

# **Digital transformation model to reduce release time of goods through the blockchain technology in a customs air: A empirical research in Perú**

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## **Abstract**

The work presents a proposal to incorporate the use of engineering tools such as blockchain, BPM and a communication plan in the customs services company located in Callao-Peru. For this, a reference framework is proposed by several authors that contemplates a theoretical and conceptual framework of the issues to be addressed. Likewise, the processes of the customs regime, the strategic aspects, process map and the execution for the approach of the problem are indicated. The re-export area is chosen in the same state (Regime 20) where the critical processes will be analyzed, and an optimized improvement model will be proposed. For this work, software such as Bizagi, Arena Simulation and excel data (Datamart) are used. An indicator scheme is developed and the value of the KPIs is displayed. At the end, the conclusions are drawn.

## **Keywords**

Blockchain, Release Time, International Trade, Digital Transformation, Temporary Merchandise.

## **1. Introduction**

International Trade is defined as the important part of economic growth of each country, that is why it is sought that the customs agencies seek the way to optimize the processes and adapt them in such a way that it can contribute to international development and exchange. For the Peruvian legislation, the customs entity is qualified as an essential service that is intended to favor foreign trade, to contribute to national development and to ensure customs control and fiscal interest. In this world globalized, the responsibility of customs administrations is based on the control entry and exit of goods, not only for the purpose of collecting taxes, but also to safeguard national sovereignty, the protection of human life, plant and animal health, preservation of the environment and conservation of the artistic, historical, and cultural heritage. From this point on, it should be noted that trade is in a changing state with respect to time, taking as an example that the current use of the various means of transport, raw material and labor meant a limited resource years ago, but has evolved to root of globalization, you can make better use of technology and seek the optimization in the current scenario. That is why the importance of customs must be recognized as they are the oldest intermediary that has regularized the processes of economic integration across its borders. The problems identified, according to the review of the literature, revolve around the need to streamline all the procedures that facilitate this exchange, the security of international trade, the reduction of time and costs, as well as all the processes related to the foreign trade logistics chain. In this context, globally, customs processes have been affected by COVID-19 in the last 2 years, in which air customs have been faced with the need to carry out a series of changes to your processes. Similarly, the emergence of criminal organizations linked to drug trafficking, money laundering, arms trafficking and terrorism jeopardize the control of goods. It is for this reason that customs must play an essential role in guaranteeing a balance between the protection of society and the simplification of international exchanges. These obstacles can be seen in other countries and regions of the world, forcing them to find new and better instruments to facilitate and recover their trade. A case study of success is in China, in which, through remote techniques and

controls, their labor costs were reduced by 70% and their efficiency increased by 30%. Likewise, the Port of Valencia in Spain is considering becoming a smart, paperless port given the new technologies developed in the country. Finally, the Port of Veracruz in Mexico is adopting the automation of its processes involving the actors of the port community, to build trust between them. As mentioned above, it can be affirmed that the customs administration in Peru must apply policies of management of risks for compliance with customs obligations and ensure the continuity of the supply chain while seeking to speed up these processes, as is done by the Korea Customs Service, pioneers in implementing technologies in customs administrations around the world. The motivation of carrying out the research is reflected in the need to study the regimes of the Peruvian air customs in which the state has the role granting benefits and guarantee of good development of the customs processes. For it the case study of the temporary admission of re-exportation in the same state was chosen to solve problems regarding the time required at the time of merchandise release. This new proposed model is based on the use of digital transformation within a national body for the contribution of solutions within the customs control system that has a problematic issue of inefficiency of customs control and operating cost overruns in storage. The solution is aligned in the use of tools such as: blockchain, VSM, BPM and a communication plan.

### **1.1 Objectives**

The main objective of this research is to contribute to the development of new tools that facilitate the process of international trade and the acceptance of goods that have foreign origin. In this way, it is planned to use new methods that guarantee the reduction of waiting time, costs, and security to share information between the entities involved during the process of acceptance of temporary goods in Peru.

Likewise, it is expected that the proposed model will serve as the first of many advances for the continuous improvement of international trade in our country, achieving the exchange facilities that the great powers in this sector have and achieving a contribution to future research.

## **2. Literature Review**

For this chapter, some scientific articles were necessary for the investigation. This will help us better understand the development of the topic.

### **2.1 Blockchain application**

The blockchain is a technology that has a virtual and secure database that manages to provide information on transactions of a corporation, a network of suppliers, a mutual fund, or an international supply chain. It was originally applied in the financial system with the development of Bitcoin; however, in the last decade, this tool has been expanded in different sectors such as energy, health, education and security. Its use has served as a digital catalyst, accelerating a new trend that had been developing and that will not stop with the end of the pandemic, but rather it will configure a new logistics reality. The Blockchain network is profitable and efficient, eliminating the duplication of tasks and reducing the need for intermediaries, making it less vulnerable. In transactions, operations are secure, authenticated, and verifiable. Inside of the foreign trade, the blockchain carries out procedures associated with international operations and in the optimization of processes. Also, its incorporation merchandise traceability, security of payments and financing and information on real time. In this context, in various research shows the application of blockchain in commerce international because it would be a tool that greatly reduces the times obsolete and the streamlining of bureaucratic procedures. In a case study, an analysis regarding the challenges faced by the governments of Latin America and the Caribbean given the demands by citizens to achieve better quality standards in your services. For this new scenario, the information is the greatest asset of organizations, which the development of big data or the machine learning can significantly improve the efficiency of services, incorporating added value and differentiating itself from the competition. That is why, this tool should be used as it provides a way to record transactions or any digital operation in a safe, transparent, highly resistant to interruptions, auditable and efficient.

### **2.2 Application of BPM (Business Process Management)**

A tool for continuous improvement of processes within an organization of services is the management of BPM processes (Business Process Management) that combines software capabilities and business experience for optimization and business innovation. Management helps the organization to document, design, describe, compare, eliminate, and align activities in such a way that it contributes to a better efficiency, productivity, and quality to achieve organizational goals. On the other hand, for the registration of controlled goods within the customs, BPM technological change is studied to implement measures of registration, control and inspection of Controlled Assets that can be used

in the elaboration of illicit drugs and legal mining. Regarding an executive design of the new customs system in Colombia, the author models under the BPM methodology, specific procedures (level of interaction, review, authorization) as required and that will be channeled through the Portal of Authorized Users to the responsible areas of the Customs Management Directorate.

### **2.3 Application of Communication Plan**

This Communication Plan that is being carried out by the Superintendency National Customs Office determines the strategic axes carried out by the Customs Management Communications and Institutional Image in the framework of 2018-2022. In this sense, the management encourages the change of behavior of the taxpayer and user of the foreign trade towards greater compliance with its tax obligations. This tool is educational and understandable for the target audience of the organization since, it is considered that the planning and execution of an effective communication improves the work environment and promotes teamwork. Based on this, the Peruvian customs has been carrying out the process of adapting the regulations related to customs clearance for the implementation and redesign of processes and systems. In this context, the intention of the Customs Administration is to carry out advance clearance as part of a general reform program for the reduction of release time and costs of the trade supply chain that is monitored by the World Bank through annual Doing Business reports that evaluate the investment climate in Peru. The process of an adequate communication of the Customs Intendancies of the Republic, of the operators and the user in general must be complemented with training customs officials as well as external users, thus building a means effective for facilitating customs clearance procedures.

### **2.4 Model to increase the efficiency of customs clearance**

For our case study, with the use of the tools mentioned above, establishes the clear importance of foreign trade to government agencies in response to the rapid growth of investment within our country. Businesses in the modern era continue to adapt to innovation and technological developments. The growing trend of using blockchain technology has been featured in several review articles, as well as proposals to improve competitiveness within of customs services. The early dispatch modality complies with the requirements for our model because it allows the user to save costs by not need your merchandise to enter a temporary warehouse. Since 2019, the customs of Dubai have been implementing an improvement based on the blockchain that has allowed the integration of companies that provide logistics services to facilitate international transactions. In a case study carried out by the customs of Peru, the implementation of blockchain technology in its processes is observed and how it had a positive impact on them, such as the information regarding the merchandise from its origin, the prevention of duplication of data, the review and approval of attention times and, finally, the transactions fast and safe. Finally, the incorporation of technologies not only reduces time administrative costs, but also generate savings in tax management. An example is the application of the pDT (facilitation of sworn statements) that reduced expenses by 20% due to typing of forms and the shortening of personnel in the reception process which resulted in a 50% reduction in costs of printing and distribution of forms. Currently, customs carry out electronic system programs that come minimizing the possibility of errors in the information of the declarations and online payments.

## **3. Methods**

After a review of the literature, it was possible to identify that the most outstanding tools in research in recent years can be seen in the following Table 1.

Table 1. Comparative matrix of the components of the proposal vs state of the art

Author and ref.	Low efficiency of a digital system	Low promotion of other types of dispatch	Unknowledge methods	Variability in additional expenses
Díaz, R. M., Valdés Figueroa, L., & Pérez, G. (2021)	Blockchain			
Ganne, E. (2018)	Blockchain			
García, P., & Rozemberg, R. (2020)	Blockchain			Financial planning
Barbero, J. (2010)		Communication plan	Communication plan	BPM

Duarte, F (2010)			Communication plan	
Piscini, E., Dalton, D., & Kehoe, L. (2020)	Blockchain and cybersecurity			
Guzman.,D & Sañay., I. (2018)				BPM
Vergara Moncada, R. J. (2009)	New technologies			
Proposal	Blockchain	Communication plan	Communication plan	BPM

### 3.1 Proposed model

The **Figure 1** shows a tool implementation plan to improve merchandise release time. This implementation plans to eliminate repetitive process activities, reduce long waiting times, and technologically upgrade the efficiency of each activity and its components. The first is the analysis of the current model, which involves as a visual result the detection of all the delays in the main process, interpretation of the data obtained periodically and the preparation of a VSM diagram to have a detailed view of all the activities, their times. and the number of operators involved per process. Second is the implementation of Blockchain technology, where with the help of potential members and the security that allows the exchange of information in real time, it is possible to adapt old processes to the use of new technological skills and thus their development. applied. On the other hand, it is sought that all these processes be registered with an information base and that in this way feedback can be provided in case of improvements or failures. Finally, in this second stage, the aim is to provide a proposed communication system that provides the necessary information on all the benefits of using another type of office. For the third stage, it is desired to evaluate all these tools used and seek continuous improvement that guarantees the advancement of time reduction as a solution to the main problem of this investigation.

**Model Stages.** This section details the phases of the proposed model.

**Stage 1: Analysis.** The analysis of the main indicators will use the following tools: Creation of a problem tree that specifies each of the activities to be reviewed and their root causes, elaboration of a Value Stream Mapping diagram to control the times in each part of the system and a Pareto Chart to organize the causes in order of importance. These previously mentioned techniques will be necessary for the first analysis and used together for its application.

**Stage 2: Development.** The development of tools that aim to reduce excess time will be evaluated in this second stage. The most important tool is Blockchain technology, which seeks to implement the technology to create a network that allows the sharing of information (documents, digital signatures, and approved authorizations) in real time, in such a way that it has a security system that Prevent the evolution of potential fraud and reduce the periodic document review process. In addition to this, the use of the BPM tool will serve as support to improve the quality of the current service, reduce storage costs generated by long waiting times and ensure the efficient application of all its processes. Finally, the communication plan is used as a tool that reinforces knowledge about other types of dispatch that are not used much, but that, according to certain circumstances, can offer a better alternative for the release process of the temporary merchandise.

**Stage 3: Evaluation.** Finally, the evaluation process resulted in feedback that guaranteed the current state of the model. In this way, it will be possible to interpret the data generated by period and identify the progress that is to be achieved with this implementation. The indicators in this last stage are very important since they allow a much broader vision of the process and the rapid detection of new problems.



Figure 1. Contribution of tools in the proposed improvement

**Proposed Process.** Figure 2 shows the process diagram made with the Visagi program. This process shows the 3 components of the system and the implementation plan that we want to use to achieve the main lead time reduction goal.

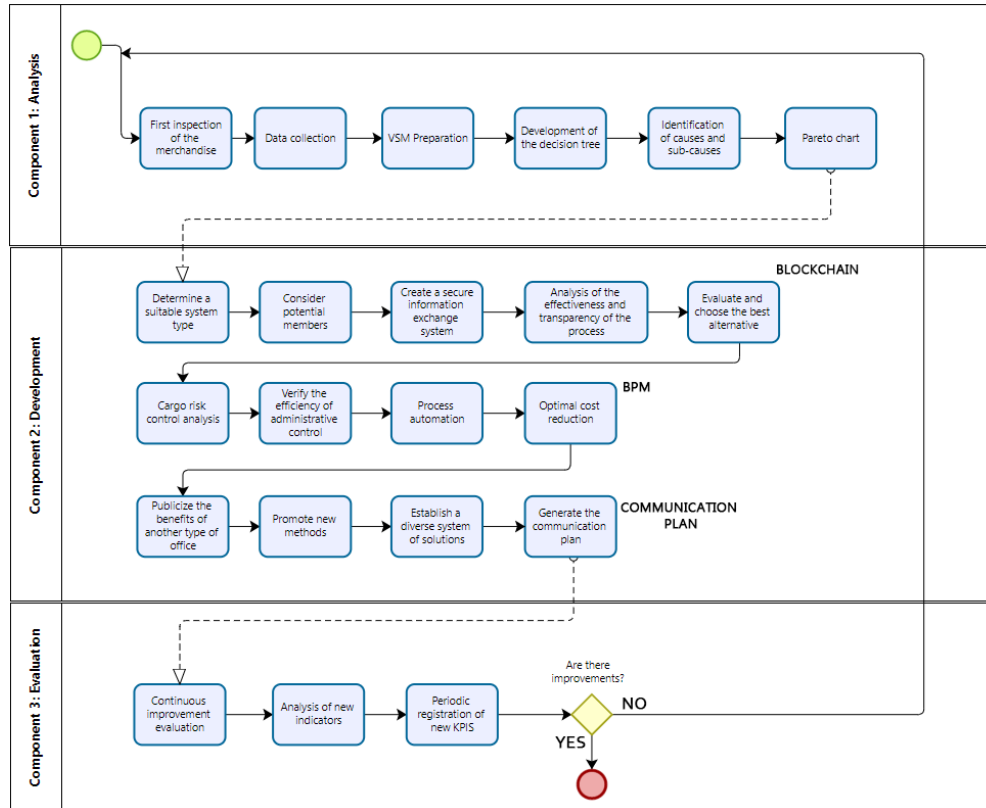


Figure 2. Process diagram - Visagi

**Model Indicator.** The following indicators will facilitate the evaluation and performance of all the improvements that can be found during the change process.

**Temporary dispatch time.** The reverse measurement type will determine the optimal processing time which should be less than 4 days.

**Model Indicator.** The following indicators will facilitate the evaluation and performance of all the improvements that can be found during the change process.

**Temporary dispatch time (1):** The reverse measurement type will determine the optimal processing time which should be less than 4 days.

$$(A - B) \leq 96 \text{ Hours} \dots (1)$$

A: Release authorization date (in hours)

B: Arrival of the means of transport with the cargo (in hours)

**Efficiency of the office (2):** The efficiency of the process will be evaluated based on the data provided. In this we can select the number of declarations within the optimal time and compare how many are made with respect to the total during a certain period. It is intended to obtain an efficiency of more than 90% since the proposed goal was to reverse the current scenario.

$$\text{Inefficient dispatches} = \left( \frac{\text{Optimal DAM's}}{\text{Total DAM's}} \right) \times 100\% \dots (2)$$

**Storage Cost (Actual/Expected) (3):** The cost of storage will be subject to the variation of the fee per warehouse, the average weight in kg and the number of days in use.

$$\text{Warehouse cost}_x = \text{Average weights} * \text{Days} * \text{Cost}_y \dots (3)$$

X: Actual or expected cost

Y: Costs that handles each warehouse independently of the other based on the days and weight in kg

**Reduction of storage costs (4):** Following the above formula, it is intended that the actual cost resembles the expected ideal cost.

$$\Delta = \left( \frac{\text{expected cost}}{\text{real cost}} \right) \times 100\% \dots (4)$$

## 4. Data Collection

The portal was used for data collection and with the help of the systems area, the number of necessary indicators of file number, time between processes, warehouse, gross weight, year, month, type of dispatch and others was obtained. Figure 3 shows in a simplified way the range of data collection. From this information it was possible to identify where the main problem was found and its possible solutions for improvement

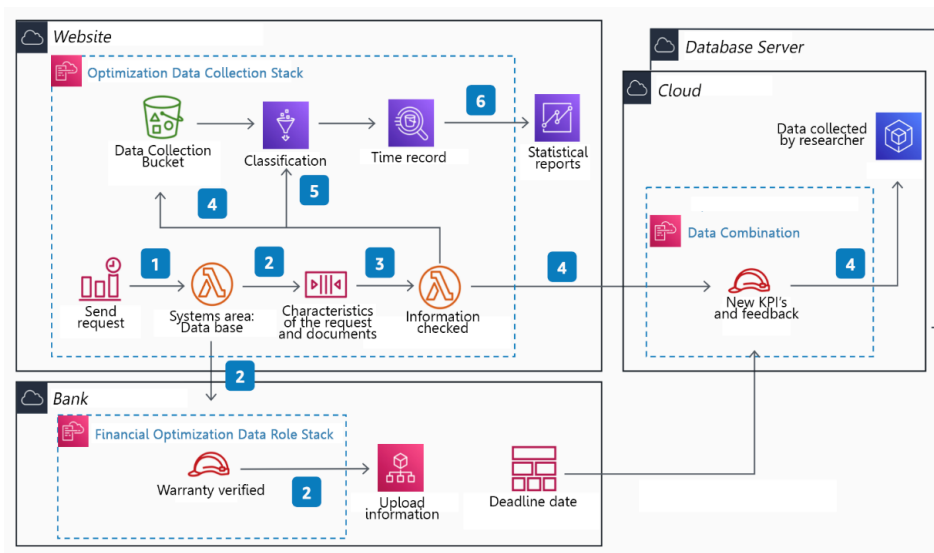


Figure 3. Data collection diagram

## 5. Results and Discussion

### 5.1 Numerical Results

To obtain the numerical results for the year 2021 and analyze its indicators, it was necessary to download the data. According to this, it was possible to obtain that the monthly records exceed the optimal average established in 96 hours. With this, the average waiting time for the process appeared 444.6 hours, which meant an excess of almost 5 times more than it should be. From this first analysis, it was possible to identify which warehouses are preferred by users. Then, a calculation of storage costs is made thanks to the fact that the data provides us with the necessary information such as gross weight, transportation, etc. Thus achieving, obtain a total storage cost of 1,047,240.60 PEN that was calculated thanks to the number of days elapsed, the weight in kilograms, the exchange rate, the rate of each warehouse and other external factors. On the other hand, it is observed that the optimal time gap does not exceed the desired 90% during the year of study and it is speculated that this is due to the changes established by the new regulations due to COVID-19. It is also understood that a stage of technological change has been experienced thanks to the pandemic, which causes a slow change in learning the new tools and, for this reason, a delay in the adaptation of times. The time between processes takes approximately 4.53 days, which means a high index since there are 6 processes and the delay is generated thanks to a bottleneck. It is sought that the time between processes can be reduced

to hours and thus facilitate their dispatch. In addition to this, it is mentioned that by law in Peru the type of recognition for this modality must be 100% face-to-face. As far as I know, with the help of technology, the aim is to reduce this modality by up to 15% and contribute to the reduction of the process in a first scenario. It is considered that this reduction will be greater in the future due to new implementations.

After the implementation of our tools, the total time could be reduced to 68.88 hours, which allows us to be within the desired optimal range. Likewise, the use of new applied technologies reduced the type of recognition to 83%. And with it, the costs presented a decrease of 277,737.62 PEN in storage for users. One of the main reasons for this improvement was the elimination of all types of physical paper documentation, since its rotation takes more time and indirectly contributes to the environment.

## 5.2 Graphical Results

Figure 4 shows the average time in hours of the total process during the chosen year, while a comparison is made with the scenario of having implemented the proposed tools for said year. Likewise, it can be identified that the hours obtained are within the limit established by previous studies. While on the other hand, an increase during the month of June 2021 is highlighted.

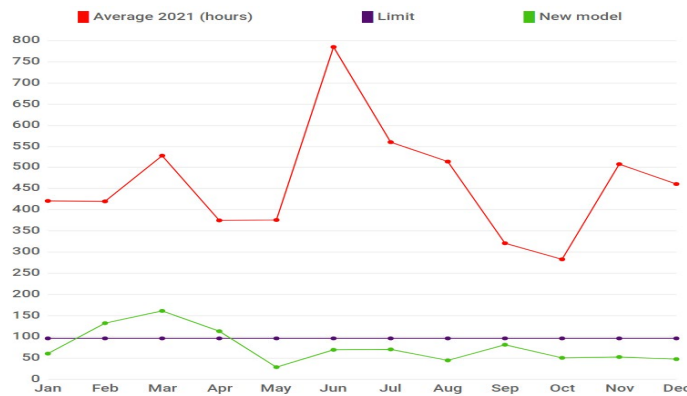


Figure 4. Average time in hours (Model in 2021 vs new model)

Continuing with the analysis of the investigation, it was necessary to recognize the most used type of warehouse and, according to this, the total cost generated for the year will be calculated in Figure 5. It should be noted that the impact of keeping the merchandise for a longer time in the warehouse only generates losses to the user but not to the customs institution. However, this does not mean that the fact that by not generating losses we must be oblivious to the situation should be ignored, on the contrary, the customs agency is committed to benefiting foreign trade and all those involved that may favor international competition.

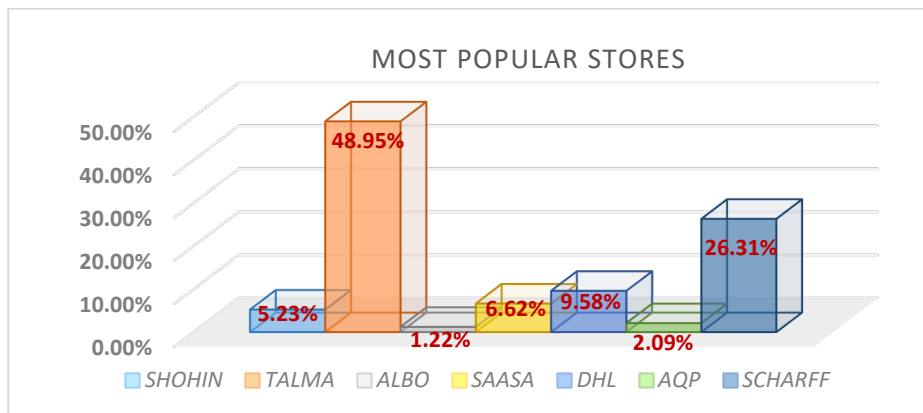


Figure 5. Percentage of use

If Blockchain technology and the other tools had been applied during said period, the storage cost could be reduced by 277,737.62 PEN in favor of international trade taxpayers. This would mean the commitment of air customs for the implementation of new methods and the annual increase of new importers. (Figure 6)

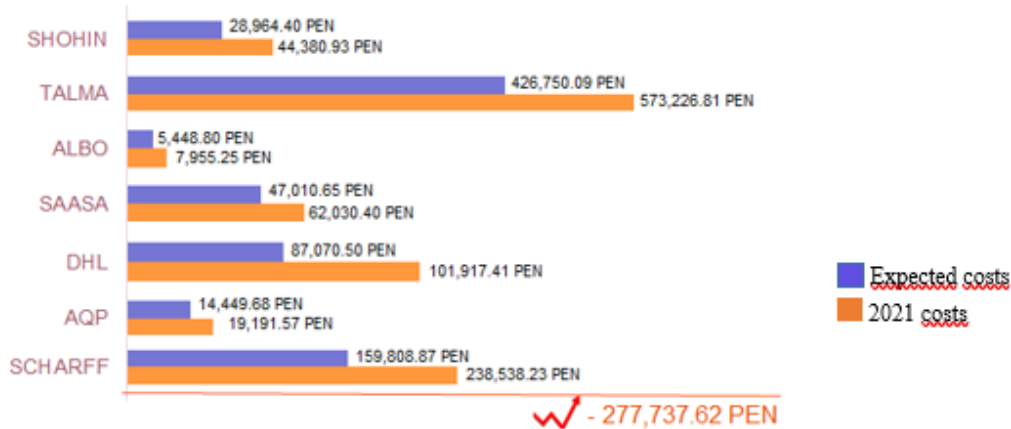


Figure 6. Costs 2021 vs Expected costs

### 5.3 Proposed Improvements

The results shown in the tables and figures are part of the improvement in the current scenario. It is observed that the proposals require an investment of money in new tools that are capable of safely managing the information collected periodically and the time necessary for agents to adapt to change. Figure 7 shows a block diagram of the new process to follow.

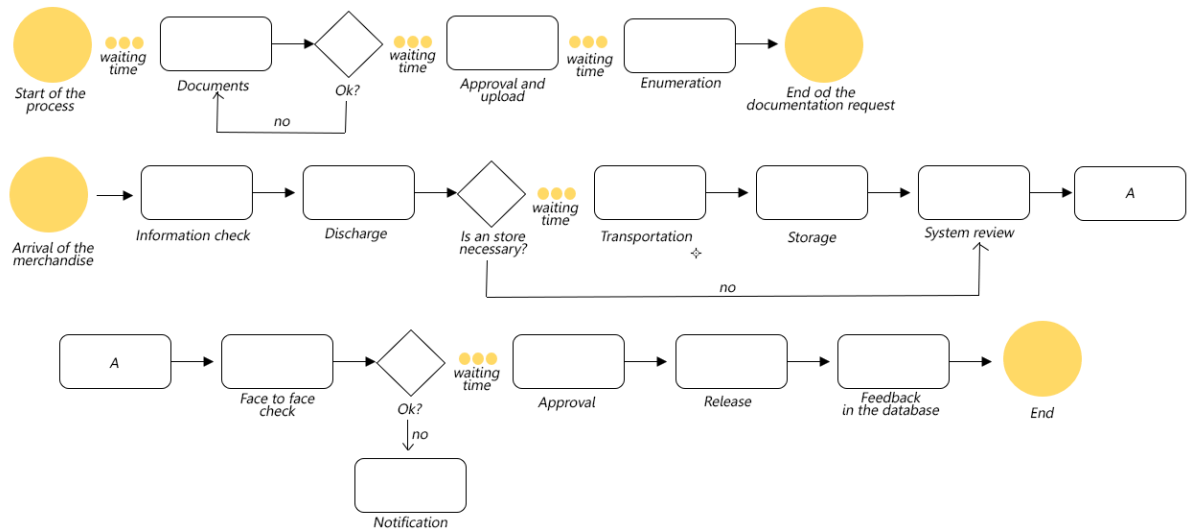


Figure 7. New service model

This new model will be possible thanks to the implementation of Blockchain, which will be characterized by containing the documentation with all its requirements in real time through a shared platform between the customs agency, the airport, the warehouses, the banking entities, and others. In addition to this, the use of the BPM tool will reduce the cost of storage thanks to new administrative proposals. This will be seen thanks to the fact that the extra



cost of the warehouses generates a constant loss in importers and gives insecurity to all those who wish to be one. Regarding the communication plan, a VSM diagram was made that could identify the waiting times between processes.

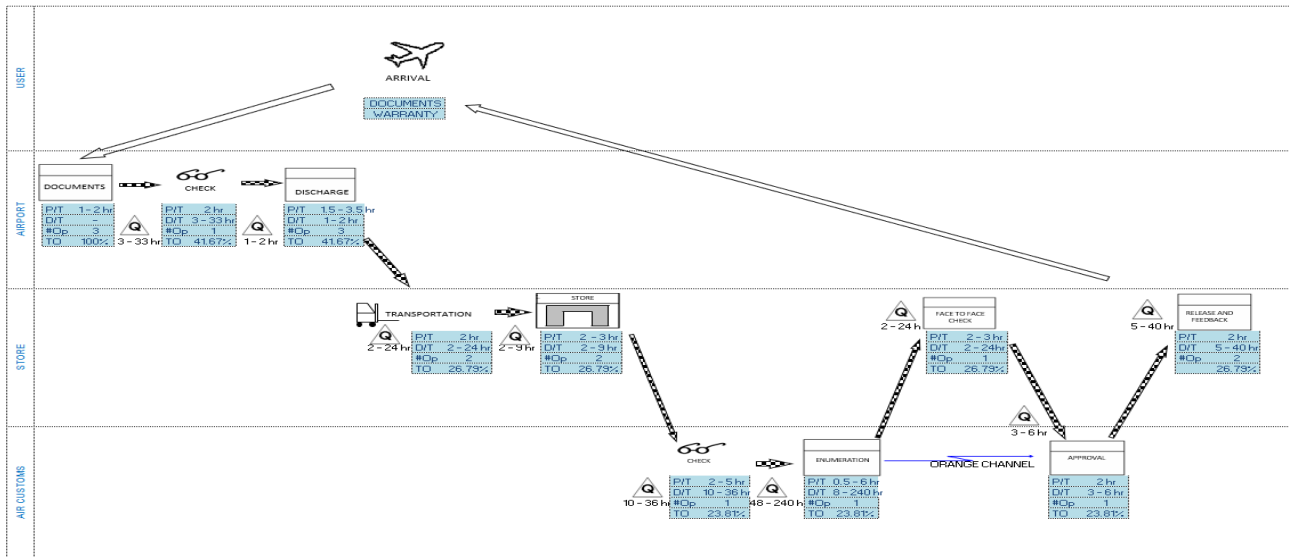


Figure 8. VSM diagram

In Figure 8, it was possible to identify that the bottleneck is found in the repetitive review process, since each entity must ensure that the documents meet their own requirements, and this causes the guide to be listed much later. However, after carrying out our proposal method, it was noted that the main headquarters of the air customs do not have the necessary infrastructure to make the desired change. Although it is true that there is talk of an implementation valued in PEN miles, this should be seen as an investment and not as an expense, since it favors the economy of Peru and the facilities for international exchange.

### 5.4 Validation

The first simulation will be carried out due to the data obtained by the customs agency during 2021. In this case, the current scenario shows an excess of time above the 96 hours, referring to this as the main problem of the investigation and the indicator to be reduced. In this real scenario, it was possible to identify the time required for each activity, the time between processes, the number of operators involved and the percentage of operation of each entity.

**Initial diagnostic.** The study carried out for the first diagnosis of the simulation shows that the average time of the process during 2021 is 268.21 hours. These long waiting times meant a storage cost of approximately 1,047,240.60 PEN in total during said year. It was also possible to observe that during the release process there are repetitive activities since each entity seeks to ensure the legitimacy of the documentation. Today it is known that the processes that generate long waiting times are the activities called “declaration numbering” and “physical recognition”. After presenting an ideal scenario for the system, the storage cost could be reduced by 277,737.62 PEN. It should be mentioned that these costs are assumed by the users who carry out these operations and not by the institution, so the necessary decisions are sought to reduce these costs and improve the competitiveness of international trade. Among the main causes are: (a) Users initiate procedures after the arrival of the merchandise in the country that represents 79.76%, (b) Limited resources and lack of administrative planning that represents 18.59%, (c) Exceptional cases with 1.65%.

**Validation design.** According to the causes identified in **Table 1**, 3 tools are proposed that seek to reduce waiting times, technological improvement of activities and elimination of repetitive processes. First, it is planned to implement the Blockchain tool, which aims to create a network system to manage documented information, permits and digitized signatures through a shared information system. This tool wants to eliminate duplicate activities and speed up processes that involve prior permissions. The security of this technology has a barrier that prevents the disclosure of

reserved information and notifies all changes made to the documents. As a second tool, Business Process Management (BPM) will be implemented, which will serve to improve the service while proper administrative management is carried out to reduce storage costs. This tool will serve as a support information system, which will work with the other 2 proposals and will improve the competitiveness of this process. The communication plan will serve as a tool that provides the necessary information for the knowledge of new methods. The complete simulation will be done in Simulator Arena version 16, which will represent the current scenario and the desired scenario. The simulation period during 2021 was carried out monthly, so all the results of this first evaluation will be based on 30 business days.

**Simulation of the proposal.** The expected scenario wants to reduce the waiting time between processes and provide the best possible quality of service. For this, it will be necessary to apply the proposed tools within the current scenario and estimate if the results are optimal in the inputs and outputs. By having both cases with respective indicators, a comparison will be made to determine their progress shown in **Table 2.**, where the following is shown: (1) the number of acceptances per period, (2) the amount of merchandise exposed to physical examination, (3) the time between waits, (4) the total average time for the releasing.

Table 2. Current Situation vs Improved Situation

Nº	Indicators	Tools	As is	To be	Δ
1	Number of applications approved per period	Blockchain technology and Communication plan	46 (requests)	119 (requests)	+258.7%
2	% Physical examination	Communication plan	99%	83%	-16%
3	Time between waits (average days)	BPM	4.53	2.79	1.74
4	Total average time in the system (hours)	Blockchain technology	268.21	68.88	131.33

As can be seen, the application of the Blockchain technology reduces the total average time from 268.21 hours to 68.88 hours. Likewise, the good administrative management generated by the BPM tool reduces the time between activities from 4.53 hours to 2.79 hours and improves the efficiency of each process to increase its effectiveness. Finally, the communication plan maintains that if there is a progressive reduction from 99% to 83%, priority should be given to generating additional information to accept many more successful inquiries per month.

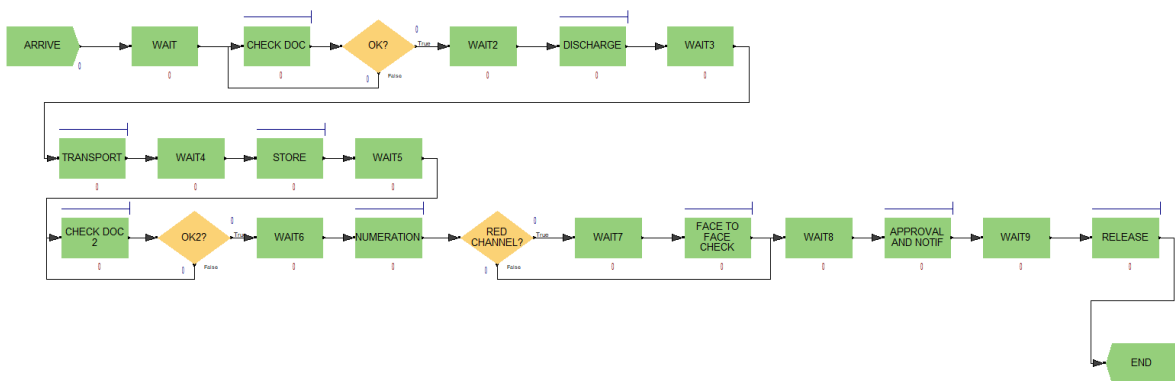


Figure 9. The proposed model simulated in the initial state

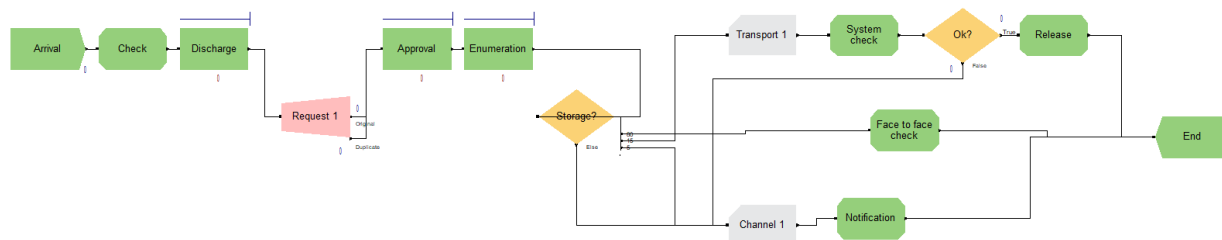


Figure 10. The proposed model simulated in the final state

## 6. Conclusions

As conclusions, we can observe that blockchain technology has been considered one of the most important technological tools of the Fourth Industrial Revolution. There are several public and private studies that agree on the multiple advantages of the tool due to its transparency, traceability, and security. It is for this reason that the blockchain, the BPM and the communication plan have been showing significant results in international trade for those who take on the challenge of implementing it in their processes. Finally, thanks to the Arena software, the proposed project managed to reduce the release time of goods by 131%.

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## Biographies

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**Alyssa Christina Saenz-Ore** graduated from the University of Lima, where she studied industrial engineering from 2017 to 2022. Management of data base (Modules), Excel, and command of the English language.

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