ORIGINAL RESEARCH

# DESIGN OF AN INVENTORY CONTROL SYSTEM OF LABORATORIO TAKIWASI FOR THE EXPORT OF TRADITIONAL AMAZONIAN MEDICINE TO BELGIUM

# PROJETO DE UM SISTEMA DE CONTROLE DE INVENTÁRIO DE LABORATÓRIO TAKIWASI PARA A EXPORTAÇÃO DA MEDICINA TRADICIONAL AMAZÔNICA PARA A BÉLGICA


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## ABSTRACT

**Objective:** To design the necessary modules that allow the proposal of an inventory control system that contributes to maintaining optimum levels of stock to facilitate the increase of the projected volume of export sales of Laboratorio Takiwasi. **Methods:** Descriptive-exploratory and designed as not experimental; Surveys, questionnaires and interviews were used as data collection instruments. These allowed the accurate understanding of the logistical problems of the Laboratorio Takiwasi and were decisive in formulating the proposal of the design of the inventory control system that best suits the needs of the organization. **Results:** This design includes an initial interface, eight (08) modules and five (05) types of alerts, the ones that are related to the levels of security stock, maximum point and re-order point. **Conclusions:** The research concludes that both, the modules and the proposed alerts, function as useful tools for the maintenance of optimum levels of stock, which facilitates the continuity of production and the attention of the unmet demand (local and export one).



**Keywords:** Design, system, control, stock, export, traditional medicine, Belgium.



## RESUMO

Objetivo: Projetar os módulos necessários que permitam propor um sistema de controle de estoque que contribua para manter os níveis ótimos de estoque para facilitar o aumento do volume projetado de vendas de exportação do Laboratório Takiwasi. Métodos: delineamento descritivo-exploratório e não experimental; Pesquisas, questionários e entrevistas foram utilizados como instrumentos de coleta de dados. Estes permitiram uma compreensão precisa dos problemas logísticos do Laboratório Takiwasi e foram decisivos na formulação da proposta de design para o sistema de controle de inventário que melhor atende às necessidades da organização. Resultados: Este projeto inclui uma interface inicial, oito (08)

módulos e cinco (05) tipos de alertas, que estão relacionados aos níveis de estoque de segurança, ponto máximo e ponto de reabastecimento. Conclusões: A pesquisa conclui que tanto os módulos quanto os alertas propostos funcionam como ferramentas úteis para a manutenção de níveis ótimos de estoque, o que facilita a continuidade da produção e a atenção da demanda não atendida (local e exportação).
Palavras-chave: Design, sistema, controle, inventários, exportação, medicina tradicional, Bélgica.

## INTRODUCTION

Aguilar (2000), proposes a comprehensive systematization of inventory control based on communication and information management among the main departments linked to the logistic processes of the object of study. For the development of this proposal, the researcher made use of tools such as surveys, databases and flow diagrams. The investigation concludes indicating that the implementation of the aforementioned system would avoid unnecessary purchases of inventories (spare parts), as well as their obsolescence.

Goicochea (2009), proposes to perform an analysis and determine replenishment policies for inventories, which includes a control system, to reduce the number of claims for incomplete orders. This research concludes by indicating that thanks to the implementation of the inventory control system it was possible to reach service levels of up to 98% to 100%; confirming, in this way, its general hypothesis.

Rodríguez and Torres (2014), comment that the implementation of the inventory control system allowed an increase in the volume of sales of the company under study. This was achieved through the identification and analysis of 14 deficiencies within the set of processes involved in the internal control of inventories.

Gómez and Guzmán (2016), point out that the development and implementation of an inventory system will allow efficient management of materials and supplies used as raw material in the production process. For the collection of information and data, two main tools were used: the survey and the interview; These were carried out both to those in charge of the logistics area and to the collaborators in charge of the operations of this area. Finally, the main results of the investigation showed that, the implementation of the inventories system in reference not only simplifies the development of logistics tasks, but also guarantees a decrease in the faults that occur in the storage of the object of study. In this way, and with the support of management indicators, an efficient and successful management of existing resources is achieved.

The Takiwasi Laboratory, since 2011, is dedicated to the development and commercialization of natural products for health and personal care, based on traditional Amazonian knowledge. This organization has as its pillars the principles of BioTrade and Fair Trade.

However, this project of global economic projection has several difficulties, mainly logistics. In a first instance, the Takiwasi Laboratory has a high number of orders (local and export) not attended due to lack of stock. Additionally, it does not have a system that allows standardizing the costing of the stocks used in the elaboration of the products.

Also, due to the inefficient planning of purchases, the processes of elaboration of the final products are constantly delayed. This same aspect directly influences replenishment costs; which, in most cases, are increased.

The research hypothesis is: the design of an adequate inventory control system, facilitates the increase of the projection of the export sales of the Takiwasi Laboratory through the maintenance of

optimum levels of stock.

The objective is to design the necessary modules that allow proposing an inventory control system that contributes to maintain optimum stock levels to facilitate the increase of the projected volume of export sales of the Takiwasi Laboratory.

Finally, it is important to consider the definition of some of the most relevant terms of this investigation. Regarding this, it is possible to consider the following:

From what was exposed by Domínguez (2012), the RAE (2010) and Arias (n.d.) it is possible to infer that a system is a set of interdependent elements, which make up a whole. In addition to this, it is important to mention that each of these elements fulfills a specific function, which generates an impact on the rest of the elements and the system itself; since they form a whole.

Also, as indicated by Chávez and Torres-Rabello (2012) and Ballou (2004) it is understood that the supply chain involves all the processes that are carried out since the raw materials and/or inputs required are transferred from the supplier's warehouses until the moment in which the finished product is delivered to the customer or final consumer. These processes include, naturally, distribution (transport), internal transfers (if applicable), production or manufacture of products and processes related to outbound logistics. However, the supply chain involves aspects that go beyond the logistics itself; it also integrates sales, marketing, R & D, pricing, accounting and finance. In other words, the concept of supply chain harbors all the processes directly or indirectly related to the logistics of an organization.

Finally, the control can be defined as "the measurement of current and past results in relation to the expected ones, either totally or partially, in order to correct, improve and formulate new plans." (Reyes, 2007, p.440).

Author Contributions

An inventory control system has been designed with the necessary and sufficient modules to facilitate tasks related to the planning of purchases of raw materials, materials and supplies necessary for the manufacture of finished products. Additionally, five (05) types of alerts have been created, which will allow maintaining optimal stock levels. In this way, inventory control can be optimized.

## MATERIALS AND METHODS

The type of research is descriptive; since, as indicated, the logistical problematic reality of the Takiwasi Laboratory was described and the data collected through the instruments to be used, were analyzed in order to propose the most viable solution. Additionally, variables were detected and found indicators related to the design of the inventory control system; therefore, the research is also exploratory in nature.

The non-experimental design was used, since as mentioned above, the reality of the Takiwasi Laboratory was analyzed and the logistical problems of this organization were observed.

Likewise, the operation of inventory control was studied and each of its characteristics was interpreted. To this, the results of the survey and the information gathered in the interviews were included. The totality of this information, plus the analysis of various models of inventory control systems, served to elaborate the design of the inventory control system proposed in this investigation.

It is important to mention that through the survey, the modules to be developed were determined in addition to the most relevant characteristics and functionalities of each of them.

Through in-depth interviews with computer

specialists and systems programmers, it was determined which are the main requirements (hardware and software) for the design of the inventory control system in reference.

Finally, the analysis of the various models of inventory control systems served to establish the order and distribution of the modules, as well as the relevant characteristics that the initial interface and the modules considered should have.

The population of the research was composed of 50 people and for the purposes of the survey, a representative sample of 45 people was taken. This group was composed of specialists in systems, personnel of the Takiwasi Laboratory and logistic staff of the company Vivadis Peru, which works as an intermediary exporter of the products of the Takiwasi Laboratory to Belgium.

The main data collection techniques were: in-depth interviews, for which questionnaires were prepared; and the survey. To process the data collected through the aforementioned instruments, the Easy Survey web portal and the Microsoft Excel statistical software were used. These allowed generating tables and graphs that facilitated the analysis of the proposed variables.

With respect to the interview, this was done by telephone with the Director of the Takiwasi Laboratory, prior coordination via email. For this, a questionnaire was prepared with key questions related to the types of product that are manufactured and the raw materials and inputs they use; In addition, we consulted about the practices that the Takiwasi Laboratory carries out in relation to BioTrade and Fair Trade. It is important to mention that the interview was focused on identifying and analyzing the logistical problems of the organization.

Interviews with computer specialists were conducted in a personal and telephone manner according to the availability of the interviewees. With them, topics related to the design of the structure of the inventory control system to be proposed were discussed. Likewise, consultations were held regarding the characteristics of the software and hardware necessary for the development of the system in reference.

In order to carry out the survey, which was directed to the people involved in the logistical and production processes of the Takiwasi Laboratory, an email was sent to the Director of the Takiwasi Laboratory in order to request the facilities of the case. This survey was sent digitally to the mail of each respondent, and a maximum response time of one (01) week was considered.

In the case of the exporting intermediary company (Vivadis Peru S.A.C.), the same procedure described in the previous paragraph was applied. For this purpose, the General Manager of the company in question was contacted.

Finally, the information was processed using the Excel program for Windows, with a computer that allowed obtaining statistical tables and graphs to be analyzed.

## RESULTS

Surveys

The main questions asked and their results were:

*Question 01: What do you consider to be the main logistical problem of the Takiwasi Laboratory?*

Table 1
*Question 01 - Results*

| Alternatives | Frequency | Percentage |
|---|---|---|
| Unavailability of stock | 33 | 73% |
| Incoordination with suppliers | 8 | 18% |
| Limited capacity of warehouses | 0 | 0% |
| Logistic costs | 4 | 9% |
| Other (Please specify) | 0 | 0% |
| **TOTAL** | **45** | **100%** |

*Source:* Own elaboration

This question allows to identify and corroborate the main logistical problem of the Takiwasi Laboratory. Both aspects are closely related, since the lack of coordination with suppliers, generate direct impact on stock availability of stocks. In the same way, the lack of stock availability of the necessary resources for the elaboration of the products, delays the manufacture of the same.

*Question 03: Do you think that the design and implementation of an inventory control system would help to increase the efficiency of inventory controls in the Takiwasi Laboratory?*

Table 2
*Question 03 - Results*

| Alternatives | Frequency | Percentage |
|---|---|---|
| Strongly agree | 30 | 68% |
| Partly agree | 14 | 32% |
| In disagreement | 0 | 0% |
| **TOTAL** | **44** | **100%** |

*Source:* Own elaboration

This question allows us to know the perception of the respondents regarding the utility and the impact that the design and implementation of an inventory control system would generate. Again, about 70% of respondents strongly agree that this system would facilitate the increase in the efficiency of inventory controls. From this information it is possible to infer that the proposed system would be a useful tool to deal with the main logistical problems of the Takiwasi Laboratory.

*Question 05: Rate the level of importance of the following functionalities and characteristics that the design of the inventory control system for the Takiwasi Laboratory should consider.*

Table 3
*Question 05 - Results*

| Alternatives | Frequency | | | | | Percentage | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Very important | Important | Less important | Expendable | TOTAL | Very important | Important | Less important | Expendable | TOTAL |
| Access to real time information | 26 | 19 | 0 | 0 | **45** | 58% | 42% | 0% | 0% | **100%** |
| Alerts for use of security stock | 24 | 19 | 1 | 1 | **45** | 53% | 42% | 2% | 2% | **100%** |
| Coding of stocks | 7 | 27 | 11 | 0 | **45** | 16% | 60% | 24% | 0% | **100%** |
| Coding of suppliers / customers | 1 | 11 | 20 | 13 | **45** | 2% | 24% | 44% | 29% | **100%** |
| Documents issuing | 3 | 20 | 19 | 3 | **45** | 7% | 44% | 42% | 7% | **100%** |

*Source:* Own elaboration

The results of this question reflect that the people surveyed consider it highly relevant that the system can reflect information in real time about the stocks. Likewise, alerts for the use of security stock are also considered of special importance. Finally, the coding of stocks and the generation of documents are functionalities that are also appreciated by the respondents, however, they do not reach the level of relevance of the two aspects indicated in previous lines.

*Question 06: Do you think that the design and implementation of an inventory control system would influence the increase in sales volume (local and export) of the Takiwasi Laboratory?*

Table 4
*Question 06 - Results*

| Alternatives | Frequency | Percentage |
|---|---|---|
| Strongly agree | 34 | 76% |
| Partly agree | 11 | 24% |
| In disagreement | 0 | 0% |
| **TOTAL** | **45** | **100%** |

*Source:* Own elaboration

About ¾ of the respondents agree that, effectively, the inventory control system would have a positive influence on sales volume. It is important to mention that none of the interviewees considered that the system would have a negative effect on the sales of the Takiwasi Laboratory.

*Question 07: In your opinion, what impact would the inventory control system have on the logistics and production costs of the Takiwasi Laboratory?*

Table 5
*Question 07 - Results*

| Alternatives | Frequency | Percentage |
|---|---|---|
| It would favor its increase | 0 | 0% |
| It would not have a significant impact | 11 | 24% |
| It would favor its reduction | 29 | 64% |
| DK / NC | 5 | 11% |
| **TOTAL** | **45** | **100%** |

*Source:* Own elaboration

About 65% of the respondents agree that an inventory control system would facilitate the reduction of logistical costs of the Takiwasi Laboratory.

Software

For the programming of the inventory control system that is proposed, it is necessary to consider the following:

*Programming language*: The suggested programming language is PHP (It is a very popular open source language especially suited for web development). The latest version of this language is 7.0 and it is recommended to use at least version 5.6, since there are certain commands that could

not be executed in previous versions. On the other hand, the JavaScript programming language ECMAScript 2016 would also be used, which allows interaction with the user, and makes the interface more user-friendly and interactive; This programming language is necessary for generating alerts and validating forms.

Database engine: The use of MySQL 5.4 is recommended. In this database engine all the information of the system in reference will be stored.

Web server: The use of Apache 2.2 is recommended. The program is installed on this web server; it is necessary so that the system can be executed locally (localhost). This web server allows the interpretation of the PHP programming language.

Hypertext Markup Language (HTML): The current version is HTML5 (es un lenguaje de marcado que se utiliza para el desarrollo de páginas de Internet). It is the language in which web pages are designed. The web page that would contain the PHP code is designed in this language. To access, you only need a free web browser.

Style sheet: The system would use CSS3 (It is a graphic design language to define and create the presentation of a structured document written in a markup language). This style sheet gives the system its appearance in terms of colors, fonts, font size, and other visual aspects. It does not intervene directly in any process.

It is important to take into account that both the programming language, the database engine and the web server suggested are free software (open source), that is, it is not necessary to pay an annual license for its use. This will allow the design, programming and potential implementation of the system in reference to be less expensive for the Takiwasi Laboratory.

It is also important to indicate that the Takiwasi Center has a hosting, which can be used to install the system. This domain can be used as an update and backup platform or support to generate backup copies of data and system information. Regarding this, it is possible to program a process that automatically updates the database of the system daily.

On the other hand, the use of the JavaScript programming language and the CSS3 style sheet will allow the system to have a friendly and user-friendly interface.

These softwares will make it possible for the system to be much more intuitive for the user. Additionally, thanks to these softwares, the generation of alerts, which will be described later, will be possible.

Hardware

To host the proposed inventory control system, a server is necessary. In the interview with Sup. Martín Huamán, head of systems of the Takiwasi Center, it was commented that "a server is a computer with special characteristics that make it much more powerful than a basic or user PC" (FM Huamán, personal communication, May 19th, 2018). The Takiwasi Center already has an HP Proliant ML310e Gen 8 v2 server, which already has the special operating system installed for Windows Server 2012 servers. This server has enough capacity to be able to install the inventory control system of the Takiwasi Laboratory and all the information that is processed in it.

Design

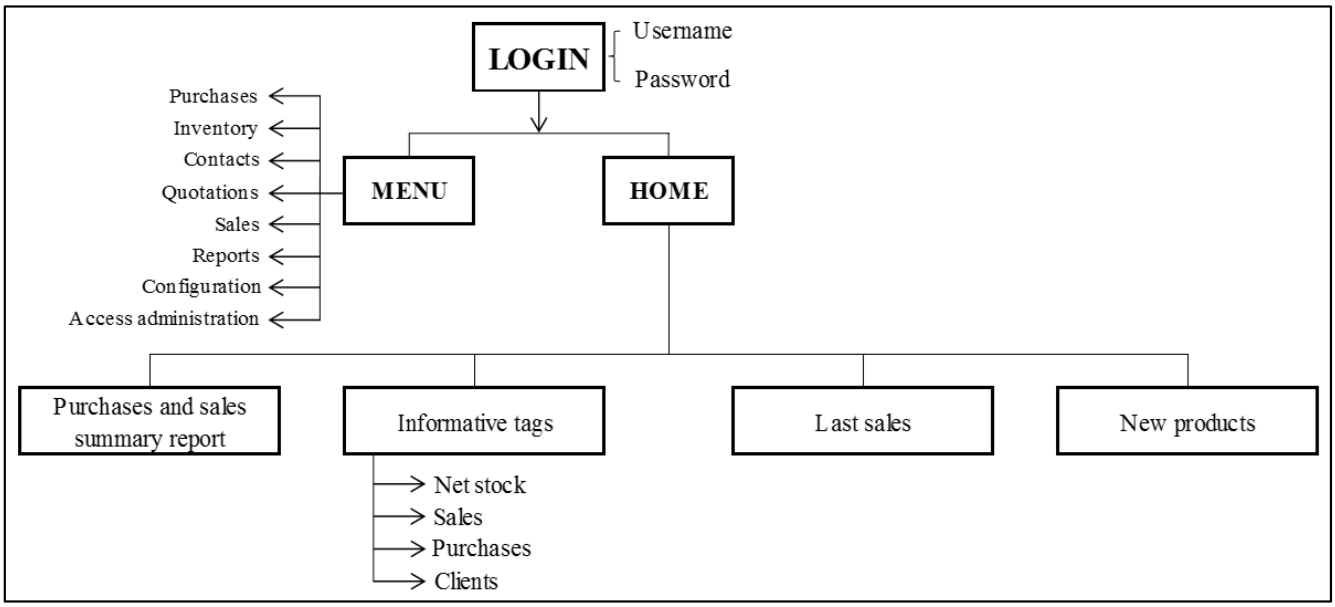


*Figure1*. Outline of the inventory control system of the Takiwasi Laboratory
Source: Own elaboration

In Figure 1, it is possible to notice that for LogIn to the system it will be necessary to have a username and password. It must be taken into account that for the LogIn and use of the system in reference, only a PC with basic characteristics is necessary.

The initial interface will contain summary information of the most used modules of the system, that is, those related to purchases and sales. This initial section will contain the following information: summary report of purchases and sales (classified by month); informative labels of the monetary value of the net inventory, the monetary value of sales and purchases, and the total number of clients served; last sales (in the form of a table); new products (which in turn will work as direct access to the inventory module - section: products).

The purchases module will facilitate the reduction of generation times of purchase orders, through the established forms that issue documents automatically. Likewise, it will facilitate the follow-up of the POs through three (03) states: in review, pending receipt and received.

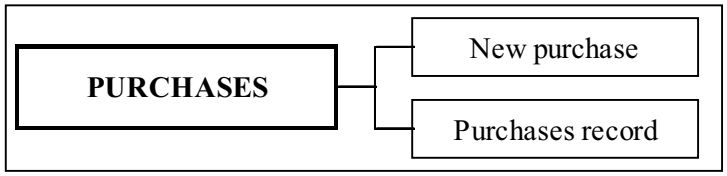


*Figure 2*. Purchases module
Source: Own elaboration

The *inventory module* will allow access to real-time information on the status of inventories. Likewise, it will allow to improve the planning of the production, by means of the generation of production orders; By applying this criterion, it would be possible to give manufacturing priority to the products with the highest turnover that meet production orders created in the system.

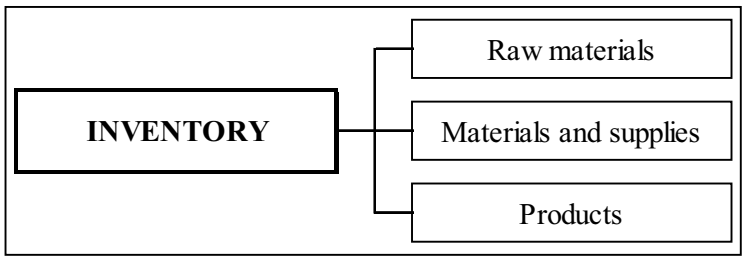


*Figure 3*. Inventory module
Source: Own elaboration

The contacts module through coding will allow customer segmentation, which will facilitate the analysis of demand behavior (local and export). Likewise, the segmentation of suppliers will also be feasible and later analysis of costs, service times and diversity of products offered will be carried out.

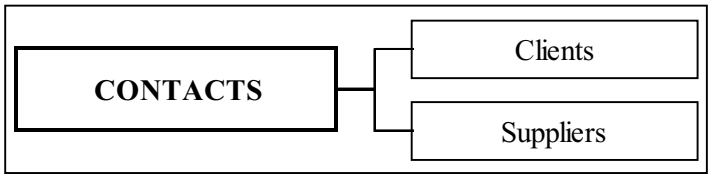


*Figure 4*. Contacts module
Source: Own elaboration

The quotations module will facilitate the reduction of customer service time, since the system allows the generation of these documents automatically, as well as allowing the sending of technical files of the products offered. Additionally, it will be possible to provide a detailed follow-up of the quotes through four (04) states: Pending (quote generated), Sent (quote sent to the client), Accepted (quotation converted to sale), Rejected (quotation not converted to sale).

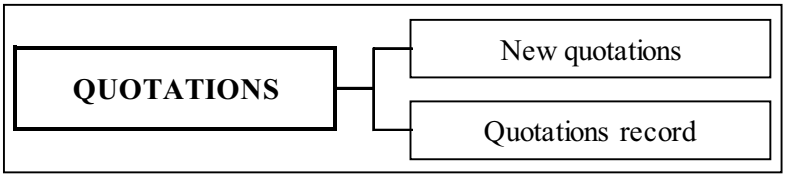


*Figure 5.* Quotations module
Source: Own elaboration

The sales module will also facilitate the reduction of response time to requirements by customers. Also, it will improve the planning of purchases and production, since the system will automatically detect stock movements, which in turn generate one of the five (05) types of alerts.

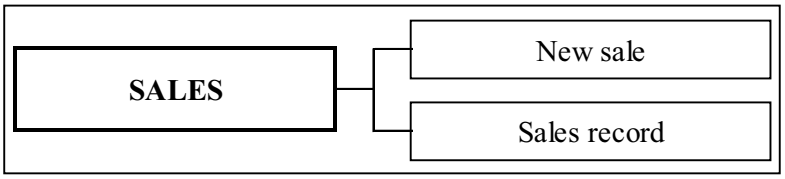


*Figure 6.* Sales module
Source: Own elaboration

The reports module allows analysis and comparisons of relevant information in a timely manner; In addition, the fact that the reports are exportable as Microsoft Excel files allows the information of the different modules to be crossed to generate more complex and detailed reports. Likewise, it is possible to analyze the frequency of the generation of the alerts, to determine if the stock parameters (safety stock point, re-order point and maximum stock level) are correctly calculated.

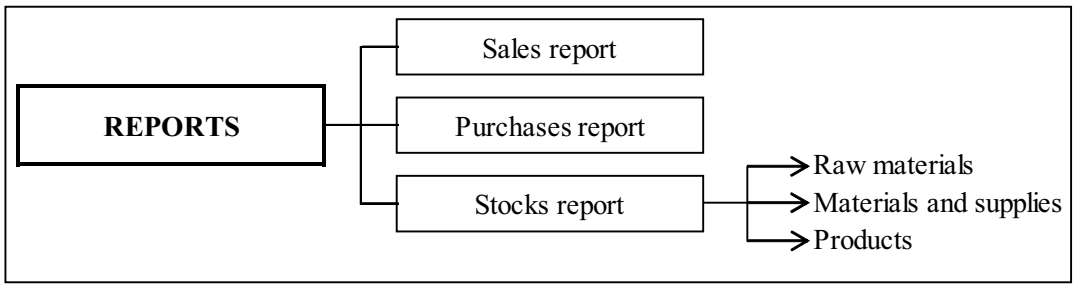


*Figure 7.* Reports module
Source: Own elaboration

The configuration module allows the standardization and systematization of the issuance of documents (quotes, purchase orders, invoices, packing list and other necessary); in this way, the operation and customer service times are reduced. It is important to mention that, in this module, only the administrator of the system will be able to place and / or modify the parameters mentioned throughout the present investigation (level of security stock, point of reorder, maximum stock).

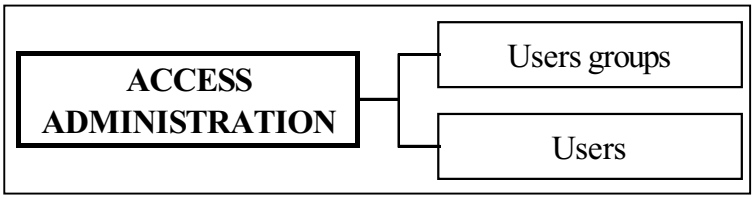


*Figure 8.* Configuration module
Source: Own elaboration

The access administration module allows granting the necessary and sufficient access for each user, in other words, for reasons of security and / or confidentiality, certain users may not have access to certain modules or certain sections of some modules. It will also allow identifying the actions generated by each user of the system; also for security reasons, the system (thanks to user coding) will allow to keep a record of all actions generated by each user within the system. This same identification principle will be used to identify the most effective vendors in the organization.

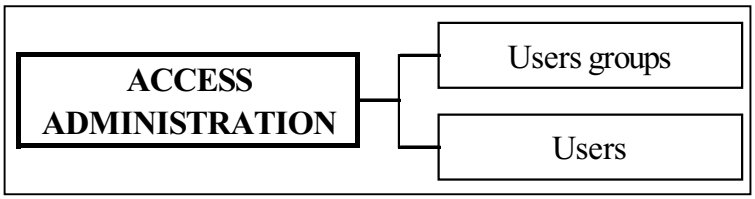


*Figure 9.* Access administration
Source: Own elaboration

Finally, the system includes the generation of five (05) types of alerts, which are generated automatically according to the parameters programmed in the same system. These are:

*Type 1: Maximum point*

The system would be capable of throwing an alert when placing a new PO, exceeding the maximum point calculated and established in the parameters of the inventory control system.

This alert would help to avoid generating purchase orders that exceed the maximum capacity of the Takiwasi Laboratory warehouses, as well as, it will be useful to avoid stock overload. However, the placement of a new PO would not be

impeded, since in certain cases (special orders), it is possible that the quantity of raw materials, materials and / or inputs required exceeds the maximum capacity of the warehouse.

*Type 2: Re-order point*

The system would be able to throw an alert when the point of reordering a raw material, material, input or product, calculated and established in the parameters of the inventory control system has been reached.

This alert would become the main tool to avoid the lack of stock availability of both raw materials, materials, supplies and finished products. Also, the consequences of a better planning of purchases based on the information that this alert can generate, would facilitate reducing the number of orders (local and export) unattended and the number of delays (in days) in the manufacture of products .

*Type 3: Re-order point for the same supplier*

In this case, the system will detect the raw materials, materials or supplies that are about to arrive at the point of reordering and in the case where the same supplier is the one that commercializes these items; the system will suggest and allow generating a single PO for all the items in reference.

In addition to the benefits generated by the generation of the type 2 alert. This alert will also facilitate the reduction of replenishment costs, since it will be possible to reduce, for example, transportation costs; commercial benefits may be accessed for purchases of larger lots, among

others.

*Type 4: Minimum point (security stock)*

The system will issue an alert when the minimum point (safety stock) of a raw material, material, input or product; calculated and established in the parameters of the inventory control system has been reached, or the remaining inventory level is lower than this point.

This alert would work as a second barrier against inventory shortages, the first being type 2 and 3 alerts. The analysis of the frequency of generation of this type of alert will be decisive in order to make the necessary adjustments to the calculation of point levels. re-order. What is sought is that the trend of the frequency of generation of this type of alert is negative (decreasing).

*Type 5: Break point of stock*

The system will issue an alert when the stock break point has been reached (zero (0) units of stock of a raw material, material, input or product).

When generating this last type of alert, corrective action would be necessary; that is, it would be required to generate urgently and immediately a new PO (or manufacturing order, as the case may be) for the existence that has reached this point. What is sought is that the frequency of generation of this type of alert store to zero.

About these results, it is possible to indicate that, the correct planning of the purchases, based on the information provided by the designed inventory control system, allows the timely availability of the raw materials, materials and supplies necessary for the elaboration of the finished products. This, in turn, allows the maintenance of optimum levels of stock, which facilitate the increase of sales volume (local and export) of the Takiwasi Laboratory.

Likewise, the data collection instruments (depth interviews, questionnaires and surveys) allowed identifying and evaluating the logistical problems of the Takiwasi Laboratory. This information, in turn, was decisive for the specification of the main characteristics and functionalities of the modules and the alerts that make up the design of the inventory control system of the Takiwasi Laboratory.

Likewise, the technical bases (software and hardware) analyzed and specified in this document are sufficiently robust to house, support and allow the correct functioning and potential performance of the modules and alerts that make up the design of the inventory control system of the Takiwasi Laboratory.

Finally, the modules and alerts contemplated within the design of the proposed inventory control system contain fundamental information that serves as a tool to facilitate the reduction of the projected number of unattended export orders, the projected number of delays in the preparation of finished products and projected replenishment costs.

## DISCUSSION

In the case of the research carried out by Aguilar (2000), the surveys were used to determine what the respondents' needs were in relation to the inventory control systems they used. In the same way, in the present investigation, the survey served to determine, among other aspects; the importance of each module of the system and the needs regarding the functionalities that these must contain. Reference is also made to the need that the design of the inventory control system must be of an integral nature. That is, that includes modules complementary to those related to the physical control of inventory units. In this same investigation, it is indicated that the design of the inventory control system should emphasize the

coding of products. For the present thesis, not only has the product coding been considered, but also that of the customers, suppliers and users. In this way the information provided by the system, based on segmentation, would allow more efficient control. Finally, Aguilar (2000) indicates that this system will reduce replenishment costs and facilitate decision making regarding the planning of purchases. These last aspects are similar to the third specific objective of the present investigation.

In the research of Goicochea (2009), the design of the inventory control system emphasizes the status of stock orders. This coincides with the states of the purchase orders that have been considered as a control tool within the design of the proposed inventory control system. Likewise, the programming of the minimum, maximum and re-order point stock levels through parameters within the system is also considered. In the inventory control system proposed in the present investigation, this aspect is fundamental for the generation of previously explained alerts.

On the other hand, in the research of Rodríguez and Torres (2014), the problem of the research object coincides with that of the Takiwasi Laboratory. That is, both organizations have unmet demand because they do not have the necessary and sufficient inventories. In the same way, with the proposal of the inventory control design, an increase in the volume of sales and orders attended in its entirety is projected. A contrasting point between the design of the system proposed by these authors and the design of the system proposed in the present investigation; is that the first emphasizes the accounting control of stocks, while the second has a holistic character.

The inventory control design proposed by Gómez y Guzmán (2016), includes the generation of documents (through templates and formats) directly from the system. This aspect coincides with one of the functionalities described for the design of the system proposed in this thesis. Likewise, emphasis is placed on the validation of the receipt and exit of stocks in the system. This validation, as the authors comment, must be carried out by the warehouse personnel. This function of the system is very similar to that considered in the design of the inventory control system proposed in the present investigation, specifically in the purchasing module (PO states).

On the other hand, a difference between the design of the inventory control system proposed by Gómez and Guzmán (2016) and that of the present investigation; is that the first, only considers the physical control of inventory units, leaving aside the accounting valuation of these stocks.

Finally, it is possible to indicate that none of the previously indicated proposals includes the generation of alerts as a critical function for the facilitation of inventory control. Additionally, there is no reference to the possibility of generating exportable reports that allow contrasting the information provided in each module of the system.

Likewise, none of the proposals analyzed above contemplate the inclusion of the configuration and access management modules.

The conclusions are the following:

The modules included in the design of the proposed inventory control system contain fundamental information that serves as a tool to facilitate the correct planning of purchases.

The types of alerts included within the inventory control system in reference, facilitate the maintenance of optimum levels of stock of raw materials, materials and supplies. This, in turn, facilitates the continuity of production and the attention of unmet demand (local and export).

The tools provided by the modules of the proposed inventory control system facilitate the reduction of the attention time of inquiries and purchase orders. This, in turn, helps to increase the level of customer satisfaction; This being a relevant aspect for the increase in sales volume (local and export).

The coding of suppliers, customers, users and stocks (raw materials, materials, inputs and finished products) will allow a more detailed segmentation of the stakeholders and will facilitate the analysis of the behavior of the demand of the stocks.

The information provided by the modules of the inventory control system in question, will facilitate the improvement of production planning; giving manufacturing priority to the products with the highest turnover.

The data generated in the various reports of the proposed inventory control system will facilitate decision-making regarding the formulation of action plans (preventive and / or corrective) regarding the replenishment, production and sales processes.

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