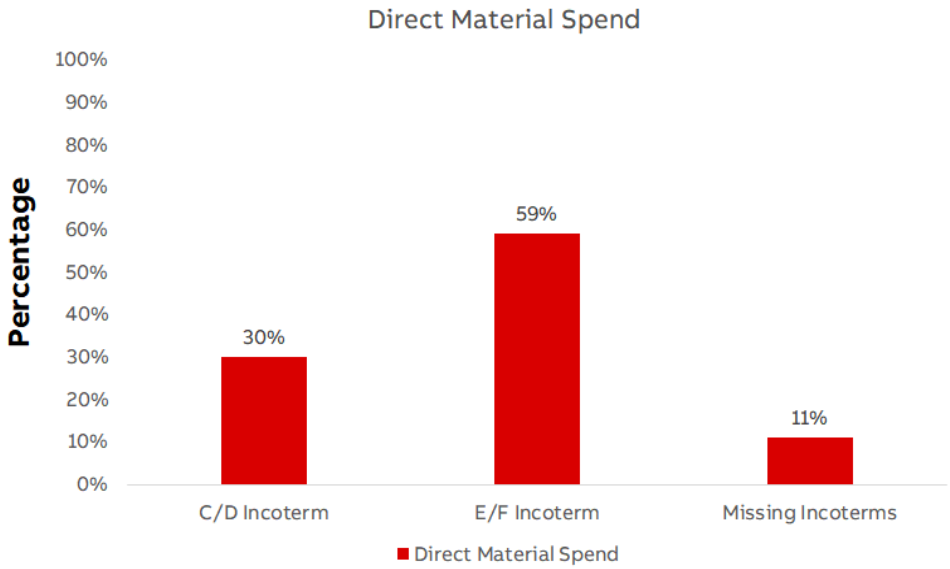


Figure 10 Material Spend Figures

Building up on the goods flows based on the data provided by the XYZ, it's clear that majority of flows are between Europe and Asia. Figure 11 shows this goods flow from the suppliers to the production sites. The total spend volume by dollar value for the XYZ Product Line 1 business line was $1900 MM during 2018.

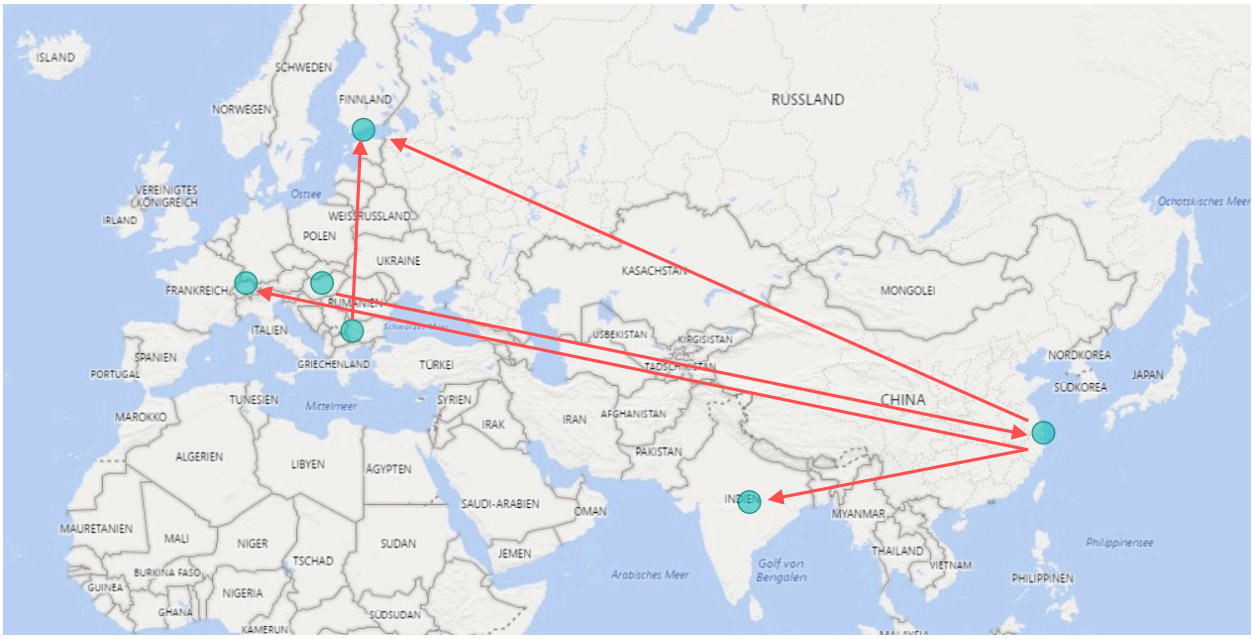


Figure 11 Material Goods Flow

Based on above factors and analysis, a total of 12 products from two suppliers were shortlisted for the capstone project and are displayed in Table 1.

Table 1 Shortlisted Products and Incoterms

Product Code	Origin	Destination	Agreed Incoterm
PRO00000001	Hungary	China	CIP Beijing
PRO00000002	China	Switzerland	DAP
PRO00000003	China	China	DAP Beijing
PRO00000004	China	China	DAP Beijing
PRO00000005	China	China	DAP Beijing
PRO00000006	China	China	DAP Beijing
PRO00000007	China	China	DAP Beijing
PRO00000008	China	Finland	DAP
PRO00000009	China	India	FCA
PRO00000010	China	India	FCA
PRO00000011	Bulgaria	Finland	Multiple
PRO00000012	China	Switzerland	Multiple

4.3 Collect and clean required data for the project (Data Collection & Cleaning)

In order to calculate the total logistics costs under different incoterms, it was agreed to collect the following data elements for period of year Q1 2018 as displayed in Table 2.

Table 2 Data Elements

Cost Category	Description	Data Elements
Product Purchase Costs	Purchase costs paid by the buyer for all units per product	Product unique code, number of units purchased, average cost per unit, total purchase cost
Ordering Costs	How much does it costs to place an order followed by total ordering costs	Number of orders placed, Cost to place one order
Inventory Costs	What is the cost of inventory in various parts of supply chain (pipeline inventory and safety stock)	Amount of pipeline inventory, amount of safety stock, the cost of capital, total inventory costs
Duties/ Tax Rates	Duties and taxes that companies pay for moving product from origin to destination	Duty rates, tax rates
Transport Costs	What is the cost of moving a unit of product followed by total transport costs	Origin, Destination, Cost to transport one unit of product, transit time, weight and dimension of the shipments
Costs not considered	Warehousing, Handling costs	

Some of the main challenges while collecting and analyzing the data were:

- No central system from where information can be pulled at once. Purchase order information was pulled from SAP whereas shipment information was collected from multiple sources, namely the Transport Management System and Excel. Warehouse and handling costs were calculated based on primary interviews and limited warehousing data
- Diverse set of values for data points such as the cost of working capital used (5% vs 10% vs 17%)

- Lack of a common consistent indicator to match purchase order information with actual shipment/transport information
- Limited and largely inaccurate information available on actual pickup and delivery dates for shipments

Assumptions:

- Ordering quantity and shipping quantity are the same. For e.g. if 10 parts were ordered, then all 10 were shipped within the same shipment.
- Demand is deterministic

4.4 Develop the model and conduct data analysis (Data Analysis)

The data model calculated the total end to end logistics costs per shipment under most common incoterms and provide the quantitative level of business risks associated with using each incoterm. The following costs element were considered in calculating the total logistics costs:

- Ordering costs
- Inventory costs
- Transport costs
- Cost of duties and taxes

During the data collection it was observed that costs such as warehousing handling for inbound shipments are miniscule compared to the transport and inventory costs; hence it was decided not include them in the final data model.

The business risks associated with using each incoterm will be calculated using qualitative input via primary interviews with the XYZ production planners, supply chain managers and buyers. A qualitative

rating of 1 to 5 will be generated based on the responses with 5 being the highest risk and 1 being the lowest. Parameters that will be included in calculating business risks:

- Country of origin where the product comes from
- How the product supplier has performed historically?
- What is the cost of the product?
- Is the product strategic in nature or a commodity?

4.4.1 Ordering costs

The ordering cost is the amount an organization incurs every time an order is placed towards the buyer. In case of products under the scope of this study, most buyers issuing the purchase order are sitting in the following countries:

- Finland
- China
- Switzerland

The ordering costs includes following elements:

- How the order is being placed (email, EDI, paper etc.)
- How much time it takes to place an order?
- What is the average number of order lines per order?
- What is the employee salary cost?
- How many orders were placed during a given period?

Based on above data points, we calculated the approximate cost of placing an order and for this capstone: the amount per order came out to be 13.4 USD per order. Table 3 and Table 4 show the demand of Product PRO000000003 for customers in China and Finland. After analyzing the data, it is evident that both

products are being ordered in different frequencies and size. The buyers in Finland as shown in table 4 are ordering more frequently (overall 51 purchase orders during the year with a median order size of 384 units) against buyers in China shown in table 3 which order less frequently and higher median order size of 960. This results in higher ordering costs for Finland compared to China but lower inventory costs for Finland than China.

Table 3 - PRO00000003 (China)

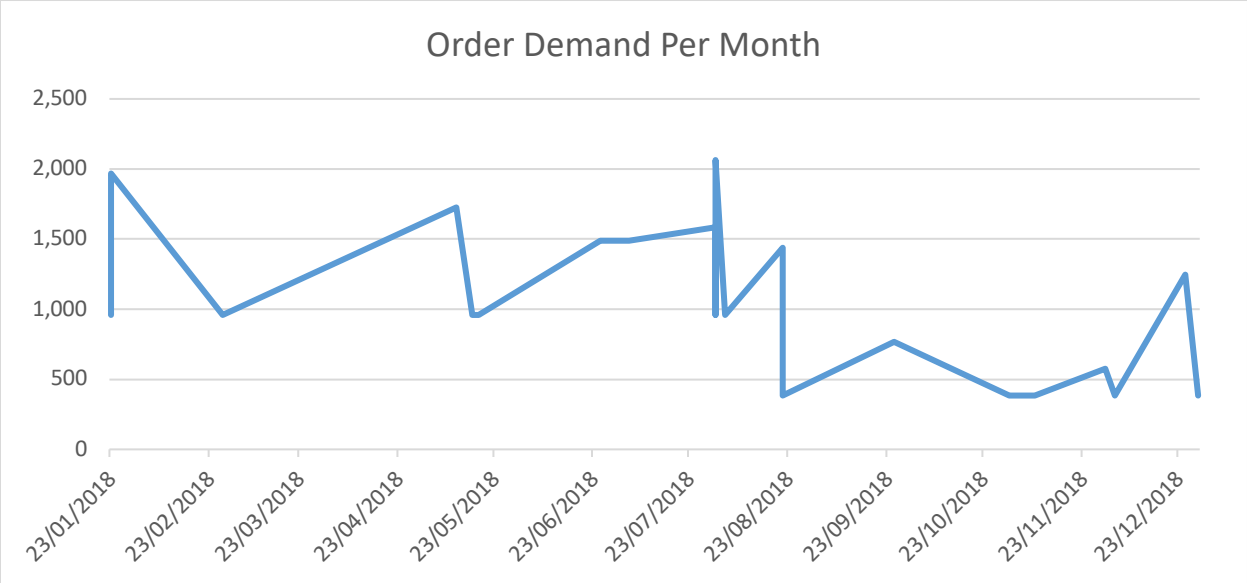
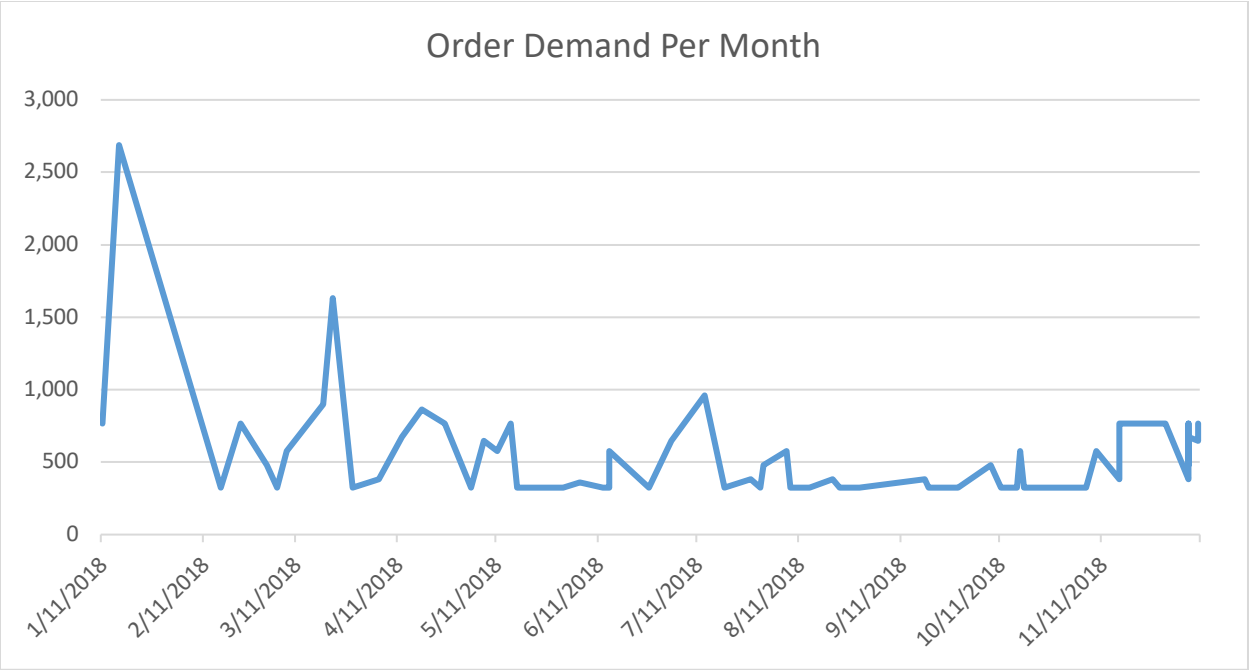


Table 4 - PRO00000003(Finland)



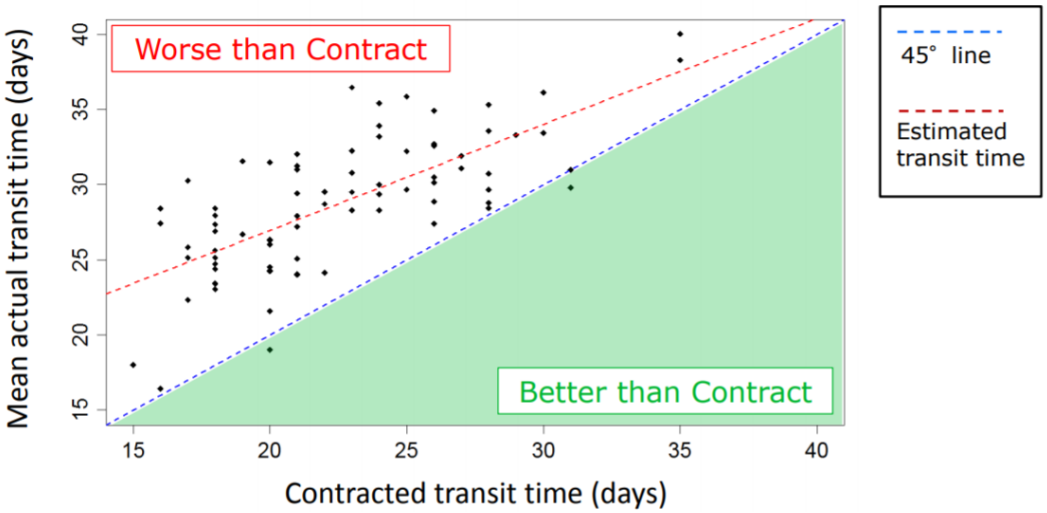
4.4.2 Inventory Costs

The pipeline and safety inventory stocks will be included in the calculations for total logistics costs. Pipeline inventory is the value of goods that are still in transit and not yet reached the destination. Obviously, it means that longer the transit times, the longer the value of goods will be locked up in transport.

On the other hand, the safety stock is the amount of inventory kept as a buffer against the uncertainties in either demand, supply or production. Another factor which affects the inventory levels is the variability in the transit times. For e.g. the ocean transit times for goods coming from Shanghai to Rotterdam port can vary from 25-65 days depending upon the weather, the number of ports being visited, Suez Canal status, etc.

Table 5 (Caplice, Kalkanci 2012) gives an estimation of the variability in ocean transit time and shows that for the majority of shipping lines, the performance is worse than the contracted time.

Table 5 Ocean Transit Time



https://ctl.mit.edu/sites/ctl.mit.edu/files/Ocean_Transportation_Reliability_Webinar.pdf (Caplice & Kalkanci 2012)

The inventory cost is calculated based on the amount of material tied up during transit and safety or buffer and what is the cost of capital for the organization. The formula for pipeline inventory and safety stock is given below:

Pipeline Inventory = D*L where

- D is the annual demand for the material (units/year)
- L is the lead time to get the product from origin to the destination (number of days)

Safety Stock:

$$s = \mu_{DL} + k\sigma_{DL}$$

Where,

µDL is the average demand of a product over the lead time

k is the safety factor which represents the level of service that an organization wants to provide σDL is the standard deviation of demand over the lead time

4.4.3 Transport Costs

The costs related to moving goods from the supplier manufacturing sites to XYZ production locations are included as the transport costs. The products in scope of the study are moved either by trucks (intra-Europe movements) or via ocean (coming from Asia to Europe). Ocean shipping costs usually include the following three high level buckets:

- Costs incurred during movement of goods from the origin to the origin port. For e.g. goods loading, trucking, documentation, customs brokerage, duties etc.
- Costs incurred during the port to port movement. For e.g. the fuel bunker, terminal handling, shipping etc.
- Costs incurred during the destination port to final destination movement. For e.g. custom clearance, trucking, unloading etc.

4.4.4 Total Logistics Costs & Business Risks

The total logistics costs in this capstone is defined as the summation of transport costs, inventory costs and ordering costs. Here is the total logistics cost equation:

Total Logistics Cost = Purchase Cost+ Ordering Cost+ Inventory or Holding Cost+ Shortage Cost+ Warehousing & Handling Cost+ Transport Cost

For the purpose of this study, we will ignore shortage, warehousing and handling cost. The business risks related to each incoterm scenario is calculated as well to present a holistic picture for the company management. It makes it easier to decide based on total logistics costs vs. risk linked with it. In

order to develop this risk model, the author of this capstone created a weighted qualitative model using the following criteria:

- Liabilities and insurance costs
- Logistics costs including the networking capital
- Risk of compliance (customs, regulatory etc.)

Each risk was evaluated per incoterm during interviews with the company supply chain managers, buyers, operation managers and finance personnel. The risk ratings per incoterm ranges from 1 to 5 with 5 representing the highest amount of risk a company is taking.

Table 6 shows the total costs per shipment under various incoterms analysis of total costs for each of the products under study per Incoterm.

Table 6 Total Logistics Costs per Shipment

Part Number	Origin	Destination	Buying Incoterm	Total logistics costs per shipment	Business Risk under the incoterm
PRO00000001	Hungary	Estonia	EXW	1000	5
PRO00000001	Hungary	Estonia	FCA	850	3
PRO00000001	Hungary	Estonia	CPT Port	650	3
PRO00000001	Hungary	Estonia	CIP	750	3
PRO00000001	Hungary	Estonia	DAT	600	2
PRO00000001	Hungary	Estonia	DAP	TBC	1
PRO00000001	Hungary	Estonia	DDP (Estonia Door)	350	1
PRO00000001	Hungary	Estonia	FOB	250	3
PRO00000001	Hungary	Estonia	CFR	200	3
PRO00000001	Hungary	Estonia	CIF	200	3

5 RESULTS

The capstone project has highlighted various benefits of using different incoterms depending upon the product characteristics such as origin, price, volume, type (strategic or commodity), tax rates, etc. Incoterms such as E&F allows an organization to enjoy the following benefits:

- Increased visibility as the product is under the buyer control
- Enhanced capability to procure consolidated volumes
- Upon analysis, we also found out that by controlling inbound, the company can save networking capital. An example of this savings could be when a supplier can invoice the buyer as soon as the goods are shipped. However, if you control the inbound, the carrier can only charge you once the goods are delivered. This increases the time window to pay for goods and reduces the networking capital required.

The results identified that although by using the E&F incoterms, buyer organization incur higher costs, the ability to effectively manage the inbound provides the organization an advantage. The problem being addressed by this capstone is a universal topic and is applicable for other organization as well. It is especially relevant for companies which are buying internationally and have high levels of working capital.

Limitations:

- The model does not consider all costs that may be relevant (such as warehousing and handling costs)
- The risk attached under each scenario is built on primary interviews with XYZ supply chain, trade and operations managers. It would be good to expand this further and assess its impact in more detail
- Details about implementation are missing in this setup. One of the main requirements in this setup will be an investment into systems such as transport management system.

6 DISCUSSION

In order to choose the right incoterm for a product category, the following decision matrix in table 7 may be used:

Table 7 Incoterm Decision Matrix

Purchase Price	Volume	Nature of Product	Origin	Destination	Inbound Operations Actively Managed	Proposed Incoterm
0-50 USD	0-10000	Commodity	Asia	Europe	Yes	CPT/ DAP/ DDP
0-50 USD	10000-100000	Commodity	Asia	Europe	Yes	FCA/ FOB
0-50 USD	100000+	Commodity	Asia	Europe	Yes	FCA
0-50 USD	0-10000	Commodity	Asia	Europe	No	DAP/ DDP
0-50 USD	10000-100000	Commodity	Asia	Europe	No	FCA/ FOB
0-50 USD	100000+	Commodity	Asia	Europe	No	FCA
50-200 USD	0-10000	Strategic	Asia	Europe	Yes	FCA
50-200 USD	10000-100000	Strategic	Asia	Europe	Yes	FCA
50-200 USD	100000+	Strategic	Asia	Europe	No	FCA

It is critical to have an active inbound operations management setup in order to take full advantage of converting incoterms from C&D terms to E&F terms. Although there are multiple ways for an organization to establish an inbound operations setup. The most commonly used methods would be when the buyer or third party manages the inbound setup or where the supplier manages the inbound setup. Based on the analysis, we have decided to not consider EXW terms as it includes additional risk of goods loading at the supplier site. Most of the products with XYZ company are larger in size and may require special loading equipment. A supply manager would not consider this as a value adding activity as it only increases risk on the consignee side.

6.1 Established inbound management setup

The fully in-house management setup requires the organization to have a structured inbound management team or contract with an external service provider to manage the inbound shipments. Key benefits to having visibility and control on inbound shipments to production sites and project sites are:

- Increased visibility allows the organization to plan its production more effectively and thus reducing the need for higher safety stocks
- Ability to consolidate inbound shipments from multiple suppliers coming from same origin country/region
- Increased carrier performance management with data
- Potential to design and procure backhaul instead of just one-directional flows

Key challenges:

- Requires additional investment in people and systems
- May not be considered as critical as outbound by the organization/local employees
- Increased risk/liability for the organization
- Overall benefits may take longer to materialize
- Suppliers may not be ready to provide data via interfaces

6.2 Third party managed inbound logistics setup

One of the alternatives to establishing the in-house inbound management setup is to work with a third party (3PL) or fourth party (4PL) logistics service provider and allow them to manage the inbound operational activities such as:

- Calling the supplier to check if the goods are ready for pickup
- Consolidate all cargo from the supplier to same end destination

- Conduct compliance check on the customs declaration and material codes

Despite having several advantages such as lower cost of implementation and ease of rolling out, this setup does have several inherent disadvantages such as:

- Limited control on what services the suppliers can use with the carrier (for e.g. in case of delays, they may use expensive airfreight against a cheaper consolidation service)
- Supplier may not inform the buyer about shipment details

7 CONCLUSION

This capstone recommends evaluating incoterms when purchasing to achieve the lowest total cost for the company, the optimal visibility of arrival and understanding of risk associated with each incoterm. This scenario is best achieved with in-house management of inbound logistics in most cases followed using third-party providers which manage the inbound on company's behalf and are measured against certain operational performance metrices. Future research options could verify the cost savings vs. the implicit risks associated with this option. Another research option could be to compare the tradeoffs such as the total costs, risk of outsourcing etc. involved with managing inbound internally vs. outsourcing them to a third party. Finally, there could be additional research regarding the implementation of this inbound management strategy resulting in best practices that could be applied to multiple industries that utilize international sourcing.

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