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Enhancing South American Direct Invoicing Deliveries. A Comprehensive Approach Using the ADA Freight Model System and INCOTERMS 2010

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ABSTRACT

In global business, specific terms like "delivery" have a different meaning than in everyday conversation. For companies engaged in international trade, it is crucial to standardize these terms to secure market share, optimize supply chain efficiency, and reduce costs. The International Chamber of Commerce's INCOTERMS are crucial for achieving this consistency and are widely recognized internationally. These terms define the responsibilities of buyers and sellers in delivery, risk, and cost obligations, making trade negotiations and contracts more transparent on a global scale.

This thesis proposes adapting the ADA Freight Model System, a framework used successfully in other European countries, to optimize freight logistics for a South American company's direct invoicing deliveries. By aligning with the INCOTERMS CPT and CFR, the studied company in this research can improve its competitiveness and support its sales offices.

The research methodology includes a case study integrating theoretical frameworks and company information. Logistics professionals were interviewed to gain qualitative insights, and a survey was conducted to measure the company's understanding of INCOTERMS. The findings show a significant gap in understanding that impacts export performance, underlining the need for comprehensive training and communication strategies.

Although data scarcity presented developmental hurdles, the ADA model and the company's lean supply chain approach show promise for successful implementation in enhancing logistical procedures and global competitiveness.

KEYWORDS: Direct invoicing delivery, Incoterms 2010, Freight transport model, ADA aggregate-disaggregate-aggregate freight model system.

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TIIVISTELMÄ

Globaalia liiketoimintaa käsiteltäessä jotkut termiinit, esimerkiksi "toimitus", saavat aivan toisenlaisen merkityksen verrattuna tavalliseen päivittäiseen puhekielen käyttöön. Kansainvälistä kauppaa harjoittavien yritysten intresseissä on standardisoida nämä termit varmistaakseen markkina-asemansa, optimoidakseen toimitusketjun tehokkuutta ja vähentääkseen kuluja. Kansainvälisen kauppakamarin INCOTERMS-järjestelmät ovat ratkaisevassa roolissa tämän johdonmukaisuuden saavuttamisessa; ne ovat laajasti tunnustettuja globaalisti. Nämä termit määrittävät ostajien ja myyjien vastuut toimitus-, riski- ja kustannusvelvoitteissa, edistäen näin kauppaneuvotteluiden ja sopimusten läpinäkyvyyttä globaalisti.

Tässä tutkielmassa ehdotetaan, että Etelä-Amerikkalaisen yrityksen suoralaskukuljetuksissa hyödynnettäisiin rahdin logistiikan optimoimiseksi ADA-rahtikuljetusmallia, jota on käytetty menestyksekkäästi muissa Euroopan maissa. Yhdenmukaistamalla toimintansa INCOTERMSin CPT:n ja CFR:n kanssa, tutkimuskohteena oleva yritys voi parantaa kilpailukykyään ja tukea myyntikonttoriaan.

Tutkimusmetodologiana käytetään tapaustutkimusta, joka yhdistää teoreettiset viitekehykset ja yrityksen tiedot. Logistiikan ammattilaisia haastateltiin laadullisen tiedon saamiseksi, ja kyselyn avulla arvioitiin yrityksen ymmärrystä INCOTERMSistä. Tulokset paljastavat merkittävän puutteen ymmärryksessä, joka vaikuttaa vientituloksiin, mikä tuo esiin tarpeen laaja-alaiselle koulutus- ja viestintästrategialle.

Vaikka tiedonpuute on ollut kehityksen este, ADA-malli ja yrityksen ketterä toimitusketjun lähestymistapa ovat lupaavia menestyksekästä toteutusta varten, parantaen logistisia prosesseja ja globaalia kilpailukykyä

AVAINSANAT: Suora laskutuksen toimitus, Incoterms 2010, Rahtikuljetusmalli, ADA aggregaatti-disaggregaatti-aggregaatti rahtimallijärjestelmä.

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ABBREVIATIONS

BSC Brazilian Supply Center

CCC Customer contract carrier

CO Customer order = sales order in M3

COM CO Management team

D2D Day-to-day

E10 M3 order type standard delivery process allowed

E20 M3 order type standard delivery process not allowed

EDI Electronic Data Interchange

ERP Enterprise Resource Planning

F10 M3 order type standard delivery process allowed; the order automatically released

FC Flow Control

FWD Forwarding department

GBI Global Business Information

HSC Helsinki Supply Center

IHS In-house service

IPO Intercompany Purchase Order

IQI Internal Quotation Inquiry

LTP	Legal Transfer Price
M3	Lawson's ERP system
CTOP	Company Transportation Optimization Project
MVM	Company Valve Manufacturing
MTG	Metso Transport Gateway
PO	Purchase Order
POD	Proof of Delivery
SO	Sales Order
SS	Sales Support

1. **INTRODUCTION**

Exploring novel methods to enhance the performance of invoicing deliveries in South America is extremely important. Although interesting, reliance on the ADA Freight Transport Model and Incoterms 2010 structure appears optimal. Smith (Smith, 2020) presents these systems as a broad, maybe the only, basis, assisting in improved performance and logistics efficiency of direct invoicing deliveries.

The ADA Freight Transport Model uses advanced algorithms to optimize freight transportation, making operations more efficient and cost-effective. Particularly beneficial are its adaptability to multiple contexts and capability to guide strategic decision-making within the logistics sector (Zenezini & Tavasszy, 2022) Meanwhile, Incoterms 2010 provides a set of international rules, laying out responsibilities of buyers and sellers in the trading of goods, and thus significantly impacting the invoicing system (Jones, 2010).

The aforementioned allows uncommonly direct invoicing in deliveries in South America, which can improve interactions substantially. From the perspective of company case studies, this approach offers high potential to transform corporative performance and implement it into a new era of good flows and financial transactions. Thus, using the ADA Freight Transport Model alongside Incoterms 2010 in South American direct invoicing deliveries is auspicious. As a robust, scalable method, it can be revolutionary at a regional scale and globally.

1.1 Background

Numerous research endeavors have indicated that the interplay of the global economy and trade liberalization heavily shapes the methods through which goods are sourced and disseminated (Hien, Laporte, & Roy, 2009) have observed that in response to the ever-increasing complexities of customer and retailer needs and to maintain competitiveness within their market niches, international firms are now more than ever obliged to reimagine and enhance their supply chain frameworks. The imperative for adaptability within multinational corporations has escalated, necessitating a comprehensive re-evaluation of modes of freight transportation.

Fully comprehending the complexity of export processes, including the vital aspect of delivery terms, is essential for organizations involved in global logistics operations. Establishing appropriate delivery terms is central to maintaining a malleable supply chain architecture, optimizing cost management, and streamlining billing processes. Furthermore, in commercial agreements, the pricing is closely tied to accurate awareness of delivery terms, as any misinterpretation could lead to confusion and misallocation of expenses between exporter and importer, risk assumption, the juncture of transfer for goods, customs charges, export documentation, and overall product and operational expenditures.

The studied Company in this research, with expansive international transactions and customers, must also precisely navigate goods transported to its clientele using the correct INCOTERMS 2010. Customer needs and geographic localities influence the Company's choice of INCOTERMS 2010; the terms DAP and CPT, for instance, are efficient within the European context (Lottanen, 2015).

With heightened global rivalry, the studied Company strives to remain competitive across various domains, including technological advancement, innovation, management, operational activities, and logistics. Recent studies and data from the Company indicate that

certain INCOTERMS adopted within the South American markets lead to elevated operational expenses. As the Company's Transport Presentation (Company Annual Report 2012) demonstrated, transportation costs in 2008-2009 exceeded 200 million Euros. Embracing "lean management and production principles," the Company has striven to eradicate waste in its processes. Success has been marked in areas such as negotiation effectiveness, compliance enhancement, and transportation fine-tuning, as well as the establishment of the Company Transport Gateway (MTG) allowing a reduction in annual transportation expenditure from 200 million Euros to 161 million Euros in 2014 (Company Annual Review 2015) Nevertheless, further improvements remain a priority, especially in the South American region where freight costs are high. There is a strong desire to lower them.

(Ben-Akiva, Meersman, H, & Van de Voorde, 2013) point out that transport modelers increasingly focus on disaggregated behavioral analysis, identifying three crucial spheres: the interconnection of transportation and economic activity, decision-making and processes within logistics, and the integration of traffic flow with network infrastructures. This shift has allowed for more versatile scenario planning, enabling additional variables or coefficients to be integrated into these models. For instance, this study suggests that the studied Company should incorporate CPT and CFR incoterms in forthcoming sales contracts for clients receiving direct billing.

Embracing the adage "You cannot control what you cannot measure," espoused by Tom De Marco (Malfliet, 2011), this study’s foundational issue is identified as the use of the FCA INCOTERM 2010 coupled with transport modalities such as Customer Contract Carrier and Customer Pick, predominantly utilized by direct billing customers.

The FCA term grants customers the autonomy to organize freight from the production facilities to the destination ports in South America. However, historical data from the Company highlights inefficiencies in how customers engage with the FCA option (Siivonen,

2015) It is often noted that customers may place their orders but need to coordinate the freight in tandem. Once production is complete, they are notified through the Company's South American sales offices to arrange freight collection from the Finnish factory. This leads to delays in freight organization and resultant extended warehousing periods for the goods, at times spanning up to ten months, thus inflating operational costs in warehousing, maintenance, personnel, product pricing, and lifecycle management.

The organization intends to advocate for new recommended INCOTERM 2010 protocols, particularly CPT and CFR, within its South American subsidiaries for incorporation into new sales agreements. Moreover, it aims to enhance clients' understanding in South America regarding the alternatives to the FCA INCOTERM 2010, which has proven ineffectual within the region.

The objective of this research is to analyze and propose the enactment of an Aggregate-Disaggregate-Aggregate (ADA) freight transportation model for the studied Company. According with (Guozheng, 2022) The ADA freight transportation model integrates decision support systems, enhances supply chain efficiency by optimizing time series forecasting, ensures accurate customer order plans, and improves cost-effectiveness.

The studied Company´s prime business division operates in sectors such as mining, aggregates, recycling, oil and gas, pulp, paper, and process industries (Company web site, 2016). The implementation of this model is intended to enable the Company to utilize its own Contract Carrier for deliveries, thereby discarding customer contract carrier and pick-up arrangements, increase shipping volume to bolster negotiation leverage with freight companies, facilitate immediate booking upon readiness of goods, and maintain smooth follow up of the delivery process.

1.2 Research Gap

Numerous studies across scientific and academic disciplines have delved into the different types of INCOTERMS, their application, and the factors influencing their selection. Most scholars agree that the choice of INCOTERMS is shaped by business environmental factors and export performance (Hien, Laporte, & Roy, 2009) In determining the most appropriate INCOTERMS, companies often aim to optimize profit and mitigate the risks and uncertainties tied to global shipping. Business environmental factors consist of the external elements a company must respond to or those that influence it (Lawrence & Lorsch, 1967) An analysis of the business environment is crucial for identifying relevant factors in a given context. The PESTEL method is a valuable tool for assessing the political, economic, social, technological, environmental/ecological, and legal aspects of the environment (Sanchez & Heene, 1997)

Moreover, various researchers, including (Sanjeev & Sridhar, 1992), (Brouthers, 1995), (Tse, Yigang, & Au, 1997), (Pan & Tse, 2000), and (Osland, 1983), have identified additional factors influencing market entry within specific regions. Commonly cited factors include a company's size, resources, negotiating capacity, competitive level, product features, regulatory environment of the market, and familiarity with and understanding of the regional market (Katsikeas, Leonidou, & Morgan, 2000). They analyzed 103 export performance-related articles, classifying them based on economic, non-economic, and universal indicators. They identified 42 distinct metrics to assess export performance: 23 economic, 14 non-economic, and five universal indicators. Six indicators regularly surfaced in the literature: export sales volume, growth in export sales, export profitability, ratio of export sales, and export performance perceptions from management.

As a corporation, the Company has extensively researched freight and cost optimization within various business lines and global locations. Nevertheless, internal studies on freight arrangements in South America concerning their operations and the resulting cost escalations from customer delays still need to be included. This unique issue needs

immediate investigation and resolution, leading to this research: Enhancing South American Direct Invoicing Deliveries. A Comprehensive Approach Using the ADA Freight Transport Model and Incoterms 2010.

1.3 The objectives of the study

1.3.1 To reduce carrying costs resulting from customer delays in arranging shipping or promptly collecting products upon availability at the factory.

By adhering to a lean philosophy, producing products in response to customer pull signals facilitates immediate dispatch, thereby eliminating the necessity of storing finished goods. This assumes that factories have reached this level of responsiveness through the sales department's blend of confirmed customer orders with forecasted ones, transferring ownership of finished goods after they leave the factory. In this context, manufacturing entities do not have to be concerned with the inventory of finished goods “the responsibility rests with the company and the sales department collectively” (Baudin, 2004). Supporting the findings of (Williams-Timme & Timme, 2003) companies frequently neglect the benefits of reducing non-capital carrying costs in supply chain evaluations due to inaccurate cost assessments.

The adoption of the updated Incoterms 2010 CPT and CFR enables the company to assign a contract carrier owned by the company for product deliveries, rather than depending on customer carriers. This also establishes a true pull signal that aligns with lean practices by avoiding the unnecessary warehousing of goods.

1.3.2 To expedite the delivery times of goods to customers.

Rapid response time is a crucial competitive advantage in global markets. Implementing quick delivery requires a strategic approach that requires several components, such as identifying customer types, predicting demand and orders, and fulfilling these orders.

According to (Bhatnagar, Mehta, & Teo, 2011) global manufacturing companies utilize third-party logistics (3PL) services to manage multimodal transportation effectively, balancing the competing demands of achieving economies of scale with meeting timely demand. Sales and Operations departments that receive orders should identify patterns to streamline internal processes and negotiate more consistent delivery schedules with customers (Baudin, 2004).

By applying the company's recommended new Incoterms 2010 CPT and CFR, the company can monitor and track shipments to the final destinations for direct invoicing customers. This addresses both the logistical need for economies of scale and the requirement for prompt demand fulfillment, thus facilitating larger shipment volumes that enhance bargaining power in subsequent transportation negotiations.

1.3.3 To enhance the quality of deliveries.

In logistics, failure often serves as a key criterion for assessing performance quality. Improvements are observed when issues such as delays, lost or incorrect items, damaged parcels or products, and deliveries to wrong addresses are effectively resolved. These factors significantly affect adherence to, and fulfillment of the delivery terms stipulated in a contract. It is crucial that goods are delivered in unspoiled condition to the correct location and intended recipient, all within the agreed-upon time frame and at the specified cost. Any deviations, such as delays or errors, result in considerable additional time and financial costs for the company and are contrary to the principles of lean methodology (Savy & Burnham, 2013).

The company employs both individual and team performance metrics to monitor, motivate, and reward its workforce, thereby optimizing an essential segment of the supply chain. The introduction of Key Performance Indicators (KPIs) at the company is intended to measure, manage, and improve performance. KPIs should be seen primarily as tools that enable companies to achieve their visions, steer their future strategic planning, improve quality, and establish benchmarks for excellence in setting best practices (Christensen, Germain, & Birou, 2007).

The current study will employ KPIs such as on-time delivery, complete and first-time accurate orders, proper documentation, correct use of Incoterms, reduction of damage claims, achievement of perfect orders, total order cycle time, customer complaints, and management of back orders to enhance the quality of goods delivery.

1.3.4 To increase flexibility in delivery.

According to (Christensen, Germain, & Birou, 2007) to increase flexibility in delivery, one has to comprehend the extent to which the Company can produce and ship, or what specialists often refer to as the “mobility of goods” . Comprehensive research will be required to evaluate the type and amount of goods shipped, the spatial deployment of flows, and changes in its volume at different times. Usually, changes are non-linear; the some of the main factors that can affect the mobility of goods are an economic decline, an industrial restructuration, or increased globalization trends. The Aggregate-Disaggregate-Aggregate (ADA) freight transportation model enhances delivery flexibility by optimizing various aspects of freight operations. The model allows for joint optimization of headways and zone sizes for flexible-route freight deliveries (M. Edward, A, & Chelsie, 2022)

The studied Company, having undergone numerous acquisitions and divestitures over the years, faces challenges in analyzing its goods mobility and improving delivery flexibility. The Company's core business sectors are Mineral Capital, Mineral Services, and Flow Control. Specifically, improvements in the Flow Control division's flexibility will be examined to determine the advantages and potential benefits of implementing the newly recommended Incoterms 2010 CPT and CFR.

1.3.5 To educate the Company’s sales offices in South America about the new Company’s policy on INCOTERMS 2010 CPT and CFR to customers.

According to the Company´s financial statement for 2015, the Company employed 12,375 personnel. South and Central America account for 20% of this workforce, with over 2,500 employees and an average of approximately 600 million Euros in net sales annually for 2013-2015 (Company Annual Review 2015). Given this significant representation, continuous monitoring, and alignment with the Company’s strategic focus on fostering continuous learning and professional growth are required (Company Annual Report 2012). In future

transactions, the application of Incoterms 2010 must be fully comprehended and adhered to the Company's overall standards by South American sales offices rather than applied by default.

1.3.6 To educate Company’s customers in South America about CPT and CFR.

The Latin America and Caribbean region have abundant natural resources, but still it has historically struggled to convert this wealth into sustained economic development (CELAC, 2015). With vast reserves of lithium, silver, copper, gold, coltan, and hydrocarbons, among other resources, this area also represents substantial business opportunities for the Company’s sustained growth. Consequently, the Company's sales office must provide solid support to current and potential customers, ensuring value creation through consistent delivery quality. Using the newly recommended Incoterms 2010 gives customers a logistical advantage by guaranteeing the perfect condition of the delivered goods, relieving them of contracting responsibilities with freight carriers, and potentially reducing delivery lead times.

1.3.7 Just-in-time invoicing.

With the adoption of the new Incoterms 2010 CPT and CFR, the studied Company can issue invoices immediately upon dispatch of goods from the factory. By contrast with D terms, this allows for timely invoicing, obviating the need to wait until the shipment reaches its destination. As a result, there is a time-saving opportunity for both sales and delivery departments, with shipments tracked via the Company Transport Gateway program (MTG).

Disaggregate models, like the one proposed in the ADA model system, offer advantages such as a stronger empirical foundation, detailed policy-relevant variables, and avoidance of aggregation biases (Abate, Vierth, Karlsson, Jong, & Baak, 2019). The ADA freight transportation model aids in Just-in-time invoicing by simulating time, speed, and cost parameters for an efficient response to risks, enhancing profitability, and reducing

transportation price components. The implementation of this model can predict invoice amounts at different shipment milestones, enabling early invoice factoring for carriers and aligning with Just-in-time invoicing needs (Narayanam, Dayama, & Nishad, 2022).

The aim is to update and employ the existing freight transportation model systems to create harmony within the supply chain management structure.

1.4 Research Questions.

To delve into the objectives of this research, three pivotal questions shall guide the inquiry:

1.4.1 How to select the appropriate Incoterm 2010 for a sales contract?

To select the appropriate Incoterm 2010 for a sales contract, a company must analyze the nature of the goods, the roles and capabilities of the parties involved, the desired balance of cost and risk, and transportation modalities, ensuring alignment with specific transactional needs and international trade practices.

When selecting an Incoterm 2010 for a sales contract within the ADA freight model, is important to consider the specifics of the transaction and transportation modes. The ADA model provides a detailed view of freight flows and integrates aggregate and disaggregate data. Transit-time reliability greatly affects carrier choice due to its influence on lead times and demand variability. This comprehensive approach assists traders in making informed choices on the appropriate Incoterm based on these operational factors.

1.4.2 What are the advantages of employing CPT and CFR from Incoterms 2010?

Using CPT or CFR from Incoterms 2010 benefits the seller by making them responsible for arranging and paying for the shipment of goods to a named destination, while the buyer benefits from a clearly defined transfer point for risk of loss or damage to the goods.

Using CPT and CFR Incoterms 2010 in conjunction with the ADA model enhances risk management and transaction smoothness, aligning with modern trade practices. These terms, recommended by the ICC, provide clarity to traders in cross-border dealings within customs unions (Malfliet, 2011) and (Gavrilă & Roşu, 2011).

1.4.3 What improvements can the organization expect in its freight transportation operations by implementing the ADA model, especially in relation to cost savings, efficiency, and supply chain optimization?

The ADA freight transportation model brings significant advantages to an organization by enabling informed decision-making, improving cost efficiencies in logistics, enhancing supply chain management, allowing better evaluation of policies, providing dynamic analysis of transportation scenarios, and ultimately strengthening the organization's strategy and competitiveness in the market.

By implementing the Aggregate-Disaggregate-Aggregate (ADA) model system for freight transport can bring significant benefits to the studied Company. By utilizing disaggregate models based on behavioral theory and detailed variables (SAE technical paper series, 2023) organizations can achieve more accurate cost analysis and optimization in transportation operations. The ADA model system addresses the gap between transportation operations modeling and cost functions, providing a more systemic approach to transportation considerations in optimization models (Mahani, 2015). Furthermore, the ADA model system can enhance system-level modeling efficiency without significant simulation time overhead.

Overall, the ADA model system offers a comprehensive framework for improving cost savings, efficiency, and supply chain optimization in freight transportation operations.

These inquiries have been formulated to facilitate a systematic examination of the application of Incoterms 2010 and the ADA model within the organizational framework. The focal points of this investigation include the methodologies employed in the selection of Incoterms, the distinct advantages conferred by the CPT and CFR terms, and the comprehensive benefits accrued from the adoption of the ADA model.

The motivation for the selection of these inquiries is manifold. Firstly, the aim is to procure a comprehensive understanding of the current application of the FCA Incoterm 2010 within the context of the organization's standard sales contracts. The above questions will help to determine a dynamic and market-sensitive strategy that will be designed to improve the efficiency of the company’s delivery timeframes. As such, they are also educational to the company’s customers, helping them understand the basis on which an INCOTERM is chosen to meet their transactional need.

Secondly, this investigation seeks to elucidate to the company's customer base the intrinsic benefits associated with the CPT and CFR Incoterms. Highlighting these advantages is imperative, as they yield mutually beneficial outcomes for both the organization in question and its valued customers, by potentially optimizing operational efficiency and cost-effectiveness.

1.5 Research Design

The application of Incoterms in transportation models is complex. It requires an understanding of the legal implications of these terms and their operational impact on logistics. This research design leverages insights from international trade, transport economics, and supply chain management.

The research aims to determine whether the use of the new Company's recommended Incoterms 2010, CPT and CFR, will fulfill company expectations of optimizing its supply chain by smoothing the delivery of goods, reducing operational costs, increasing volume negotiation for shipments, applying JIT shipment booking, and enhancing the invoicing process. This research addresses scientific, academic, and company concerns, and engages stakeholders in the manufacturing industry. Consequently, the worldview ontology adopted for this thesis is 'pragmatism.' According to Creswell, 'Pragmatist researchers look to what and how to research based on the intended consequences' (Creswell, 2009), by employing mixed methods.

The research is both qualitative and quantitative, as creating a freight transport model using the new Company's recommended Incoterms 2010 requires data analysis, validation, and the application of mixed methods. Therefore, the research approach is inductive, allowing the Company and future researchers to adjust the intended path based on new findings and changes in the business environment.

Multiple research methods, both qualitative and quantitative, are utilized in this study. RCA (Root Cause Analysis), surveys, think-aloud protocol interview techniques, Company report analysis, scientific articles, and journal analysis among others, are applied to enable the use of various data collection methods that ensure the reliability and validity of the case study and make it cross-sectional for the time horizon.

To design a research framework using Incoterms CPT and CFR within the context of the ADA Transport Model, it is essential to consider and integrate the following elements:

Literature Review: The research investigates existing academic literature on Incoterms, particularly CPT and CFR, and how they are utilized within transport models. This includes their cost, risk, and efficiency implications within logistic chains (Malfliet, 2011) and encompasses a comprehensive literature review on the implementation of the Aggregate-Disaggregate-Aggregate (ADA) model system for freight transport.

Data Collection: The research gathers data relevant to transportation using CPT and CFR terms, such as logistics costs, delivery times, risk assessment, and transportation routes. For instance, reports from the studied Company are utilized for this purpose.

Model Integration: Determine how the ADA Transport Model functions and identify where and how Incoterms can be integrated into the model. This involves adapting the model to include specific cost allocations and risk transfer points as dictated by CPT and CFR terms.

Case Studies: Analyze cases where CPT and CFR have been implemented, assessing the outcomes and challenges associated with their use in various transport scenarios.

Comparative Analysis: Contrast CPT versus CFR in different scenarios within the ADA Transport Model to identify which conditions favor one term over the other.

Sensitivity Analysis: The research intends to conduct sensitivity analyses to ascertain how changes in Incoterms conditions or external factors, such as fuel prices or rules changes, affect the transport model.

Surveys and Interviews: In 2016, a survey was conducted to obtain qualitative data from industry professionals and experts on the practical use and preferences for CPT and CFR in transportation.

Risk Assessment: the research evaluates the risk profile for each Incoterm and its influence on the transport model, such as determining at which point the risk is transferred from the seller to the buyer and how this impacts logistics planning.

Economic and Policy Implications: Assess the broader economic and policy implications of selecting between CPT and CFR within the transportation model, for example, how they influence international trade agreements or customs processes, particularly outside the EU zone and inside the South American regions.

1.6 Limitations

There is abundant literature analyzing transportation costs in international trade. According to (Ananda, Desi Dwi, Eva Arista, Vingky, & Septya, 2022) the complexity of Incoterms in transportation models requires understanding legal implications and operational impacts on logistics, necessitating a comprehensive research approach integrating various methods and elements.

For instance, the first limitation we found is that the use of Incoterms is not mandatory; they are a tool available to companies that can theoretically choose to use them or not. Understanding Incoterms plays a crucial role in international trade; some experts regard Incoterms as the “Bible of International Commerce” (Malfliet, 2011). Nonetheless, it is vital to recognize that the ADA transport model’s limitations may not entirely accommodate the specific challenges and considerations involved in South American direct invoicing deliveries.

Regarding South American direct invoicing deliveries, utilizing the ADA transport model with Incoterms CPT and CFR presents limitations and challenges. First, the ADA transport model may need to accurately capture South America’s specific logistical challenges and infrastructure constraints. These issues range from poor road conditions and unreliable transportation networks to customs and border control difficulties. Incoterms CPT and CFR

might only partially cater to South American customers' unique requirements and expectations. Moreover, the ADA transport model may overlook the cultural and business practices prevalent in South America, which can influence the effectiveness and success of the delivery process.

1.7 Structure of the study

When building a study structure for utilizing the ADA transport model with Incoterms CPT and CFR for direct invoicing deliveries in South America, there are various aspects that require consideration. An understanding of the dynamics of regional integration in South America, primarily through entities such as Mercosur, can provide insights into modeling requirements at the regional level (Rodrigo & Alejandro, 2021).

Mercosur is a South American trade bloc established in 1991, which includes Argentina, Brazil, Paraguay, Uruguay, and Venezuela. It has been successful at creating a common market, which has facilitated trade within the region. However, there are still challenges in the transport sector, which need to be taken into account when building a study structure. According to a report by the Inter-American Development Bank, improving transport infrastructure and logistics is key to increasing competitiveness in the region (Alberti & Pereyra, 2016).

Utilizing an integrated Land-Use and Transport Interaction (LUTI) model, such as the one implemented in Bogotá, Colombia, can be advantageous for estimating transport emissions and assessing policy interventions (Guzman & Orjuela, 2017). The LUTI model considers the interplay between land use and transport, a crucial aspect for urban planning and policy formulation. This model offers valuable insights into the potential impact of transport policy changes on land use patterns and serves as a reference for the ADA transport model.

Analyzing the impact of institutional variables on road transport efficiency in Latin America and the Caribbean can guide the selection of relevant organizational factors for the study

structure (Alberti & Pereyra, 2016) According to the World Bank, the transport sector in Latin America and the Caribbean is facing significant challenges, including inadequate infrastructure, low levels of investment, and a lack of regulatory frameworks (Universidad de la Costa, 2022) Therefore, it is essential to consider institutional variables when building a study structure.

Finally, studying the adaptability of agglomeration transport supply and demand structures, as proposed by entropy theory, can provide a theoretical foundation for achieving equilibrium in transport structures (Universidad de la Costa, 2022) Entropy theory is a mathematical framework that can be used to model complex systems, including transport systems. It can help to identify the factors that contribute to the efficiency of transport systems and provide insights into how to achieve equilibrium in supply and demand structures. This theory proposes that these structures tend towards equilibrium, and this concept can be applied to the ADA model to study the distribution of freight transportation demand and supply chain.

The literature review presents a detailed summary of the information available in this area, specifically regarding the ADA transport model using incoterms CPT and CFR. It also encompasses a comprehensive analysis of the INCOTERMS literature. The key findings and implications of these studies will be examined and incorporated into the current research.

2 LITERATURE REVIEW

2.1 Incoterms

Incoterms, a set of standardized rules developed by the globally recognized International Chamber of Commerce, outline the responsibilities and duties of buyers and sellers in international trade transactions (ICC, 2011) These concepts, commonly used in contracts and sales agreements, provide a solid framework for the parties involved to decide who bears the costs, risks, and responsibilities of transporting/delivering goods, giving confidence in international trade dealings.

A "trade term" such as CPT denotes specific delivery obligations for the seller or the buyer, streamlining contractual agreements. Despite originating in 19th-century Great Britain to standardize international trade practices, differing interpretations across countries and industries have posed challenges. To address this, the International Chamber of Commerce (ICC) introduced uniform interpretation rules in its 1936 publication of the International Commercial Terms or Incoterms, ensuring legal certainty for trade contracts (Jonas, 2011)

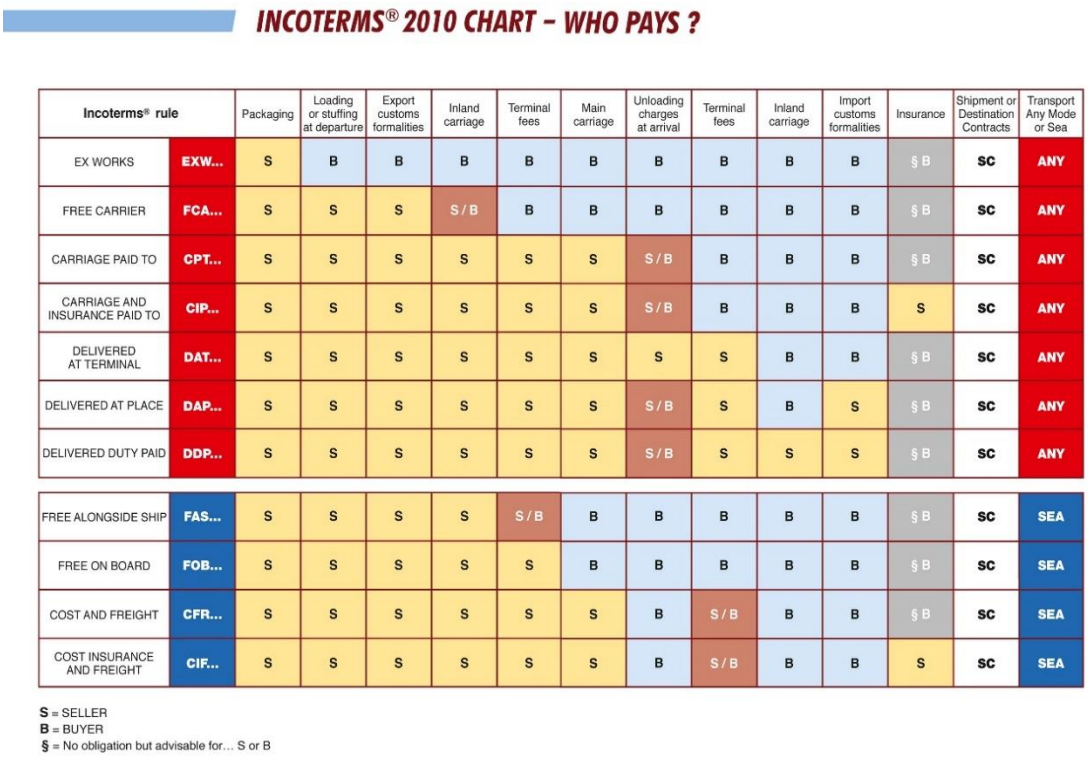
The selection of Incoterms is often viewed as a difficult decision because of the general lack of knowledge on the subject and because the choice of appropriate Incoterms tends to be considered as a constraint rather than as an opportunity to improve the efficiency of an International deal (Hien, Laporte, & Roy, 2009) Unfortunately, nowadays, Incoterms are not well known by the different actors across the supply chain, including shippers and carriers.

When it comes to applying Incoterms, it is not just important; it is crucial to address three key aspects. This is the foundation for a smooth transaction process:

1. It is essential to determine who bears the transportation costs involved.

2. Another crucial point is understanding the specific point in the transaction where the risk is transferred. This potential turning point could lead to loss or deterioration, and it is imperative to be aware of it.
3. Clarifying the responsibilities concerning import and export customs formalities is equally significant.

By meticulously considering these fundamental aspects, businesses can facilitate seamless international trading operations and mitigate potential risks and uncertainties. The image bellow shows a table of the respective responsibilities, rights and obligations of the signatories.



INCOTERMS® 2010 CHART – WHO PAYS ?

Incoterms® rule		Packaging	Loading or stuffing at departure	Export customs formalities	Inland carriage	Terminal fees	Main carriage	Unloading charges at arrival	Terminal fees	Inland carriage	Import customs formalities	Insurance	Shipment or Destination Contracts	Transport Any Mode or Sea
EX WORKS	EXW...	S	B	B	B	B	B	B	B	B	B	§ B	SC	ANY
FREE CARRIER	FCA...	S	S	S	S / B	B	B	B	B	B	B	§ B	SC	ANY
CARRIAGE PAID TO	CPT...	S	S	S	S	S	S	S / B	B	B	B	§ B	SC	ANY
CARRIAGE AND INSURANCE PAID TO	CIP...	S	S	S	S	S	S	S / B	B	B	B	S	SC	ANY
DELIVERED AT TERMINAL	DAT...	S	S	S	S	S	S	S	S	B	B	§ B	SC	ANY
DELIVERED AT PLACE	DAP...	S	S	S	S	S	S	S / B	S	B	S	§ B	SC	ANY
DELIVERED DUTY PAID	DDP...	S	S	S	S	S	S	S / B	S	S	S	§ B	SC	ANY
FREE ALONGSIDE SHIP	FAS...	S	S	S	S	S / B	B	B	B	B	B	§ B	SC	SEA
FREE ON BOARD	FOB...	S	S	S	S	S	B	B	B	B	B	§ B	SC	SEA
COST AND FREIGHT	CFR...	S	S	S	S	S	S	B	S / B	B	B	§ B	SC	SEA
COST INSURANCE AND FREIGHT	CIF...	S	S	S	S	S	S	B	S / B	B	B	S	SC	SEA

S = SELLER
B = BUYER
§ = No obligation but advisable for… S or B

Image 1. Incoterms- Who pays what? Sourced from (ICC, 2011)

Nonetheless, the use of (Jânia, 2017) Incoterms is not obligatory; they are a tool offered to companies which can theoretically at least choose to use them or not even though the

knowledge of Incoterms plays a crucial role in the international trade and some of the expert in the matter consider Incoterms as the Bible of International Commerce (Hien, Laporte, & Roy, 2009).

2.1.1 Incoterms 2010 categories

The Incoterms, established by the International Chamber of Commerce (ICC), are not just a set of rules but a fair and balanced framework for international trade (Petronaft, 2024). They are logically divided into rules applicable for any mode or modes of transport, and rules respectively designed for sea and inland waterway transport. This division seeks to correct the prevailing practice of using maritime terms where multimodal terms would be more fitting, thus promoting a more accurate and efficient use of these international trade terms (Jones, 2010).

The Incoterms are organized based on balancing obligations between the buyer and seller. At one end of the spectrum is the EXW (Ex Works) term, which signifies the minimum obligation for the seller as the goods are made available at the seller's premises, placing nearly all responsibilities on the buyer. At the opposite end is the DDP (Delivered Duty Paid) term, where the seller assumes the highest level of obligation, bearing all costs and risks until the goods reach the specified delivery point in the buyer's country (Jonas, 2011).

According to ICC, within this framework, there are four distinct categories:

E Term (EXW) focuses solely on making goods available at the seller's premises.

F Terms (FCA, FAS, and FOB) are when the buyer takes charge of the main international transport costs and risks.

C Terms (CPT, CFR, CIP, CIF), in which the seller pays for the main carriage but does not assume the associated risks; and

D Terms (DAT, DAP, DDP), where the seller bears full responsibility for costs and risks up to the delivery destination (ICC, 2016).

Understanding these categories and terms is crucial for anyone engaged in international trade, as it ensures clarity and precision in allocating duties and managing logistical responsibilities (Jonas, 2011).

2.1.2 The Impact of Incorrectly Chosen Incoterms

According to (Lewins, 2009) International trade can be daunting, and one area that often poses challenges is the proper use of Incoterms. While these terms are designed to provide clarity and consistency, a lack of understanding or misapplication of Incoterms can lead to significant consequences for businesses engaged in global trade. However, this goal has proven extremely difficult to achieve, as many countries have refused to be party to international conventions that seek to ensure comity. Some have enacted laws that reflect part but not all of those conventions or seek to improve the protection offered by the conventions.

Let us provide some examples of choosing the wrong Incoterm. Let us say a company in the United States is exporting machinery to a buyer in Germany. They choose the Incoterm FOB (Jane, 2016) (Hulkkonen, 2008), assuming their responsibility ends when the goods are loaded onto the ship at the departure dock.

However, FOB only really applies to waterway transportation. The goods are damaged during inland trucking to the port. Since the company was still responsible for the goods during this stage of the journey, it is liable for the damages and incurs unexpected costs. Had they chosen FCA (Hulkkonen, 2008) instead, their responsibility would have ended when they handed over the goods to the carrier for trucking, shifting the liability and subsequent costs to the buyer.

In another scenario, a company might choose EXW (Hulkkonen, 2008)and (Jane, 2016) for an international shipment, thinking it is the easiest option as it minimizes their responsibility. However, this burdens the buyer on organizing and paying for all transportation and export procedures. The buyer might find this inconvenient and opt for a supplier who offers a more comprehensive Incoterm, leading to lost business opportunities for the seller.

The table below shows more hypothetical, yet realistic examples based on common Incoterm misunderstandings. A wrong choice can result in unexpected costs, delays, legal disputes, and damage to business relationships (Jones, 2010).

Scenario	Example
Small Business, Big Delay	A small business owner new to exporting agrees to sell handcrafted furniture to an Australian buyer using the Incoterm CIF They understand this means they are responsible for the costs, insurance, and freight until the goods reach the Australian port. However, they need to account for customs clearance at the destination port. Due to improper documentation, the goods are held up in customs for weeks, leading to storage fees, frustrated customers, and a strained business relationship.
Miscalculated Costs, Damaged Reputation	A company selling industrial equipment to a buyer in Brazil chooses DAP, believing it is only responsible for delivering the goods to the agreed-upon location. However, it didn't realize that DAP requires it to handle import clearance and pay import duties. These unforeseen costs significantly eat into its profit margin, and the delayed delivery due to customs clearance damages its reputation with the buyer.
Unforeseen Risks, Financial Loss	A company agrees to sell textiles to a buyer in India using CFR. They assume their responsibility ends when the goods are loaded onto the ship. However, during the voyage, a storm damages a significant portion of the textiles. Since CFR does not include insurance, the seller is left to bear the cost of the damaged goods, resulting in a substantial financial loss.

Table 1. Common Incoterm misunderstandings. Sourced (Malfliet, 2011)

These examples vividly demonstrate how seemingly minor misunderstandings about Incoterms can profoundly impact businesses. They underscore the critical importance of seeking expert advice or conducting thorough research and understanding the implications of each Incoterm before finalizing any international trade agreement, thereby avoiding potential pitfalls.

According to (Jones, 2010) in the journal "The Impact of Incoterms 2010 on Global Trade," consistently choosing the wrong Incoterms can expose a company to various legal implications, potentially placing them at significant risk. Here are some potential consequences:

Breach of Contract: Choosing the wrong Incoterm can lead to disputes over responsibilities that must be accurately reflected in the contract. For example, if a company is obligated to insure goods under a chosen Incoterm but fails to do so, it could be sued for breach of contract if those goods are damaged in transit (Johnson, 2014)

Financial Losses: As demonstrated in the previous examples, misconceptions about the costs associated with specific Incoterms (such as mistakenly assuming responsibility ends at the port of departure) can result in unforeseen expenses related to transportation, insurance, customs duties, and storage fees (Rosal, 2013). This underlines the potential for significant financial loss, a prospect that should instill caution and a sense of the importance of thorough understanding and research before finalizing any international trade agreement.

Damaged Business Relationships: Disputes and delays stemming from Incoterm misunderstandings can significantly strain buyer relationships. This can lead to a loss of future business, a negative industry reputation, and difficulty securing new partnerships. The potential for damaged business relationships should underscore

the urgency of choosing the right Incoterms to maintain trust and goodwill, thereby making the audience feel the need to prioritize this aspect in their international trade practices (Jones, 2010).

Legal Disputes and Litigation: If disagreements over Incoterm interpretations cannot be resolved amicably, they can escalate to formal legal disputes.

2.1.3 Case Study Incoterms 2010

FCA (Free Carrier) Vantaa, the cornerstone of the case study company's operations, is the most widely used Incoterm for direct invoicing deliveries in South America. This term, which may also involve locations such as warehouses, ports, or airports within Finland, plays a pivotal role in the company's international trade (Avenue, 2016) Under FCA Incoterms 2010, the company, as a seller, is responsible for delivering the goods by loading them onto the buyer's chosen vehicle at their premises. Consequently, the shipper listed on the waybill will be the seller. Additionally, in the case of FCA at another place, the seller delivers the goods at the agreed location using their means of transport, ready for unloading, and the shipper on the waybill should be the buyer. Regardless of the specific scenario, the seller is accountable for clearing the goods for export (Jonas, 2011).

In the primary international transport arrangement, the buyer assumes a leading role. If necessary, the seller may handle the transportation at the buyer's risk and expense based on commercial practices or the buyer's request (Jonas, 2011) with the buyer taking the lead, this clear division of responsibilities ensures a smooth and efficient process.

The newly recommended Incoterm, CPT (Carriage Paid To), has two crucial stages. Delivery and risk transfer occur at the departure location when the seller transfers the goods to the contracted carrier for transport to the designated destination. Notably, the seller covers the transportation costs (freight) until the goods reach the agreed destination, which is included in the selling price (Avenue, 2016) The seller funds the carriage, but it is at the buyer's risk.

However, it is essential to note that the seller does not cover all costs until the destination. CPT stands for 'Carriage Paid To,' not 'Costs Paid To' (Jonas, 2011) This clear explanation of risk allocation should give us confidence in understanding the terms.

The second newly recommended Incoterm, CFR (Cost and Freight), has two critical elements. The delivery and transfer of risk occur at the departure port when the seller loads the goods onto the vessel (similar to FOB) In this case, the seller covers the freight costs until the goods reach the destination port. This means the seller bears the sea carriage costs but is at the buyer's risk. This clear delineation of responsibilities ensures a smooth and efficient process (Jonas, 2011).

2.2 Freight Transport

Freight transport encompasses the expenses involved in relocating goods via water, land, or air. This includes activities such as packing, palletizing, documentation, loading and unloading fees, transport costs, and maritime insurance charges (BusinessDictionary, 2016)

Freight transport is an integral part of the SCM, but it is usually considered a readily available service when suppliers and distributors require it. Also, transport is typically beheld as a non-value-adding activity in the supply chain even though its plays and essential role in the supply chain and, when appropriately managed, can allow supply chains to work more efficiently and effectively (Vaan Weele, 2010, p. 123)

Understanding the advantages of CPT (Carriage Pay To) and CFR (Cost and Freight) Incoterms can be particularly beneficial when exploring freight transport options (Baudin, 2004). Under CPT terms, the seller assumes responsibility for transportation costs, providing the buyer with a clear understanding of the financial outlay. This arrangement also simplifies the logistics process for the buyer as the seller arranges the transportation (De Jong & Ben-Akiva, 2007) This is particularly advantageous in streamlining operations and mitigating any logistical complications arising during shipping.

On the other hand, CFR Incoterms offer distinct advantages, notably in terms of limited liability and streamlined export formalities. Under CFR, the seller's liability is confined to ocean shipments, excluding the obligation to take out insurance, which can reduce overall risk exposure for both parties (ICC, 2011) Furthermore, the seller is tasked with handling export formalities, including obtaining necessary licenses and completing customs documentation, thereby relieving the buyer of a significant administrative burden. The choice between CPT and CFR ultimately hinges on the buyer's and seller's specific needs and preferences, highlighting the importance of a thorough understanding of each term's benefits in global trade logistics (Jonas, 2011).

2.2.1 Freight Transport Demand

Freight transport demand, encompassing the volume of goods requiring transportation from suppliers or manufacturers to customers or end-users, is critical in logistics and supply chain management (Savy & Burnham, 2013) This demand determines the capacity needs for various transportation modes, such as trucks, ships, trains, and airplanes (Zhang, Janic, & Tavasszy, 2015) Influencing factors range from economic growth, which escalates the demand for goods and consequently transportation, to alterations in consumer behavior, such as the surge in online shopping, impacting freight needs. Additionally, global trade agreements, tariffs, and seasonal shifts in agriculture and retail industries significantly affect freight transport dynamics. For instance, changes in trade agreements can alter the cost and availability of transportation, while tariffs can influence the choice of transportation mode. Seasonal shifts in agriculture and retail industries can lead to fluctuations in demand and affect the choice of transportation mode (Mangan, Lalwani, Butcher, & Javadpour, 2012).

According to (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) one of the most significant aspects of managing freight transport demand efficiently is selecting appropriate Incoterms. These are the standardized three-letter trade terms by the International Chamber of Commerce (ICC) that delineate the responsibilities between buyers and sellers regarding

transportation costs, risk transfer, and insurance obligations (ICC, 2016) The correct choice of Incoterms is not just instrumental; but pivotal, in ensuring comprehensive coverage for goods in transit by precisely managing who bears transportation expenses and at what point the risk transfers from seller to buyer.

Several commonly utilized Incoterms play pivotal roles in freight transport demand management. For instance, EXW (Ex Works) places transportation responsibility on the buyer from the seller's premises. At the same time, FOB (Free on Board) requires the seller to manage initial shipping phases, transferring responsibility to the buyer post-port shipment. Conversely, CIF (Cost, Insurance, and Freight) requires sellers to cover delivery costs to the destination port, including insurance, whereas DDP (Delivered Duty Paid) obliges the seller to manage transportation to the buyer's doorstep, encompassing customs, duties, and taxes (ICC, 2011).

The importance of selecting the right Incoterm cannot be overstated. It is a crucial step in mitigating risks, curtailing costs, and enhancing the overall efficiency of freight transport demand management (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) The right Incoterm clearly delineates responsibilities, ensuring smoother transactions and better preparedness for handling the dynamic aspects of global logistics. This, in turn, significantly contributes to a more resilient supply chain infrastructure.

2.2.2 Freight Transport Model

Freight transport modeling is a complex field that simulates the movement of goods within logistics and supply chains (Pourabdollahi, Mohammadian, & Kawamura, 2012) These models aim to reflect real-world scenarios by considering vital factors such as demand and supply, transportation networks, modes of transport, costs, and regulations. They track where goods come from (supply). Their destinations (demand), incorporate different transport routes like roads, railways, waterways, and air routes, and weigh the capacities

and costs associated with each (Mangan, Lalwani, Butcher, & Javadpour, 2012) Additionally, various modes of transport, such as trucks, trains, ships, and airplanes, are factored in based on their respective strengths and limitations. Equally important are the included costs, fuel, labor, infrastructure usage, and potential delays, alongside the regulatory framework that provides for trade barriers, emissions standards, and safety regulations (Baudin, 2004).

Incoterms play a significant role in freight modeling by defining responsibilities between buyers and sellers in international trade (Ananda, Desi Dwi, Eva Arista, Vingky, & Septya, 2022) While Incoterms do not directly control model operations, their influence is profound. They clarify who is responsible for each transport stage, significantly impacting cost allocation and ensuring accurate cost modeling (ICC, 2011) Furthermore, they detail when the risk of loss or damage shifts from seller to buyer, affecting insurance and liability decisions. By consistently using Incoterms in contracts and data inputs, the model can work with trustworthy information regarding costs and responsibilities (Ananda, Desi Dwi, Eva Arista, Vingky, & Septya, 2022).

Correct usage of Incoterms is vital for creating realistic cost estimates in freight transport modeling (Jonas, 2011) Incoterms are instrumental in providing accurate cost allocation, leading to more reliable projections for various transportation scenarios, which aids in optimized decision-making (Ananda, Desi Dwi, Eva Arista, Vingky, & Septya, 2022) Understanding when risk transfers between parties also supports informed choices about insurance, routing, and mode selection. Moreover, clear definitions of responsibilities help reduce misunderstandings and disputes, which could otherwise disrupt the model's assumptions and reliability (Jonas, 2011).

In summary, freight transport models are indispensable tools for analyzing and improving merchandise flow. While Incoterms may not directly dictate the mechanics of these models, their correct application is crucial for their accuracy and reliability. Logistics professionals

can now make informed decisions by improving the efficiency and effectiveness of the supply chain (CIO Wiki, 2023).

2.2.3 Modes of Transport

Transportation mode is an integral aspect of logistics and supply chain management, involving various modalities such as air, road, water, rail, and pipeline. Each transportation mode has distinct characteristics that influence its appropriateness depending on factors like freight volume, travel distance, and cost. (Vaan Weele, 2010) For instance, air transport is known for its speed, making it ideal for perishable goods or urgent deliveries. In contrast, road transport offers flexibility for shorter distances and door-to-door services (Baudin, 2004).

Water transport, using ships and vessels, is optimal due to its cost-effectiveness; bulky goods can be transported over long distances efficiently despite being slower than air and road transport. Rail transport offers a balanced solution for long distances within continents, possessing higher capacity than road and being more eco-friendly. Though less common for general freight, pipeline transport is essential for moving liquids and gases, offering a continuous, reliable flow with minimal human intervention (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

Intermodal transport, a game-changer in the field, involves freight movement within an Intermodal Transport Unit (ITU). It significantly enhances efficiency by allowing goods to remain in the same unit across different modes of transport (Vaan Weele, 2010). This method is crucial for sustaining the integrity of the cargo, reducing handling times, and optimizing overall logistics (Baudin, 2004). Common ITUs include standardized containers for trucks, trains, and ships and igloo containers specifically designed for air freight (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

Understanding and implementing Incoterms is vital in freight transportation by clarifying who bears the risk at various stages of the shipment, the associated costs, and who handles documentation (Vaan Weele, 2010) These terms serve as a beacon of clarity, providing a common language and rules, thereby reducing misunderstandings and disputes (ICC, 2011) Incorporating them effectively ensures smooth transit across international borders, aligning expectations between trading parties from different countries (Ananda, Desi Dwi, Eva Arista, Vingky, & Septya, 2022) For example, EXW (Ex Works) places maximum responsibility on the buyer from the seller's premises onwards. At the same time, DDP (Delivered Duty Paid) makes the seller responsible for delivering goods to the buyer's location, including duties and taxes (Brouthers, 1995).

Businesses can enhance their logistics operations' efficiency, cost-effectiveness, and reliability by carefully choosing the appropriate mode of transport and understanding the role of intermodal transport units and Incoterms (Vaan Weele, 2010) This systematic approach ensures timely delivery and maintains the quality of the products being transported, fostering better customer satisfaction and streamlined international trade (Jonas, 2011).

2.3 The Aggregate-Disaggregate-Aggregate (ADA) Freight Model System

The freight transportation modeling landscape has evolved significantly in recent years, introducing more comprehensive and granular approaches to capture the complexities of commodity movements (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) One such model is the Aggregate-Disaggregate-Aggregate (ADA) freight model system. It is a freight transportation model that estimates the movement of goods and commodities with a three-stage modeling approach that simulates the behavior of shippers, carriers, and the transportation network. It has gained attention for its ability to bridge the gap between macro-level and micro-level freight analysis (Havenga, 2018).

The ADA Freight Model System originated from multiple projects completed for various organizations, including the Work Group for Transport Analysis in Norway, the Samgods group in Sweden, the Government of the Flanders region in Belgium, and the Technical University of Denmark (DTU) (Carrese, 2021).

A chapter by Moshe Ben-Akiva and Gerard de Jong thoroughly explains the model in the book "Freight Transport Modelling," published by Emerald Group Publishing Limited in 2013 (Carrese, 2021).

The Aggregate-Disaggregate-Aggregate (ADA) Freight Model System is a sophisticated approach to freight transport modeling that enhances accuracy and policy relevance by leveraging aggregate and disaggregate data. Disaggregate models utilize data at the level of individual travelers, groups, or shipments to provide a detailed behavioral foundation and avoid aggregation biases. In contrast, aggregate models offer a broad overview by grouping data according to geographic zones or other criteria (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) The ADA model system effectively combines these strengths by using aggregate data to identify general trends, then disaggregating to capture specific behaviors and preferences, and finally re-aggregating to produce comprehensive forecasts. This method is particularly beneficial in contexts with varying data granularity, such as the Flemish model, which integrates diverse data sources with different levels of precision and classification (Stefan, 2016) The ADA Freight Model System is widely used in transportation planning and policy analysis to estimate freight demand, evaluate the impacts of infrastructure investments, and assess the effects of policy changes on the freight transportation system (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) The table below shows a breakdown of the ADA Freight Model System.

A	**Aggregate Stage**	In this stage, the model estimates the total amount of freight that needs to be transported between different zones or regions. This typically uses economic and demographic data, such as GDP, population, and industry trends.
D	**Disaggregate Stage**	In this stage, the model breaks down the aggregate freight demand into individual shipments, considering factors such as shipment size, commodity type, and mode of transportation. This stage uses discrete choice models, such as logit or probit models, to simulate the behavior of shippers and carriers.
A	**Aggregate Stage (again)**	In the final stage, the model aggregates the individual shipments back up to estimate the total flow of freight on the transportation network. This stage considers the capacity and characteristics of the transportation infrastructure, such as road, rail, and waterway networks.

Table 2. Breakdown of the ADA Freight Model System. Sourced (Ben-Akiva, Meersman, H, & Van de Voorde, 2013)

2.3.1 The ADA model structure

As (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) described in their investigation that the ADA model emphasizes a clear distinction between Production-Consumption flows and Origin-Destination flows. While PC flows represent the movement of goods from production sites to consumption points, OD flows capture the specific routes taken, including intermediate stops and mode choices. This differentiation is crucial for accurately modeling freight transportation.

The logistics model acts as a link between these two types of flows. It takes aggregated PC flows as input and generates disaggregated OD flows, considering factors like the feasibility of direct transport, the use of terminals such as ports and distribution centers, and the choice of modes or vehicles for each transport chain (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

Akiba et al. place particular emphasis that the most current freight transport modeling systems utilize sub-models that generate production-consumption (PC) or origin-destination (OD) matrices, often differentiated by transport mode, and processes for assigning these matrices to networks, whether unimodal or multimodal (Ben-Akiva, Bottom, Gao, Koutsopoulos, & Wen, 2007) The ADA logistics model innovatively uses PC flows to generate OD flows, which are then assigned to networks. It follows a three-step process: first, it disaggregates aggregate flows into PC flows and subsequently into OD flows for network assignment by linking supply points (P) with consumption points (C) at the firm level. Second, it models firms' logistics decisions, including determining shipment sizes, employing consolidation and distribution centers, choosing transport modes, and using specific loading units like containers. Finally, the model aggregates shipment details to form OD flows ready for network assignment, ensuring a comprehensive and efficient logistics planning approach (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) The image below shows the ADA structure of the (inter)national/regional freight transport model system.

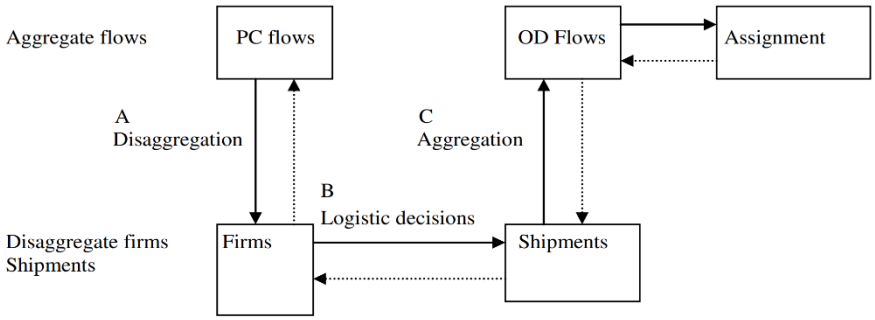


Image 2. ADA structure of the (inter)national/regional freight transport model system. Sourced from (Ben-Akiva, Meersman, H, & Van de Voorde, 2013)

2.3.2 Logistical model a crucial factor for ADA freight model implementation

The logistics model acts as a bridge between these two flow types. It takes aggregate PC flows as input and generates disaggregated OD flows, considering factors like direct transport feasibility, terminal (ports, distribution centers) utilization, and mode/vehicle selection for each transport chain.

Separating PC and OD flows offers several advantages. Firstly, PC flows directly reflect economic realities, such as trade patterns and industry structures. Changes in these economic factors directly impact PC flows, making them a valuable indicator of economic activity.

Conversely, logistical choices, such as depot locations or transportation costs, indirectly influence how PC flows are allocated to specific transport chains. Their impact on overall economic patterns occurs through the feedback loop of logistics choices influencing network assignment and subsequently affecting trade. This intricate relationship underscores the importance of considering PC and OD flows in freight transportation modeling.

It is important to note that directly assigning PC flows to networks would be less accurate. For instance, a road-sea-road transport chain would be misrepresented as separate road segments ending and starting at ports, neglecting the maritime leg. Similarly, consolidation and deconsolidation points within a road-based chain would be overlooked if only PC flows were considered. This underscores the need for a more comprehensive approach to freight transportation modeling.

The ADA model allows for flexibility in handling mode choice. In a multimodal assignment scenario, the logistics model might not explicitly predict mode choice, which can be determined by deterministic optimization within the network model. Alternatively, mode choice could be incorporated directly into the logistics model, leading to a stochastic

determination alongside other logistical decisions. While potentially more complex, this latter approach offers a more nuanced representation of real-world logistics and underscores the need for a comprehensive approach to freight transportation modeling (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

2.3.3 Model specification

The ADA model, a meticulously designed system, derives its reliability from three crucial components. These components, which include the generation of PC flows, the logistics model in three steps, and assignment, as detailed in this section, play a pivotal role in the model's functionality. The generation of PC flows, for instance, involves the use of multi-regional input/output models or spatial computable general equilibrium models, necessitating input-output statistics, production and consumption statistics, and international trade statistics (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

The logistics model, with its comprehensive approach, is a testament to its thoroughness. It is divided into three steps: A, B, and C. Step A involves the conversion of zone-to-zone flows to firm-to-firm flows, enabling the modeling of trade between firms such as manufacturers, wholesalers, and retailers. The generation of a disaggregate population or sample of firm-to-firm flows may be accomplished through re-weighting, synthetic draws, or a hybrid approach (De Jong & Ben-Akiva, 2007).

As mentioned, step B of the logistics model plays a crucial role in simulating logistics decisions at the disaggregate level. This includes determining frequency/shipment size, choice of loading unit, use of distribution centers, and mode of transport for each leg of the transport chain. The model primarily aims to minimize total logistics costs, considering order costs, transport costs, holding costs, and other relevant factors (De Jong & Ben-Akiva, 2007).

The logistics model aims to represent goods shipments in terms of the number of shipments, tons, ton-kilometers, and vehicles/vessels per year by accounting for sending and receiving

firms, commodity types, shipment sizes, transport chain types, and various logistic decisions made at the micro-level (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

The logistics model's framework accommodates the complexity of millions of firm-to-firm relations. It employs sampling and expansion factors to obtain population estimates while considering the endogenous nature of inventory decisions and minimizing total logistics costs (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

The (De Jong & Ben-Akiva, 2007) work provides additional details on the logistics model. It provides an example of how the synthetic or hybrid approach for step A can be implemented in practice.

The aggregate representation of the PC flows feeds into the logistics model, enabling a detailed and insightful analysis of the movement of goods, costs, and decision-making processes at both aggregate and disaggregate levels within the ADA system. This detailed analysis provides a wealth of information for understanding and optimizing logistics operations (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

2.3.4 Data Requirements for the ADA Model

Disaggregation breaks down complex data into smaller, more manageable components, such as sales, customer demographics, or production data. This step is critical for identifying specific data patterns, trends, and anomalies. By disaggregating data, the model can process more detailed information, improving accuracy and reliability in subsequent analyses (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

The next step involves making logistic decisions using the disaggregated data to inform routing, scheduling, and resource allocation choices. This often involves using algorithms and statistical methods to optimize processes and ensure efficient logistical operations. Key

factors during logistic decision-making include minimizing costs, optimizing time, and effectively utilizing resources (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

The final step, aggregation, entails compiling the processed data into a comprehensive format that provides a holistic view of the analyzed information. Aggregation summarizes findings, making it easier to draw broad conclusions and insights. This step is also crucial for policy-making, strategic planning, and reporting, as it enables stakeholders to understand the impact and effectiveness of the decisions made during the logistic phase (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

By integrating these three steps, the model ensures a thorough analysis and a systematic approach to data management, ultimately leading to more informed and effective decision-making processes. The role in this process is integral and valued, as it significantly contributes to maintaining precision and accuracy throughout each step. These contributions are not just appreciated but crucial to deriving meaningful and actionable insights from the data (Ben-Akiva, Meersman, H, & Van de Voorde, 2013). The table below resumes the data requirements needed to implement the model.

Disaggregation This step requires data on	Number of firms: By commodity type, geographic zone, production, and consumption. Firm size: Measured by turnover or number of employees for both production and consumption. Consumption patterns: The types of commodities firms consume within each production commodity class.
Logistic Decisions This step requires detailed information on individual shipments, including the most crucial data on individual firm shipments at the zone level.	Shipment characteristics include sender and receiver sectors, origin and destination zones, the value of goods, modes and vehicle types used, cargo unit, shipment size, and frequency. Transport chain details: Freight terminals (including intermodal), consolidation/distribution centers, ports, and airports. Ideally, this includes information on direct shipments vs. those using intermediate points. Location of logistics infrastructure: Data on the geographic location of freight terminals, consolidation/distribution centers, ports, and airports. Transport and logistics costs: Per kilometer for each mode, terminal handling costs, storage costs, and other relevant costs for all available transport options.
Aggregation	This step does not require any additional data beyond what is used in the previous steps.

Table 3. Data Requirements for the Logistics Model. Sourced (Freight Transport Modeling, 2013).

2.3.5 Estimation, calibration and validation

The estimation process employs disaggregated data and formal statistical methods to accurately determine the logistics model's parameters. This model, which encompasses detailed information on individual shipment logistics choices, including shipment size, transport chain, and mode choice, is accurate and robust. It systematically integrates total annual logistics costs and introduces random cost components to account for omitted variables and measurement errors, ensuring a robust representation of the logistics environment. By leveraging comprehensive data and sophisticated analytical techniques, the approach enhances the precision and reliability of logistics planning and decision-making, ultimately facilitating more effective and efficient logistics management strategies (De Jong & Ben-Akiva, 2007).

Calibration in a deterministic logistics model involves iteratively adjusting model parameters, such as implied discount rates and mode-specific constants, to align closely with aggregate data. This aggregate data can include observed origin-destination (OD) information by mode and commodity type for specified zones. The objective is to attain a perfect alignment that accurately represents the movement patterns within the model despite the absence of disaggregate estimation data. By meticulously fine-tuning these parameters, the model becomes a reliable tool for understanding and predicting logistics behavior across different aggregate zones, facilitating more informed decision-making in logistics planning and management (De Jong & Ben-Akiva, 2007).

Validation in transport modeling entails meticulously comparing the model's predicted link flows to observed link flows derived from traffic counts, encompassing both road and occasionally rail transport. Any substantial discrepancies detected during this validation process necessitate the recalibration of model parameters through an iterative approach, thereby enhancing the model's accuracy. This rigorous procedure ensures that the model's results are precise and consistent with real-world traffic data, thus reinforcing confidence in its predictive capabilities and ensuring its reliability for various applications (De Jong & Ben-Akiva, 2007) The model application process from (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) involves a rigorous iterative approach to maintain its accuracy and reliability in dynamic environments. This process features an inner loop that continuously adjusts the model's variables, encompassing inputs and outputs, ensuring immediate and real-time responsiveness to new data. Concurrently, an outer loop recovers the model's coefficients to achieve a stable equilibrium that accurately reflects the underlying patterns and trends. This dual-loop mechanism ensures sustained precision and robustness. By iteratively fine-tuning these elements, the model remains a trustworthy tool for predictive analysis and decision-making, providing results when needed. The image below shows the model's estimation, calibration, and validation.

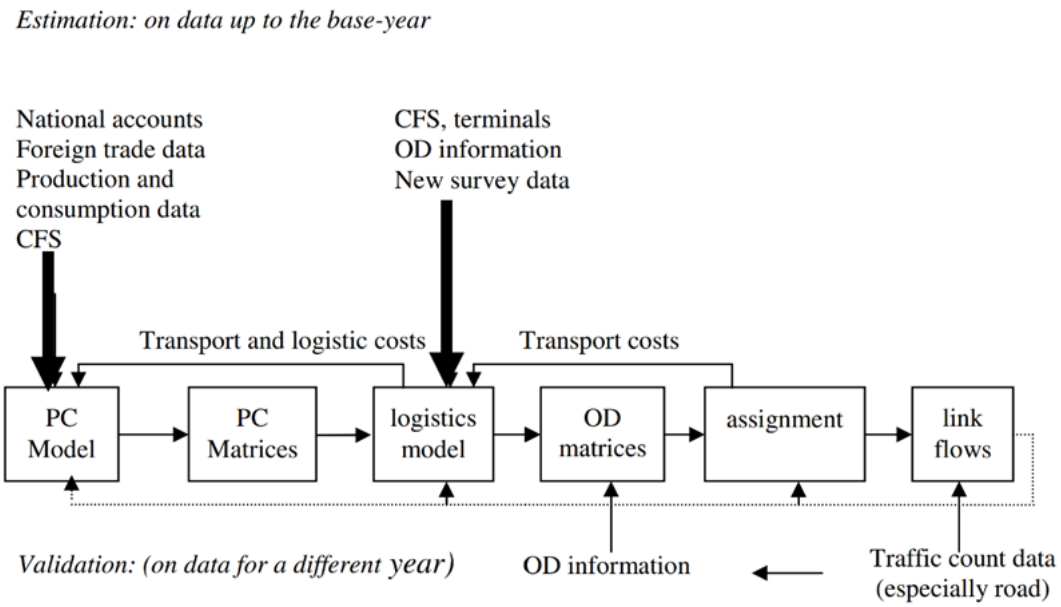


Image 3. Estimation, calibration, and validation of the model systems. Sourced from (Ben-Akiva, Meersman, H, & Van de Voorde, 2013)

2.3.6 Application of ADA Freight Transport Model System

The Aggregate-Disaggregate-Aggregate freight model system was meticulously applied to a project in Norway and Sweden. (De Jong & Ben-Akiva, 2007) both countries had existing model components for deriving production-to-consumption flows and for network assignment. Prototype versions of the logistics model were methodically developed and rigorously tested for each country, demonstrating the thoroughness and rigor of the research, which should reassure the audience about the reliability of the findings.

While the Norwegian and Swedish models have the same structure, each country has two different models. The Norwegian model is part of the national freight model system, while the Swedish model is used for the national freight transport forecasting system (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

In 2006-2007, a Version 1 model was constructed. This improved model features a rigorous two-step logistics cost-minimization process (De Jong & Ben-Akiva, 2007). First, optimal trans-shipment locations are determined for each type of transport chain and origin and destination zone, considering factors such as distance, infrastructure, and demand. Second, shipment size and transport chain are determined by enumerating all available options for a specific firm-to-firm flow and selecting the one with the lowest logistics costs, ensuring the most efficient and cost-effective transport solutions (Hovi, 2011).

The version 1 model uses all firm-to-firm flows based on data on firms by the number of employees and municipalities in Norway. However, Sweden's model uses a sample of firm-to-firm flows for different size classes. This necessitates an expansion procedure to arrive at Sweden's population totals, highlighting the research's complexity (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

2.3.7 Applying the ADA Freight Transport Model in a Valve Manufacturing Company

After many readings in the (Valve Manufacturers Association, 2024) Here are some factors to consider when applying the ADA model in this industrial sector. As detailed in this document, the ADA freight transport model offers a valuable framework for optimizing a valve manufacturing company's supply chain and logistics operations. This section will explore how the model's principles can be practically applied to a specific valve manufacturer, highlighting the critical steps involved and the potential benefits.

Disaggregation and Data Collection

The first stage involves disaggregating the company's operations into granular units for analysis. This begins by categorizing valve types based on attributes like size, material, and production volume. Next, the company's customer base needs to be segmented based on factors like industry, consumption patterns, and geographical location. This comprehensive

understanding of customer demand and valve-type consumption patterns is crucial for accurate forecasting and inventory management.

Logistic Decisions and Data Gathering

To utilize the ADA model effectively, detailed shipment data must be collected for each valve movement. This data should encompass origin, destination, valve type and quantity, transportation mode, vehicle type, shipment size and frequency, and route details, including terminal usage. This detailed data forms the foundation for optimizing logistics costs, including transportation, terminal handling, and inventory costs.

Aggregation and Network Optimization

The collected data is then aggregated to develop a comprehensive transportation network model. This model represents the company's supply chain, encompassing production facilities, potential distribution centers, customer locations, and transportation links. The model is the backbone for optimization, enabling scenario analysis, facility location optimization, transportation mode selection, and inventory optimization.

Practical Implementation

The successful implementation of the ADA model necessitates a robust data collection and management system, potentially leveraging the company's ERP and transportation management systems. However, it is essential to note that implementing such a system can be complex and may require significant resources and time. Challenges such as data integration, system compatibility, and change management should be anticipated. Specialized logistics modelling software or optimization tools are essential for building and analysing the network models. Furthermore, effective collaboration between departments like sales, production, logistics, and IT is critical to ensure data accuracy and model efficiency.

Benefits for Valve Manufacturing

The successful application of the ADA freight transport model promises a host of benefits for the valve manufacturing company, instilling optimism and anticipation. These include:

The model enables route optimization, mode selection based on cost-effectiveness, and shipment size optimization, ensuring significant transportation cost savings and financial security for the company. Optimized Inventory Levels: The model helps balance inventory holding costs against transportation and service level requirements, leading to optimized inventory levels across the supply chain.

The model comprehensively explains the company's logistics operations, reassuring the audience about its effectiveness, enabling better decision-making, and proactively addressing potential disruptions. Data-Driven Decision-Making: The model encourages informed decision-making based on quantitative analysis, minimizing reliance on intuition and subjective assessments.

In conclusion, the ADA freight transport model offers a powerful tool for optimizing the logistics operations of a valve manufacturing company. By meticulously collecting data, developing a comprehensive network model, and leveraging specialized software tools, companies can achieve significant cost savings, enhance delivery performance, and gain valuable insights into their supply chain, leading to enhanced competitiveness and profitability. However, not adopting such a model could Create bottlenecks, increased costs, and a need for a competitive edge in the market (Valve Manufacturers Association, 2024).

2.3.8 Challenges of Exporting Finnish Valve Products to South America

With their resilience and adaptability, Finnish valve manufacturers aim to export their products to South America, overcoming many challenges, particularly concerning freight transport and delivery logistics. The geographical distance between Finland and various

South American countries adds a layer of complexity to the shipping process. Transportation typically involves transitions between multiple modes, such as ocean, air, and overland trucking, which can complicate logistics and increase transit times (López, 2018). Furthermore, the inefficiencies often associated with global supply chains, exacerbated during disruptions like the COVID-19 pandemic, can lead to unexpected delays that may hinder the timely reaching of markets (D. Ivanov, 2020).

In addition to logistical complexities, navigating the customs landscape in South America presents significant hurdles for Finnish exporters. Each country within the continent possesses its own set of customs regulations and procedures, which can vary widely and are often subject to change (World Trade Organization, 2021) This complexity not only prolongs the clearance process but also increases the risk of incurring additional costs related to tariffs and duties, which can be prohibitively high compared to other markets. To manage these risks, Finnish exporters can consider hiring local customs brokers, staying updated on regulatory changes, and building solid relationships with local authorities. Finnish exporters must remain vigilant in understanding these regulations to prevent unexpected financial burdens and avoid delays associated with non-compliance (Amiti, 2007) .

South America's competitive landscape challenges Finnish valve manufacturers. Competing with established local firms necessitates a robust understanding of market dynamics, customer preferences, and cultural nuances. Local manufacturers may benefit from lower operational costs and established supply chains, which can create obstacles for foreign companies attempting to penetrate the market (Giuliani, 2014) Additionally, quality standards and certification requirements can vary significantly across the region, necessitating further investments in compliance efforts (Liesch, 2014). Addressing these multifaceted challenges is essential for Finnish valve manufacturers to successfully navigate the South American export landscape and establish a competitive foothold (Valve Manufacturers Association, 2024).

2.4 Useful concepts

2.4.1 Outbound/Inbound Logistics

Outbound and inbound logistics are very close, but they are two sides of the coin in supply chain management (Ballou, 2004). Outbound logistics deals with the functions involved in getting a good from its initial production to final delivery and into the hands of an end user. It does so through order fulfillment, warehousing, transportation, and customer service (Chopra, 2016). By comparison, inbound logistics is quite more oriented in the efficient sourcing and managing of raw materials, components, and anything that are related to production as well as distribution and warehousing issues (Chopra, 2016). The movement of goods across the distribution network requires smooth and active outbound logistics from the manufacturer to the end users.

Effective outbound logistics is necessary because it is the key to ensuring customer satisfaction and a smooth sales process (Christensen, Germain, & Birou, 2007). Delivering products on time and at a low cost is not just a business strategy but a commitment to establishing customer trust and loyalty (Bowersox, 2016) It leads to complex scheduling of distribution routes and intelligent planning in line with the warehouse control system (Mentzer, 2001) At the same time, a solid inbound logistics system is necessary to provide continuous raw materials and components requirements for production. This includes building strong supplier relationships, right-sizing inventory levels, and streamlining procurement processes (Chopra, 2016).

This is why the two sides of logistics are so closely linked (Ballou, 2004) A good example is a solid inbound logistics system, which means regular, on-time delivery out to production and through the warehouse (Amiti, 2007) On the other hand, efficient outbound logistics ensure JIT delivery of manufactured goods, which releases space in warehousing and also helps in the smooth irruption of material movement (Ballou, 2004) By optimizing inbound and

outbound logistics processes, companies can save costs and improve overall supply chain productivity (Guozheng, 2022).

Collaboration is the needed success factor for any logistics system, whether inbound or outbound. Efficient communication and coordination among suppliers, manufacturers, and certified distributors are the keys to a well-oiled supply chain flow of goods (Bowersox, 2016) Strategic alignment of inbound and outbound logistics processes allows businesses to achieve meaningful operational efficiencies, boost customer satisfaction, and differentiate themselves in the market (Amiti, 2007).

2.4.2 Transport cost

The logistics industry defines transport costs as moving goods and individuals from one place to another (Ballou, 2004). These costs include labor, equipment, fuel consumption, line haul, terminal handling, billing, and collection pick-up and delivery (Baudin, 2004). Market fundaments, product specifics, flow volume are frequency influence transportation costs. However, these costs can be controlled with effective tracking and management, leading to significant company cost savings and increased competitiveness (Guozheng, 2022). Last-mile delivery costs are a substantial portion of logistics and supply chain costs (Caputo, Fratocchi , & Pelagagge , 2006). Companies can optimize spending and improve overall efficiency by carefully researching and controlling all transportation costs, generating significant savings (Capgemini Research Institute, 2019).

2.4.3 Operational cost

The operational cost usually refers to operating costs or operating expenses (OPEX) and involves the expenses that a business or organization has during its regular operations. These expenses are essential for maintaining the fundamental operations of the business and for providing its products or services (Horngren, 2015).

Operational costs can include many categories, each of them are impacting the overall financial efficiency of a business. ***Direct costs*** include expenses directly regarding to the production of goods and services, such as raw materials, labor expenses, and manufacturing overhead. ***Indirect costs***, on the other hand, include expenses essential to the overall operation but not directly linked to the manufacturing process; these include rent, utilities, administrative costs, and marketing expenses. ***Fixed costs*** remain constant regardless of the level of production or service output, for example, rent, insurance, and employee salaries. On the other hand, ***variable costs*** refer to the volume of production or service output and include raw materials, direct labor, and commissions. Understanding these classifications motivates businesses to manage and allocate resources effectively, ensuring sustainability and profitability (Horngren, 2015).

Understanding operational costs is not just important; it is also a strategic advantage for businesses. By evaluating and controlling these costs, they can improve profitability and make well-informed decisions regarding pricing, resource distribution, and general business strategies. (Horngren, 2015).

2.4.4 Sales Contract

A sales contract is a formal binding agreement between a buyer and a seller that includes the terms of selling goods or services (ICC, 2011) It is an essential component of commerce, enabling the exchange of goods and services in a structured manner. The sales contract has evolved from the traditional trade system, providing a more efficient and reliable negotiation method by clearly defining the rights and obligations of the parties involved (Soreya, 2024) A sales contract is essential because it provides legal protection and understanding, ensuring that the parties involved perceive their responsibilities and the direction of the negotiation (Bowersox, 2016).

INCOTERMS are essential in international sales contracts as they define the obligations and responsibilities of buyers and sellers, particularly concerning the delivery of goods, risk transfer, and cost allocation (Khalaf Karimipour, 2014) They specify the point at which the seller fulfills their delivery obligation, influencing logistics and transportation costs (Khalaf Karimipour, 2014)and determine when the risk of loss and possible damages transfers from the seller to the buyer, which is crucial for insurance and liability considerations (Christiana, 2005) INCOTERMS also clarifies which party is responsible for costs such as shipping, insurance, and tariffs, preventing disputes (Supardi, 2015). Selecting the appropriate INCOTERM affects the economic balance between the parties and is vital for the contract's profitability and efficiency (Lazăr, 2011) However, they do not cover all aspects of a contract, such as payment terms and quality specifications, demanding other comprehensive negotiation and legal expertise (Christiana, 2005).

2.4.5 Delivery Performance

Supply chain management is a critical area that significantly influences customer satisfaction and business success and is the backbone of consistent delivery performance between buyers and sellers (Cunningham, 1983) This process, which requires crucial planning, coordination, and execution at different stages of supply chain management, is significantly enhanced by Incoterms 2010 (Burghard, 2020) Developed by the ICC, Incoterms 2010 is a primary rule strategy defining buyers' and sellers' roles and responsibilities in international trade (ICC, 2016) Understanding and applying this rule, along with the ADA freight transport model, empowers companies to improve reliability in delivery and ensure a smooth flow of goods along the supply chain (Wen, 2011)

The ADA freight transport model, a significant player in supply chain management, is a tool for balancing delivery performance, other costs, and environmental factors (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) When used with the Incoterms 2010 rules, the ADA model ensures the timeliness of delivery processes and reduces additional costs incurred

due to delays or compliance (Nagi, 2006) When the ADA model is reflected in Incoterms 2010, it helps companies consider and manage all aspects of supply chain management effectively (Burghard, 2020) (Zhang, Janic, & Tavasszy, 2015) Moreover, the ADA model with Incoterms 2010 ensures that the risks and uncertainties of international trade, such as insurance, customs clearance, and sharing responsibilities, are reduced or avoided. Therefore, adherence to the ADA model with Incoterms 2010 positively influences high delivery performance, increases customer satisfaction, and makes the supply chain more resilient (De Jong & Ben-Akiva, 2007).

2.4.6 Material Flow

Material flow, in terms of the movement of goods from their place of origin to their point of consumption, is one of the critical factors that define the efficiency of the supply chain and, consequently, the success of a business (Waters, 2003) To achieve this goal, companies need to refine the processes related to material flow, cut costs, and work on customer satisfaction (Hovi, 2011) One of the essential considerations for optimizing material flow, especially in international trade, is the implementation of Incoterms 2010 alongside a freight transport model (ICC, 2016) The crucial reasons include clarifying principal factors, such as delivery points, cost distribution, risk transfer, and a subsequent decrease in adverse agreements or misunderstandings. For example, the ADA freight transport model used to minimize the costs and enhance the delivery performance of motor and multimodal transportation is designed to account for the targets of material flow, costs, and environmental impact (Hovi, 2011).

Therefore, for material flow to operate efficiently in the global market, it must be complemented by Incoterms 2010 in alignment with the ADA freight transport model. Since, in this case, it is always clear which party is liable for transportation costs, an organization can optimize its costs and choose the most fitting route or mode of transport according to the ADA model (Hovi, 2011).

2.4.7 Warehousing

Warehousing is an essential part of logistics and supply chain management. Operate a warehouse as central storage, consolidation, and distribution of goods to meet the changing market demand efficiently (Candrianto, 2020) By using space-saving and the movement of goods and time, they will move along the transport and production chain in a perfectly still manner (Kučera, 2017) Its principal function is to store raw materials, intermediate products, and ready-made products in limited quantities to ensure smooth production and sales flow (Candrianto, 2020) ADA's cargo transport model is a widely used carrier decision-making model in transportation and logistics. In ADA's freight transport model, a warehouse plays a significant role in the flow of goods (Hovi, 2011) It is often used as a temporary organization, connecting the manufacturer with the following link in the product delivery chain- the buyer or customer. The warehouse provides many advantages or benefits to the companies, e.g., enabling reduced transportation costs, joint storage being cheaper than individual storage, reduced transportation and operational costs, storing goods in one place and providing customer service by quickly ordering goods, and dealing with indifference in terms of distance and time from production companies to the customer (Kučera, 2017) The most important aspect is choosing the right incoterm because plays a significant role determining the rights, obligations, costs, risks, and any other aspect of the delivery and transport of the goods (Alan, 2023) A warehouse is a significant part of the transport chain. It allows companies to store the necessary raw materials and half-finished and finished goods, as stated by John Warman (Candrianto, 2020)

2.5 Thinking aloud method

According to (Charters, 2003) Think-aloud is a research method in which participants speak any words in their minds aloud as they complete a task. A literature review has shown that think-aloud research methods have a sound theoretical basis and provide a valid source of data about participant thinking, especially during language-based activities. However, a

researcher needs to design a process that considers several concerns by selecting a suitable task, a role for the researcher, a source of triangulation, and, most importantly, an appropriate method of interpretation. This paper argues that think-aloud research can be effectively interpreted qualitatively. A qualitative approach also has implications for the choice of participant(s) and the treatment of the data. Participants should be treated as quasi-researchers, and their efforts should be rewarded with reciprocity.

2.5.1 The Theory of Think-Aloud Research

Although think-aloud techniques in their current form have their roots in cognitive psychology, to understand the relationship between thought and words, it is helpful to go back to (Vygotsky, 1962) and its concept of 'inner speech.' His theory was that the 'inner speech' of verbalized adult thought processes evolves from the 'egocentric speech' of toddler monologues, which is also a form of 'thinking aloud' to solve problems. Vygotsky described inner speech as 'almost inaccessible to experiments' except through its earlier manifestation as egocentric speech (Vygotsky, 1962). However, it is likely that the words adult participants in think-aloud studies utter are closely related to inner speech, especially considering their characteristics. Like egocentric speech, 'think-aloud protocols' are 'elliptical,' usually not expressed in complete, reasoned sentences (Charters, 2003) Vygotsky noted that 'sentences' in egocentric and inner speech are dominated by predicates since the subject of the 'talk' is usually evident to the 'speaker,' and they may be even more fragmented (Vygotsky, 1962).

Similarly, anyone trying to understand another person's thought processes from think-aloud transcripts will find them more challenging than everyday speech or writing. This is a natural reflection of the purpose of inner speech, which is not meant to be communicative to anyone but the thinker. Another important concept from the (Vygotsky, 1962) theory involves the relationship between abstract thought and inner speech. Although translation into language is necessary before thought can assume a form others can understand, much

of our thoughts are kept from being verbally stored. As people develop and build their mental networks, their thoughts become increasingly abstract, and words are only part of their elaborate patterns of meaning (Charters, 2003) Vygotsky needed the working and long-term memory, storage, and retrieval vocabulary to clarify these concepts. However, his ideas are essential to understanding what think-aloud methods can and cannot reveal. Researchers must be aware that even thinking aloud, which makes inner speech external, cannot reveal deeper thought processes in their true complexity because they have to be simplified into words before anyone, even the thinkers themselves, can honestly know them (Charters, 2003) This 'bottleneck' between the breadth of abstract thought and the narrower, temporal emergence of verbal thought slows down thought processes (Vygotsky, 1962) Researchers need to find out how much it also changes them before verbalizing them as 'inner speech,' which can be thought aloud (Michael Pressley, 1995)

A speaker often takes several minutes to disclose one thought. In his/her mind, the whole thought is present at once, but in speech, it must be developed successively because thought does not have an automatic counterpart in words. The transition from thought to words leads through meaning and then through words (Vygotsky, 1962)

(Vygotsky, 1962) Understanding the complex and dynamic relationship between thought and verbalized inner speech is helpful to remember when studying the theoretical underpinnings of think-aloud methods in the simplified models of information processing theory, best explained in Ericsson and Simon's (1980) seminal study, Verbal Reports as Data. (Ericsson, 1980) Stressed the importance of the theoretical basis of think-aloud methods and related 'introspective' research techniques. Their theory is based on a distinction between working memory, in which concurrent reasoning occurs in verbal form, and long-term memory, where some ideas from working memory are eventually stored, not necessarily in words (Ericsson, 1980) Think-aloud research aims to give the researcher insight into working memory processes, but researchers must be aware of that difficulty.

First, only 'heeded' or noticed information goes into working memory. Also, since working memory has a limited capacity, this information is held there only briefly and can disappear as soon as new thought patterns supersede it (Charters, 2003).

For this reason, only verbal reports that follow very rapidly after a thought process can be supposed to reflect conscious thought accurately, and researchers must focus on the participants' 'immediate awareness,' not delayed explanations for their actions (Bowersox, 2016) In addition, many thought processes are not verbalized in working memory, either because they are automatic (such as the recognition of familiar words and images) or because their 'intermediate' processing passes through so quickly that there is no time to verbalize it (Ericsson, 1980) For this reason, researchers need to choose the research task very carefully. Ideally, researchers should aim to think aloud about natural processes "Thinking Aloud as a Research Tool (Creswell, 2009)

(Michael Pressley, 1995) (Olson & Mack, 2018) The think-aloud technique is one of the most effective ways to assess higher-level thinking processes (those that involve working memory). It could also be used to study individual differences in task performance. Ericsson and Simon (1980) conclude that even if their view of thought processes is necessarily incomplete, verbal reports such as those from think-aloud data are a “thoroughly reliable” source of information about thought processes (Ericsson, 1980) Nonetheless, before designing a research plan involving think-aloud methods, researchers need to decide on the type and level of difficulty of the research task, the appropriate degree of prompting, the use of other data to support inferences from think-aloud protocols, and the method of analysis (Olson & Mack, 2018).

2.5.2 Implementing Think Aloud Methodology in Logistics Model Enhancement

According with (Prokudin, 2022) and (Alan R. R., 1992) The Brief "Loud Thinking Methodology," widely adopted in UX research to find out how people perform tasks, can

also help to refine the logistics and freight transport model. This is how it can uplift these sectors:

Pinpointing Inefficiencies: By observing how logistics planners and operators perform their tasks, one learns about the decision-making processes behind these operations. This display of various activities can lead to identifying inefficient activities or determining where in the system or process there may be a need for change (Prokudin, 2022).

Insights into Cognitive Processes: It provides insights into the cognitive processes underlying planning and decision-making, enabling model developers to realize how human aspects impact logistics functions (Pourabdollahi Z. M., 2012) That knowledge can translate into more human-centered and intuitive design in logistics models (Alan R. R., 1992).

Enhancing UI: For any digital tools or interfaces utilized by these logics, a think-aloud can reveal usability problems. Such information can be a gold mine when it comes to creating interfaces that are more efficient and user-friendly (V.Aulin., 2019).

Improving Training Methods: Watching how the users address logistics problems in real time may reveal areas where training is needed. From there, organizations can create training programs for their employees' everyday challenges (Gerald, 2015).

Enabling Collaboration and Communication: Verbalizing or thinking out loud necessarily requires team members to be on the same page and want to share their underlying thought processes (V.Aulin., 2019). This can result in better collaboration and a shared understanding of logistics activities.

Iterative Model Development: An organization will always have qualitative feedback if it constantly uses the thinking-aloud approach when developing a model (Alan R. R., 1992) This will help iterations and ensure the models are realistic by considering “users” use cases.

Better algo design: Companies can create better technically oriented algorithms and cater to the user with real-world solutions and hacks that logistics personnel have acquired over years of working (Prokudin, 2022)

Encouraging Innovation: Judging thoughts aloud may expose comments that stimulate or suggest novel solutions and ideas that can be infused with new logistics strategies or models.

To summarize these statements, choosing human interaction and experience and making decisions above any theoretical models through the Thinking Aloud Methodology brings the best bridge between theory and practice (V.Aulin., 2019). Companies are getting better, easier, and more accurate logistics and transport models.

3 METHODOLOGY STUDY

This research sought to study and increase the performance of direct invoicing deliveries in South America for a case study company using an integrated approach with the ADA Freight Transport Model and Incoterms 2010. The organization employed FCA Incoterms 2010, causing ineffective processes associated with warehousing expenses and delivery periods. This study analyzed whether changing these supply chain parameters to CPT or CFR Incoterms with the ADA Freight transport model could enhance these supply chain parameters.

The central research problem resulted from the high costs associated with customer delays in South America; notably, the study company was experiencing escalated freight arrangements (Siivonen & Schroeder, Metso's strategic transportation management interview, 2015) Although previous studies offered an analytical basis for assessing how Incoterms and freight transport models affect cost and effectiveness, no such frameworks have been applied to South America, let alone the specific context of direct invoicing deliveries and the cultural factors surrounding them.

This study used an exploratory mixed-method design for quantitative and qualitative data collection approaches. Quantitative data is used to assess cost savings, timelines, and the effect on delivery metrics on exporting profiles under the implementation of the respective change. Interviews, surveys, and think-aloud protocols collect qualitative data regarding the freight arrangement's decision-making processes and the stakeholders' perceived challenges and benefits.

This research aimed to increase the efficiency of the company's logistics and sales activities. Firstly, the research aimed to minimize the carrying cost due to delays from the customer side, such as damage to the shipping or collecting the product from the factory at the right time. The study aimed to improve customer satisfaction by reducing delivery times and

ensuring timely reception. Enhances the quality of deliveries, ensuring items are delivered in the best possible state. Another goal was to make it easier for customers to receive their goods by offering more flexibility in how these goods were delivered. The study also aimed to assess the company's South American sales offices concerning the new Incoterms CPT and CFR defined by the company and inform the South American customers on how to use the terms correctly. Additionally, there was an emphasis on creating just-in-time invoicing to enable the seamless flow of financial transactions, which ultimately helped enhance operational efficiency.

3.1 Case Study Company

The research study company is a prominent provider of flow control solutions and services, catering to diverse process industries, including oil and gas refining, pulp and paper, bioproducts, chemicals (V. Corporation, 2023) With a global presence and a robust financial performance, the company has established itself as a leading player. Its unwavering focus on delivering high-quality products and services has earned its clients' trust worldwide. With a workforce comprising thousands of skilled professionals, the company has consistently demonstrated its commitment to innovation, sustainability, and customer satisfaction. Its comprehensive range of solutions and services is underpinned by cutting-edge research and development, and its unwavering commitment to excellence makes it a go-to partner for businesses across the globe (Avenue, 2016).

This company has built a strong reputation in the valve industry, and its well-known brands have secured a solid market position. The high performance of these brands contributes to a favorable business mix, enabling the company to navigate challenging markets successfully (Avenue, 2016) As a result, the company has been presented with opportunities to broaden its global reach and expand its sales channels across various regions (Valve Manufacturers Association, 2024) This growth strategy allows the company to serve a more diverse

clientele and strengthen its presence in the international market (Metso Financial Statement 2014).

The Company's specific business area in this research is flow control; the department is responsible for a range of quotation and order management activities at the Company's valve manufacturing plant. It is within the D2D (day-to-day) sales support department and provides services to the Automation business line's global sales network. The department's primary focus is to ensure that the sales process for valves and related products runs smoothly and efficiently (Avenue, 2016).

The team utilizes advanced technologies and tools to manage the entire process, from quotation to order management, ensuring that customers receive high-quality products in a timely and cost-effective manner. The Flow Control department comprises highly skilled professionals adept at handling complex sales processes and meeting customer needs. They work collaboratively to create innovative products with superior performance, durability, and reliability (Avenue, 2016) Furthermore, the department is essential to the Company's research and development efforts, continually developing new solutions to meet the market's evolving needs. The team comprises experts in various fields, including engineering, design, and materials science.

In conclusion, the Flow Control department ensures the Company remains competitive and thriving globally. Its commitment to providing high-quality products and services and its focus on research and development make it an essential and valuable asset to the Company (Avenue, 2016).

3.1.1 Company´s brief history

The company's roots go back to the 1750s in Helsinki, where a small shipyard in Suomenlinna operated and was later transferred to the ownership of the State of Finland. In the 1800s, at least four companies, Karlstad and Sunds Bruk in Sweden, Atelier Bergeaud

in France, and Nordberg Manufacturing Corporation in the United States, formed part of the present company (Company, 2016).

The company was created in July 1999 by merging a paper and board machine supplier. Its operations focused on fiber technology, rock crushing, and flow control solutions (Company, 2016).

After several acquisitions and divestments, the company has shaped its corporate structure. It brings the leading innovations in rock and minerals processing, pulp and paper making, power generation, and process automation. Image 1 briefly shows the company's history from the beginning to 2014, when it sold its Procedure Automation System (PAS) business. This divestment is part of the company's 2014 strategy, focusing on the product and services business.

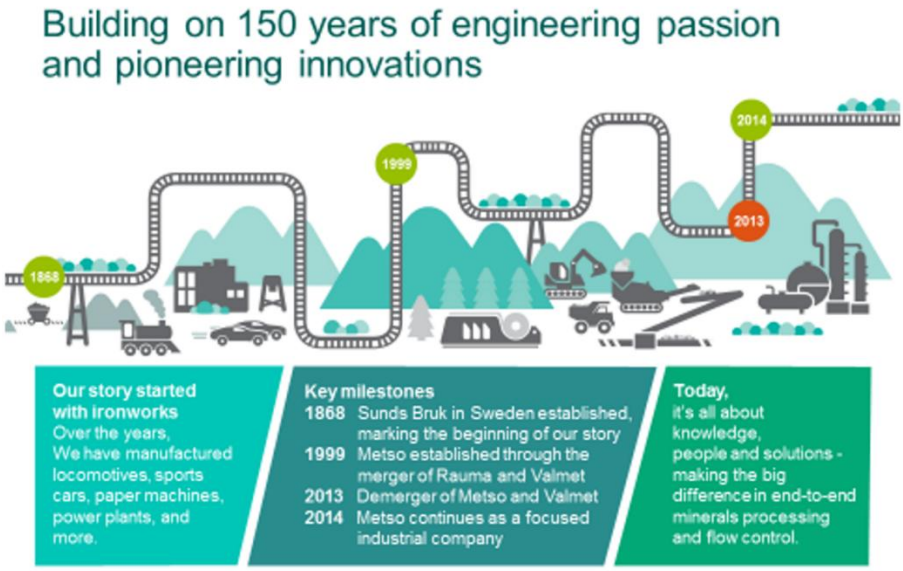


Image 4. Company´s 150 years history. Sourced from (Company, 2015)

3.1.2 Company Today

Originally a part of a larger organization, the study company was spun off as a separate entity in a strategic move aimed at achieving greater autonomy. In 2015, the company was listed on the NASDAQ Helsinki stock exchange (V Company, 2023) For several years, the company focused on providing innovative flow control solutions for various industries. Later, the company merged with the flow control businesses of two other companies to form a new business line. This merger occurred in 2020, and the newly formed business line became a significant player in the flow control market (V. Corporation, 2023) With a diverse range of products and services available for process industries, the business line has become a destination for those seeking reliable and efficient flow control solutions.

Companies have influenced the industry in various ways since the transition. One area of focus has been the energy transition, with the growing importance of Carbon Capture, Utilization, and Storage (CCUS) technologies. Due to this shift, specialized flow control solutions are now in demand, and companies have adapted by developing new technologies to meet these changing requirements (Valve Manufacturers Association, 2024).

Valve design now considers material selection a pivotal aspect, and companies use their material engineering expertise to provide optimal solutions for customers. The transition from demo units to industrial-scale production presents a real challenge, and alternative solutions must be explored when the same type of valve is unsuitable (V. Corporation, 2023).

The industry is witnessing diverse technologies competing for prominence in future energy production. Companies are actively monitoring these innovations, ready to seize opportunities as they arise (V. Corporation, 2023)

3.1.3 Flow Control

The company is widely recognized as a global leader in providing top-tier flow control solutions and services. Its valves, pumps, and valve automation technologies are esteemed for their superior quality, reliability, and safety. Serving a diverse range of process industries such as pulp, paper, board, mining, metals, chemicals, refining, and energy, this organization leverages its market-leading expertise, products, and services to drive business advancement (V Company, 2023)

3.1.4 Day-to-Day Business Support

The Department of Day to Day (D2D) manages quotation and order activities, encompassing valve certification services. This responsibility spans the initial internal quotation inquiry to factory delivery and invoicing. The department is committed to offering exceptional customer services to the global sales network and business processes of the Automation business line while providing operational systems development support (Avenue, 2016).

The primary stakeholders of the D2D department include all global operation factories, flow control businesses, product lines, and sales regions across EMEA, North America, South America, and Asia Pacific (Avenue, 2016) Simultaneously, the D2D team is responsible for maintaining the systems that support the business lines' operations. This might involve creating new tools or processes to help the sales team better manage their leads and customers or refining existing systems to make them more efficient and user-friendly (Company, 2016).

By efficiently managing the quotation and order processes, the D2D team can help the business lines win new customers and grow revenue. Simultaneously, by maintaining and improving the systems that support the business lines' operations, they can ensure that they operate smoothly and efficiently, even as they grow and evolve (Avenue, 2016).

The D2D department is dedicated to achieving several vital targets. These include enhancing on-time delivery, improving cost competitiveness, reducing lead times for quick responses, ensuring high-quality customer services, and fostering constant process development. The following table provides a detailed breakdown of the department's composition and leading activities (Avenue, 2016).

D2D BUSINESS SUPPORT DEPARTMENT UNITS	TASK
Quotation Support	It consists of two teams: Quotation engineering gives technical support to sales offices globally, mainly for products manufactured or assembled in the plant. The global Pricing team prepares price calculations for all products.
Customer Order Receiving (COR)	Receive all D2D orders and is in charge of completing technical and logistical reviews for every order line before releasing to engineering and production.
Customer Order Management (COM)	Takes over order responsibility after customer order engineering has been completed and the order has been released to production. It follows the order process from beginning to end, keeping contact with the sales offices globally.
Factory to Factory Order Management (F2F)	takes over order responsibility after receiving the order from any supply center. The team belongs to production planning.
Customer Order Planning (COP)	It is composed of customer services-oriented engineers. Their main tasks are to create delivery schedules and follow up on order status, customer inspections, order prioritization, and expedite customer visits.
Forwarding	Consist in D2D, project, and import delivery handling—export documentation and assistance in logistical matters for internal customers.
Valve certification	Provide document packages called Certificate of Compliance and test for valve assemblies.

Table 4. D2D Business Support teams (Avenue, 2016)

4.1.5 D2D Order Types

The Company uses Electronic Data Interchange (EDI) systems, and D2D order types play a pivotal role in electronic order management systems (Company, 2016) These systems are

essential for businesses to streamline operations and enhance efficiency. The EDI framework comprises three main interconnected programs to facilitate a fully electronic transactional process. This system eliminates manual data entry, thereby reducing the possibility of human error and synchronizing order management (Avenue, 2016).

EDI order types can be categorized into three groups:

Automated Releasing (F10 / F20)

These orders are processed without manual intervention, typically encompassing standard and routine transactions that meet predefined criteria. Automated releasing can be divided into two subcategories:

F10. Represents a specific protocol or condition under which automation occurs, often involving standard orders.

F20. Another automation level or type may refer to a different set of predefined criteria for order processing.

Manually Releasing (E10 / E20)

Due to unique or complex conditions outside the automated system's parameters, these orders require individual assessment and input. Manually released orders undergo closer scrutiny by personnel to ensure accuracy and specificity in the transaction. This category includes:

E10. Represents one level or type of manual processing required, often involving custom product configurations or unique discount structures.

E20. This is another level or type of manual processing, which may involve non-standard shipping arrangements or other unique transaction requirements (Avenue, 2016)

EP4 for Claims Cases Direct Invoicing Customers

This category focuses on direct claims cases, denoting a process for resolving claims or discrepancies in orders directly invoiced to customers, bypassing the standard company sales office channels. EP4 orders may arise from warranty issues, returns, or other post-sale service requirements, necessitating a tailored approach to meet customer needs and resolve claims satisfactorily (Avenue, 2016).

The Company's sales office typically carries out the invoicing process for South American orders. However, special processing is required when the invoicing address differs from the Company's. This process often involves consolidated freight deliveries to optimize logistics and cost efficiency. Using consolidated freight; the Company can streamline deliveries to South America, reducing transit times and lowering customer freight charges (Avenue, 2016)

In summary, EDI order types in order management systems consist of automated and manually released orders and direct invoicing for claims cases. Direct invoicing and freight consolidation are critical components of the South American orders' order management and delivery process.

3.1.6 D2D order process

The order flow process within the day-to-day (D2D) department is a crucial and collaborative effort that begins when a customer inquiries the sales office (Avenue, 2016). With the support of the sales support team, the sales office evaluates the inquiry and prepares a quotation. The sales office may request the sales support team's assistance in generating an internal quotation inquiry if needed. Once the quotation is approved, an Internal Purchase

Order (IPO) is created, marking the significant collaboration between the sales office and the D2D department.

The IPO is then transmitted to the Plant facility through the company's Electronic Data Interchange systems (EDI) from the local Company sales offices. The D2D department, with its unwavering commitment to accuracy, meticulously reviews the IPO, paying close attention to logistical and technical details through the Quotation, Customer Order Responsibility, and Customer Order Management teams. This thorough review, crucial to ensure accuracy before the order is approved for manufacturing, is a testament to the D2D department's dedication. The Order Acknowledgement is generated and sent to the customer to confirm the order.

The IPO document is usually divided into three essential sections, each serving a specific purpose. The first section is the Header section, which includes the time of creation, a list of items, and comprehensive details of the vendor and customer. This section sets the voice for the rest of the document and provides basic information about the company's offering.

The second section is the Product Details section, which describes the technical specifications of the ordered product. This section is critical for investors who want to understand the company's products and the technical details that make them unique. It includes information about the product's design, features, functionality, and associated patents or trademarks.

The third and final section is the Delivery Information section, which contains logistics details such as the mode of transportation, the agreed-upon Incoterms 2010 delivery terms, identification of who is responsible for freight costs, and the agreed-upon pricing negotiation. This section is crucial for investors who want to understand how the company plans to deliver its products to customers and the associated costs (Company, 2016).

The figure below visually represents the steps outlined above, from the customer's inquiry to the processing and acknowledgment of the order. The D2D department is committed to accuracy and works collaboratively to ensure customer satisfaction.

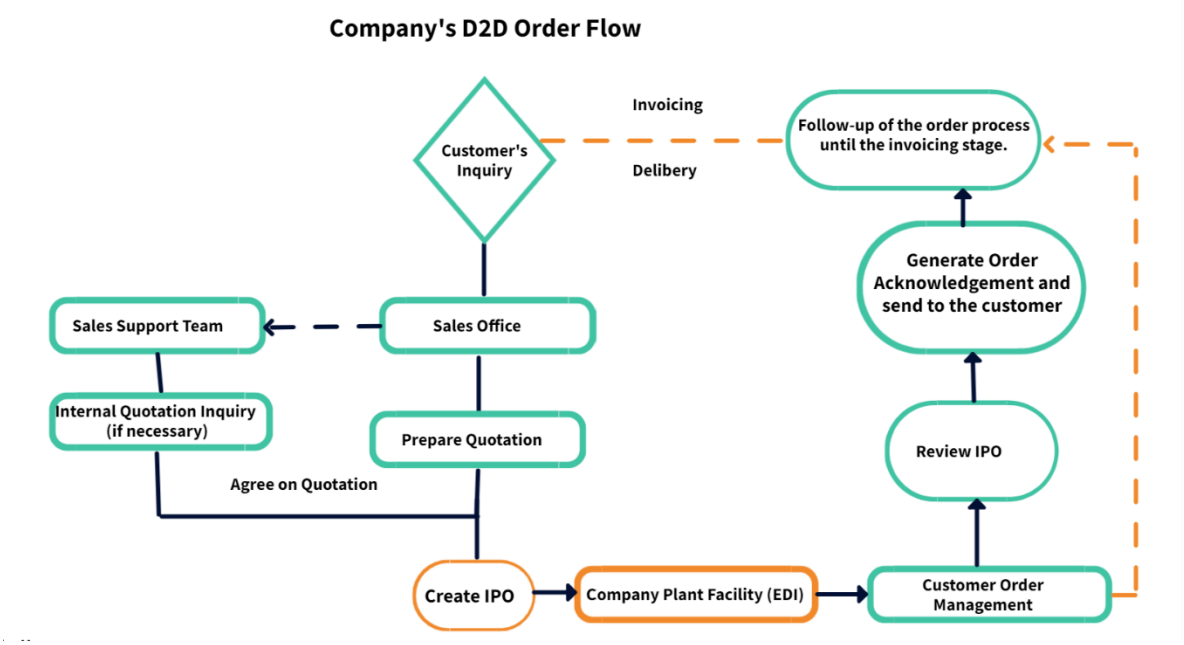


Image 5. Company´s Order flow

3.1.7 Company´s Direct invoicing customers

Direct invoicing customers are those which are not a part of any company unit. In other words, they are customers who are not associated with any company or organization. These customers can order directly from the sales office without any intermediaries involved (Company, 2016).

Several Company sales offices, including Finland, India, Russia, Korea, Denmark, Estonia, and South America, are responsible for placing direct invoicing orders. These orders require constant revision to align with the customer's purchase orders. A key aspect is ensuring the delivery address matches the customer PO and IPO, along with the payment term and the Incoterm 2010 (Avenue, 2016).

The payment term specifies when the customer must pay for the order, while the Incoterm 2010 specifies the responsibilities of the buyer and seller for the delivery of goods (VS&B Containers, 2016) The most common Incoterm used is FCA (Free Carrier) which means that the seller delivers the goods to a carrier, or another person nominated by the buyer at a named place of delivery (Forwarderx, 2017)

The delivery address must match the customer's purchase order, and the transport modality must be FCA or CCC (Customer Contract Carrier). This is to ensure that the delivery is made to the correct location and that everything is clear and timely in the delivery process. Some requirements for using FCA or CCC Incoterms may be a problem. However, it is essential to note that these standards have been established to ensure efficient delivery in some companies' defined periods. While it may be tempting to use alternate Incoterms, such as CPT and CFR, under an ADA freight transport model, it is essential to carefully consider the potential risks and costs associated with deviating from the established standards (Invexic, 2023) Using different Incoterms could lead to confusion, errors, and additional costs.

3.1.8 Company´s Transportation Mode

The Company's logistics control software is a powerful tool that provides real-time data to all parties involved, enhancing efficiency and planning (Avenue, 2016) The cloud-based feature ensures that detailed information is accessible, improving data accuracy and logistics control. Beyond this, the Company is deeply committed to sustainable transportation solutions (Company, 2016) They are developing lightweight, standardized packaging and exploring alternative transport models. They also collaborate with key transportation suppliers to promote 'sustainable development' and are actively accelerating the adoption of alternative shipping modes (Company Annual Report 2012) The company uses a range of beneficial transportation methods for the valve industry, including rail, sea, and air transport. However, it continues to work to expand the share of rail freight in goods

transportation and diminish the number of CO2 emissions connected to transportation (V Company, 2023).

3.1.9 Company´s Recommended Incoterms 2010

In October 2010, a working force team was established to study the new edition's implications and publish standard Company recommendations regarding using the new Incoterms 2010 rules.

The recommended main Incoterm for external purchases is FCA (Free Carrier). This Incoterm, including all modes of transportation, offers a range of benefits. It controls delivery, Supplier Delivery Performance, transportation costs, and material flows. It also allows for using the Company's transportation contracts and can lead to better rates through consolidated volume (Avenue, 2016)

DAP (Delivered at Place), named place of destination, is the secondary choice, including all modes of transportation.

For external sales, CPT is the primary choice; delivery is recognized at the same point as using FCA. This enables the Company to use the Company´s nominated, which can add some benefit margin to net transportation cost. The secondary choice can also be CPT with all modes of transportation (Avenue, 2016)

The company pays careful attention to the Incoterms it utilizes in various scenarios, likely aiming to balance control and risk against the efficiencies and cost savings that can sometimes be obtained by transferring responsibilities to the other party in the transaction.

The table below shows the "Incoterms 2010 Rules for any Mode or Modes of Transport," recommended for use in the company. It outlines which Incoterms are preferred for different types of transactions within the organization. The table also suggests how the company seeks to optimize its use of Incoterms based on the nature of the transaction,

ensuring that responsibilities for transportation and risks are appropriately allocated to themselves or their partners, depending on which is most advantageous or competitive for their business model.

Name of the Incoterm	Use in external Purchasing	Use in internal Purchasing	Use in Sales	Use in Project deliveries	NOTE!
EXW Ex Works - EXW comment: Not suitable for export deliveries, shall be replaced by FCA	NO	NO	NO	NO	
FCA Free carrier -FCA comment: In sales to replace EXW or FOB, if other preferred terms can not be used	YES	YES	(YES)	(YES)	
CPT Carriage paid to	NO	NO	YES	YES	
CIP Carriage and Insurance Paid to - CIP comment: use CIP instead of CPT if transport insurance is the Company's obligation	NO	NO	(YES)	(YES)	
DAT Delivered at terminal	NO	NO	NO	YES DAT comment: Discharge at terminal by the Seller	
DAP Delivered at Place	YES -DAP comment: - If FCA not competitive	(YES) - DAP comment	(YES) - DAP comment: CPT preferred	YES	
DDP Delivered Duty Paid - DDP comment: May be used in domestic or European project / "turn key" deliveries or in other export projects to well known countries. Seller must be able to take care of the import customs clearance in the country of destination.	NO	NO	NO	YES - DDP comment: ok for domestic or European "turn key" deliveries or in projects to well known countries if Seller able to take care of the import customs clearance in the country of destination.	

Table 5. Incoterms 2010 Rules for Modes of Transport (Company Annual Review 2015)

When implementing sales areas in South America, particularly in the business environment of transportation involving the IPRO organization in Finland and Latin America, negotiations under the FCA Incoterm default can lead to challenges (Jânia, 2017) For instance, when the studied company's sister negotiated an order, issues like operational costs, such as facility expenses during pick-up waiting times, can arise due to the nature of the Incoterm FCA. This situation highlights the importance of understanding the implications of specific Incoterms in different geographical areas, especially when dealing with direct customers in South America. Typical cases in such scenarios may involve customer pick-up routes and difficulties tracking orders until the end, impacting operational efficiency and costs. However, by analyzing various case scenarios, the company can better prepare for and mitigate the challenges associated with Incoterms like FCA, leading to smoother logistics operations and increased customer satisfaction.

3.1.10 The purpose of the study

The research study begins by identifying the foundational issue of using specific Incoterms in conjunction with transport modalities. It aims to harmonize the supply chain management structure by selecting appropriate Incoterms for sales contracts.

It further aims to educate the company's customer base and sales offices in South America about the benefits of CPT and CFR Incoterms, highlighting the importance of understanding and adhering to these terms to optimize operational efficiency and cost-effectiveness.

The study employs a mixed-methods approach, combining qualitative and quantitative research to create a freight transport model that incorporates the recommended Incoterms. Thus, it addresses both academic and practical concerns within the supply chain.

By analyzing the business environment and integrating Incoterms into the ADA Freight Transport Model, the research assesses logistics costs, delivery times, and risk management, aiming to improve the company's competitive edge and reduce operational expenses.

3.2 Research Questions

The research provided answers to the following primary questions:

How to select the appropriate Incoterm 2010 for a sales contract?

What are the advantages of employing CPT and CFR from Incoterms 2010?

What improvements can the organization expect in its freight transportation operations by implementing the ADA Freight Transport model, especially concerning cost savings, efficiency, and supply chain optimization?

3.3 Research design

3.3.1 Research Philosophy

The research philosophy upon which this study is based is pragmatism. Pragmatism does not exclude any methodological approach, and it thrives on using the best methods to help answer specific research questions and objectives. Hence, paradigms that emphasize a holistic view are more appropriate for complex studies that can bring together different viewpoints and approaches (Creswell J. W., 2017) This study used a mixed-methods strategy, conjointly applying quantitative and qualitative methods to explore the multidimensional characteristics of freight transport operations and the situation of supply chain decision-making.

3.3.2 Research Approach

The study combines quantitative and qualitative methodologies to gain an extensive perspective of a research problem (Creswell J. W., 2009) By combining these methods, the research has both measurable characteristics of freight transport operations and inquiry into stakeholder views and experiences.

The ADA Freight Transport model is identified as a multimodal transport system consisting of road, rail, and sea transport modalities (Zhang, Janic, & Tavasszy, 2015) It investigates the synergies of these forms within the scope of Incoterms 2010 CPT and CFR.

The study applies a mixed methods design to quantify operational performance and cost while further exploring decisional needs and barriers from the perspective of key stakeholders. This holistic approach highlights the functional efficiencies for ADA Freight Transport mode and the strategic deployment of CPT and CFR long-haul freight terminologies.

3.3.3 Research Strategy

The research strategy aims to find the implications of integrating Incoterms 2010 within the ADA Freight transport model for optimizing freight transport operations, using a company´s case study of a Finnish valve manufacturer operating in the South American region. According to (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) the ADA freight transport model focuses on logistically complex scenarios within different geographical scenarios context, which necessitates extensive transportation, the study analyses the impact of integrated CPT and CFR Incoterms on cost minimization, risk allocation, and multimodal transport efficiency. The research explores how direct billing, combined with CPT and CFR, can enhance coordination across road, rail, and maritime transport, streamlining bureaucratic processes and improving cash flow for stakeholders engaged in South American trade (Malbon, 2014) By examining the company´s specific import/export report. The study aims to demonstrate the practical applicability of the ADA model informed by Incoterms, offering a strategic tool for policymakers and transport planners to develop more efficient and sustainable freight systems and promote optimized and sustainable freight operations.

3.3.4 Time Horizon

Retrospective. The study analyses data from the past (2013-2015) to examine the existing situation and provide a baseline for comparison against potential future changes.

3.3.5 Data Collection Methods

Quantitative. Company data REPIT report from the years (2013-2015) on logistics costs, delivery times, shipment volumes, Incoterm usage, and transport modes for South American deliveries (obtained from the company's internal records).

Qualitative. Semi-structured interviews with logistics professionals (both internal and external to the company). Think-aloud protocols were incorporated into the interviews.

Surveys were distributed to sales personnel and South American customers to measure the understanding and acceptance of Incoterms.

3.3.6. Data Analysis Methods

Quantitative: Descriptive statistics (means, standard deviations, frequencies) to compare between South American countries' correlations aiming to assess relationships between variables.

Qualitative: Thematic analysis was used to identify recurring themes and patterns in the interview transcripts and survey responses. Triangulation between quantitative and qualitative data enhanced the reliability and validity of the findings.

3.3.7 Sampling Strategy

This study addressed some challenges inherent in freight transport operations within the case company operating in South America. It turned to mixed methods research, providing

multidimensional viewpoints through quantitative and qualitative data analysis as possible structures for its findings.

Quantitative data was extracted from the company's internal REPIT reports from 2013 to 2015. These reports contain information such as delivery times, shipment volumes, INCOTERMS, and frequency, forming a rich data series for considering questions about patterns and delays in logistics. This material closely follows themes about how the use of INCOTERM affects actual operations within negotiations.

The qualitative data was collected through interviews and structural INCOTERMS surveys organized to gain strategic and operational insights into the current state of freight transportation in South America. Data from the interviews was focused on key personnel involved with the company's overall logistics operations. These interviews included two upper-level global logistics managers and two middle-level logistics operators. All four were based at the company headquarters in Vantaa and Tampere in Finland. In addition, an enterprise-wide survey was conducted among the company's sales and purchase employees, especially those connected with South American operations. This survey aimed to gather more knowledge about INCOTERMS. The survey obtained and analysed a total of 24 replies.

Data analysis began with the quantitative data. Descriptive statistics and time series analyses were employed to identify key trends and patterns from the shipping records of freight transported. These themes were then put into larger conceptual frameworks, providing a more global view of case company logistics.

Finally, triangulation integrated quantitative and qualitative findings. This method guaranteed data convergence and verified the study's conclusions.

Throughout the research process, ethical considerations were addressed by seeking approval from all interview participants and maintaining the confidentiality of their

information. Respondents to questions in the groups had their data treated anonymously individually to protect individual privacy and prevent sensitive company materials from becoming known in public. The research adhered to relevant academic institutions' ethical guidelines and complied with all local data protection regulations.

4 EMPIRICAL STUDY

4.1 Key Transportation Challenges for Valve Manufacturers in South America

The transportation of goods plays a pivotal role in global supply chains, particularly for valve manufacturers operating in the South American region (Valve Manufacturers Association, 2024) As these manufacturers manage imports and exports, they encounter challenges influenced by political, economic, social, and technological (PEST) factors. These challenges, when not addressed adequately, can disrupt the smooth flow of goods, increase costs, and impact competitiveness in a highly dynamic market (V. Corporation, 2023) A comprehensive understanding of the PEST factors is crucial for mitigating risks and improving logistical efficiency, which is aligned with modern supply chain management (Christopher, 2022).

From a political perspective, South America's regulatory frameworks and trade policies significantly affect transportation activities (De Freitas, Marston, & Bakker, 2015) Frequent changes in import-export tariffs, customs regulations, and regional trade agreements, such as Mercosur, can create uncertainty for valve manufacturers (Fuentes Sosa , 2014) For example, some countries' inconsistent customs clearance procedures and political instability increase lead times and transportation costs (CELAC, 2015) These political factors underscore the need for valve manufacturers to develop robust compliance strategies and maintain strong relationships with local authorities to navigate regulatory complexities effectively (Grant, 2017).

Economic factors, such as currency volatility, inflation rates, and infrastructure investments, also play a critical role in shaping transportation challenges (Alberti & Pereyra, 2016) Many South American countries face infrastructural deficits, including inadequate roads, congested ports, and inefficient rail systems, which hinder the efficient movement of goods (CELAC, 2015) Moreover, currency exchange rate fluctuations can impact freight costs, especially for international shipments (Alberti & Pereyra, 2016) Valve manufacturers must

consider these economic variables when planning their logistics operations, adopting cost-efficient solutions like consolidating shipments or partnering with local logistics providers to mitigate risks (Valve Manufacturers Association, 2024).

Social factors, including workforce availability and consumer expectations, further complicate transportation for valve manufacturers. The region's diversity in cultural norms and languages necessitates a localized approach to logistics management (Valve Manufacturers Association, 2024) Additionally, the increasing demand for sustainable and ethically responsible practices has led manufacturers to reconsider their transportation models (Alberti & Pereyra, 2016) This aligns with the global trend toward corporate social responsibility, where companies are encouraged to adopt environmentally friendly practices, such as optimizing delivery routes to reduce carbon emissions (Kotler, 2016).

Lastly, technological advancements provide both opportunities and challenges for transportation in South America. While digital tools like GPS tracking, route optimization software, and automated customs systems improve logistical efficiency, the uneven adoption of technology across the region poses significant hurdles. In some areas, outdated systems and limited access to technological infrastructure create inefficiencies in supply chains (Alberti & Pereyra, 2016) Valve manufacturers must invest in modern logistics technologies while addressing the digital divide to remain competitive (Valve Manufacturers Association, 2024) Moreover, integrating advanced analytics can help anticipate disruptions and optimize transport networks, offering a long-term solution to persistent challenges (Lambert, Issues in Supply Chain Management., 2000).

The image below shows in resume the PEST analysis for valve manufacturers in South America.

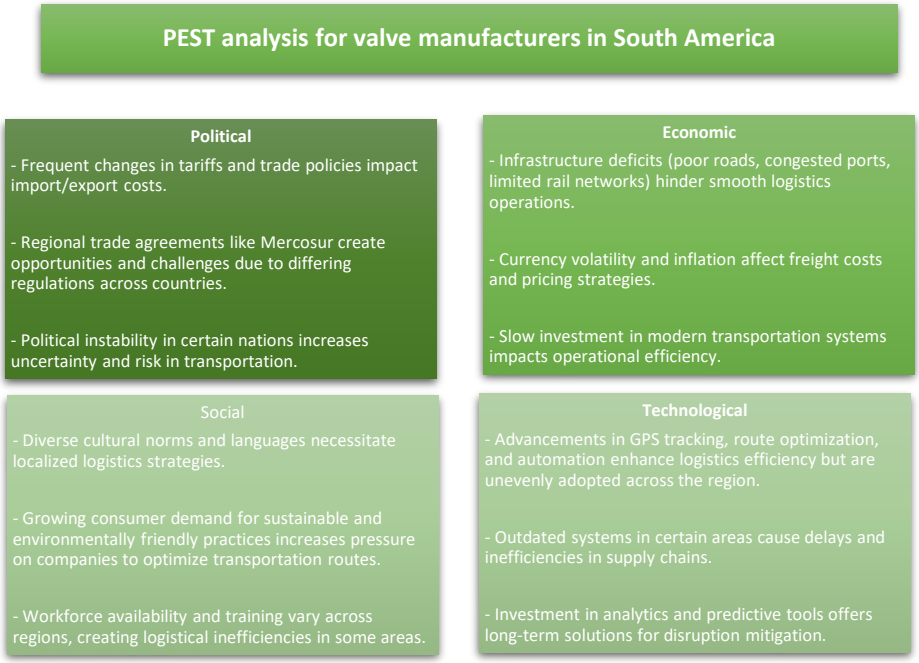


Image 6. PEST analysis for valve manufacturers in South America

For valve manufacturers trying to navigate challenging market conditions effectively, there is no substitute for making the ADA freight transport model using Incoterms CPT (Carriage Paid To) and CFR (Cost and Freight). With these globally recognized trade terms, companies can eliminate much of the inefficiency from their logistics, concentrating instead on managing costs and responsibilities in transporting goods so that buyers and sellers know clearly where these buck-stops are. This clarity in trading terms not only averts possible disputes but also helps to improve operating efficacy and assurance of costs (ICC, 2016).

4.2 Quantitative Study

"For supply chain and logistics providers, eradicating delivery delays is key to keeping customers happy" (Siivonen, Global Logistic Manager, 2014) In supply chain and logistics, histograms are a powerful tool for visualizing the frequency and distribution of delays. They are helpful to decision-makers, who can find patterns and abnormalities in logistics processes using them as well (Mentzer J. T., 2001) Histograms display data organized into

intervals in charts, offering visual confirmation of performance indicators. This makes them especially useful when analyzing data sets in challenging regions like South America (De Freitas, Marston, & Bakker, 2015).

Histograms are particularly useful in logistics because they help us understand the variability in delivery times. By showing how often delays occur within defined intervals, they enable supply chain managers to quickly see where trouble spots lie whether, for example, deliveries are coming late or early ahead of schedule (Lambert, 2000) This approach serves as a window into logistics performance. It provides a diagnostic tool to ferret out inefficiencies and chokepoints, which aligns with the overall goals of supply chain optimization (Mentzer J. T., 2001).

This analysis is pivoted for the South American region, which is performed based on strategic decision-making and combined with histograms. It conforms to the best logistics management practices, combining analytic tools with strategic decision-making. The following Histograms are made under specific categories, considering delay from the original delivery schedule as a primary variable. Orders with a speed-up process are considered for general statistical calculation but not analysis. All the orders are under Incoterm 2010 FCA, transport mode Customer Contract Carrier, and Customer Pick up for direct invoicing customers. The data is extracted from the study Company REPIT report.

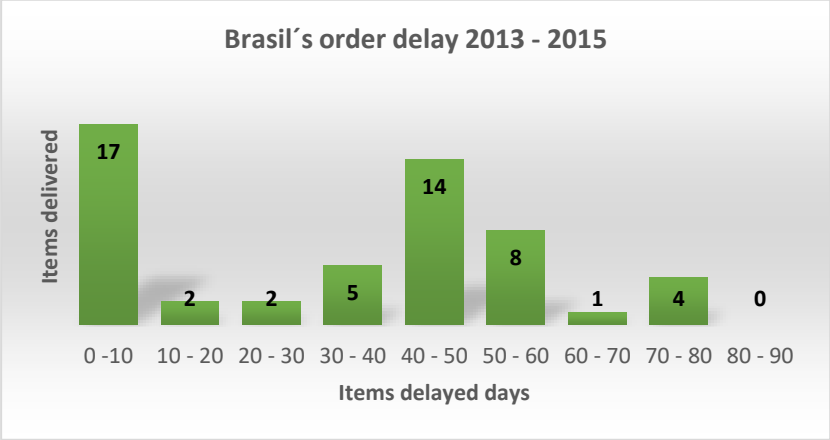
4.2.1 Argentina order delays

Total delivery lines	**369**
Earliest delivery	**-104**
Latest delivery	**413**
Range	**517**
Mean (Delay average)	**53.21**
Standard deviation	**75.63**

Image 7. Argentina´s order delay histogram. Sourced from study Company REPIT report.

Between 2013 and 2015, the company delivered 369 items to Argentina under Incoterm FCA and transport modality Customer Contract Career and Customer Pick up for direct invoice customers with an average delay of 53,21 days and a standard deviation of 75,63. To make the results more tangible, the histogram was categorized with a 50-day width of beans to create intervals, given the high data range. The chart highlights a significant number of delayed deliveries between 0 and 50 days and nearly 40 deliveries with over 150 delayed days, which is a substantial portion of the company´s total deliveries.

4.2.2 Brasil order delays



Total delivery lines	**53**
Earliest delivery	**-14**
Latest delivery	**77**
Range	**91**
Mean (Delay average)	**33**
Standard deviation	**27**

Image 8. Brazil's order delay histogram. Sourced from study Company REPIT report.

Analysis of Brazilian delivery data from 2013-2015 reveals a moderate average delay of 33 days across 53 deliveries, with over 90% of delays falling within the 0–60 day range. A standard deviation of 27 days indicates variability, though most delays were relatively short. Results may not be representative due to limited data, and further investigation is needed to determine the root causes of the delays and improve on-time delivery. All deliveries used Incoterm FCA with Customer Contract Carrier and Customer Pick-up for direct invoicing.

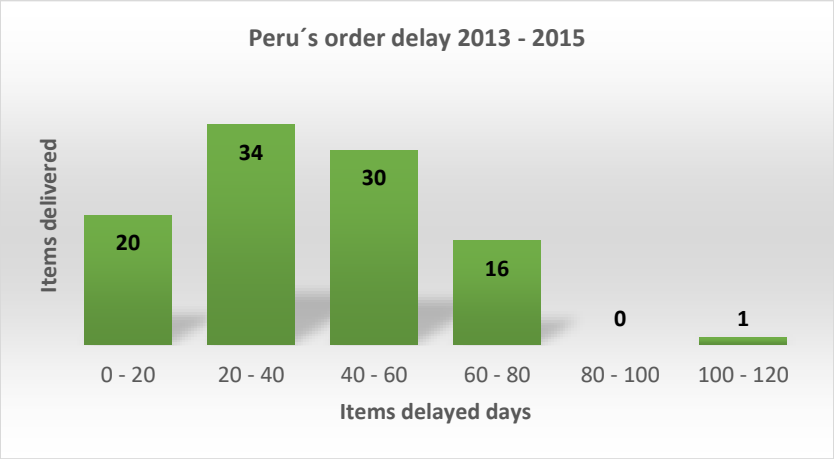
4.2.3 Chile order delays

Total delivery lines	**126**
Earliest delivery	**-47**
Latest delivery	**248**
Range	**295**
Mean (Delay average)	**46,24**
Standard deviation	**45,54**

Image 9. Chile's order delay histogram. Sourced from study Company REPIT report.

Compared to Brazil, deliveries to Chile during 2013-2015 (126 deliveries) took much longer, averaging 46.24 days with high variability. While most were under 100 days, a significant portion extended beyond 50 days. According to (Siivonen, Interview, 2015) Efficient logistics and supply chain practices are essential for minimizing delays, particularly in the Chile case. Given the significant range of delays observed, further investigation is needed to understand the causes of Chile's longer and more inconsistent delivery times.

4.2.4 Peru order delays



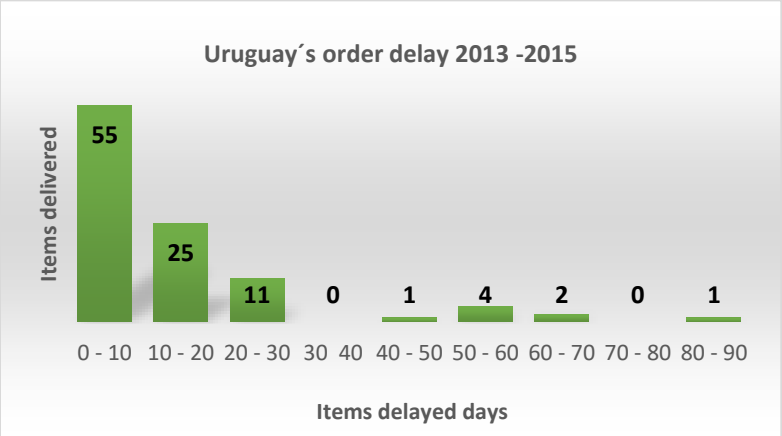
Total delivery lines	**101**
Earliest delivery	**-104**
Latest delivery	**116**
Range	**220**
Mean (Delay average)	**35,5**
Standard deviation	**29**

Image 10. Peru's order delay histogram. Sourced from study Company REPIT report.

Peru's delivery performance from 2013-2015, based on 101 deliveries, shows a moderate average delay of 35.5 days, comparable to Brazil's but significantly shorter than Chile's. The standard deviation of 29 days indicates less variability in delivery times than in Brazil or Chile, suggesting more consistent performance. Over 90% of delays were contained within the 0-60 day range, highlighting a concentration of relatively short delays.

While the results suggest a relatively efficient delivery system compared to Chile, the use of INCOTERM can identify the root causes of delays and verify the accuracy of extreme data points, such as the unusually early delivery. The consistent use of Incoterm FCA and the same transport modality across all South America's countries allows for a more direct comparison of logistical performance.

4.2.5 Uruguay order delays



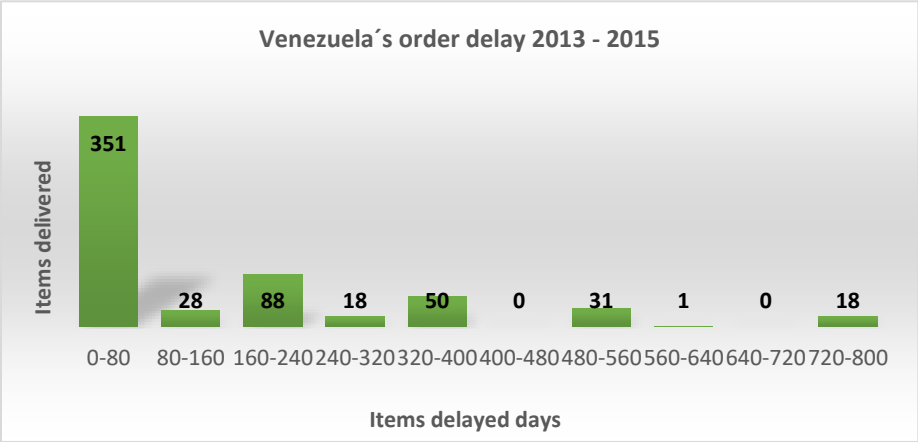
Total delivery lines	**99**
Earliest delivery	**-30**
Latest delivery	**81**
Range	**111**
Mean (Delay average)	**10,71**
Standard deviation	**17,2**

Image 11. Uruguay's order delay histogram. Sourced from study Company REPIT report.

Uruguay's delivery performance from 2013 to 2015 stands out significantly, with an average delay of only 10.71 days across 99 deliveries, considerably shorter than Brazil, Peru, and Chile. The low standard deviation of 17.2 days indicates high consistency in delivery times, with over 90% of delays falling within the 0-30 day range. This exceptional performance showcases a highly efficient and reliable delivery system, using the same Incoterm FCA and transport modality as other countries in the study

Uruguay's success with FCA highlights the importance of efficient delivery systems. However, exploring alternative Incoterms, such as CPT and CFR, in conjunction with the ADA freight transport model warrants consideration as a potential pathway to further optimize delivery performance across all regions.

4.2.6 Venezuela order delays



Total delivery lines	**585**
Earliest delivery	**-14**
Latest delivery	**749**
Range	**763**
Mean (Delay average)	**138,86**
Standard deviation	**185,30**

Image 12. Venezuela's order delay histogram. Sourced from study Company REPIT report.

Venezuela's 2013-2015 delivery performance stands apart from the other countries studied, with a staggering average delay of 138.86 days across many shipments (585). This dramatically exceeds the delays seen elsewhere, and the significant variability (standard deviation of 185.30 days) points to significant inconsistencies in delivery times. Many shipments experienced exceptionally long delays beyond 400 days, sometimes suggesting deep-seated problems within the delivery system. The same Incoterms (FCA) and transport methods were used as in other countries, suggesting the root causes likely lie elsewhere.

The stark contrast between Venezuela's performance and other nations is impossible to ignore. The unusually long average delay and the wide range of delivery times strongly indicate systemic issues beyond typical logistical challenges. Simple tweaks to shipping

methods will not likely fix this. This pattern of severe and unpredictable delays demands a careful examination of broader factors affecting deliveries to Venezuela during this period.

To get to the bottom of this, a thorough investigation is crucial, looking at economic conditions, political stability, and Venezuela's infrastructure at the time. While the FCA Incoterm and transport methods were consistent across all countries, exploring alternative approaches might be worthwhile, but only after pinpointing the core issues driving these extraordinary delays in Venezuela.

4.3 Quantitative Analysis and Limitations of Countries' Performances

The analysis provides an overview of delivery performance in six countries (Argentina, Brazil, Chile, Peru, Uruguay, and Venezuela) from 2013 to 2015. It identifies significant differences in performance and suggests the adoption of CPT/CFR Incoterms within the Ben-Akiva Aggregate-Disaggregate-Aggregate (ADA) freight transport model. This recommendation promises to enhance operational efficiency and improve delivery performance across the study company.

The performance variations among these six countries are significant, underscoring the need for a comprehensive analysis. Uruguay stands out with the lowest average delays at 10.71 days and minimal variability, while Brazil and Peru experience moderate delays at 33 and 35.5 days, respectively, along with moderate variability. Chile's performance lags with longer average delays of 46.24 days and higher variability, and Venezuela performs the worst, encountering an average delay of 138.86 days and substantial variability. These performance discrepancies likely stem from logistical challenges, macroeconomic conditions, and the political landscape unique to each country.

According to (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) the ADA model is a comprehensive framework comprised of three stages: aggregate prediction of production (consumption flows), disaggregate modeling of logistics (decisions at the firm level), and aggregate network assignment. This model is particularly critical for understanding the inconsistent delivery performance among countries (Ben-Akiva, Bottom, Gao, Koutsopoulos, & Wen, 2007) It can factor in shipment size, mode selection, and the use of consolidation centers, effectively addressing the various challenges impacting delivery times (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) Importantly, its iterative nature allows continuous refinement through feedback between the aggregate and disaggregate stages (Abate, Vierth, Karlsson, Jong, & Baak, 2019).

The study recommends interviewing company personnel in the transition to CPT (Carriage Paid To) and CFR (Cost and Freight) Incoterms within the ADA framework to enhance delivery performance (Lottanen, 2015) Unlike FCA (Free Carrier) where risk shifts at the point of shipment, CPT and CFR allocate more responsibility for transport to the seller, potentially improving control and cost management during transit (Siivonen, Interview, 2015) Integrating these Incoterms into the ADA model's logistics analysis component provides an opportunity for a detailed evaluation of their impact on organizational decision-making (Abate, Vierth, Karlsson, Jong, & Baak, 2019) This granular approach and the ADA model's refinement capabilities can address the identified regional performance variations effectively. Furthermore, the data-intensive requirements for the disaggregate component, including shipment specifics, transport logistics, and cost analysis, will help pinpoint delay sources and inform tailored strategies for efficiency improvements (Abate, Vierth, Karlsson, Jong, & Baak, 2019).

The notable delivery performance discrepancies underscore the need to tackle each country's specific challenges (Baudin, 2004) The adaptability of the ADA model makes it possible to integrate factors like macroeconomic data, infrastructure limitations, and

political instability that affect delivery time (Alberti & Pereyra, 2016) Leveraging the model's capabilities to incorporate this information, the study can gain a holistic view of systemic issues and develop targeted optimization strategies relevant to each context. This underscores the potential of the ADA model to address the regional performance variations and provide tailored solutions.

Employing the Ben-Akiva ADA model with CPT/CFR Incoterms creates a strong base for improved delivery performance. The model's disaggregate analysis capability and adaptability to regional factors facilitate a data driven optimization approach. The study's recommendations for future research, including a comparative cost-benefit analysis of the suggested changes and rigorous model testing with the company's updated data, underscore the ongoing commitment to improving delivery performance.

4.3.1 Limitations

Firstly, the transition to Incoterms CPT/CFR and Ben-Akiva ADA model brings challenges of non-negligible scale: the model requires highly detailed information about every shipment, its routing, and the expenses involved (Ben-Akiva, Bottom, Gao, Koutsopoulos, & Wen, 2007) The data for this research can be challenging and vary significantly in reliability from region to region. Most of the time, the data provided for the research was insufficient or unreliable, which could lead to inaccurate predictions by the model. Ways need to be found to increase the quality of input data.

Secondly, the ADA model is rather complex, operating through some stages with results being validated and refined all along the way (Bierlaire & Ben-Akiva, 2002) This complexity calls for large amounts of computing power and time (Caputo, Fratocchi , & Pelagagge , 2006) The model's long run times make it less suitable for continual tracking and fine-tuning than shorter, I this is the case the study company might have to consider using simpler versions of the model or look for more efficient operational strategies. According to

(Siivonen, Interview, 2015) the study company has been creating and consolidating a sophisticate logistics software capable to afront this challenge specific making it more flexible to adapt to any constrain in the logistic process.

Thirdly, while the model effectively incorporates logistical factors, it does not cover all variables. Unforeseen factors, such as political instability, natural disasters, and major economic shifts, have the potential to disrupt delivery timings massively (Sheffi, 2005) The model cannot predict these events. There is a need to find out the way to fit external, unpredictable factors like these into the model or at least consider their possible impacts on forecasts.

Lastly, transitioning to CPT or CFR Incoterms is not a simple solution. It is simply a transition to comprehensive changes in contract terms, operational processes, and sharing responsibilities (ICC, 2016) Such a change requires careful planning, time, and expense. It may encounter opposition from those who are used to doing things in a certain way. Furthermore, the optimal settings for the model are likely to vary by shipping destination because elements such as infrastructure, legal frameworks, and business practices are quite different from place to place (Chopra, 2016) The study company must know that what is effective in one region might be inappropriate for use in another.

4.4 Qualitative Study

Conducted qualitative research through structured interviews and Incoterms surveys to gain strategic and operational insights into freight transportation in South America. Engaged key logistics personnel from company headquarters in Finland at upper and middle management levels. Additionally, a comprehensive survey with 24 questions regarding the use of Incoterms targeting sales and purchasing employees involved in South American operations, resulting in valuable data from 24 respondents

4.4.1 Incoterms Survey

The survey results are designed to assess how well employees at the study company understand and use Incoterms. Understanding this is crucial because using the right Incoterms is key to clear contracts, knowing who is responsible for what, and ensuring the company's finances are sound (Jonas, 2011) It is following the law (Ananda, Desi Dwi, Eva Arista, Vingky, & Septya, 2022) this analysis pinpoints where employees are strong and weak in their knowledge, suggesting ways to improve training and processes.

The survey was not a mere yes/no quiz about Incoterms. It delved into people's familiarity with different terms, not just their knowledge but also their frequency of use and the specific situations in which they were used. This comprehensive approach provides a robust understanding of Incoterm knowledge, surpassing a basic recognition test, and allows the company to identify its strong and weak areas in Incoterm practices (Chopra, 2016) It also identifies a correlation between employee roles and their Incoterm knowledge.

4.4.2 Survey analysis, limitations

Some truly insightful findings emerged from the study of the company's understanding and application of Incoterms 2010, which surveyed 24 participants. It found that 87.5% had a high awareness of Incoterms 2010. However, people's level of understanding varied greatly; 62.5% had a basic grasp, and only 25% were experts.

83.3% of respondents confirmed their company's in-house policy for using Incoterms 2010 in commercial exchanges. The Incoterm used FCA most often at the organization from which data were collected; CPT and DAP followed behind. Most respondents (79.2%) recognized the advisability of defining Incoterms in written contracts, which suggests that most of these respondents have mastered fundamental business knowledge.

Most of those surveyed preferred full delivery tracking (79.2%) and transparent calculation of freight tariffs (83.3%), which takes Incoterm details into account. During sales talks, the most commonly used term was FCA, followed by various modifications, such as FCA / CPT / DAP and CPT, to a lesser extent (Siivonen, Interview, 2015). The overwhelming importance of punctual delivery was further underscored; almost everyone agreed (95.8%). However, the report also found typical challenges previously unidentified in literature, such as delays due to poor Incoterms selection (54.2%) and severe delays in buyer pick-up time (52.2%). Maximum delays lasted 45 days.

Research showed that 70.8% of the survey participants knew of their company's internal transport gateway system, indicating an acceptable acceptance rate. However, customs clearance was complex, as shown in the figure below. Nearly 39% said bureaucratic hurdles were overwhelming, so efficient procedures and external communication strategies should be promoted.

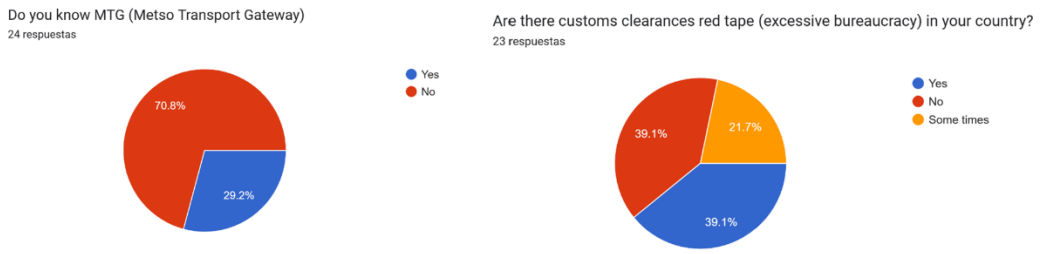


Image 13. Awareness of internal transport tools and customs clearances. Sourced from survey

Various views emerged regarding the best Incoterms to use. As the figure below shows, from a production standpoint, "F terms" and "C terms" were preferred as negotiation tools for sales contracts; however, within the corporation itself, "D terms" and "C terms" were

favored as means of structuring contracts. This discrepancy suggests that closer examination is necessary and that standardization of business practices could eventually evolve.

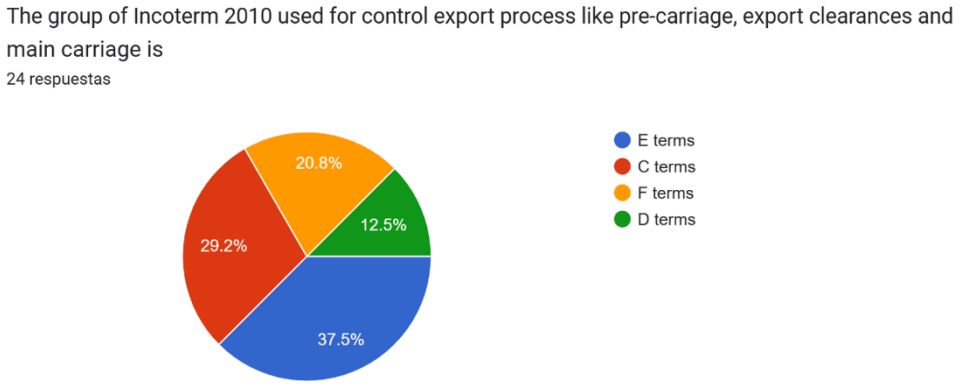


Image 14. Group of Incoterms 2010 was used to control the export process. Sourced from survey

In summary, this study points to an array of opportunities for streamlining processes. According to (Jonas, 2011) many hindrances could be overcome with further training on Incoterms 2010 and improved overall operation. Revised communication around in-house best practices. It seeks to align departmental views on Incoterm selection to optimize contract negotiation and operations within the supply chain (Gavrilă & Roşu, 2011) Finding ways to alleviate the bottleneck in customs clearance is also essential, as it offers valuable pathways toward rising productivity and lowering the risk factor (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

The Aggregate-Disaggregate-Aggregate (ADA) freight transport model offers a robust framework that enhances the practical use of specific Incoterms (Abate, Vierth, Karlsson, Jong, & Baak, 2019), such as CPT and CFR. Unlike more basic models, the ADA model models intricate, firm-level logistics choices, encompassing shipment size, mode selection, and distribution center usage (Ben-Akiva, Bottom, Gao, Koutsopoulos, & Wen, 2007) This in-depth detail effectively addresses the need for accurate responsibility allocation intrinsic to

CPT and CFR, thereby boosting precision and diminishing ambiguity in transferring goods' responsibilities (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) This is particularly pertinent in survey findings that indicate significant delays (54.2%) due to improper Incoterm application, as well as strong demand for delivery tracking (79.2%) and transparent freight cost calculations (83.3%).

The ADA model's comprehensive approach enhances the application of CPT and CFR by clearly identifying the exact point of responsibility transfer, thereby reducing the likelihood of misunderstandings and disputes regarding delivery (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) This increased accuracy is crucial, especially given that 52.2% of survey respondents.

Using CPT and CFR Incoterms under the ADA freight transport model provides significant advantages but comes with some challenges. The fact that the ADA model relies on detailed, firm-level data may be problematic for businesses without established logistics information systems (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) Moreover, the survey shows that a considerable percentage of the respondents (12.5%) have little knowledge of Incoterms 2010, an aspect that might affect the correct implementation of CPT and CFR since a detailed knowledge of their content and meaning is a prerequisite (Jonas, 2011) Also, the high percentage of respondents (54.2%) that reported delivery delays resulting from misuse of Incoterms highlights the risk of misinterpretation, accentuating the need for proper training and an enforced standardization of processes. The model's success also dramatically relies on input data precision; inaccurate or lacking data may lead to flawed forecasts and impractical logistics planning (Ballou, 2004).

Also, although the ADA model gives variable insight, it could be too complex for some smaller businesses with fewer resources. To ensure that the ADA model is implemented optimally, it will likely involve a significant investment in IT infrastructure and potential specialized training, as the survey results show a wide range of technological sophistication

among the participants (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) This financial requirement could limit adoption, especially for smaller organizations. Moreover, while the ADA model helps assign the responsibility accurately, the actual enforcement of the responsibility rests with the effective communication and coordination of all parties engaged in the shipping process (Ben-Akiva, Bottom, Gao, Koutsopoulos, & Wen, 2007) The survey's revelations on customs clearance problems (39.1% finding too much bureaucracy) point to external challenges that can smooth the application of even the most thorough logistics plans.

4.4.3 Interviews

This summary of key insights from interviews conducted in a freight coefficient modeling study for Metso's South American direct invoicing deliveries. The interviews explored various aspects of the study company´s current logistics practices in the region, including preferred Incoterms, delivery procedures, common challenges, and opportunities for optimization. The data gathered provides valuable context for evaluating the potential benefits of adopting the ADA freight transport model and implementing CPT and CFR Incoterms. These interviews were conducted in 2015 with two global logistics managers and two logistics coordinators. Refer to the appendix section to see all the interviews.

The first interviewee, working in the study company as a Sales Coordinator for D2D Business Support, revealed that the significant issues with the direct invoicing process in South America were the wide use of FCA Incoterms, combined with a lack of knowledge about accurate pricing and delivery timeframes for CPT shipments. These issues highlight some serious operational shortcomings. The requests for sale permission delivery make the delivery process slower. Significant discrepancies in delivery volumes, particularly the predominance of spare parts, vocational the challenge of optimizing logistics strategies.

The first interview expressed positivity around the potential benefits of migrating to CPT and CFR and identified enhanced transparency and more precise delineation of responsibilities as the main components to making operations more efficient and preventing friction. Her catchments from previous shipments using CPT/CFR reinforce this perspective. It will be essential to improve the situation (Forsstrom, 2015).

The second interviewee is essential to understanding Metso's direct invoicing operations in South America, underscoring critical deficiencies in the current system. It is commonplace for the company in our industry to use a standard FCA Incoterm. Still, it was not the best option for cost and delivery estimates for CPT shipments in this case. The interviewee emphasized the importance of a more tailored approach based on the transaction's unique factors, including how Incoterms (CPT, CFR, and, in some cases, DDP) were selected. She added that delivery processes remained highly variable across the region, leading to significant challenges unique to each country. Chile is a relative outlier, given its superior logistics infrastructure. The substantial (though highly variable) overall delivery volume, skewed by spare parts shipments, bolstered the desire to establish a logistics model capable of adapting to diverse operational realities.

The need for precision and adaptability supports the CPT and CFR switch, as suggested by the interviewee. The increased transparency and more precise delineation of responsibilities associated with these Incoterms would streamline processes, enhance communication, and reduce the potential for disputes. She also pointed to a necessary central management system with comprehensive tracking and documentation capabilities and issues with communication and clarity in operations. These findings accord closely with the objectives of the freight co-efficient modeling project, underscoring the need for an adaptable, data-informed model that is sensitive to regional disparity and the variance that is characteristic of the study company delivery operations in South America.

Interviewees' third and fourth interviews showed the study company's strategic approach to transportation management, which provides strong insight from interviews with both interviewees. According to the company transportation presentation, in 2014, they made a substantial investment of 161 MEUR, which is reflected significantly in their delivery performance and efficiency by strengthening procurement, re-negotiating logistics contracts, and managing risks (Presentation, 2015) This preventative approach, powered by MTG data analytics and predictive enablement, is at the heart of continuous improvement activities. They pointed out that the shift to CPT and CFR Incoterms, which offer greater clarity over responsibility than FCA, aligns with survey results that reflect the need for transparent calculations of freight costs. He described cost-saving methods across transport modes, emphasizing consolidation, negotiating by volume, and proactive rate management to improve through better category management.

Both interviewers spoke of MTG's transformative approach to communication, data sharing, vendor management, and compliance. Real-time tracking and reporting features enable timely interventions, ensuring compliance with KPIs. In addition, MTG's ability to adapt its solutions to new technologies ensures that Metso will persist far into the future in controlling transportation costs and optimizing the supply chain. Overall, the interviews proactively promote a data-based approach to transport optimization, stressing the leverage of targeted Incoterm choices (CPT/CFR) and MTG's powers in a constant improvement and optimization cycle (Siivonen & Schroeder, Metso's strategic transportation management interview, 2015).

4.4.4 Interviews analysis, limitations

Analysis of the Information Gathering will identify the need for improved efficiency and transparency in the Company's Direct Invoicing Delivery System in South America. First, the interviewee identified major problems, including incorrect pricing, inaccurate delivery time projections, a complex invoicing system, and delays caused by customs bottlenecks. The

second interviewee's point of view for having a more flexible Incoterm selection for the particularities of the transaction instead of using Incoterm FCA was also confirmed. Both stressed the need for better tracking and a more efficient authorization process.

In addition, the third and fourth interviewees spoke of the Company's extensive investments in the optimization of transportation and the MTG's critical function in improving delivery performance and lowering costs. CPT and CFR Incoterms were emphasized during the transition as they clearly define responsibilities, resulting in better predictability and risk control. A key example of this approach can be seen in the successful implementation of cost-saving measures across multiple transport modes, demonstrating that data-driven strategies and diligent oversight can lead to more efficient logistics operations. The stress on KPIs' continuous improvement and leveraging MTG's data analytics capabilities directly translate into the requirements for a more powerful logistics framework.

The proposed shift towards adopting the ADA freight transport model, aligning with CPT and CFR Incoterms, offers the study Company great potential for improving its operational efficiencies in South America. Conversely, the ability of the ADA model to overlay granular, firm-level logistics data directly satisfies the need for accurate cost estimations and delivery time predictions for CPT and CFR shipments represented, critically, as a research gap within both interviews and the survey. Moreover, the Model's Aggregated Data processing capabilities can enhance decision-making when selecting Incoterms specific for each transaction to ensure cost minimization and risk reduction.

Integrating the ADA model with MTG enables the study Company to create a well-structured, data-driven transportation process management and improvement system. That would help them make more competent freight vendor selection, proactive risk management, and continuous improvement through real-time tracking and data analytics. This grown, unified, and transparent system would not only optimize the invoicing workflow. Still, it would also address many of the problems brought up in the interviews, reducing the

delays, improving communication flow, and ultimately increasing the efficiency and customer satisfaction in the study Company's direct invoicing deliveries within South America.

5 CONCLUSIONS

5.1 Answering Research Questions

How to select the appropriate Incoterm 2010 for a sales contract?

For the study company, selecting an appropriate Incoterm 2010 for a sales contract should consider factors such as the nature of the goods (valves or spare parts), the mode of transport (air or sea), the level of risk each party is willing to assume (the Incoterm selection decision making), and the specific responsibilities each party is prepared to undertake (Grafer & Schlich, 2006) Incoterms define the responsibilities of buyers and sellers in terms of delivery, risk, and cost obligations, which are crucial for transparent trade negotiations and contracts (Burghard, 2020).

What are the advantages of employing CPT and CFR from Incoterms 2010?

CPT (Carriage Paid To) and CFR (Cost and Freight) Incoterms 2010 can enhance risk management and transaction smoothness, aligning with modern trade practices (Alan A. , 2023) These terms provide clarity to traders in cross-border dealings, especially within customs unions, and are recommended by the International Chamber of Commerce (ICC, 2016) By implementing this Incoterm in the negotiation, the study company will be willing to control the freight process and mitigate the risk.

What improvements can the organization expect in its freight transportation operations by implementing the ADA Freight Transport model, especially concerning cost savings, efficiency, and supply chain optimization?

Implementing the ADA Freight Transport Model offers the study company a powerful tool to streamline its South American direct invoicing deliveries and address persistent inefficiencies associated with the current FCA Incoterm system. This model provides a

comprehensive framework for enhancing cost savings and operational efficiency by leveraging advanced algorithms to optimize freight transportation (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) By enabling informed decision-making and providing dynamic analyses of various transportation scenarios, the ADA model strengthens the company's strategic position and enhances its competitiveness within the market (Ben-Akiva, Bottom, Gao, Koutsopoulos, & Wen, 2007) Specifically, the model's ability to integrate transportation operations modeling with cost functions allows for a more systemic approach to optimization, addressing a crucial gap in traditional methodologies (Caputo, Fratocchi , & Pelagagge , 2006).

The model's implementation within the company requires careful consideration of data requirements, including disaggregation of data into individual shipments to accurately capture specific logistical choices, such as transport mode, type of shipment (valves or spare parts), and shipment size. According to (Ben-Akiva, Meersman, H, & Van de Voorde, 2013) research shows that this detailed information feeds into the model's three-stage process (aggregate, disaggregate, aggregate) to optimize freight flows and minimize costs. This aligns with the company's objective to reduce warehousing expenses, expedite delivery times, and optimize the direct invoicing process. Adopting CPT or CFR incoterms further enhances the model's effectiveness by clarifying responsibilities and risk transfer points, leading to smoother transactions (Gavrilă & Roşu, 2011).

Successful implementation will depend upon effective collaboration among various departments (sales, production, logistics, IT) to ensure data accuracy and model efficiency. The adoption of CPT or CFR incoterms, coupled with the utilization of data-driven insights from the model (Hien, Laporte, & Roy, 2009) will support the company's strategic aims of streamlining operations, reducing costs, and improving customer satisfaction in South America. The ADA model's iterative nature allows for continuous refinement and adaptation to dynamic business conditions (Ben-Akiva, Meersman, H, & Van de Voorde, 2013).

5.2 Key Findings

Uruguay emerged as a success in the study, boasting the best delivery performance. On the other hand, Venezuela faced significant challenges, ranking the lowest in the study findings. These disparities were evident across South American countries. Bureaucratic hurdles, especially in customs clearance, were recurring issues that caused delays.

Some employees in the study do not understand Incoterms well.

Company Interviews emphasized the importance of clear communication, efficient processes, and accurate pricing. They also emphasized the necessity of a more tailored approach to fulfilling customer needs.

5.4 Recommendations

Switch to CPT or CFR Incoterms 2010

The study company must prioritize it and enhance communication and coordination among all stakeholders involved in the delivery process. This will streamline operations and foster a sense of shared responsibility and commitment to reach KPIs.

Educate personnel on Incoterms and other best practices

Facilitate customs clearance processes.

5.5 Limitations

The ADA model is complex, requiring large amounts of data and processing power.

Data quality and availability can be a significant challenge.

The model does not account for all external factors that could impact delivery (e.g., political instability and natural disasters).

Finally, this thesis demonstrates that implementing the CPT or CFR Incoterms and the ADA model can enhance the operational efficiency and cost-effectiveness of the direct delivery invoicing process for the company in South America. Successful execution requires a significant investment of time and money and a willingness to measure and analyze results.

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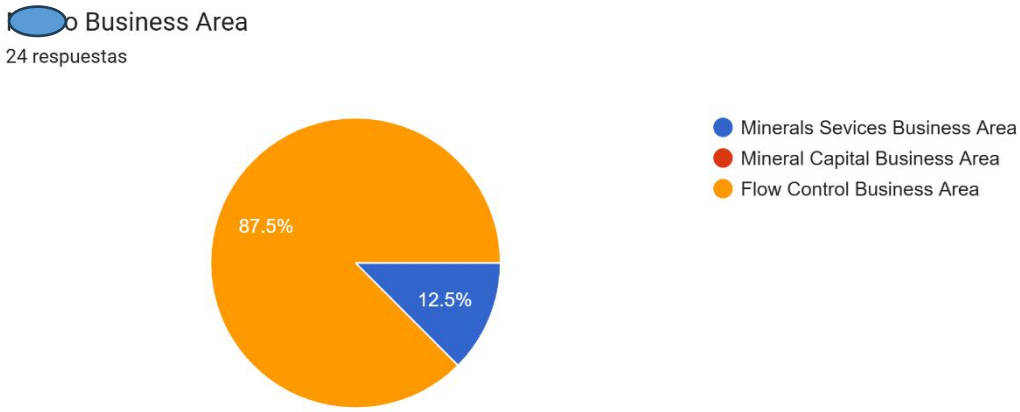
APPENDIX

Survey

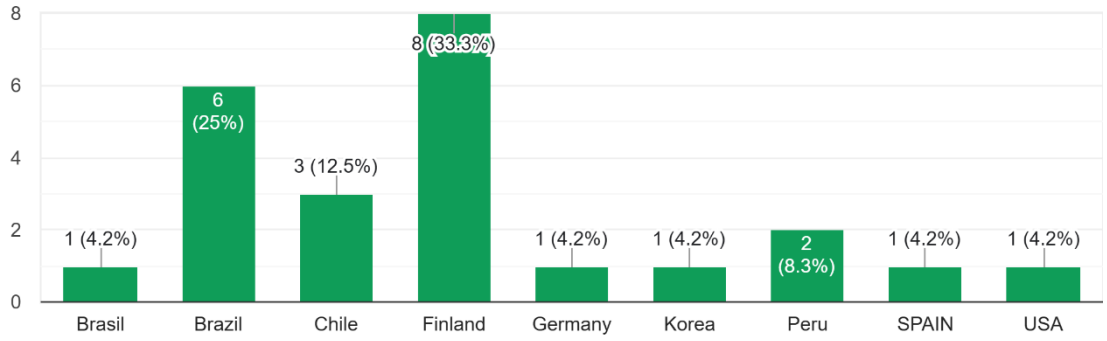
Study Research: Incoterms Survey

PRIVATE LINK



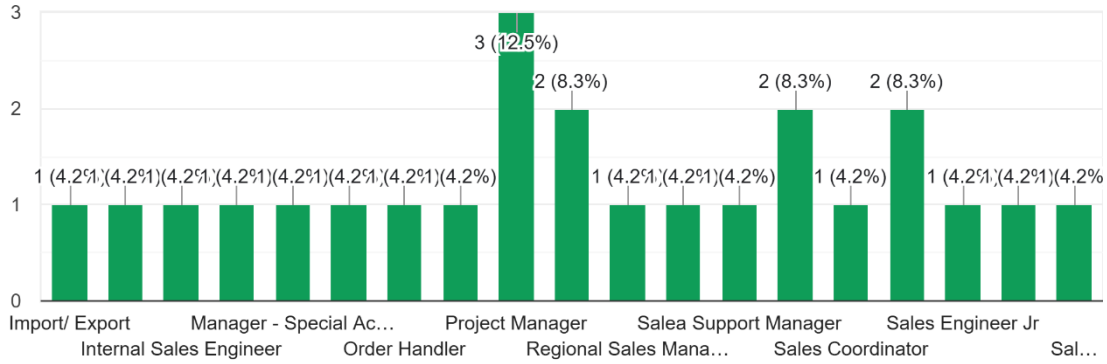
Chile

24 respuestas



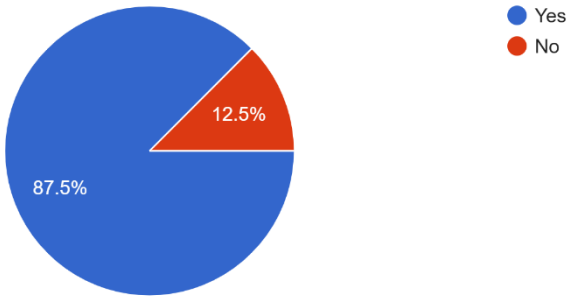
sales coordinator

24 respuestas



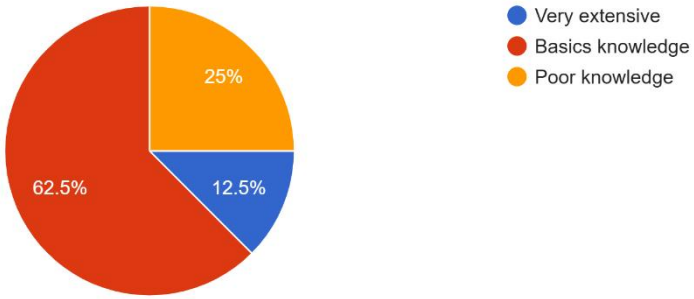
Do you know Incoterms 2010?

24 respuestas



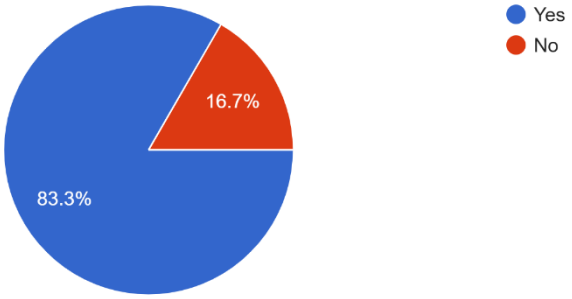
How extensive is your knowledge of incoterms 2010?

24 respuestas



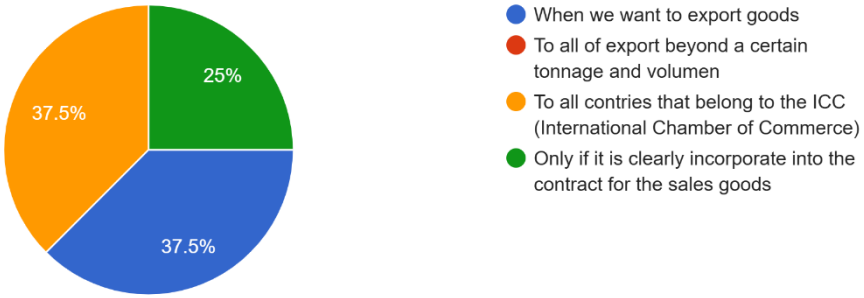
Do you know [redacted] has recommended Incoterms 2010 for purchasing and selling negotiations?

24 respuestas



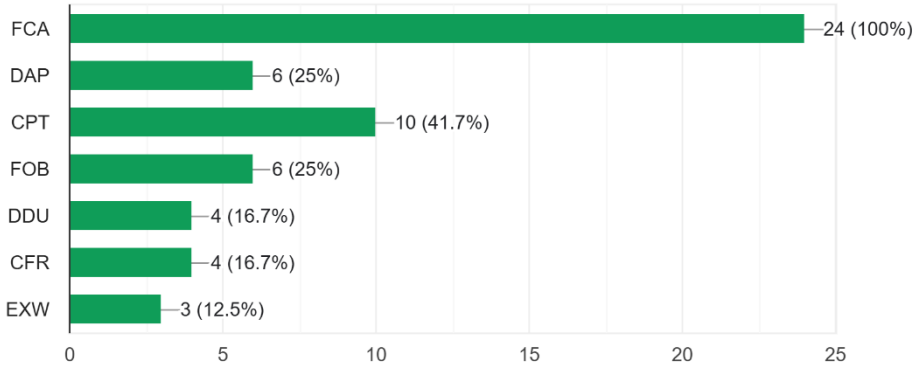
Incoterm applies when ...

24 respuestas



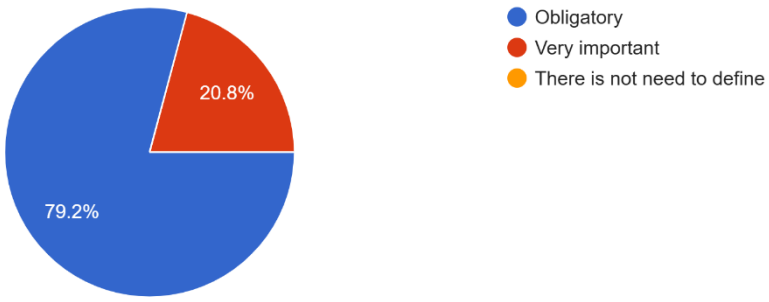
[redacted]o´s more commonly used recommended Incoterms 2010 are (multiple choice)

24 respuestas



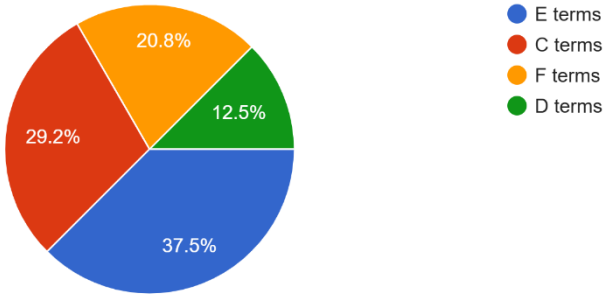
Defining the Incoterm 2010 in sales contract, Internal Purchasing order (IPO) and Purchase Order (PO) is:

24 respuestas



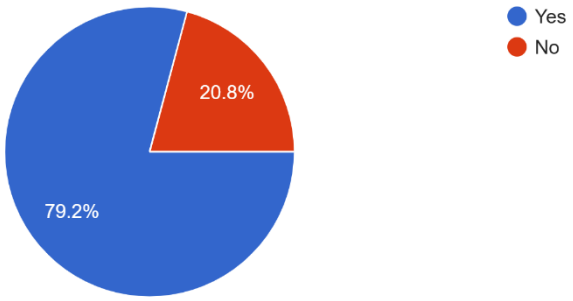
The group of Incoterm 2010 used for control export process like pre-carriage, export clearances and main carriage is

24 respuestas



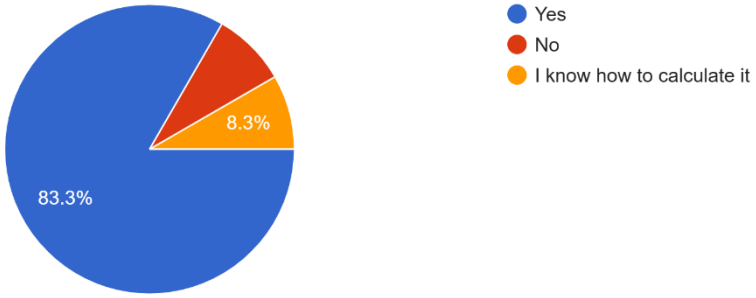
Would you like to track and keep control of all your deliveries even when the transport mode is Customer Contract Carrier or Customer Pick up?

24 respuestas



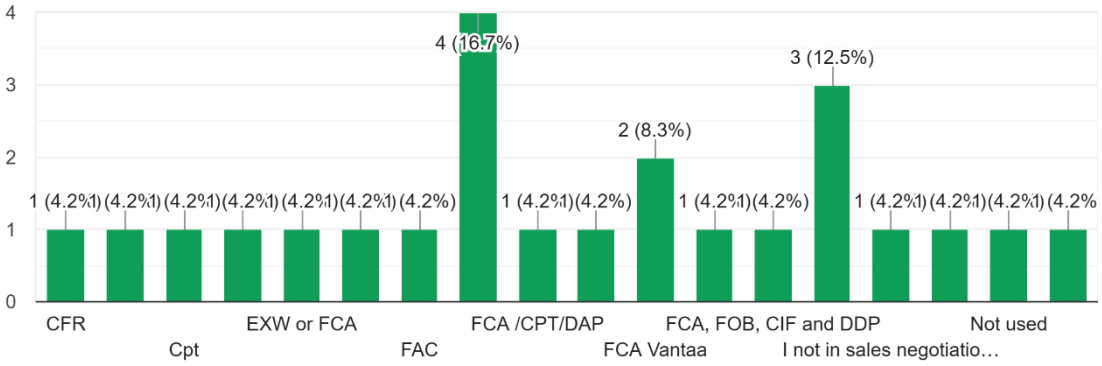
Would you like to know how to calculate your delivery freight cost taking in consideration the incoterm 2010?

24 respuestas



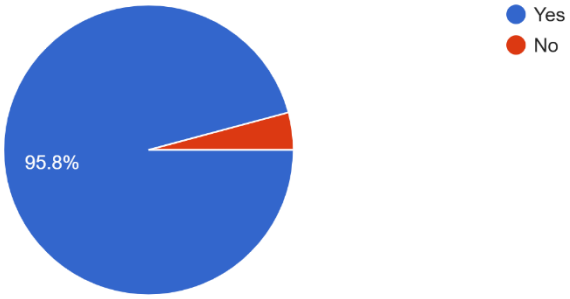
Which Incoterm you commonly use in your sales negotiations?

24 respuestas



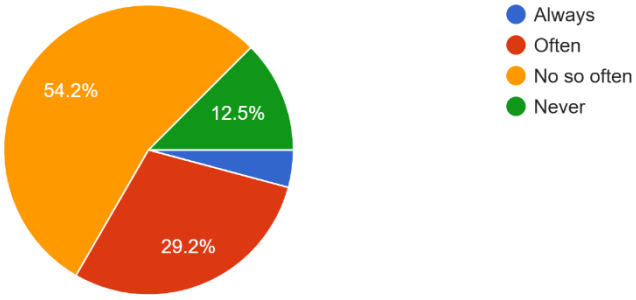
Do you consider the time of delivery a quality issue?

24 respuestas



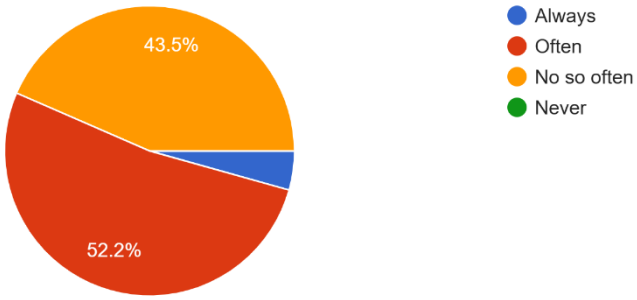
How often deliveries are delayed due to wrong Incoterm?

24 respuestas



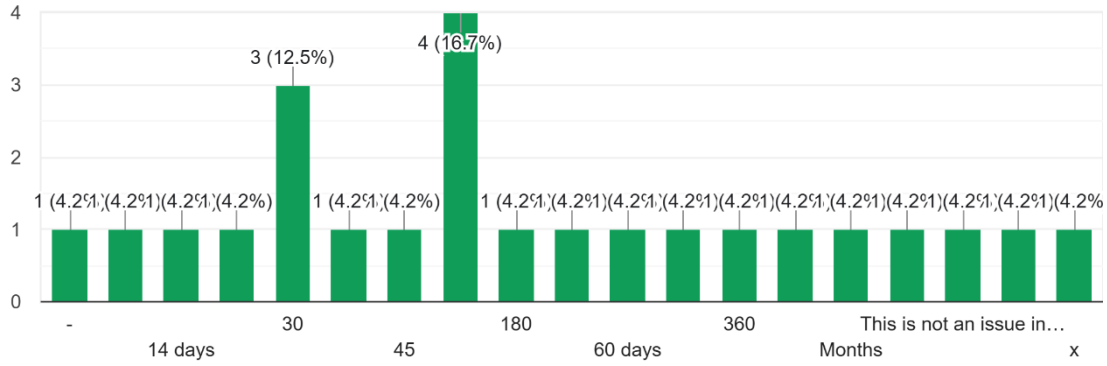
How often goods are ready at factory but you wait long time for the buyer to pick up the goods?

23 respuestas



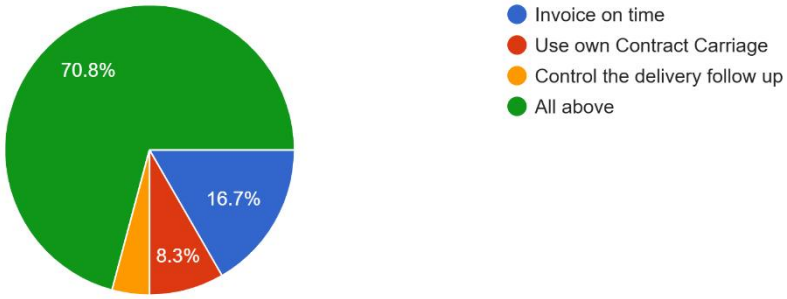
What is the longest time you have been waiting the buyer to pick up the goods at factory? (in days)

24 respuestas



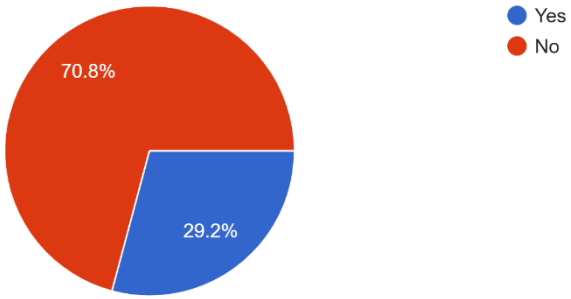
Sales contacts with C-Terms enables the seller to...

24 respuestas



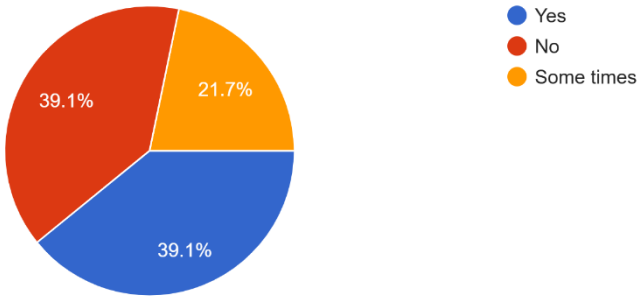
Do you know MTG (M[redacted] Transport Gateway)

24 respuestas



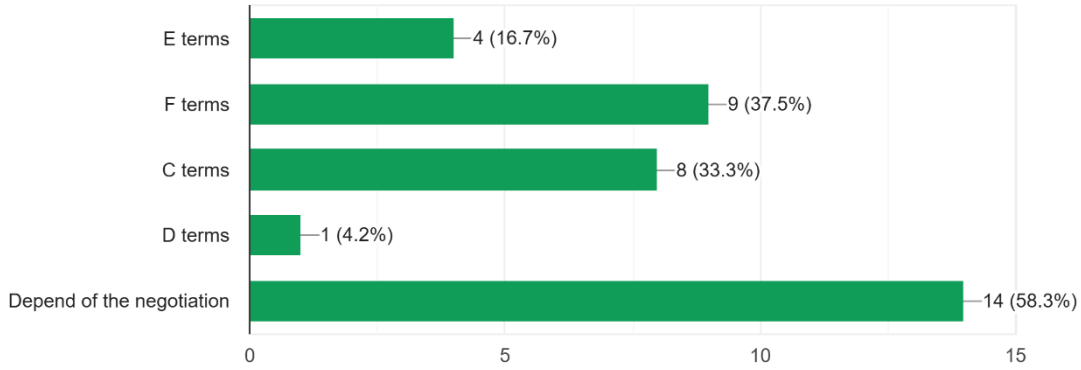
Are there customs clearances red tape (excessive bureaucracy) in your country?

23 respuestas



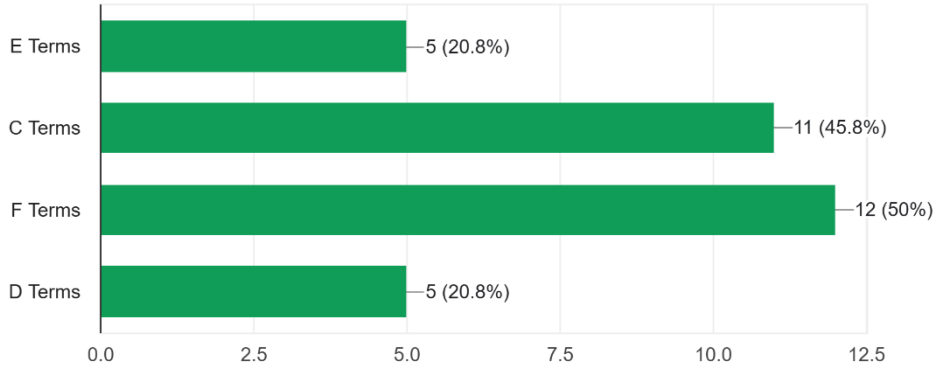
As a manufacturer which group of Incoterms suites better for sales contract negotiation? (multiple choice)

24 respuestas



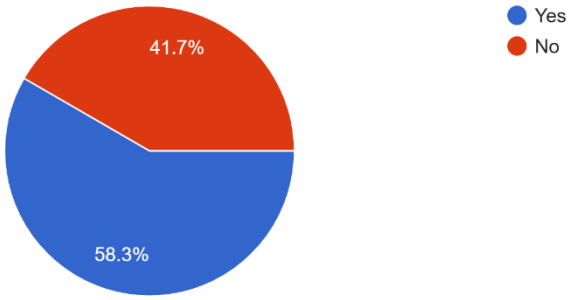
As a local [redacted]o which group of Incoterms suites better to the sales contract? (multiple choice)

24 respuestas



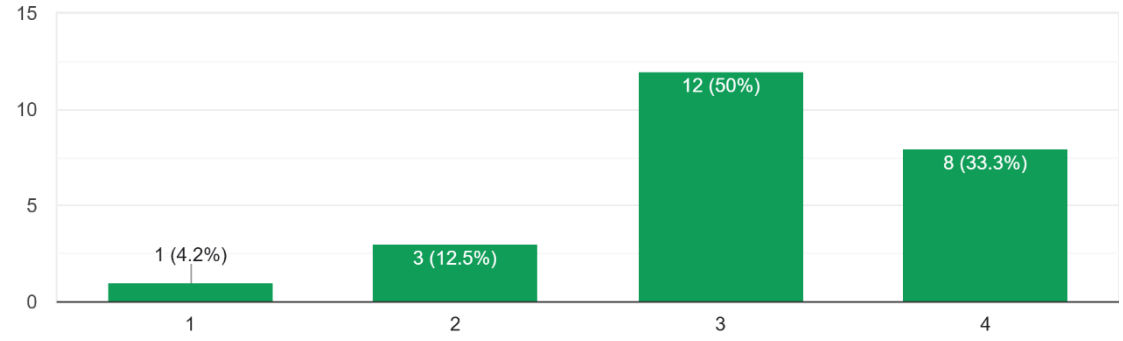
Would you use CPT and CFR for your next sales negotiation and for Import of goods?

24 respuestas



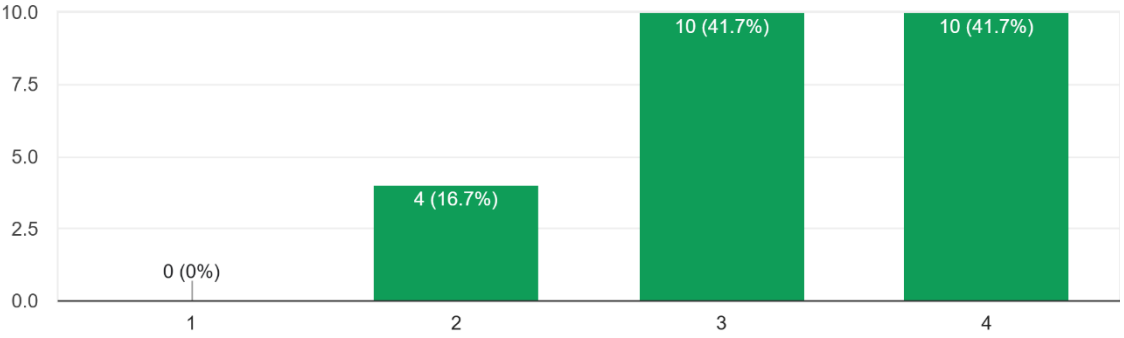
The choice of right Incoterm have a significative impact on Service improvement

24 respuestas



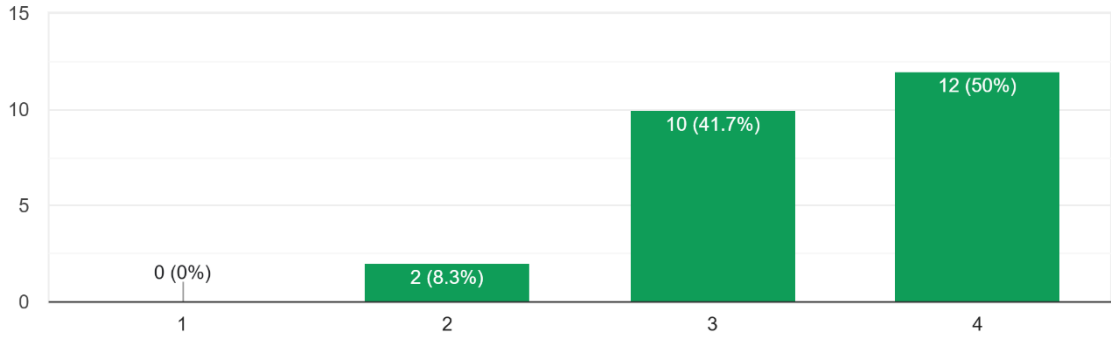
The choice of right Incoterm have a significative impact on Supply Chain Performance

24 respuestas



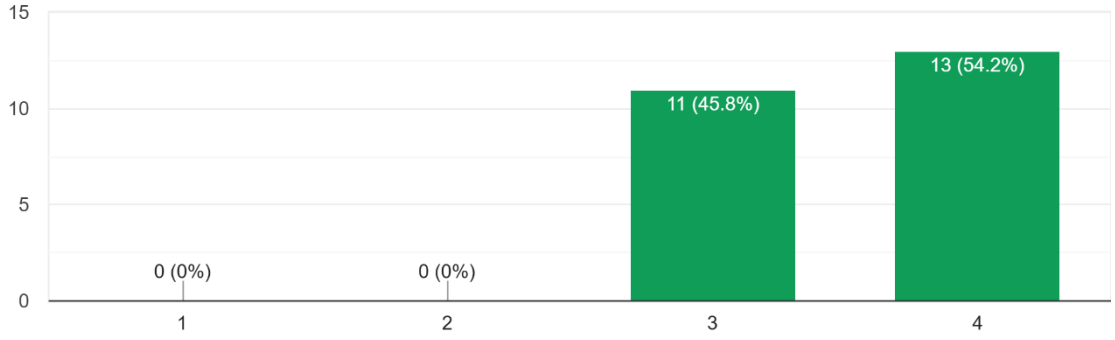
The choice of right Incoterm have a significative impact on Operational Costs

24 respuestas



The choice of right Incoterm have a significative impact on Logistics Operation

24 respuestas



Interviews

Interview with Global Transport Manager and Category Manager of Air and Ocean.

The interview was made at Helsinki Vanta Airport on May 18th, 2015. Transcription in Jue 2015.

TS and CS, thank you both for conducting the interview. Now, let's get into the overall themes.

Question 1: Given the Company´s investment of 161 MEUR (64MEUR at the corporate level) in transportation optimization since 2014, how has this backing impacted its transport and overall efficiency? What KPIs have improved the most, and where do you see the opportunities for additional optimization?

TS: Every investment has been key to changing our mindset. We have shifted from a largely reactive decentralized architecture to a centralized proactive environment. We focus on cost-effective gains in quality and service that have improved our delivery performance, which has reached 87% in certain areas. Improvements can be attributed to improved procurement practices, more efficient logistics contracts, and risk management. We will look at how to use MTG's reporting mechanisms to drive continuous improvement, explicitly developing predictive models to anticipate and avert future disruptions.

Question 2: Regarding Incoterms CPT and CFR Incoterms, what are the critical advantages these Incoterms offer over other Incoterms like FCA or FOB? In particular, low Incoterm awareness has led to delivery delays. How do these decisions shape the Company's contracting negotiations and supplier collaborations?

CS: CPT and CFR enable a more precise distribution of responsibilities, reducing misunderstandings and conflicts. FCA transfers this responsibility earlier in the journey, placing extra balancing expenses and risks on the company if problems occur during

transport. The clarity provided by CPT and CFR and detailed delivery information through our systems, such as MTG, provide higher control and predictability. Contract negotiations incorporate Incoterms with templates and training to drive selection based on risk profile and cost-effectiveness. This resulted in fewer disputes and stronger relationships with suppliers.

Question 3: According to Incoterms, there is a need for improved accuracy in freight price quotations. How does your existing company system address this concern? How will the growing use of MTG enhance the accuracy and transparency of such calculations?

CS: Traditionally, freight cost calculation has been extracted and is prone to errors. MTG now solves this by clustering all shipment data with specifics on Incoterms, allowing for accurate and consistent cost calculations. MTG seamlessly integrates with our existing systems to provide real-time visibility (enhancing transparency from all parties).

Question 4: The materials mention late delivery as necessary. How is on-time delivery performance secured and monitored, including the effectiveness of the MTG implementation to meet KPIs (e.g., 95% On-Time Delivery across Ocean freight)?

TS: Delivering on time is also one of our key performance indicators. With MTG at its foundation and bolstered by robust vendor management, continuous monitoring for every shipment, optimal routing, and proactive communication, we take a comprehensive approach. By harnessing its advanced real-time tracking and reporting features, the system equips you with crucial insights into possible delays earlier in the process, allowing quick intervention and thus improving our overall on-time delivery metrics.

Question 5: Managing transport providers, how has the company set up its relationships from a strategic perspective? Regarding vendor management and balanced scorecards, what are some criteria and processes for selecting, managing/assessing transport

providers? And how does the risk management framework (mentioned in the audit scores) fit into this process?

CS: We have a systematic vendor selection process in place, where we are based on existing criteria such as our Code of Conduct, KPIs, or services. Balanced scorecards and constant performance reviews provide formal oversight and the ability to identify areas of concern quickly. We also conduct audits regularly and set up risk-mitigation improvement plans on many critical areas, from packaging to handling, ensuring we reduce risks while increasing operational efficiencies as a strategic roadmap.

Question 6: The significant cost savings across different modes of transportation (Ocean, Air, Road) are impressive. Can you discuss the key strategies and initiatives contributing to these reductions? How has advanced category management delivered these outcomes?

CS: Savings stem from various sources: broadening the scope of consolidation, better negotiations due to larger shipment volumes, continuous optimization through Rates and Tenure Reviews, and firm counteractions against unjustified rate increases. Centralized category management, maximizing our unified volumes, and standardizing our processes have been key to these results.

Question 7: Given the difficulties with customs compliance, what measures has the company introduced to enhance compliance, and how does MTG support it? How does the company measure and manage the compliance KPIs?

CS: For us, customs compliance is paramount. We have implemented large training projects, standardized documentation, and improved communication procedures. MTG helps us ensure compliance as it becomes a one-stop repository of all the necessary documentation and a means to track shipments in real-time to proactively identify compliance risk, reducing the chances of getting delayed or incurring penalties. We pay close attention to KPIs to ensure compliance and finetune our processes.

Question 8: The materials highlight the importance of the Company Transport Gateway (MTG). How does MTG support internal communication and data sharing (sales, logistics, finances) and external parties (suppliers, carriers) at Metso?

TS: This is a disrupter for us. It is a unified platform, dramatically improving communication and data exchange between internal departments and external influencers. With MTG's real-time visibility, we can make effective decisions faster and manage our transportation operations proactively.

Question 9: What new modes or technologies do the Company anticipate adopting in their transport?

TS: We keep exploring new technologies such as predictive analytics, AI-driven route optimization, and blockchain solutions for better security and transparency. MTG uses a modular design, making it versatile and allowing for easy scaling depending on the needs of each new technology it adopts. This makes adapting emerging technology and managing the data it produces far easier.

Question 10: The RFQ and contract enrollment processes are orderly flows. When faced with the challenges of keeping track of different transport modes and multiple suppliers, how does this standardized approach ensure a consistent process for the company's transport operations around the globe and within various business units? How does the MTG system contribute to maintaining this consistency and allowing for real-time performance monitoring against set KPIs?

TS: Our framework ensures consistent application of best practices around the globe. We define strict policies, use templates (Master Frame Agreements, SOPs), and conduct constant auditing. MTG plays a vital role in ensuring this consistency, providing a single platform for managing and tracking every aspect of transport operations, from RFQs to contract management to KPI performance reporting, which allows us to identify potential

areas of improvement before they become significant and maintain high levels of operational standards across the business units.

Interview. Sales Coordinator Team Leader D2D Business Support 20.05.2015

1. Which country in Latin America uses more direct invoicing, Mode?

I would not pinpoint one country. Due to their market size, Brazil and Mexico likely have a higher volume of direct invoicing.

2. Which customer can efficiently work with LTP (E10 AND F10) or direct invoicing?

- Generally, customers familiar with established processes and readily available information prefer LTP. However, those needing quicker processing and more straightforward documentation often prefer direct invoicing. Customer preference often depends on their internal structures and capacity.

3. What kind of delivery procedure uses direct invoicing customers?

- The exact steps vary based on the specific shipment and destination country requirements, but They are more varied than standard procedures. It involves the delivery permission (which is frequently used), shipping documentation, details from the freight forwarder (when used), and manual invoicing

4. Which of the countries in Latin America is easier to work with?

- Defining “easier” is subjective and depends on multiple factors. However, Chile generally offers a more streamlined process and established logistics infrastructure, making it comparably simpler than some others.

5. What are the most common inconveniences with deliveries in Latin America?

- Besides the previously mentioned issues with documentation, inconsistent address formats (especially in rural areas), customs regulations, and unpredictable customs clearance and freight transport delays represent significant obstacles.

6. What kind of deliveries there are often: spares or valves?

- fluctuates; however, currently, spare parts constitute a larger share of our delivery volume.

7. **Are all countries' direct invoicing customers in Latin America working with FCA delivery terms?**

- No, FCA is the most common *default*, but the choice of Incoterms needs to be tailored to the specific transaction based on factors such as product value, transport mode, and risk assessment. Many shipments employ CPT, CFR, and occasionally DDP for higher-value or more sensitive goods.

8. Is the delivery volume high, medium, or low per year?

It's relatively high, but significant variations exist across countries and product types. Smaller and more frequent spare parts contribute to the higher overall volume.

9. **What would you think about starting to work with delivery terms CPT and CFR with direct invoicing customers in Latin America?**

This is a positive move. The more transparent and defined liability under CPT and CFR promotes more precise communication, facilitates more efficient processes, and reduces the risk of disputes. The shift will require training and clear guidelines, but it will be beneficial in the long run.

10. **What would be your general opinion about direct invoicing Latin America deliveries, and what could be an idea for optimizing the delivery process?**

Direct invoicing remains valuable, but optimization is essential. More transparent communication and improved tools for tracking and documentation would improve the whole process. Implementing a centralized system for tracking and management, such as the suggested freight co-efficient model, would enhance transparency and control, minimizing delays and potential issues.

Interview. Sales Coordinator D2D Business Support 18.02.2015

1. **How long have you been managing the Latin America Area?**

- More than four years

2. Which country in Latin America uses more direct invoicing, Mode?

- All of them in South America, but I would say Chile, Venezuela and Brazil

3**. Which customer is easier to work with LTP (E10 AND F10) or direct invoicing?**

Direct invoicing is likely easier due to the simplified process, but sales offices lack knowledge of pricing and delivery times, implying complications with LTP.

4. What kind of delivery procedure uses direct invoicing customers? (DELIVERY PERMISSION, SHIPPING INVOICE, FORWARDER DETAILS, MANUAL INVOICING)

- Direct invoicing deliveries use all these modalities depending on the freight

5. Which of the countries in Latin America is easier to work (Chile)

6. What are the most common inconveniences with Latin American deliveries? (ZIP CODE AND ARGENTINA PAYMENT CODE)

Yes, ZIP code can be a problem for Argentine, but the most common problem with the deliveries is customs clearances as a general hurdle across South America and the choice of INCOTERMS in the selling contracts.

7. What kind of deliveries there are often: spares or valves?

- Both of them, but, of course, spare parts have more delivery volume

8. Are all countries' direct invoicing customers in Latin America working with FCA delivery terms?

- Not at all. FCA is the default but not the only method used. Lastly, we are suggesting the use of CPT and CFR for sea

9. Have you managed Latin America´s direct invoicing deliveries with delivery terms CPT or CFR? If yes, how was the delivery?

-" Yes. it was good."

10. What would be your opinion about starting to work with delivery terms CPT and CFR with direct invoicing customers in Latin America

-CPT and CFR could be beneficial despite the existing preference for FCA.

11. Is the delivery volume high, medium, or low per year? (in terms of order and accuracy)

- It depends on the time of the year and the country in South America. Chile, Brazil, and Venezuela have quite a reasonable volume of deliveries

12. If there is a low delivery volume, it will be convenient for the company to change delivery terms to CPT and CFR. (cost)

- For long distances freight it will be convenient for the company to negotiate CPT and CFR to keep control of the freight and maintain the KPI achievable

13. When you have a direct invoicing delivery, do you always need" delivery permission from sales?

-Yes, and the goal is to streamline the process. I think removing this step could improve efficiency

14. Do you think that delivery permission from sales dilates the delivery process?

Yes.

15. **What would be your general opinion about direct invoicing Latin America deliveries, and what could be an idea for optimizing the delivery process?**

Direct invoicing is the primary method, highlighting the need for improved tracking, transparency, and more efficient customs handling.

Data