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TECHNIQUE FOR ESTIMATION OF COSTS AND PRICES IN CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS BASED ON INCOTERMS®

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Keywords: Settlement prices, settlement costs, Incoterms®, SMEs, international sale of goods.
Abstract: The settlement of costs and prices in international business is an essential aspect of the competitiveness of internationalized companies. In this way, the "International Commercial Terms" (Incoterms)® as rules for the involved parties to a contract of international sale of goods become strategic, not only to define the conditions of delivery of the goods but also to define the value of an export according to the point of delivery within the international physical distribution chain. This study presents a detailed example of the costs derived from an international sale and purchase process, considering different databases published on the Internet, and provides a technique to simulate the value of each Incoterm 2020 rule. The results indicate the estimated prices for an export case from Colombia to the United States for containerized cargo. It is concluded that this technique facilitates the planning of the international sale and purchase, allowing to know the export values for each Incoterm, besides presenting an innovative model adaptable for other goods.

1 Introduction

In the last decades, the behaviour in the traffic of goods shipped around the world by type of cargo has had sustained growth, including the case of transport of goods by container. In this sense, cargo traffic has tripled from 3,304 million tons in 1974 to 11,076 million tons until the end of 2019. Similarly, in the last year, the world commercial fleet by type of vessel (tankers, bulk carriers, general cargo, container ships, among others) grew by 81 million deadweight tons (DWT) between January 2019 and January 2020 [1].

However, despite the impressive statistics of international trade in recent years, globalization is facing new challenges that intensify the panorama of uncertainty. Therefore, it is necessary to consider trade tensions such as those that occurred with the trade war between the United States and China and the challenges of geopolitics arising from differences in the foreign policy strategies of countries [2]. Likewise, problems such as the global public health difficulties arising from the recent pandemic, among many other aspects that impact the evolution of world trade and the international transport of goods [3-4].

Thus, considering all the previous challenges, digital technologies and information technologies take a significant role in improving productivity within organizations, favoring exchange processes and the signing of contracts with companies in other countries [5-7]. Likewise, the OECD [8] indicates that technologies and the internet can mitigate problems related to the environment, encourage the inclusion of societies and promote social development, especially in developing countries such as Latin America.

Thus, internationalized companies, including SMEs, should seek tools that facilitate the development of their logistics processes to effectively direct their goods to different markets in other countries [9]. For this reason, the objective of this document focuses on a technique for estimating costs and prices based on the "International Commercial Terms" (Incoterms)® version 2020, which is also applicable to international merchandise sales contracts. This technique also facilitates the determination of the export value of exclusively containerized goods according to their delivery point within the international logistics chain. This study addresses an export case of synthetic polymer paints due to the ease of grouping on pallets and the versatility of containers to transport them.

The case of containerized goods is considered because Incoterms® has been focused on adapting to contemporary commercial practices subject to the use of containers [10-11], and because of the current relevance of the container ships since sending goods through "Twenty-Foot Equivalent Units" (TEUs) and "Forty-Foot Equivalent Units" (FEUs) reach the second place of the total cargo of the world commercial fleet [1]. In this way, conclusions of the document constitute fundamental knowledge for further decisions in the management of cost and price settlement operations within international businesses.

2 Literature review

2.1 Incoterms and the logistics chain for settlement of costs and prices in the international sale of goods

International Commercial Terms (Incoterms®) have been since their creation in the mid-19th century in the 1930s, i.e., for almost a century of existence, an important issue and a recurring theme for the facilitation and regulation of the exchange of goods between companies of different nationalities involved in trade operations on a global scale. Thus, Incoterms® have allowed clarifying mainly the international logistic costs, among other essential commitments of the parties, delimiting then the responsibilities of both the seller and the buyer, thus reflecting the current practice in the transport of goods within the international physical distribution [12].

According to Cavaller [13], the International Chamber of Commerce (ICC), founded in France in 1919, has been in charge of Incoterms® since 1936. Then, different versions of the Incoterms® have been published in 1945, 1953, 1967, 1976, 1976, 1980, 1980, 1990, 2000, 2010, and 2020. Although it is necessary to point out, in any case, that the updating in all the versions of these terms, which seek to adapt to the changes that international trade is experiencing, does not mean invalidation of the previous versions since Incoterms® are retroactive. Hence, if the exporter and the seller by mutual agreement decide to use a version before the most recent one, they may do so since the rules do not repeal in time.

Thus, this set of uniform and complementary rules plays an essential role in the contract's configuration for the international sale of goods. Through these voluntarily accepted rules, the exporter and the importer can identify the commitments to fulfill according to their responsibilities related to logistics costs, documents, and physical risk to be assumed [14]. According to Anaya [15], Incoterms® represent an essential tool for commercial exchange planning in internalized enterprises by selling their products and buying raw materials within foreign markets. Therefore, Incoterms® manage to reduce uncertainty by clearly defining each party's role according to the point of delivery within the international logistics chain.

Incoterms® play such an essential role in the drafting of export and import contracts that the 1988 United Nations Convention on Contracts for the International Sale of Goods is still in force today. It provides the following statement in Part III, Sale of goods, section D, Passing of risk: "(...) the parties may regulate the issue in their contract either by an express provision or by the use of a trade term such as, for example, an Incoterm". It undoubtedly implies that these rules or terms of negotiation complement the contracts in anticipation of possible scenarios that could pose significant problems for the parties regarding the transfer of risk and liabilities [16].

For this reason, these rules can avoid interpretation differences that subsequently lead to complex commercial disputes in which the parties may lose money and time, hindering the international trade of goods. In other words, the essential function of Incoterms® is to establish a set of terms that act as a discretionary regulatory framework, which through its rules complements the international sales contract, thus allowing agree on some rights and obligations in different circumstances according to the capabilities of the parties [17].

Similarly, Incoterms® are considered an element of significant importance in settling both the cost and price of the goods to be traded. Therefore, the understanding of these negotiation terms depends on the international logistic chain itself since it represents the transport stages, from origin to destination, delimiting the risk transfer from the seller to the buyer [18]. According to Long [19], the international logistics chain generally groups the internal and external movements of an international sale and purchase of goods (see Table 1). Therefore, the management of this process represents a key factor for effective planning within the operations of internationalized companies, which seek to meet the demand in globalized markets and achieve the best possible results at affordable costs.

Therefore, each Incoterm 2020 version (see Table 2) will always be subordinated from their theoretical definition, which determines the place of transfer for the cargo within the international physical distribution process. It means that each of these rules offers a concrete alternative where the seller must leave the goods and where the buyer must receive them, which will end up defining the exact place to transfer risks, change goods' ownership and add logistics costs to the ex-factory price in the international logistics chain [27].

Table 1 Links and costs of the international logistics chain

N.	Node	Description	Related costs	Consultation web page
1	Exporter (EXP)	It is the company or natural person registered before the chamber of commerce in the country of origin to carry out commercial activities, including export operations from the Colombian customs territory to foreign countries. This is also often referred to within the commercial invoice as the shipper [20].	A. Packing, crating and leaving the goods ready for pickup.	https://bit.ly/3c9ebOq
2	Internal Transport of Origin (ITO)	It is the foreign trade company or operator, contracted by the exporter or importer according to the Incoterm, to move the container with the cargo from the exporter's facilities to the port of origin [21].	B. Loading of the merchandise in ITO. C. ITO loading insurance D. Cost of ITO (Medellin - Cartagena). E. ITO insurance. F. ITO unloading in POD with insurance included.	https://bit.ly/30l6wqJ
3	Customs of Origin (CUO)	It is a public organism located at strategic points in the exporter's country and its function is to supervise the outbound traffic of goods through the request of requirements and documents established by the customs legal system in force [22].	G. Hiring of the customs broker (processing of approvals and other documents).	https://bit.ly/3kUV9iL
4	Port of Origin (POR)	It is the physical space where both foreign trade operators and governmental institutions converge; all this, just before the goods are dispatched in international transport to another country. This place can be not only a seaport but also an airport or a land transport terminal [23].	H. POD costs (warehousing, handling, port taxes, etc.). I. Loading of goods at the INT and loading insurance.	https://bit.ly/3caoxgT
5	International Transport (INT)*	This is the process of moving the merchandise by the shipping line, airline or land carrier that moves the merchandise from the exporter's country to the importer's country. This activity can generate other costs such as insurance, fuel costs, issuance of documents and other associated costs [24].	J. Cost of the INT "Ocean Freight". K. All risk insurance and/or full coverage of the INT.	https://bit.ly/3egW3EU
6	Port of Destiny (POD)	It is the physical space in the destination country where both foreign trade operators and governmental institutions converge. This is the place where the merchandise arrives and where the process of nationalization and importation of the cargo begins, and it can be either a seaport, an airport or a land transport terminal [23].	L. TRI unloading in the POD. M. Insurance of unloading at POD, N. Costs at POD (storage, handling, port fees, etc.).	https://bit.ly/2OcYM7N
7	Customs of Destiny (CUD)	It is a public agency located in the importer's country whose function is to supervise the incoming traffic of goods through the request of requirements and documents established by the customs legal system in force. The customs also collect the tariffs that apply according to the type of merchandise and according to the existing international trade agreements [22, 25-26].	O. Hiring of the customs broker at destination. P. Ad-valorem Tariffs "Preferential tariffs must be considered according to the Free Trade Agreement (FTA) in force".	https://bit.ly/3kQS7Mu https://bit.ly/2PCEwwx
8	Internal Transport of Destiny (ITD)	It is the foreign trade company or operator, contracted by the exporter or importer according to the Incoterm, to move the container with the cargo from the port of destiny to the importer's facilities [21].	Q. Loading of goods in ITD. R. ITD cargo insurance S. ITD cost (Port Miami - final delivery point). T. ITD insurance.	https://bit.ly/3ecl306
9	Importer (IMP)	It is the company or natural person registered with the chamber of commerce in the country of destination of the merchandise to carry out commercial activities, including import operations. This is also usually known within the commercial invoice as the consignee [20].	U. Unloading of the goods at the final delivery point. V. Insurance of unloading of the goods at the final point.	https://bit.ly/3kRMOMG

**In this case, the technique for estimating costs and prices in contracts based on Incoterms® will be used for containerized cargo and will only apply to maritime transportation through shipping lines.*

Source: Authors

Table 2 Definition of Incoterms® for 2020 version

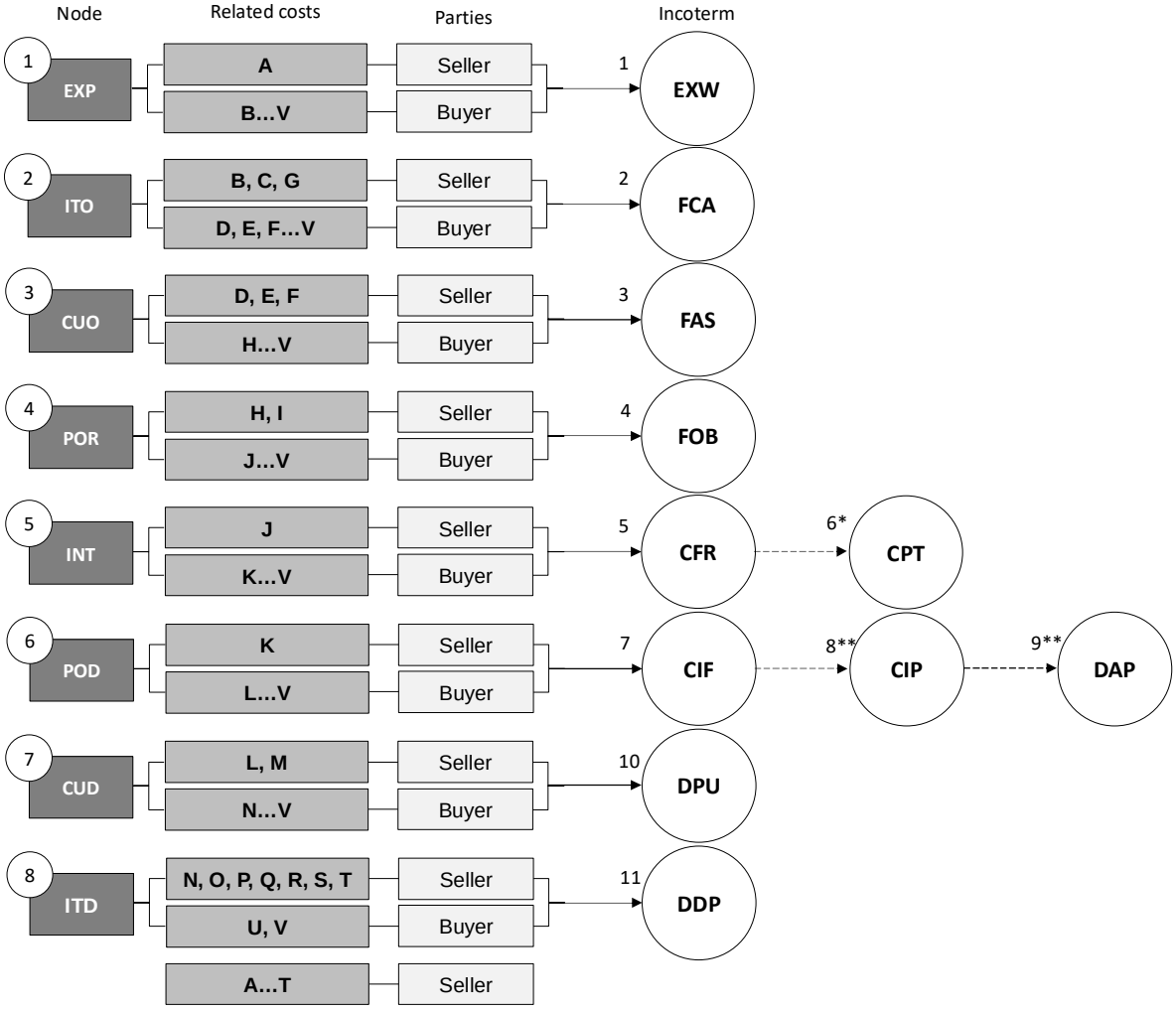
N.	Incoterm	Brief definition
1	***Ex Works* (EXW)**	The EXP will finish with its delivery responsibilities just when the goods have been placed in the warehouses of its own company packed and packed at the IMP disposal. Thus, the buyer will be responsible for loading the goods in the ITO and perform all other logistical operations in order to bring the goods to the facilities of his own company. This Incoterm places most of the responsibilities on the buyer who picks up the goods from the seller's warehouse and takes them to his facilities in the country of destination.
2	***Free Carrier* (FCA)**	The EXP must leave the goods in its warehouse. Similarly, he must carry out the documentary procedures with the CUO, in addition to assuming the costs and risk involved in loading the product in the ITO, which in this case will always be contracted by IMP, which in turn will be responsible for continuing with all the relevant processes until all the links in the international logistics chain have been overcome.
3	***Free Alongside* (FAS)**	The EXP must load the goods at the ITO in addition to hiring him directly. Then, he must move goods from his company to the POR and unload the merchandise at that place next to the vessel. On the other hand, the IMP will receive the cargo at the POR, and the IMP must also load the cargo on the vessel, which acts as the INT, and later carry out the necessary operations to take the goods to his own company in the country of destination.
4	***Free On Board* (FOB)**	The EXP is responsible not only for taking the goods to the POR but also for loading them at the INT, which in this term will be a motor vessel or ship, where its commitments end. Thus, the IMP must assume the responsibility of transporting the goods exclusively by sea, from the POR to the POD, and continue with the other stages of the international logistics chain.
5	***Cost and Freight* (CFR)**	The EXP must carry out the necessary processes to take and load the merchandise in the INT, in addition to assuming the costs generated by the transport operation, which in this term will be exclusively by maritime means. Similarly, the IMP will be responsible for acquiring international insurance to cover the journey from the POR to the POD. Likewise, IMP will have to carry out the rest of the operations until the merchandise arrives at its own company's facilities.
6	***Insurance and Freight* (CIF)**	The EXP will carry out all the necessary procedures to load the merchandise in the INT and pay this freight, which will always be with a shipping line since this rule must be used exclusively by maritime means. Likewise, the EXP must contract insurance for the INT to cover the merchandise in case of unforeseen events; despite the beneficiary of the insurance will be the IMP, who will also complete all the other necessary processes to take the merchandise to its facilities.
7	***Carriage Paid To* (CPT)**	This term has the same characteristics as the CFR Incoterm; therefore, the EXP must carry out all the necessary processes to take the goods to the POR and charge the goods to the INT, in addition to assuming the costs generated by the transport operation. Then, the IMP will be responsible for acquiring international insurance to cover the merchandise from the POR to the POD and subsequently take the goods to its own company's facilities. In any case, it is necessary to emphasize that this term, unlike the CFR used only through seagoing mode, can be used in the INT to move the goods by land, air, or sea.
8	***Carriage and Insurance Paid* (CIP)**	This term has the same characteristics as the CIF Incoterm; therefore, the EXP will carry out all the necessary procedures to load the merchandise at INT and pay this freight with its corresponding insurance covering the merchandise, making the beneficiary IMP. Likewise, the IMP will complete all the other processes to finalize the international logistic chain stages. However, it is necessary to emphasize that this term, unlike the CIF used only through seagoing mode, can be used in the INT to move the goods by land, air, or sea.
9	***Delivered At Place* (DAP)**	The EXP must take the goods to the POD or pointed agreed place in the IMP country; the above, with the INT´s insurance, included where the beneficiary will be the same seller. Thus, the goods must be prepared for unloading at the POD so that the buyer is in charge from this point to take it to its own facilities.
10	***Delivered At Place Unloaded* (DPU)**	This international negotiation term is the only rule inserted in the latest 2020 version. In this Incoterm, the seller is responsible for carrying out all the necessary operations from his company's facilities to unloading the goods at the POD in the buyer's country. There the goods must be unloaded from the arriving means of transport by EXP. Then the IMP will nationalize the goods with the CUD and take them to its warehouses by contracting the ITD.
11	***Delivered Duty Paid* (DDP)**	The EXP will finish with its delivery responsibilities when the merchandise has been taken to the country of destination, likewise, nationalized with the CUD paying the corresponding tariffs and finally contracting the ITD, leaving the merchandise at the disposal of the IMP in its facilities ready to be unloaded. Unlike EXW, this Incoterm places most of the sales contract's responsibilities over the seller, who takes the goods to the buyer's facilities, completing all the international logistic chain's nodes.

Source: Authors based on ICC [28]

In this regard, this article focuses on the Incoterms® 2020, considering that this version is the last one published by the ICC, adopting the present rules to the commercial practices of the current international trade [29]. Thus, the liquidation of the goods' prices for foreign markets will always follow the related costs derived from the different nodes of the international logistics chain. Therefore, these logistics costs determine the cargo's value reflected in the international sales contract and the commercial invoice [30]. Similarly, the inclusion of logistics costs that impact the final price of the export merchandise is the result of considering all those processes that must be performed and contracted with foreign trade operators to complete the international sale and purchase. In this sense, proper planning of international physical distribution and the negotiation of the Incoterms® will favor the competitiveness of the exported product's price [31].

3 Methodology

It is necessary to consider a scheme of the international physical distribution chain to develop a standardized technique to estimate costs and prices for international sales contracts, as described in Table 1. As shown in Figure 1, the scheme of the stages for an international sale and purchase process will facilitate the discrimination of the merchandise value according to the delivery point defined by the Incoterm agreed between the parties.



**Cost settlement and CFR and CPT price are the same.*
*** Cost settlement and CIF, CIP and DAP price are the same.*

Figure 1 Representation of Incoterms® within the international logistic chain according to the standard costs of an export or an import

Figure 1 shows that the number of related costs in the international logistics chain determines each Incoterm. Then, the first term, known as EXW, entails the lowest responsibility in terms of costs for the seller and the highest responsibility for the buyer. However, as the international physical distribution chain progresses, costs, and prices of merchandise increase; therefore, the last of these rules, known as DDP, entails the most significant responsibility for the seller and the lower responsibilities for the buyer. Therefore, the cost incurred by the EXP term from the manufacturing cost and the cost incurred in international trade in each Incoterm must be defined. The cost variables incurred by the EXP to calculate the cost of the merchandise are defined as follows:

Cost variables for EXP

C_{MP}: Merchandise raw material costs
C_{MO}: Merchandise labor costs
C_{CIF}: Manufacturing indirect costs
C_{MU}: Profit margin of the merchandise

Likewise, the cost variables incurred in international trade to calculate the settlement of the merchandise price in the different Incoterms is expressed below:

Cost variables to settle Incoterms®

C_B: Cost of loading the merchandise in ITO
C_C: ITO cargo insurance
C_D: ITO cost
C_E: ITO insurance
C_F: ITO download cost in POD, insurance included
C_G: Contracting costs of the Customs Agent at Origin (approvals and others) “0,5% EXW value"
C_H: Costs in POR (warehousing, handling, port fees, etc.)
C_I: Cost of loading freight at INT and cargo insurance
C_J: INT costs
C_K: All risk insurance and / or total INT coverage

C_L: Cost of unloading the INT in the POD
C_M: Download insurance in POD
C_N: POD costs (warehousing, handling, port fees, etc.)
C_O: Hiring the Customs Agent at Destination (Custom broker)
C_P: Ad-valorem Tariffs
C_Q: Cost of loading the merchandise in ITD
C_R: ITD cargo insurance
C_S: ITD cost (Port Miami - final delivery point)
C_T: ITD insurance

In order to distinguish the settlement values from the merchandise price in the different Incoterms®, the following settlement variables are used:

Price variables to settle de Incoterms®

V_{EXW}: Merchandise value in EXW
V_{FCA}: Merchandise value in FCA
V_{FAS}: Merchandise value in FAS
V_{FOB}: Merchandise value in FOB
V_{CFR}: Merchandise value in CFR
V_{CIF}: Merchandise value in CIF
V_{CPT}: Merchandise value in CPT
V_{CIP}: Merchandise value in CIP
V_{DAP}: Merchandise value in DAP
V_{DPU}: Merchandise value in DPU
V_{DDP}: Merchandise value in DDP

Therefore, the settlement value V_{EXW} is calculated using Equation (1), representing the value of the merchandise to be exported, including the costs of raw materials, labor, indirect manufacturing costs, and profit margin per unit.

$$V_{EXW} = C_{MP} + C_{MO} + C_{CIF} + C_{MU} \quad (1)$$

Once the settlement value V_{EXW} has been calculated, the basis for calculating the settlement value of the other Incoterms® is obtained, which successively will incur different cost variables related to foreign trade. Consequently, the settlement value V_{FCA} is calculated through Equation (2).

$$V_{FCA} = V_{EXW} + C_B + C_C + C_G \quad (2)$$

Equation (3) is used to calculate the V_{FAS} settlement value, which can take the V_{FCA} value as a reference and add the ITO cost, ITO insurance cost and ITO download cost in POD with insurance included.

$$V_{FAS} = V_{FCA} + C_D + C_E + C_F \quad (3)$$

The settlement value V_{FOB} can be based on the value V_{FAS}, to which the costs in POR and the costs of loading the merchandise in the INT and cargo insurance are added, as shown in Equation (4).

$$V_{FOB} = V_{FAS} + C_H + C_I \quad (4)$$

For the settlement values V_{CFR} and V_{CPT}, V_{FOB} is taken as a base to add the INT cost as shown in Equation (5) and Equation (6) respectively. The difference between V_{CFR} and V_{CPT} is that V_{CFR} exclusively considers international maritime transport, while V_{CPT} considers transportation by land, air, or sea.

$$V_{CFR} = V_{FOB} + C_J \quad (5)$$

$$V_{CPT} = V_{FOB} + C_J \quad (6)$$

In the case of the settlement values V_{CIF}, V_{CIP}, and V_{DAP}, the V_{CFR} value can be taken as a base when exclusively international maritime transport is considered, and the V_{CPT} value will be taken as a base when the transport mode is used independently. To these base values the cost of the all-risk insurance and/or total INT coverage is added, in such a way that the settlement value V_{CIF}, V_{CIP}, and V_{DAP} are calculated respectively with Equation (7), Equation (8), and Equation (9). The difference between V_{CIF} and V_{CIP} lies in the fact that the V_{CIF} is versatile while the V_{CIP} refers exclusively to transport by ship, whether maritime and/or fluvial. Similarly, V_{CIF} differs from V_{DAP} in that the insurance beneficiary is the buyer for the first case, and in the second case, the insurance beneficiary is the seller.

$$V_{CIF} = V_{CPT} + C_K \quad (7)$$

$$V_{CIP} = V_{CFR} + C_K \quad (8)$$

$$V_{DAP} = V_{CPT} + C_K \quad (9)$$

According to the aspects negotiated in the stages of international trade related to the settlement costs V_{CIF}, V_{CIP} and V_{DAP}, the settlement cost V_{DPU} can be calculated through Equation (10) by adding the INT download cost on POD and download insurance cost on POD.

$$V_{DPU} = \begin{cases} V_{CIF} + C_L + C_M \text{ if the INT is polyvalent} \\ V_{CIP} + C_L + C_M \text{ if the INT is polyvalent} \\ V_{DAP} + C_L + C_M \text{ if the buyer is the beneficiary of INT's insurance} \end{cases} \quad (10)$$

Equation (11) is used to calculate the settlement value V_{DDP}, which take as a reference the V_{DPU} value and add the

POD costs, costs of hiring the customs broker, ad-valorem tariffs, costs of loading merchandise in ITD, loading insurance ITD, cost of ITD and insurance of ITD.

$$V_{DDP} = V_{DPU} + C_N + C_O + C_P + C_Q + C_R + C_S + C_T \quad (11)$$

On the other hand, identifying the stages in the international physical distribution process is essential for the proposed estimation technique (see Figure 2). The product to be exported in this study is "paints based on synthetic polymers dispersed or dissolved in an aqueous medium with tariff nomenclature 32.09.90". This product was identified as its general presentation, including packaging, packing, and certain physical-technical specifications related to the stowage on half pallets and the subsequent cubing in a forty-foot equivalent unit (FEU). The abovementioned allow planning the international physical distribution of the merchandise considered in this study. Within this technique, it is necessary to define the port of origin (POR) and the port of destiny (POD) according to the export circumstances, which in this case are represented by Cartagena Colombia (POR) and to Miami USA (POD).

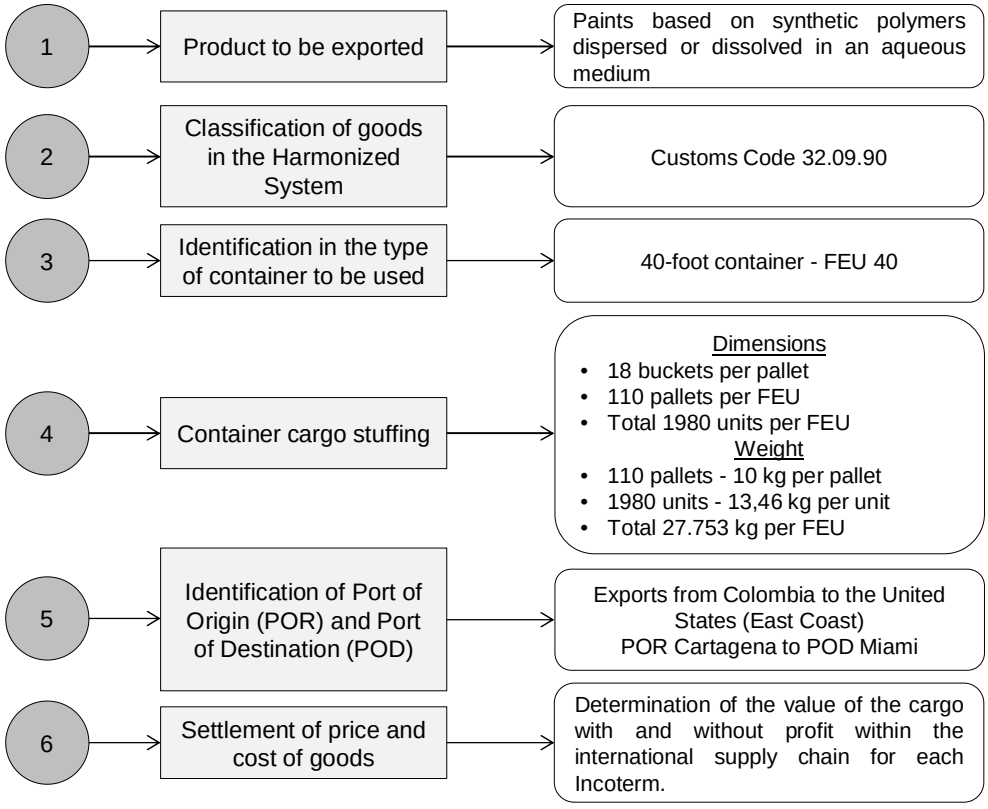


Figure 2 Stages for estimation of costs and prices in contracts for the international sale of goods

4 Result and discussion

The stowage process is performed according to the information of the export product, assigning products to pallets to facilitate their handling and transport in the international physical distribution chain. For this, Figure 3 shows the distribution of products in half Euro-pallets with measures of 0.8m x 0.6m x 0.14m in length, width, and height respectively, assigning six units per pallet level, and allowing to stow three layers of products, for a total of 18 units per pallet.

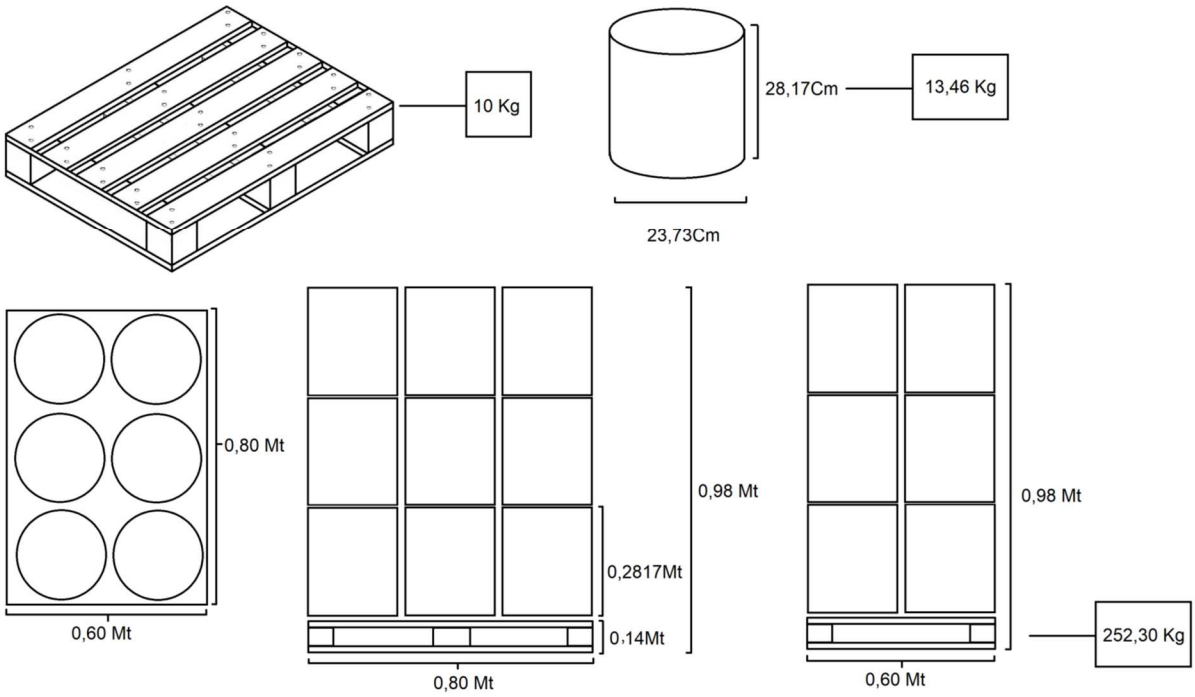


Figure 3 Buckets stowed per pallet

In order to optimize the available space in a 40ft container, which includes internal dimensions of 12.03m x 2.35mx 2.69m in length, width, and height respectively, a total of 55 pallets are assigned per level, and two stowage levels, for a total of 110 pallets, which allow the transport of 1.980 buckets, representing a net weight of 27.75 tons.

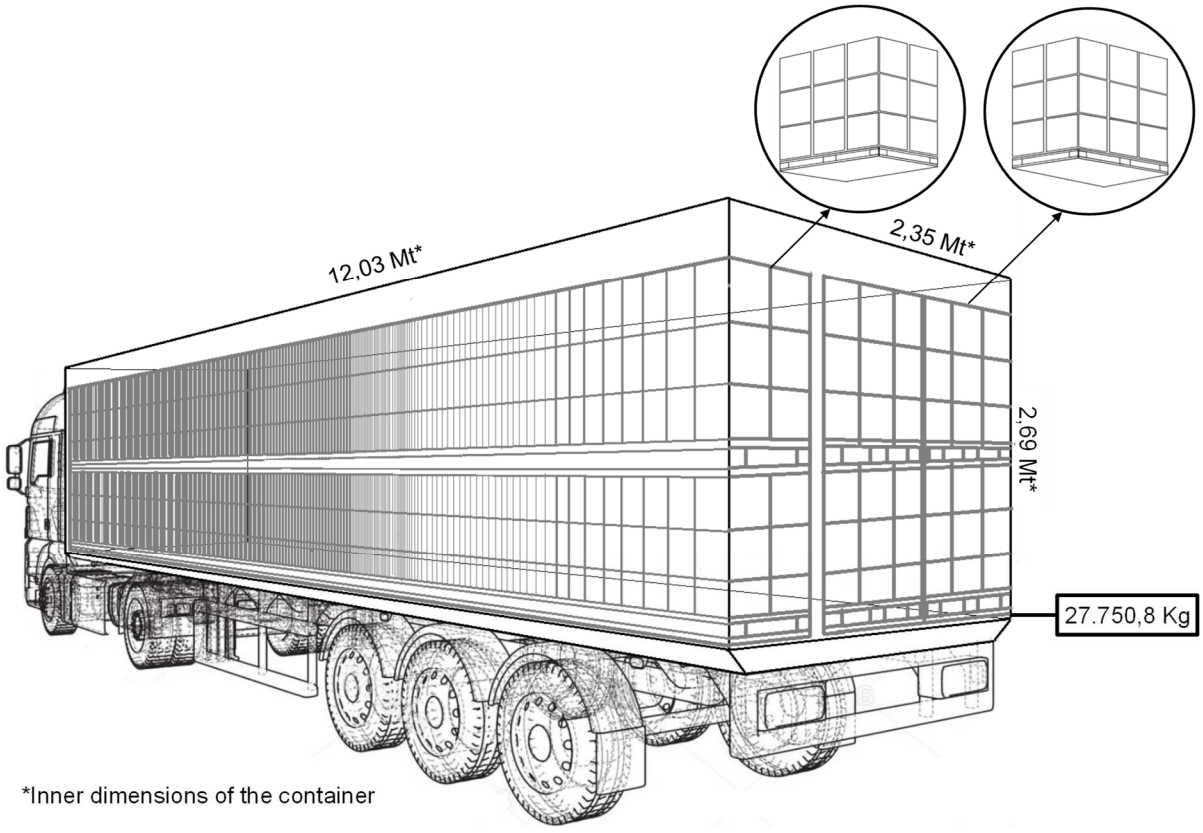


Figure 4 Cubing and stowage for paint buckets in FEU

In this way, the container occupancy is maximized to reduce the unit price in each Incoterm, which results from dividing the total settlement price by the number of export units. Therefore, it is possible to settle the price of each Incoterm considering the values of the cost variables shown in Table 3, which represent the input for Equations (1-11).

Table 3 Cost variables for Incoterms® settlement

Variable	Description	Value
C_{MP}	Merchandise raw material costs	$ 9,72
C_{MO}	Merchandise labor costs	$ 4,17
C_{CIF}	Manufacturing indirect costs	$ 5,56
C_{MU}	Profit margin of the merchandise	$ 5,56
C_B	Cost of loading the merchandise in ITO	$ 55,6
C_C	ITO cargo insurance	$ 13,9
C_D	ITO cost	$ 1.000,1
C_E	ITO insurance	$ 27,8
C_F	ITO download cost in POD, insurance included	$ 55,6
C_G	Contracting costs of the Customs Agent at Origin (approvals and others) “0,5% EXW value"	$ 247,5
C_H	Costs in POR (warehousing, handling, port fees, etc.)	$ 222,2
C_I	Cost of loading freight at INT and cargo insurance	$ 69,4
C_J	INT costs	$ 1.942,0
C_K	All risk insurance and / or total INT coverage	$ 97,2
C_L	Cost of unloading the INT in the POD	$ 83,3
C_M	Download insurance in POD	$ 27,8
C_N	POD costs (warehousing, handling, port fees, etc.)	$ 208,3
C_O	Hiring the Customs Agent at Destination (Custom broker)	$ 222,2
C_P	Ad-valorem Tariffs (if FTA agreements apply, then 0%, else 5,90%)	$ 3.140,6
C_Q	Cost of loading the merchandise in ITD	$ 27,8
C_R	ITD cargo insurance	$ 13,9
C_S	ITD cost (Miami Port - final delivery point)	$ 861,1
C_T	ITD insurance	$ 8,3

Consequently, Table 4 presents both the total price settlement and the unit price settlement for each Incoterm. Likewise, Table 4 shows the variation of the total price and unit price in each Incoterm compared to the base value of the EXW Incoterm, which is calculated using Equation 12. The results show that DDP receives the maximum variation with an increase of 16,82% on the merchandise price concerning the EXW, including there the main costs within the international logistics chain.

$$\%\Delta = \frac{V_{Incoterm} - V_{EXW}}{V_{EXW}} \quad (12)$$

Table 4 Price variables for Incoterms® settlement

Variable	Description	Total Price	Unit price	% Variation*
V_{EXW}	Merchandise value in EXW	$ 49.500	$ 25,00	0,00%
V_{FCA}	Merchandise value in FCA	$ 49.817	$ 25,16	0,64%
V_{FAS}	Merchandise value in FAS	$ 50.900	$ 25,71	2,83%
V_{FOB}	Merchandise value in FOB	$ 51.192	$ 25,85	3,42%
V_{CFR}	Merchandise value in CFR	$ 53.134	$ 26,84	7,34%
V_{CPT}	Merchandise value in CPT	$ 53.134	$ 26,84	7,34%
V_{CIF}	Merchandise value in CIF	$ 53.231	$ 26,88	7,54%
V_{CIP}	Merchandise value in CIP	$ 53.231	$ 26,88	7,54%
V_{DAP}	Merchandise value in DAP	$ 53.231	$ 26,88	7,54%
V_{DPU}	Merchandise value in DPU	$ 53.342	$ 26,94	7,76%
V_{DDP}	Merchandise value in DDP	$ 57.825	$ 29,20	16,82%

**Percentage of variation compared to EXW*

Therefore, the settlement formulations for Incoterms® proposed in this study allow us to calculate the total and unit prices to be assumed according to the responsibility and risk agreed upon, which depend on the buyer's ability to perform logistics activities. For the case study, the main increases in settlement prices correspond when changing from the Incoterm DPU to DDP, implying an increase of 8,4% in the merchandise price, represented in costs in POD, contracting the custom broker, Ad-valorem duties, loading merchandise in ITD, insurance of load in ITD, the expense of ITD, and insurance of ITD. Similarly, significant increases in merchandise settlement values of 3,8% correspond when moving from FOB Incoterm to CFR or CPT by incurring INT costs.

5 Conclusions

The technique developed in this article for the cost and price estimation in contracts for international trade can be used both for goods in containers and oversized goods that exceed the dimensions of standard containers used in international maritime transport. Likewise, the proposed technique can settle the price of goods transported by different means of international transport according to the values of each specific process within the global logistics chain and according to the nature of the Incoterm agreed between the exporter and the importer. Therefore, this study offers an easy-to-use tool to guide decision-making within the international logistics chain, providing information sources from the internet to obtain the cost variables to settle Incoterms. Similarly, this research establishes the settlement values for each Incoterm, considering the level of risks and responsibilities that the involved parties wish to assume.

Future works should apply the proposed formulations for different types of goods, points of origin, and destinations to establish the value variation generated between each Incoterms® according to the responsibilities assumed by each party. It is entirely feasible to reproduce the present technique with previous Incoterms® considering that these rules created by the ICC are retroactive, and if the parties to the contract agree, they can use versions before 2020; such as the 2010 version and the 2000 version, both still widely used in international trade operations.

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