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TITULO	REDESIGNING PROQUINAL'S DISTRIBUTION CENTER USING SERVICE LEVEL ORIENTATION		
SUBTITULO			
AUTOR(ES) Apellidos, Nombres (Completo) del autor(es) del trabajo	BARCALDO APONTE JUAN CARLOS		
PALABRAS CLAVE (Mínimo 3 y máximo 6)	Warehouse design		Service level segmentation
RESUMEN DEL CONTENIDO (Mínimo 80 máximo 120 palabras)	<p>Nowadays the company is facing problems in its supply chain because, as described before, it has acquired a retail stores chain that has particular characteristics (customer expectations, orders frequency, orders size, products variety, commercial negotiations, multiple locations, movements speed, information technologies, service promise, etc). These variables directly affect the current joint infrastructure in terms of human resources, facilities, equipment and strategy. Some examples of the issues the company is struggling are:</p>		
	· Multiple repeated operations to reach the final customer		
	· High joint inventory levels due nodes proliferation		
	· High cost of distribution operations		
	· Investment on multiple warehouses and inadequate use of fixed equipment		
<p>This actual distribution makes the logistics operations inefficient because in many cases the company is loading materials in the distribution center, transferring them to the city small warehouses called "lungs", once there, they are downloaded and then transferred to storage (5 levels/floors above the entries), there, they are stored and entered into the inventory systems manually and then finally they have to be released in order to be redistributed to retail outlets or customers.</p>			
<p>Within the operation of the company's distribution and service are other important variables as the market variation, this has increasingly shown that the counter sales are tending to decrease and the wholesale customers are constantly growing. Other fact is that current customer requires the product manufactured grouped with complementary products not manufactured that has changed the supply chain (distribution and delivery) in terms of costs, inventory planning and service performance. Based on the above issues the strategic model of supply it's not what the customer requires and what the company wants to have.</p>			
<p>So, based in the above Proquinal should analyze its current strategy and operations in order to redefine its goals, to accomplish better service and achieve synergies between the existing divided supply chains.</p>			

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**REDESIGNING PROQUINAL'S DISTRIBUTION CENTER USING SERVICE
LEVEL ORIENTATION**

**INTEGRATION, DEFINITION AND ALIGNMENT
OF PROQUINAL'S SERVICE STRATEGY WITH CURRENT OPERATION
AND RESOURCES OF THE DC IN BOGOTA**

Abstract

Purpose: Increase customer satisfaction, sales and cost optimization by redesigning Proquinal's distribution centre using a service level orientation

Approach: Blending warehouse design methodologies, slotting layout definitions and customer segmentation to align physical resources with current assets.

Findings: Deliveries typologies, entries and inventories seasonality, and product slotting are now aligned to match customer expectations by a new layout definition of the DC.

Originality: Companies that define its service level strategy based "just" on commercial ratios, should look deeper into their physical resources and processes to include SCM and its clear understanding of the capabilities in order to exploit opportunities and increase competitive advantage from core business realities.

Keywords: Warehouse design, service level segmentation.

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1. Introduction

1.1.Objective

The objective of this paper is to define and align Proquinal's service strategy for internal and external customers, taking into account the characteristics of their current resources, the resources required and the flow of operations with the recent acquisition of the retailers' chain in Bogotá. The main idea is to determine a layout for the D.C. that fits the service strategy, that is achievable and that takes into account the operational and tactical aspects that the company currently has.

The importance of this work is that many companies currently determine strategies that are not supported by their resources and processes. Therefore it is vital to analyze the company's current operation in order to determine how far existing resources could go, which others are need, and from there, what can it be promised to customers and how to do it.

1.2.Context

Proquinal is a Colombian company based on Bogotá that has been working for more than 50 years, it was founded on 1959 and since 1972 it has presence in the United States as leader on the vinyl coated fabrics market especially recognized on buses upholstery.

Nowadays it has operations in 7 countries and its production is sustained by two manufacturing facilities located in Costa Rica and Colombia, from these its serves more than 60 countries all over the world. Proquinal's main strategy over the years it has been "play as a local player in a foreign market", what this goal represents is that in every market

that the company attempt to serve, the best strategies, supported by local resources, are deployed to fulfill customer expectations in regular market expectations.

In Colombia, from where its serves almost 70% of the global total demand, it works with two retail chain stores called *Comercializadora Calypso* and *Plásticos de la Sabana* that were acquired in 2008. These retailers have presence over the Colombian territory and mostly on Bogotá city as showed on Exhibit 1¹. Nowadays the company has 54 stores over the Colombian territory, 28 of them located on Bogotá. The sales that the Colombian market represents are 40% of the total global income, of these sales Bogotá market represents 52% of the total, this is 20.5% of the total global income (Over US\$250 MM of annual sales on year 2011).

By the other side the operations of distribution by the DC of manufactured products are distributed as shown Exhibit 2. This DC is in Bogotá and performs 4 mainly activities:

- Receive, storage and distribute all raw materials for the production plant in Bogotá.
- Distribute finished manufactured products to industrial customers on Bogotá.
- Deliver to a third party logistics the manufactured products to be distributed to cities and industrial customers outside Bogotá.
- Export manufactured products.

1.3. *Problem statement*

Nowadays the company is facing problems in its supply chain because, as described before, it has acquired a retail stores chain that has particular characteristics (customer expectations, orders frequency, orders size, products variety, commercial negotiations,

¹ Exhibit 1. Retail stores distribution: Colombia and Bogotá.

multiple locations, movements speed, information technologies, service promise, etc). These variables directly affect the current joint infrastructure in terms of human resources, facilities, equipment and strategy. Some examples of the issues the company is struggling are:

- Multiple repeated operations to reach the final customer
- High joint inventory levels due nodes proliferation
- High cost of distribution operations
- Investment on multiple warehouses and inadequate use of fixed equipment

This actual distribution makes the logistics operations inefficient because in many cases the company is loading materials in the distribution center, transferring them to the city small warehouses called “lungs”, once there, they are downloaded and then transferred to storage (5 levels/floors above the entries), there, they are stored and entered into the inventory systems manually and then finally they have to be released in order to be redistributed to retail outlets or customers.

Within the operation of the company's distribution and service are other important variables as the market variation, this has increasingly shown that the counter sales are tending to decrease and the wholesale customers are constantly growing. Other fact is that current customer requires the product manufactured grouped with complementary products not manufactured that has changed the supply chain (distribution and delivery) in terms of costs, inventory planning and service performance. Based on the above issues the strategic model of supply it's not what the customer requires and what the company wants to have.

So, based in the above Proquinal should analyze its current strategy and operations in order to redefine its goals, to accomplish better service and achieve synergies between the existing divided supply chains.

2. Literature review

The objective is to apply three different approaches to create customer value, address resources to efficient operations and develop differentiated experiences.

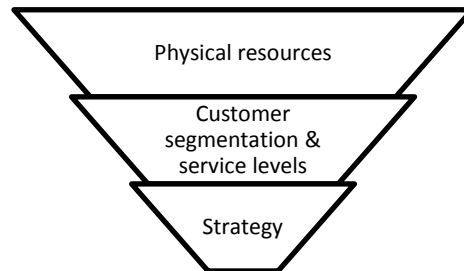


Figure 1: Paper methodology

2.1. *Physical Resources*

The goal on this part is to improve service and reduce costs through the layout design of a centralized distribution center in Bogotá where storage, reception and delivery of raw materials, manufactured products and not manufactured products for commercialization are mobilized. To achieve the above the following methodology will be applied.

The design of the layout of a distribution center is highly critical for the development of business activities but often is underestimated. Unfortunately few people understand the impact of the supply operation, reception and storage within the process of supply chain and how inefficiencies are directly translated into reduction on the expected profit margin of the businesses. The following are the 7 principles for designing a distribution center as Malcolm Walker² stated:

² Mal Walker, "The seven principles of warehouse and distribution centre design", MHD supply chain solutions – November/December 2010.

1. Determine the purpose of the facility: The most important thing is to clearly define the objectives and goals of the facility, to achieve the following questions must be answered What market its served or which is attempted to serve, What types of materials will be stored? , is part of a network?, What is the life expectancy of the installation?, it will be raised on an existing facility or on a greenfield?.
2. Define volumes and initial requirements: Determine the amount of products to be stored, the rhythm of the operation including inputs, outputs and returned outputs, the nature of orders and picking requirements (definition of logistics units, containers, pallets, boxes, etc.), finally it must defined what services should be offered such as storage of flammable products, cold chain, service areas, offices, etc.
3. Match storage modes, information systems and technologies with volumes: Once the data has been analyzed, the equipments should be selected; within these are types of shelving, mezzanines, conveyors, forklifts, etc.
4. Flows: two flow laws must be applied: a) Flow just in one way, whether if it is in a clockwise direction, from top to bottom, or other, it must always remain a design where flows do not cross each other. b) Flow vs capacity, it should be noted that flows always come first than capacities, if at some point it must selected on one of the two alternatives that will direct the design, an analysis of how it will affect the future operation and if raw speed or continuity primes on capabilities.
5. Approach to zero manipulation: within the operations of the distribution center the design should reduce to 0 the times that the staff is in direct contact with the products, the idea is to optimize costs by reducing the number of operative activities to perform.

6. Evaluate options: the defined proposal must be evaluated from two points of view to ensure that the objectives have been achieved, in a quantitative manner the return on investment should be evaluated, in order to evaluate costs of delivered products, storage cost per cubic meter and others, on the other hand the proposal should be analyzed qualitatively listing the advantages and disadvantages of the options considered.
7. Wide consultation: since the design process is multifaceted and is led by executives and managers it has to be noted that the process natural flow inside out must be always consulted with specialists in each area.

The activities to be performed are shown on figure 2:

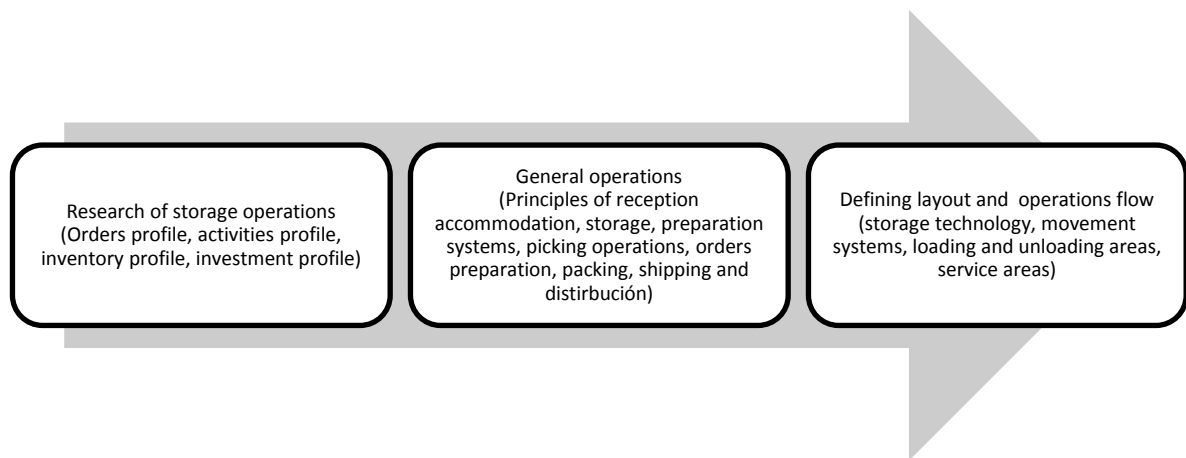


Figure 2: Warehouse design process³

³ Source: Frazelle, Edward. Logística de almacenamiento y manejo de materiales de clase mundial. Bogotá, Colombia 2007. Norma

2.2. *Customer segmentation & Service levels*

Based on the physical resources and directed by the service strategy the customers must be segmented into groups to provide them differentiated service.

There will be three different service programs to be aligned to three different customer segments as follows:

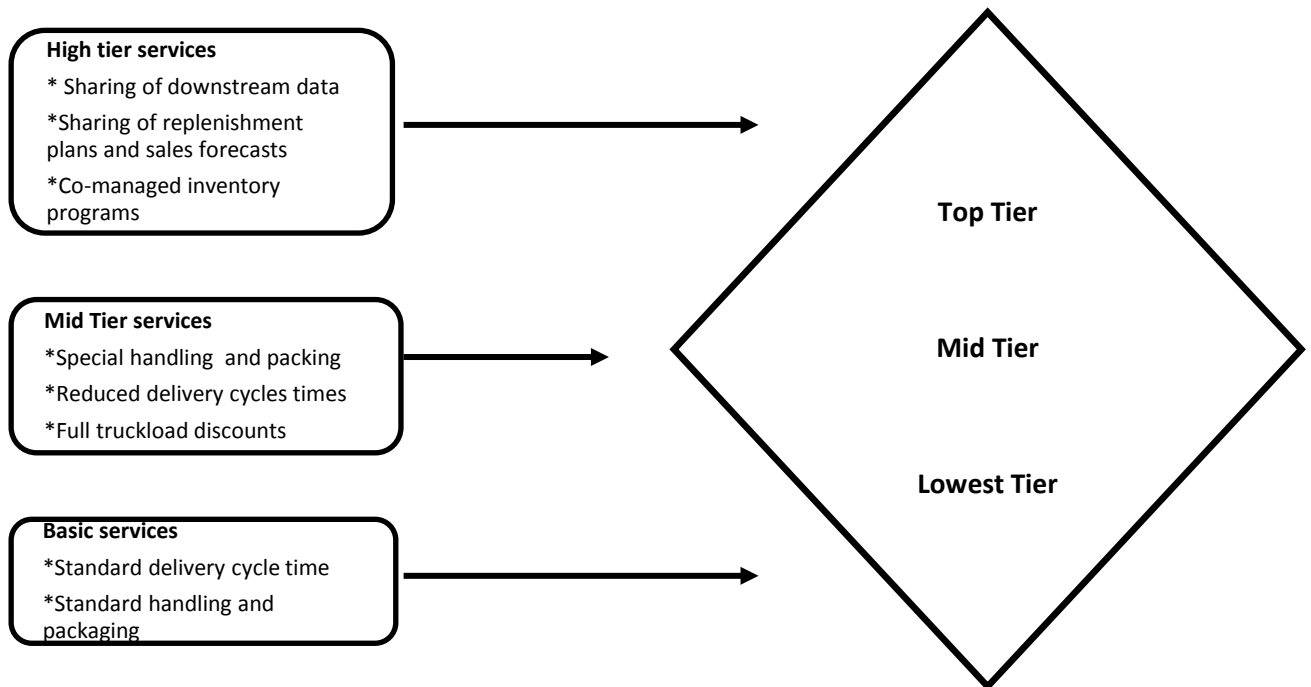


Figure 3: Service segmentation⁴

The Optimized customer segmentation and service Programs will be determined by:

1. Segmenting customers based on achieving strategic objectives.
2. Identifying tiered services based on supply competencies
3. Aligning services to each segment based on historical purchasing development

⁴ Source: Adapted from: Lapide Larry, Demand Management: Optimizing Supply and Demand Over Time. July 5 2012, Bogotá, Colombia.

2.3. *Strategy*

In terms of strategy the study will be simple and practical; the idea is to align the corporative supply chain strategy with the customer satisfaction strategy in terms of the designed customer segmentation and the proposed physical structure and resources.

3. Preliminary data and analysis

As mentioned earlier, the first stage of the analysis consists on the study of Proquinal operations from three different approaches; *distribution* (national customers, export customers, national wide stores, stores in Bogota and manufacturing plant), *storage* (inventory management and joint inventories in Bogotá) and *reception* (purchased products, raw materials and manufactured goods entries).

The information below corresponds to data of year 2011, the operation has been compared with respect to the years 2010 and 2009, the year 2010 does not differ significantly with respect to the seasonal movements of inputs and outputs, the key differentiator factor between these two years is the storage volume that has been increased by the change in business strategy (the company decided to enter the market of imported goods purchased to be distributed through our network of retail stores).

The information from 2009 has been ruled out due to the international crisis that occurred in the market, that year's data are not consistent with historical records of organizational performance.

The tasks to perform on the analysis are the following:

Task Name

Databases Recopilation & Structure (SKU master)

Information Gathering

SKU Measures (m3/sku)

Process analysis

Interviews / information gathering

Data analysis

Activity Profile Analysis

Entries DC- MP, NMP and RW

Flows per month / seasonality

Inventories DC- MP, NMP and RW

Seasonality / variability

DC Deliveries - MP, NMP and RW

Flows per month / seasonality / typology

Customer analysis

Integrated Analysis

Flow Analysis

Scope of joint inventory (retailers and DC)

Layout definition

Slotting

Customer

Customers segmentation

Strategy definition

3.1. Information gathering (SKUs and product flows).

The first stage was an investigation of flows and products that compose the current operation of the company. The different measures of the products were determined as:

Physical dimensions, types of products, types of packaging, transfer units, storage units and locations. The results are presented in tables 1 and 2:

Type	SKUs account per current location					
	RETAILERS	%	DC	%	Total	%
Raw material (RW)			759	17%	759	11%
Manufactured product (MP)	1077	29%	3383	78%	3383	48%
Not manufactured product (NMP)	2655	71%	217	5%	2872	41%
Total	3732	100%	4359	100%	7014	100%

Table 1: Information gathering results of the current SKUs

Logistic unit type	SKUs account per type of packing					
	RETAILERS	%	DC	%	Total	%
ROLL (MP & NMP)	2740	73%	3580	82%	4843	69%
NOT AVAILABLE	234	6%	203	5%	437	6%
BOX	270	7%	114	3%	384	5%
PACK	163	4%	63	1%	226	3%
POWDER BAGS	216	6%		0%	216	3%
DRUMS		0%	191	4%	191	3%
BAG	14	0%	115	3%	129	2%
SINGLE UNIT	62	2%		0%	62	1%
VERTICAL ROLL		0%	58	1%	58	1%
SMALL DRUMS	33	1%		0%	33	0%
HORIZONTAL ROLL (RM)		0%	26	1%	26	0%
IBC		0%	3	0%	3	0%
TUBE		0%	3	0%	3	0%
BOTTLE		0%	2	0%	2	0%
SPRAY		0%	1	0%	1	0%
Total	3732		4359		7014	

Table 2: Information gathering results per type of packing

The surveys and the data evidences that the company has a total of 437 SKUs without packaging unit available, these are mostly represented by products with no rotation in the last 12 months (obsoletes) and units set up to legalize the entrance of samples without commercial value that did not have the desired performance. Given this the

company has a real total of 4156 SKUs in the distribution center (54%) and 3498 on the retailers (46%). Of all SKUs analyzed 89% of the products are for sale while 11% are raw materials. In addition, of the 14 different types of logistic units 83% of the SKUs correspond to rolls, boxes, parcels and packages.

After collecting the information and identifying logistic units in order to perform the analysis on a single measurement unit (m3), the flow of materials is now break down.

3.2. Entries

Proquinal generally has three types of entries; Manufactured products (derived from the manufacturing plant), products not manufactured (imported products received in the Distribution Center which are then redistributed and local products that are directly delivered to each of the retail stores) and raw materials (imported and national that are only located on the distribution center).

The first step of the analysis is to determine the volumes of entries of the three types of products defined above, an examination of the seasonality and the impact on the operations of the distribution center and retailers.

3.2.1. Raw materials

After analyzing the monthly distribution of the entries the results are shown on table 3.

Entries Distribution	Volume on m3
Mean	2,331.93
Average	2,344.73
Max	3,019.29
Min	1,557.16

Table 3: Entries distribution of statistical measures

From seasonal data analysis it was determined that the flow entries had maximum volume in cubic meters that corresponds to a 30% increase over the mean in November, December was the lowest below the mean in 33%.

Likewise, an analysis was made of the origin of products and the result is: 45% of them are imported while 55% are of local origin (national). Since the company has this large percentage of foreign-sourced raw materials security inventories should be determined according to lead times and reliability in deliveries from various suppliers in order to meet production requirements adequately. By other side analyzing different suppliers the results are that 80% of the entries are conformed of seven suppliers of a total of 115, from these 3 are national and 4 foreign, those are located in Asia, Europe and Mexico. Moreover, with regard to logistic units the result is that powder bags are 41%, 26% boxes and 16% packages of units.

3.2.2. Finished products (Manufactured and Not manufactured)

The seasonality of the finished products is shown on table 4. The entries of Proquinal (PQN) are mostly represented by manufactured products (96%), those of the retailers, Calypso and Sabana are just 12% and 5% accordingly for MP. Regarding just the entries of the retailers 81% of the volumes are represented by 11 stores of 30 in total. These stores are mainly located on the center of the city and in the district called *Siete de Agosto*.

<i>SEASONALITY / VOLUME ENTRIES m3 / SOCIETY</i>				
Month	CALYPSO	PQN	SABANA	Total general
01	919	1,234	1,369	3,522
02	814	2,084	2,164	5,062
03	812	2,399	631	3,842
04	689	2,045	758	3,492
05	783	2,415	989	4,186
06	794	2,154	1,230	4,178
07	871	2,368	745	3,984
08	908	2,543	934	4,386
09	891	2,303	3,204	6,398
10	885	2,072	1,351	4,308
11	1,147	2,382	1,723	5,253
12	1,348	1,652	2,123	5,122
Total general	10,862	25,651	17,220	53,733
Mean	878	2,228	1,290	4,247
Average	905	2,138	1,435	4,478
Min	689	1,234	631	3,492
Max	1,348	2,543	3,204	6,398

Table 4: Seasonality distribution of entries per retailer and statistical measures

A brief summary of the entries and flows is presented of figure 4.

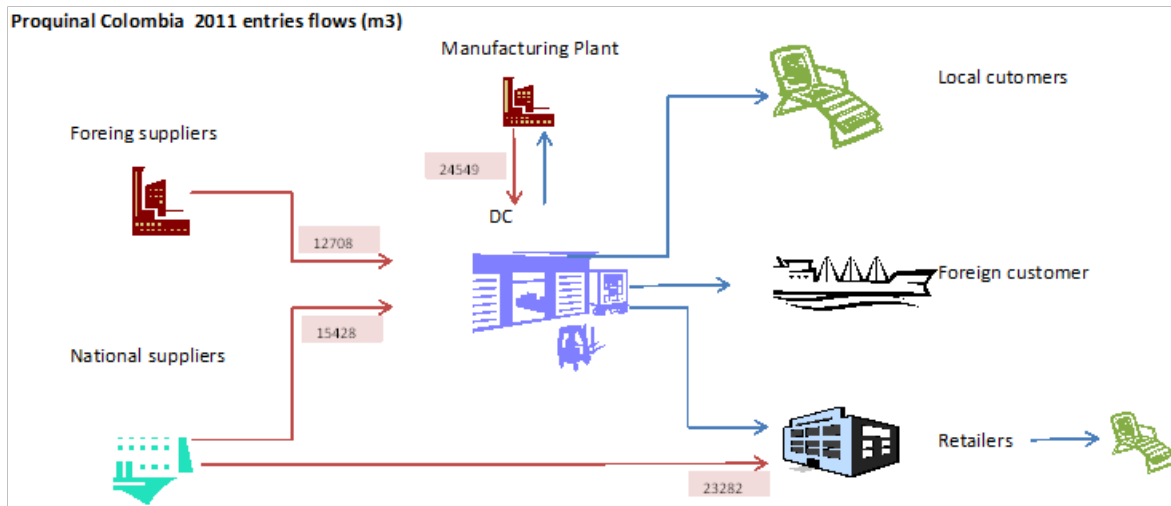


Figure 4: Proquinal's DC flow distribution

3.3. Inventories

The inventory analysis of the products and the categories defined above is focused primarily on defining and conceptualizing the capacity of the Distribution Centre currently,

to perform the analysis it must be taken into account that the company has the following storage methods defined by type of packaging.

3.3.1. Storage

Manufactured goods are stored on racks and simple shelves; racks are stacked in three levels and are intended for storage of large volumes of products from a single reference (SKU single unit), the shelves on the other hand are mainly used to store volumes generally small and for multi references per storage position. The raw materials are stored at floor level without using any storage system, they are staked using only their own pallets.

The systems are illustrated below:



Racks MP & NMP

Shelves MP & NMP

On floor RW

The physical characteristics of the distribution center consist of an area of 10,134 square meters and a height of 5.7 meters to storage. The current distribution of the area by product type and package type is the following shown of figure 5.

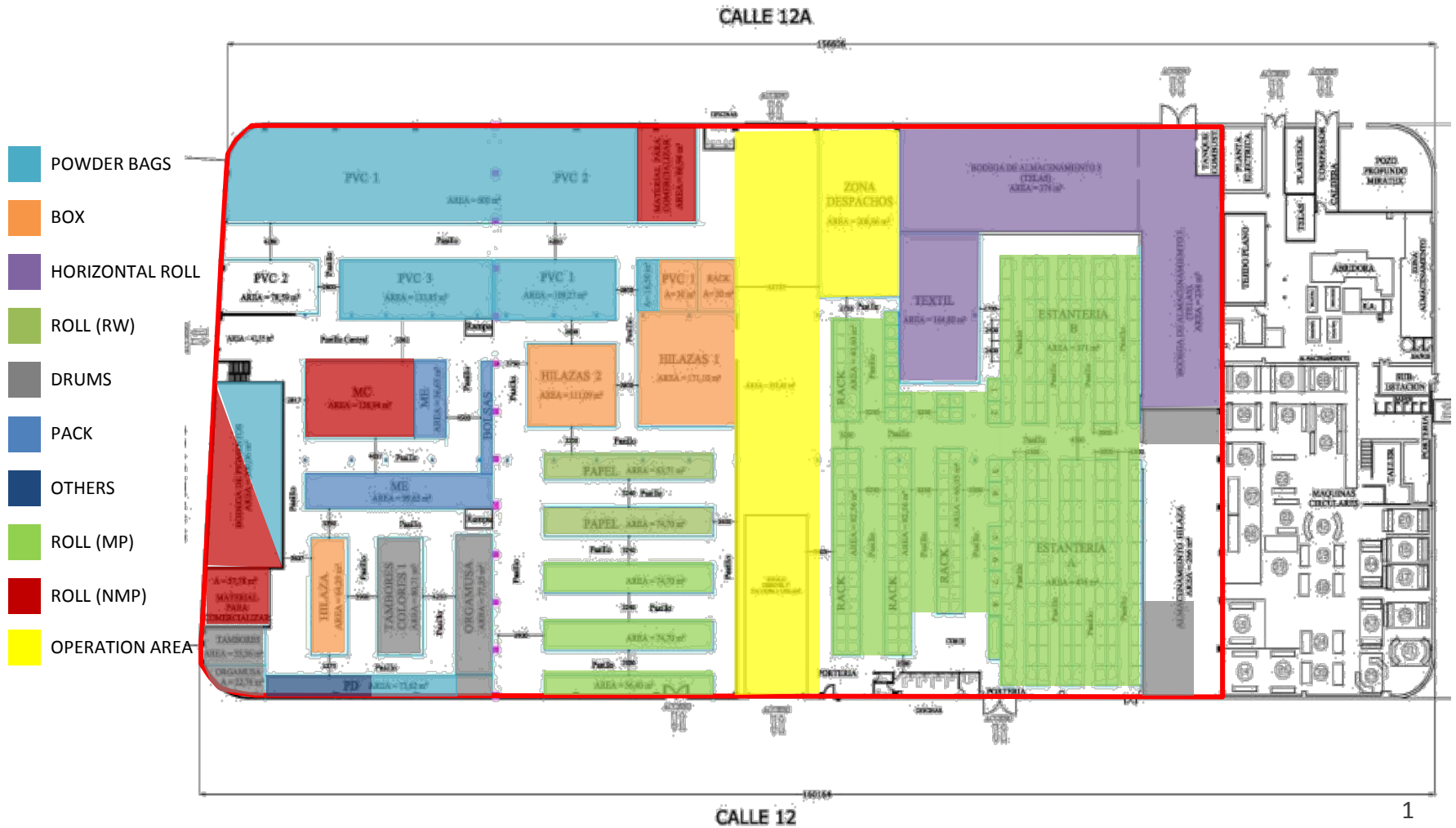


Figure 5: Current layout of the distribution centre

The area that is not defined in the figure 5 (without colors located at the right side of the blueprint) corresponds to the zone where the initial manufacturing process is performed (fabrics elaboration-circular knitting).

The current usage of the total storage space is shown on table 5:

Distribution Center / layout utilization	m2	%
MANUFACTURING PROCESS	1,802	18%
STORAGE WIP	1,056	10%
RAW MATERIALS (RW)	3,944	39%
MANUFACTURED PRODUCTS (MP)	3,039	30%
NOT MANUFACTURED PRODUCTS (NMP)	293	3%
TOTAL	10,134	100%

Table 5: Distribution Centre usage of areas

Given the above information below is now presented the seasonality of the inventory by product type on figure 6.

As observed on the graph the inventory variability is not high, the maximum increase with respect to the average is only 6.8%. In accordance with a historical analysis of the stored product at the DC and the interviews performed the volume capacity estimated with the existing storing systems mentioned above is 6500 m3. This capacity is used and distributed on 62% for raw materials, 34% for manufactured goods and 4% for not manufactured products.

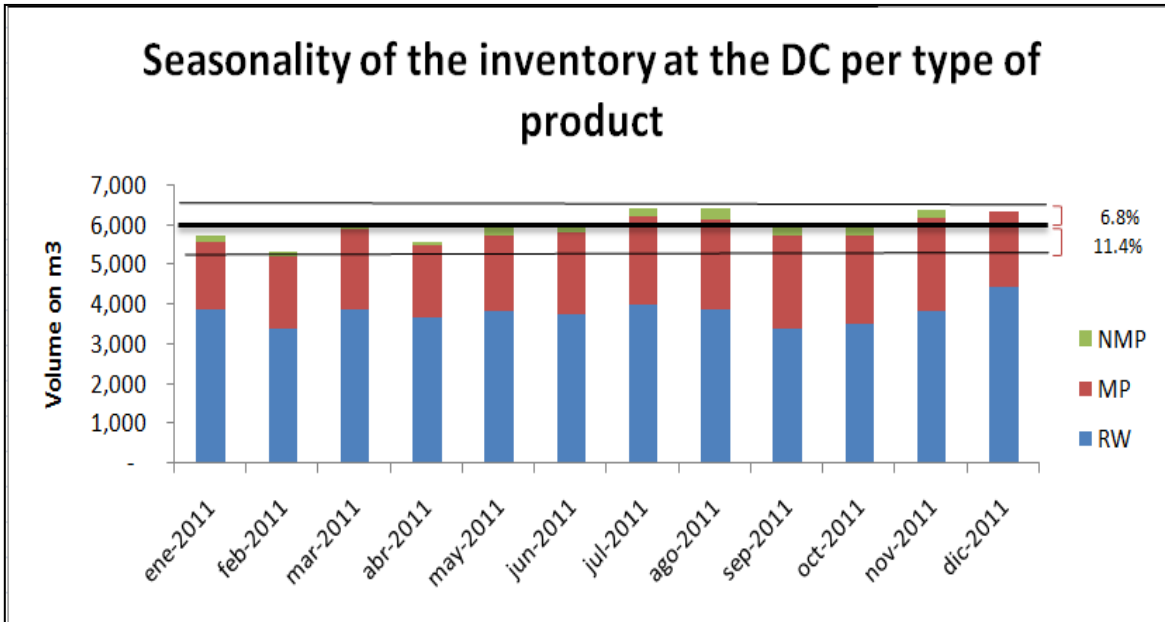


Figure 6: Seasonality of the inventories per product

Now, if we analyze the storage volume used with respect to the area in square meters dedicated to each product the result is the efficiency ratio. This efficiency ratio measures how the volume is being used. The raw materials had the greater use of space with an approximate value of 0.96 cubic meters per square meter, the ratio for manufactured goods is 0.67 m³/m² and for not manufactured materials is 0.67 m³/m².

3.4. Deliveries

The last step of the individual data analysis of the flows are the deliveries, the idea is to understand and conceptualize the outflows of products for customers and the production plant. This analysis will be divided according to the purpose of the project: Export flow, national customers flow outside Bogota and Bogota customers flow including the retailers chain. The main idea of the analysis is to determine the outflow according to the volume of shipments to customers in Bogotá and the retailers chain. Likewise, an analysis of the sales amount per customer throughout the year will be performed to

determine the profitability of each and their behavior with respect to: number of SKUs per dispatch, purchase frequency, profits and qualification regarding business strategy.

3.4.1. *Delivery by destination*

In order to analyze customer behavior and determine the service level the first step is conceptualize the volume of shipments made by the distribution centre going from the general to the particular. The figure 7 shows the total volume shipped to customers in Colombia and overseas customers.

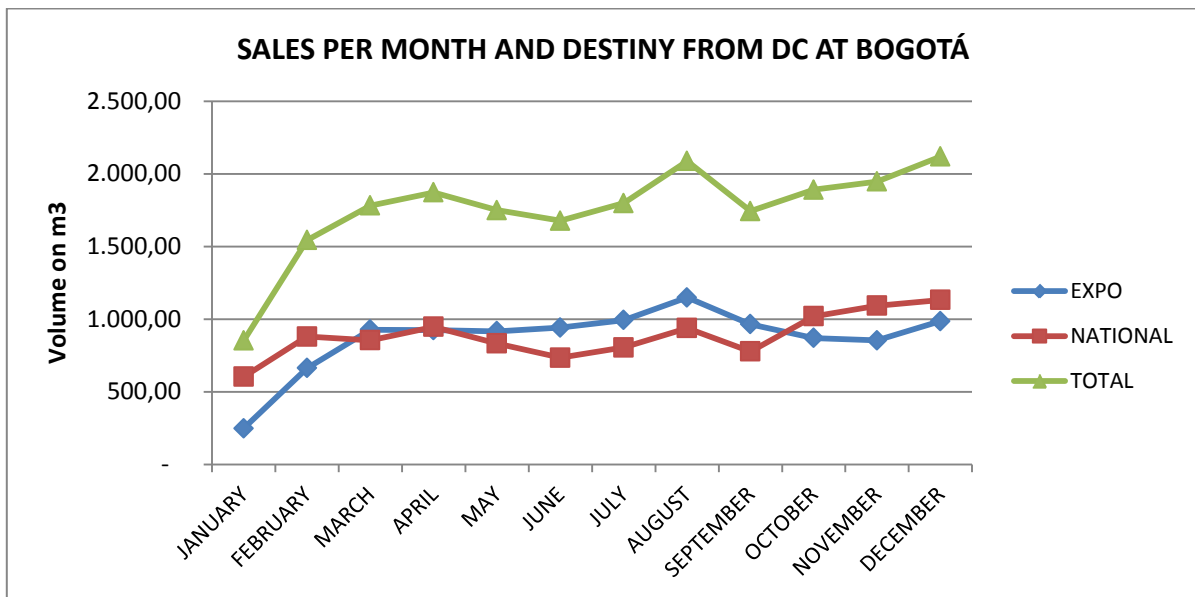


Figure 7: Sales distribution per month and type of delivery

As shown in the figure 7 there is a high annual seasonality factor at the end of the year as customers buy more in December, on the other hand it can be seen that the volume of shipments at the beginning of the year is lower until April, from there sales did not vary significantly and maintained an average of 1800 cubic meters per

month. According to the business research conducted in the early stages of the project this behavior is attributed to annual price increase and to the holiday seasons.

Furthermore, with respect to the total, the export volume represents on average 49% of sales while national volume is 51%. Going deeper on national sales the volume of the dispatches delivered to Bogotá was 55% and the rest 45% were performed to other cities. Within the cities that make up 80% of the total besides Bogotá are: Bucaramanga with 8%, Medellín with 8%, Cali 6% and Barranquilla with 3%.

3.4.2. Deliveries per destination and volume

The following analysis aims to determine the deliveries typology from the distribution centre according to the customers they are targeting. The figures 8 and 9 shown the volume per dispatch for national and export customers:

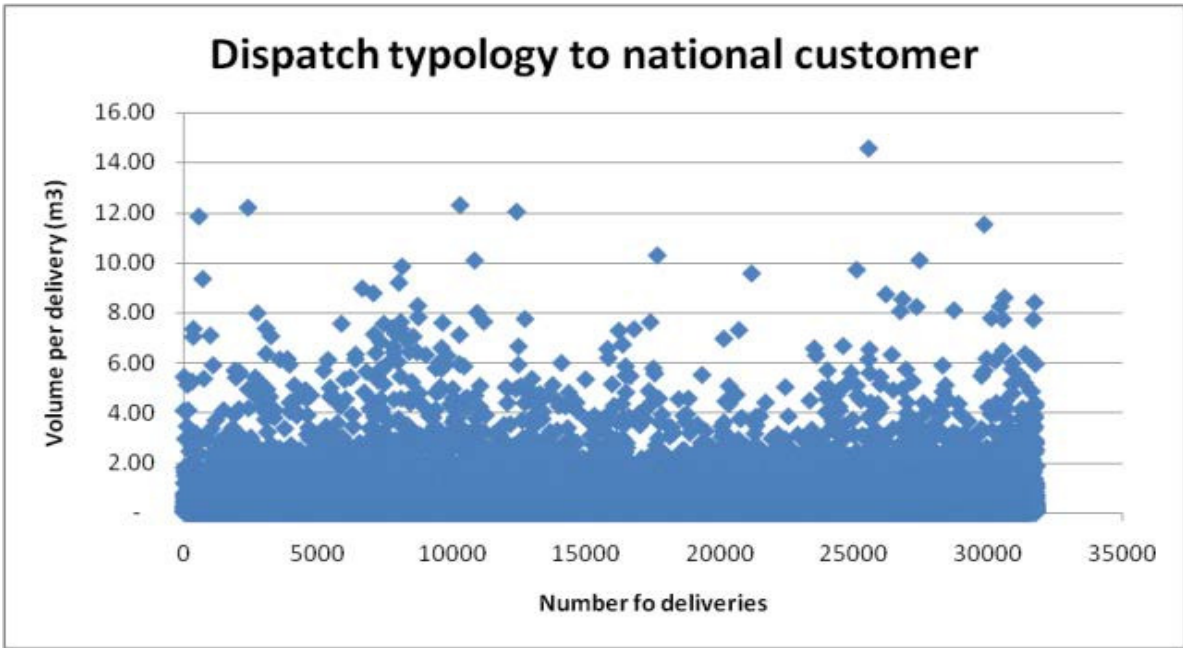


Figure 8: Dispatch typology for current customers of the DC in Colombia

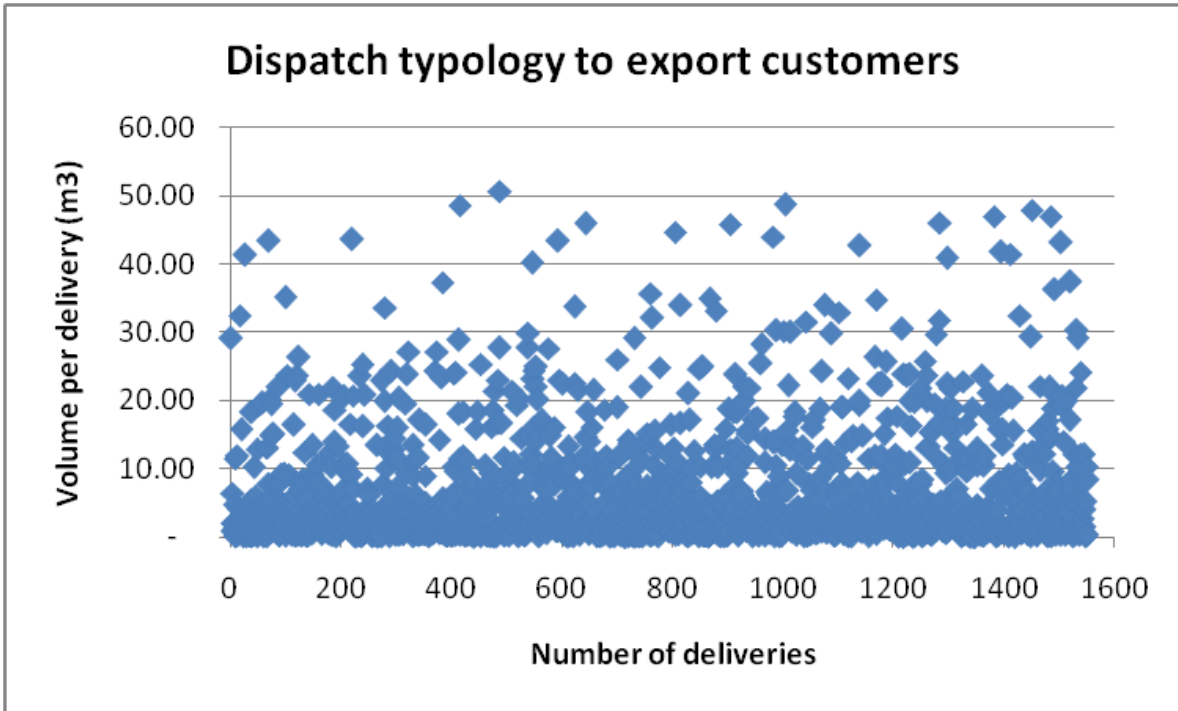


Figure 9: Dispatch typology for current customers of the DC outside Colombia

As conclusion the distribution centre performed 33,360 shipments during the year on analysis; 95% of these were made to customers in Colombia and 5% were made for export customers. The table 6 summarizes the typology by destination.

Intervals	Deliveries account			
	Export customers	% Share	National customers	% Share
Between 0 a 1 (m3)	360	23%	29,414	92%
Between 1 and 2 (m3)	226	15%	1,441	5%
Between 2 and 10 (m3)	604	39%	945	3%
Larger than 10 (m3)	361	23%	9	0%
Total	1,551		31,809	

Table 6: Dispatch typology divided on intervals

This result clearly shows the dispatch profile of operations of the distribution centre, as seen 88% of deliveries have a volume under than 10 cubic meters, this means that the current focus of the operation is well suited to operations of the retailers chain.

Another thing to consider is that the result clearly focuses storage and picking systems to quick response methods, this means that more areas should be available for preparation and a greater number of exits should be addressed to adequately attend the dispatches.

3.4.3. Customer performance

Over the year on analysis Proquinal's distribution centre served 213 customers, its sales were 63 million U.S. dollars and its average profit was 24%. The next step of the analysis consists of a deeper analysis of each customer that generated those sales taking into account the following metrics: the average number of SKUs they purchase per order, the purchase frequency over the year (number of times), the type of service strategy the company has for them (make to stock or make to order) and a metric of number of SKUs divided by the frequency.

The top customers classified by aggregated volume on sales participation are shown in table 7. As appreciated on the table, 27 customers represented 80% of the total income on sales, 12 of them are outside Colombia and represented 48% of the sales, the others inside the country represented 32% of the sales. The hugest customer in terms of sales, 23% of the total, has a ratio of purchase frequency of 0.03 while customer in position 9 has a ratio of 10.78. This means customer number 9 is outside the average ratio so it must be treated differently, other customers that must be taken into account are those with ratios

really close to 0 as customer 13, this customer orders almost the same SKUs all the year but it does it really frequently. Some other analysis can be subtracted out of this information, per example, going deeper into the SKUs per customer the analysis shown 65% of the total sales of the customers Pareto's are made with manufactured product while 1.7% are made with Not manufactured materials. Besides this valuable information, 17 customers have a policy of make to Stock represented by 35% of the sales while 10 of the 45% have a Make to order policy.

Country	City	Customer Capstone id	Average number of SKUs per dispatch	Purchase frequency (Times per year)	MTS or MTO customer	Ratio frequency (average SKUs/purchase times)	Percentage of sales participation %	Aggregated percentage
UNITED STATES	PELHAM	Customer 1	8,77	286,00	MTO	0,0307	23%	23%
COLOMBIA	BOGOTA	Customer 2	10,75	1.813,00	MTS	0,0059	14%	37%
COLOMBIA	BOGOTA	Customer 3	7,92	810,00	MTS	0,0098	6%	44%
SPAIN	CALDES DE MONTBUI	Customer 4	23,11	57,00	MTO	0,4054	5%	48%
GERMANY	LUNEBURG	Customer 5	29,15	52,00	MTO	0,5607	4%	52%
UNITED STATES	PENNSAUKEN	Customer 6	5,31	124,00	MTO	0,0428	4%	56%
UNITED STATES	HAMILTON	Customer 7	3,88	41,00	MTO	0,0946	3%	58%
UNITED STATES	BYRON CENTER	Customer 8	3,15	79,00	MTO	0,0399	2%	61%
ECUADOR	AMBATO	Customer 9	291,04	27,00	MTS	10,7791	2%	62%
UNITED STATES	ROSWELL	Customer 10	13,90	51,00	MTO	0,2726	2%	64%
COLOMBIA	BOGOTA	Customer 11	1,39	312,00	MTS	0,0045	1%	65%
UNITED STATES	MARYVILLE	Customer 12	3,24	72,00	MTO	0,0449	1%	67%
COLOMBIA	BOGOTA	Customer 13	1,45	15.196,0	MTS	0,0001	1%	68%
COLOMBIA	BARRANQUILLA	Customer 14	9,35	364,00	MTS	0,0257	1%	69%
COLOMBIA	PEREIRA	Customer 15	8,19	270,00	MTS	0,0303	1%	70%
COLOMBIA	COTA	Customer 16	1,10	242,00	MTS	0,0045	1%	71%
COLOMBIA	BOGOTA	Customer 17	3,04	666,00	MTS	0,0046	1%	72%
MEXICO	DISTRITO FEDERAL	Customer 18	3,64	22,00	MTO	0,1653	1%	73%
UNITED STATES	PELHAM	Customer 19	3,68	25,00	MTS	0,1472	1%	74%
COLOMBIA	BOGOTA	Customer 20	6,10	158,00	MTS	0,0386	1%	75%
COLOMBIA	BOGOTA	Customer 21	2,04	69,00	MTS	0,0296	1%	76%
COLOMBIA	BOGOTA	Customer 22	1,03	76,00	MTS	0,0135	1%	76%
COLOMBIA	CUCUTA	Customer 23	13,81	97,00	MTS	0,1424	1%	77%
COLOMBIA	BOGOTA	Customer 24	3,81	293,00	MTS	0,0130	1%	78%
UNITED STATES	CARSON	Customer 25	18,27	15,00	MTO	1,2178	1%	79%
COLOMBIA	MEDELLIN	Customer 26	1,06	84,00	MTS	0,0126	1%	79%
COLOMBIA	PEREIRA	Customer 27	1,45	101,00	MTS	0,0143	1%	80%

Table 7: Pareto's (80%) customer performance by sales.

4. Integrated Analysis

4.1 Flow Analysis

The first stage of the integrated analysis consists on an overview of the flows on the current layout of the distribution centre, it focalizes on the entries, storage and deliveries by type of product. The figure 11 shows the flows and its interruptions along the process.

4.2. Joint inventories analysis

One of the objectives of the project consists of the merging of a part of the retailer's inventory in the chain located at Bogotá into the new layout definition of the distribution centre to serve some customers directly. The joint inventory analysis consists of a definition of merged inventories scope in days to properly satisfy customer's service levels. The current inventories are defined to have a 90 days policy of store stocks. The model idea is shown on figure 10.

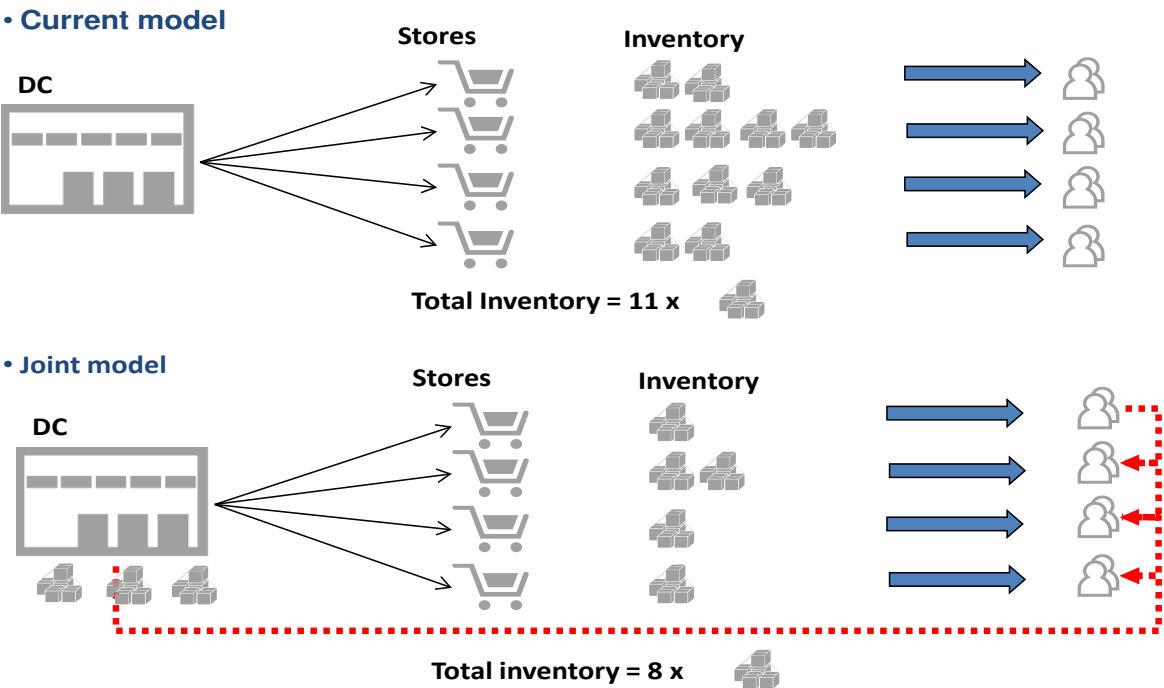


Figure 10: Inventory model intention to attend retailers selected customers.

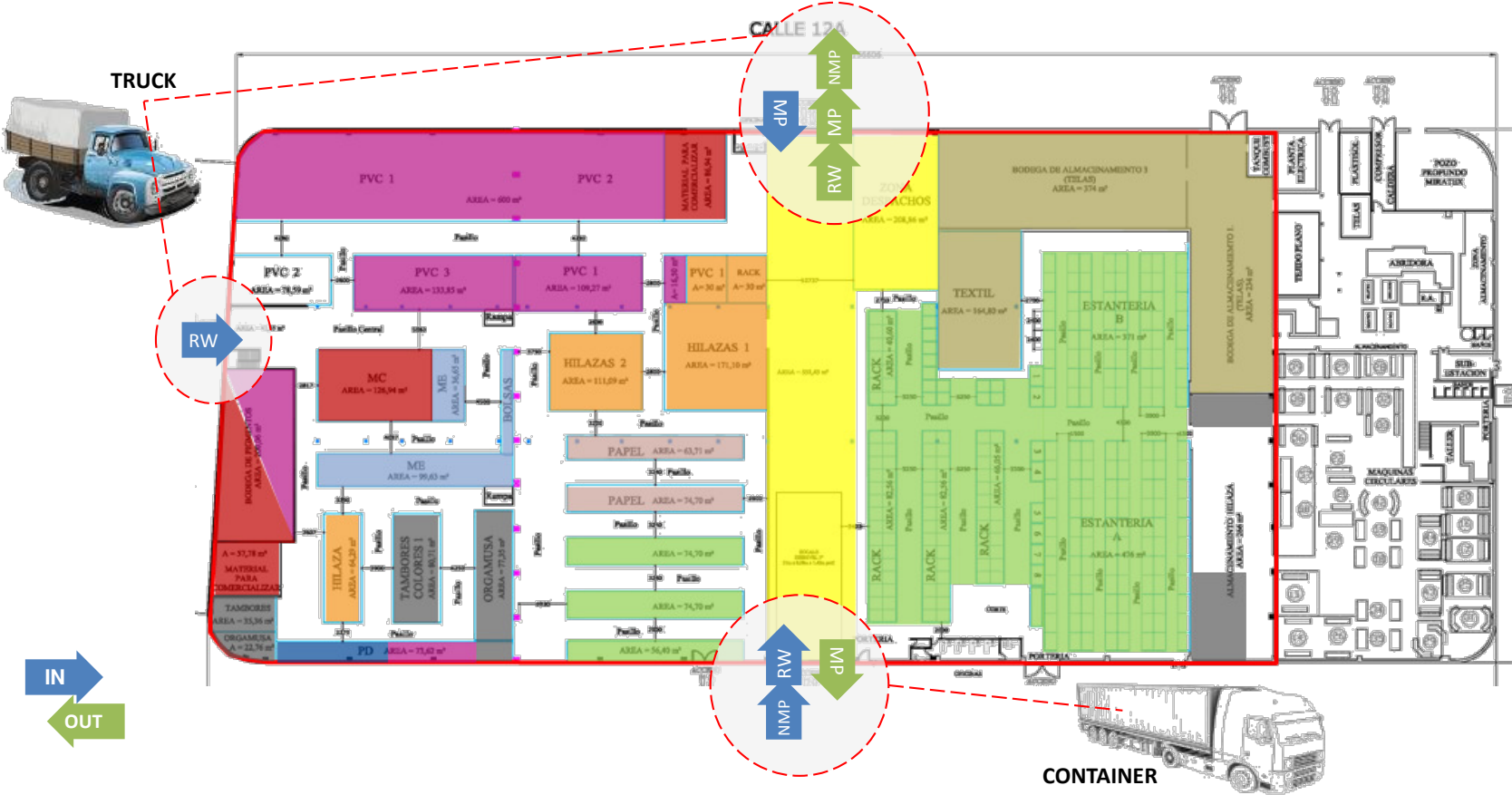


Figure 11: Gates location and type of flow products on them

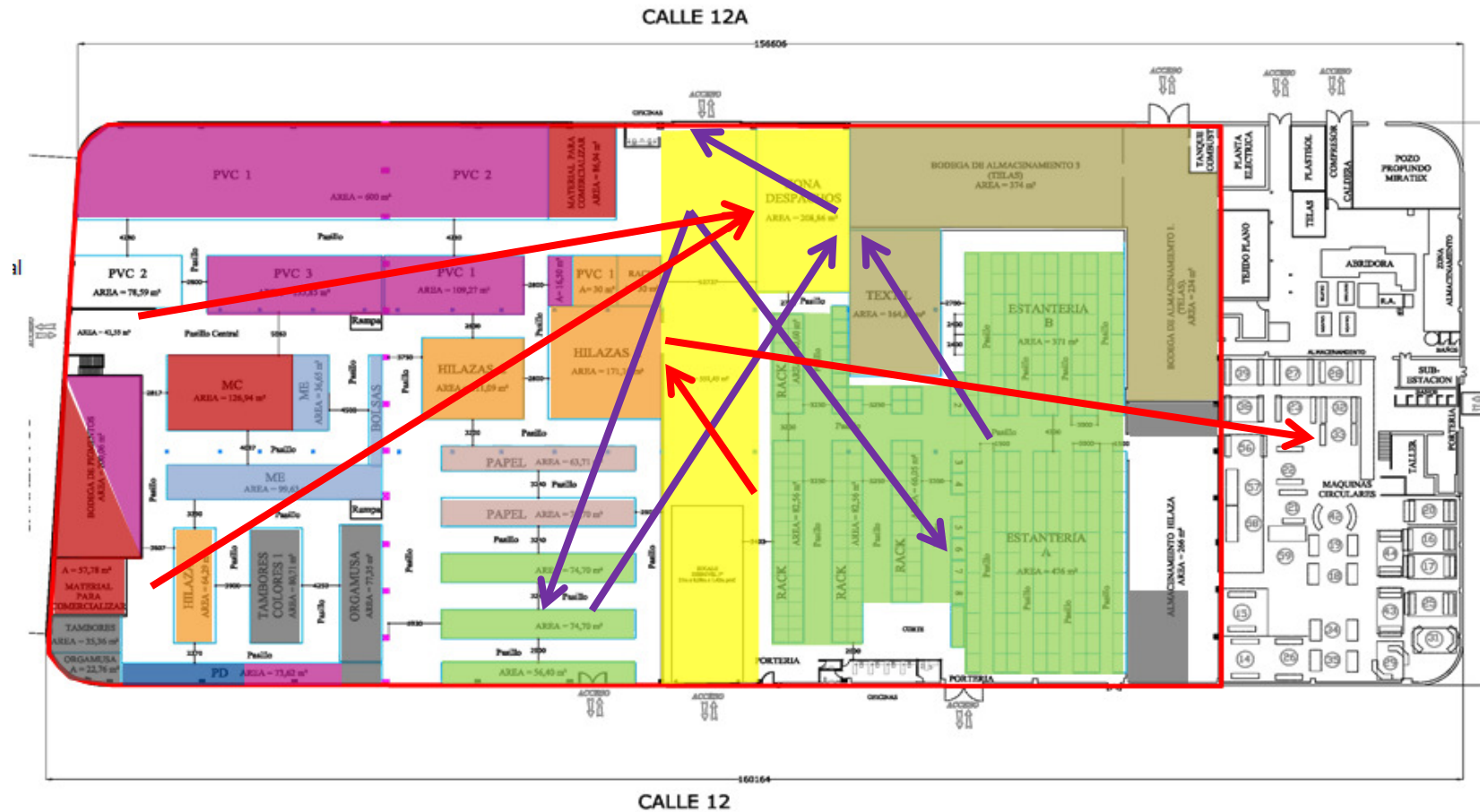


Figure 12: Main current flows on D.C. by type of product.

The concept of the model exposed on the figure 10 is supported in the fact that both links have the same kind of SKUs, the stores have a single supplier and the company D.C. and the retailers have equal policies of stock scope. So, by joining the inventories the total quantity on the entire chain must be reduced by the root square of the total number of stores to merge into a single location. By the other side safety stocks definition on retailers takes into account the lead time of the D.C. to satisfy customers, with this new model the total quantity of safety stocks must be reduced as one of the variables, the DC lead time, is eliminated.

The stock held scope of joint inventories is defined by the following formula:

$$AS(N_2) = AS(N_1) \times \sqrt{\frac{N_2}{N_1}}$$

Where:

N_2 = number of planned future locations

N_1 = number of existing facilities

$AS(N_i)$ = Aggregated stock with N_i locations

The formula will not be applied as the merging of the held stocks on the retailers will not be completely absorbed, just a part of it will be taken to fulfill the customer satisfaction. The methodology that will be applied as explained before is to fulfill 90 days of stock policy for the current demand.

4.3. Layout definition

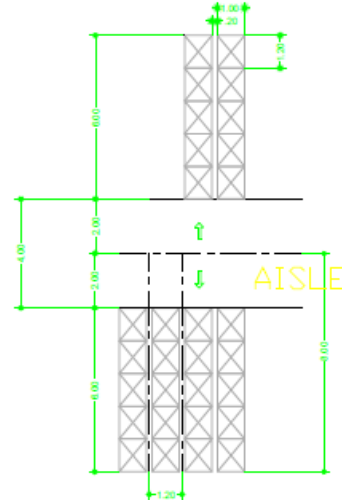
Using the findings of the product analysis and its storing methodology now the macro layout it must be defined. First of all the possible storing alternatives and the product volumes must be matched to fulfill the process flow and the space requirement.

The storing alternatives and the methods used currently and its characteristics are evaluated as follows on chapter 4.3.1.

4.3.1. Current Storing methods

- Raw materials Storing on floor:

Pallet size: 1200 x 1200 x 1800 mm
 Depth: 5 locations
 Aisle: 4000 mm
 Levels: 3 locations
 Max height: 5400 mm

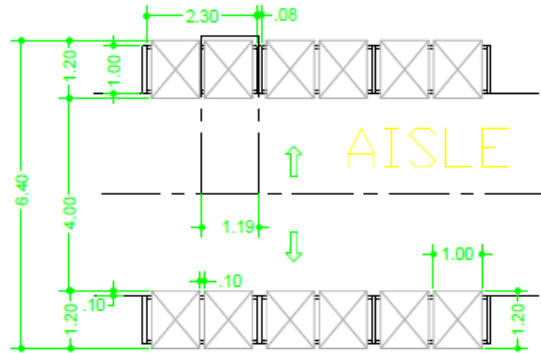


- Racks for MP and NMP

Size: 1500 x 1500 x 1500 mm
 Depth: 1 location
 Aisle: 4000 mm
 Levels: 3 locations
 Max height: 4500 mm

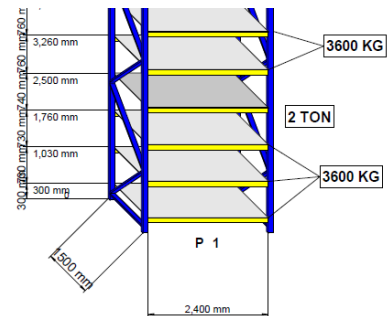
- Simple selective shelf- counter balanced forklift for RW

Size: 1200 x 1000 x 1500 mm
 Depth: 1 location
 Aisle: 3500-4000mm
 Levels: 2 locations
 Max height: 3000 mm



- Mezzanine - multiple shelves for MP and NMP

Size: 1500 x 2400 x 740-760 mm
 Depth: 1 location
 Aisle: 1500 mm
 Levels: 3 shelves per position, 2 levels
 Max height: 4800 mm

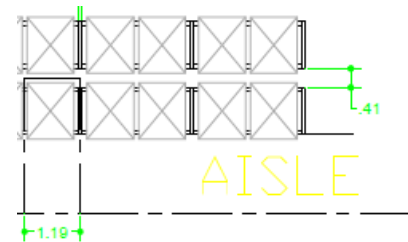


From the alternatives currently used the maximum height of storage of 4800 mm. As mentioned before the total height of the D.C. is 5700 mm, with this in mind these are the possible alternatives selected to be implemented with an increase in the height of the ceiling to reach 7000 mm:

4.3.2. Alternatives for current storing methods.

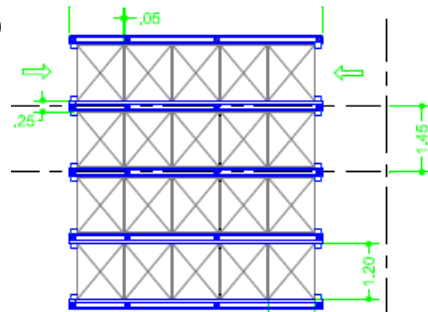
- Double depth selective Shelf – Reach truck (RW)

Size: 1200 x 1200 1500 mm
 Depth: 2 locations
 Aisle: 3300 mm (new equipment)
 Levels: 5 positions
 Max height: 6000 mm



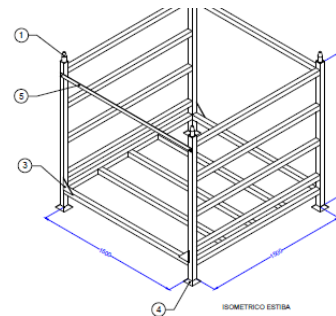
- Raw materials storing- Drive In 4 x 5 (RW)

Size: 1200 x 1200 x 1500 mm
 Depth : 5 locations
 Aisle: 4000 mm
 Levels: 4 positions
 Max height: 6000 mm



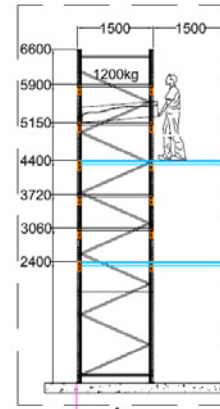
- Fourth level rack (MP & NMP)

Size: 1500 x 1500 x 1500 mm
 Depth: 1 location
 Aisle: 4000 mm
 Levels: 4 locations
 Max height: 6000 mm



- Mezzanine - multiple shelves for MP and NMP

Size: 1500 x 2400 x 660-760 mm
 Depth: 1 location
 Aisle: 1500 mm
 Levels: 3 shelves per position, 3 levels
 Max height: 6600 mm



4.3.3. Alternatives evaluation

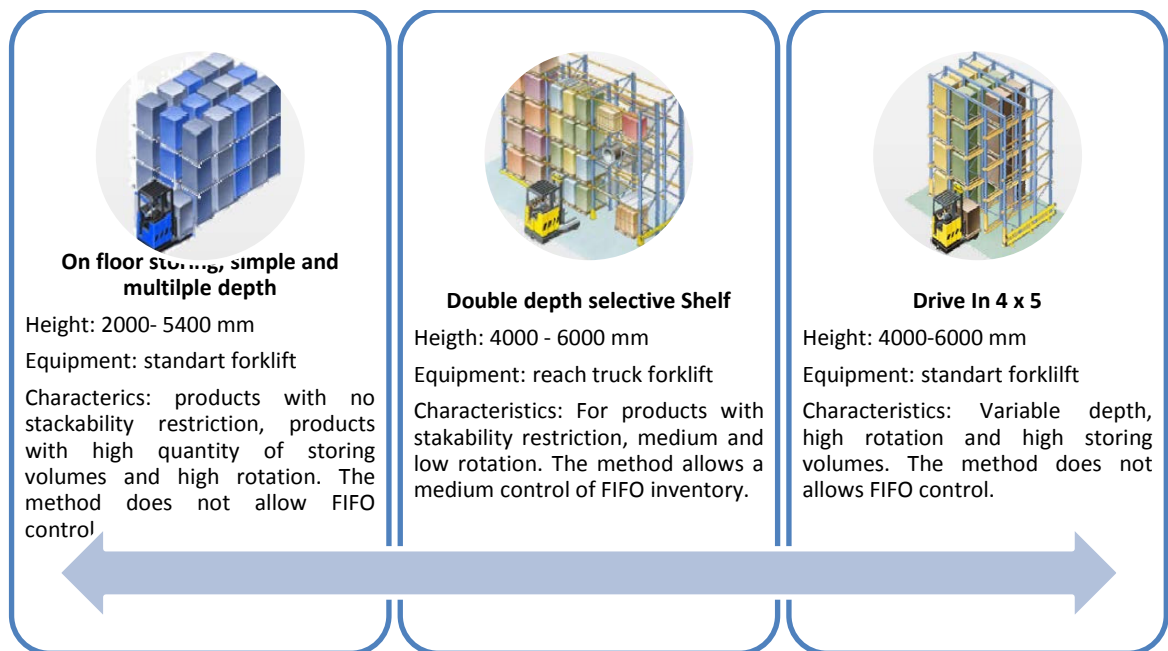


Figure 13: Alternatives for RW storing methods characteristics

All alternatives for raw materials have pros and cons. Storing at floor limits the height due to the stability of the pallets but does not require an investment in infrastructure and is highly flexible. The storage using double depth shelf allows more control on inventory methodology, provides a degree of flexibility that requires medium to high volumes of product in storage and increases the current storage capacity on one level. By the other side requires a medium investment in infrastructure and especially on

equipment that the company does not currently own to reach the second pallet. The third and last alternative on analysis allows increasing the storage height level, requires a high investment in shelves but does not require investment in moving equipment's.

The alternatives to store finished products are the same as those currently used, due to the irregularity of the products (rolls of coated fabric), the difference is basically the increase in height per position for both possibilities. The two solutions increase the storage capacity and therefore the use of the area, but on the other hand reduce the speed of operation and require an investment.

4.3.4. Products matching

The macro layout definition is a combination of several of the alternatives evaluated; the objective is to match products evolution regarding turns per year and volumes on stock with the storing solutions.

In chapter 3.3 an analysis of the inventory evolution was performed, the results of it allows to determine the inventory policies to be applied in each type of product and logistic unit regarding the stock and the storing alternative. In the case of raw materials, which represents 40% of the total area usage, the analysis is based on the current logistic unit, the average month selected (May) of volume on stock, the number of SKUs of the category and a ratio of volume occupancy per SKU. The table 8 shows the values used to select the best alternative to each category of product.

Using the information gathered on the RW matching table 8 and the knowledge of process some conclusions can be made, per example, the category of PVC, yarns and thickeners match perfectly with Drive in storing solution, they have a low quantity of SKUs and a high volume of product on stock. The others categories which have a ratio between 7

and 4 could be stored on double depth shelves and the rest can be stored on simple selective shelves.

Category	Volume on an average month	number of SKUs	Ratio m3/#SKU	Logistic unit
PVC	1.590	30	53,0	BAGS
YARNS	743	21	35,4	BOX
PACKING MATERIALS	293	69	4,2	PACK/BAG
PAPER	203	64	3,2	VERTICAL ROLL
MISCELLANEOUS	182	26	7,0	NOT AVAILABLE
FABRICS	174	77	2,3	HORIZONTAL ROLL
PU	150	122	1,2	DRUMS/BAGS
THICKENERS	101	3	33,8	DRUMS
PLASTICIZERS	92	16	5,8	IBC AND DRUMS
FILLERS	67	14	4,8	BAGS/BOX
PIGMENTS	59	109	0,5	BAGS/DRUMS/BOX
FR FILLERS	55	8	6,8	BAGS/DRUMS
FOAMINGS	27	4	6,7	BOX/BAGS
ACRILICS	23	14	1,6	DRUMS/BAGS
LUBRICANTS	15	9	1,7	BAGS/DRUMS/BOX
DISSOLVENTS	13	6	2,1	DRUMS
STABILIZERS	9	18	0,5	DRUMS/BAGS
ADITIVES	9	24	0,4	DRUMS/BAGS/BOX
ACCELERATORS	5	3	1,7	DRUMS/BAGS
BIOCIDES	4	3	1,5	DRUMS
RW FOR M PROCESS	4	19	0,2	BOTTLE/DRUMS
ADHERENT	0	1	0,3	DRUMS
Total	3.819	660		

Table 8: Raw materials categories match evaluation.

As mentioned before on chapter 4.3.3. the finished products alternatives are equal to the methods currently used but increasing a level of storing height so the analysis must be directed to select the alternative that suits the product turnover and maximize the effectiveness of the operation. To achieve this, a slotting methodology will be used in chapter 4.4.

4.3.5. Macro location- process flows

The final part of the layout design consists on defining the macro positions of the groups following the best practices that better match the process flows and logic movements. The current layout as shown on figure 5 has a mixture of product types over the area, this increases the number of movements that an operator makes to complete an

order and the distances he has to walk. Having these divided locations also makes the area usage efficiency lower as the number of aisles are more than need it and the out/in doors are misallocated. The first change on the layout consist on moving all raw materials and WIP to a single area located as close as possible to the manufacturing process, this means the finished products must be moved and allocated at the left side of the blueprint while the raw materials are now at the right side all in one single place. The second part of the macro movement consists on placing the products with highest turns closer to the doors to reduce the numbers of movements the operators have to do. Per example, for the raw materials the product with highest turns per year and inventory is the PVC this product is used on the manufacturing plant and must be closer to the Raw materials exit door, another example are the yarns, these are used on the manufacturing plant that is located at the same building of the D.C. (right side), so they must be closer to the plant to reduce the distance they have to travel.

In order to select the macrolocation of the finished products a discussion was conducted with respect to the forecast of the upcoming years in order to know the typology of dispatches that the company will have in the future, the conclusion showed that the industry in which the company is immersed and where it wants to strengthen is increasingly focused on the retail market. Taking into account the above the company has decided that the storage alternative that best fits this process is the shelving in mezzanine as it allows faster extraction of the product as the alternative in racks. The conclusion indicates that the mezzanine must be allocated closer to the receiving and exist doors, this means it will be placed at the middle hall of the D.C.

The final allocation to consider is the position of the doors that consequently encloses the preparation zones. Nowadays the D.C. has three possibilities of in/out process,

this makes the operation flows intersect and the optimization of operations more complex. In order to achieve a cleaner process flow, the entries and deliveries must be located against each other to allow the product to transit through the installation without obstacles. Analyzing the doors and taking into account the cars transit flow of the avenues surrounding the D.C., the gate located at the left side of the blueprint is the most hampered due to the inability of using the outside zone as parking for the delivery and receipt trucks, it's also the gate positioned in 90° with respect to the other gates creating more flow chaos.

4.3.6. Layout proposed

As result of the analysis generated in the previous parts of the chapter the macro layout definition and its flows are show in figures 14 and 15. As appreciated in the new layout, the flows proposed are cleaner due to the new methodology of location of the products that takes into account the number of movements performed per SKU, it also completely separates the types of products, those directed to the manufacturing plant from those going to our direct customers. To accomplish this proposal some minor changes on the floor and walls infrastructure must be performed and are shown on figure 16.

It should be also noted that all of the zones proposed take into account the current and future space requirements using the new alternatives of storage and the volumes of products on stock. It also presents a new order preparation area located immediately next to the local distribution gates that allows the company to reduce the amount of time required to load and unload trucks and containers; this reduces the amount of money investment required on more gates and increases the planning and organization of the installation.

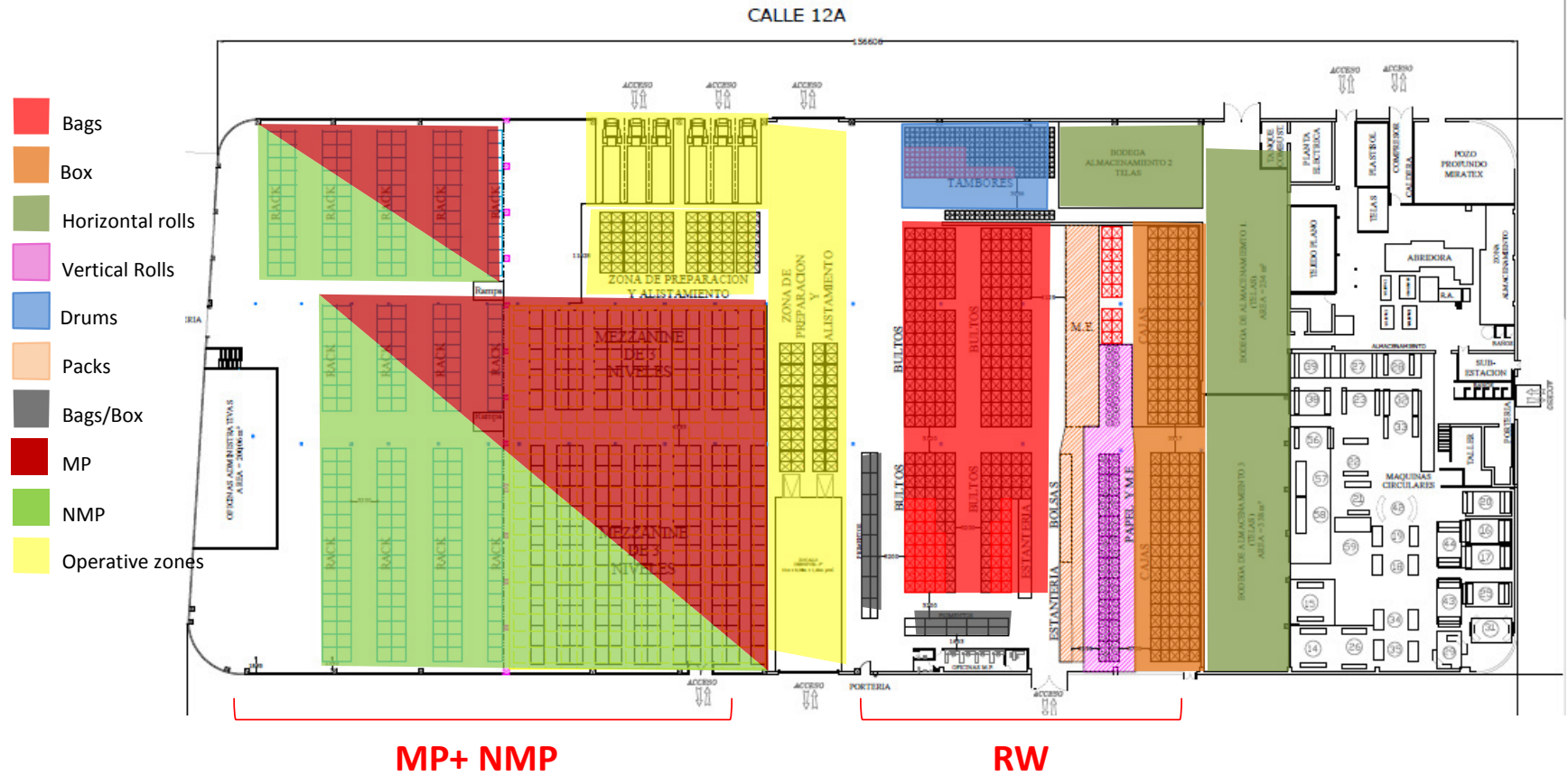


Figure 14: Macro Layout products location proposed

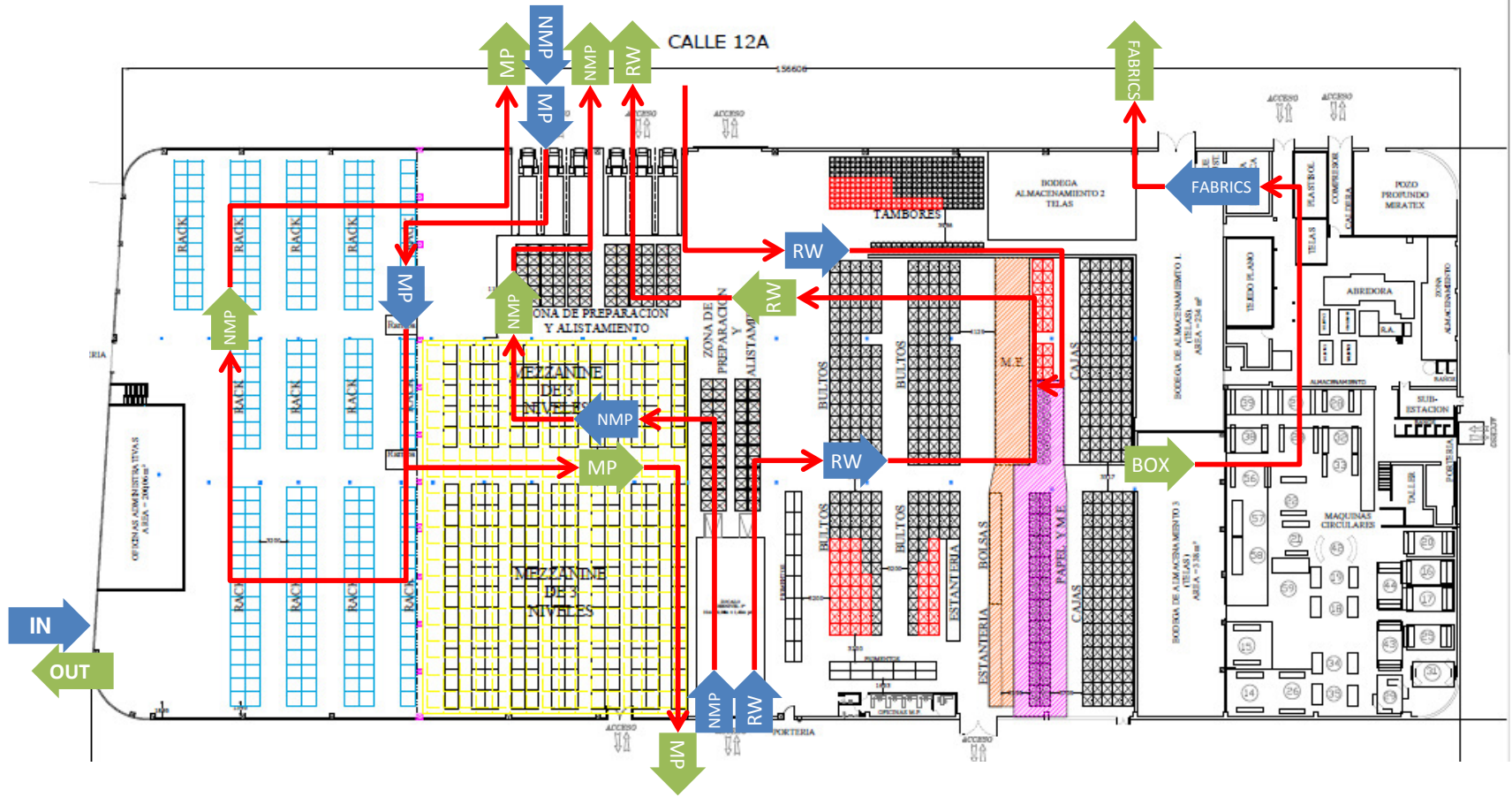


Figure 15: Layout proposed - products flow

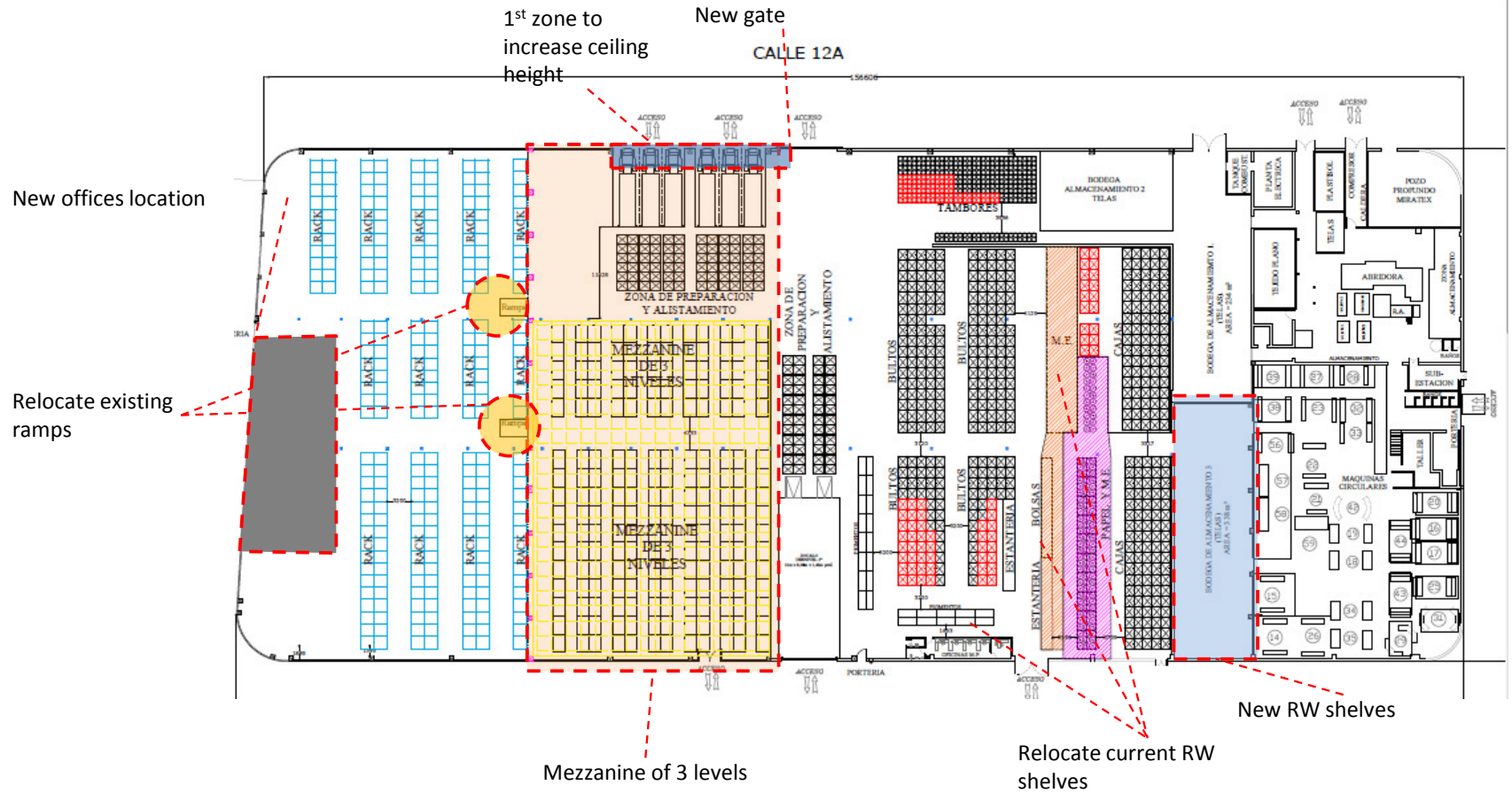


Figure 16: Structural changes to the distribution centre

4.4. *Slotting*

This chapter is about designing a methodology on excel to allocate products into the distribution centre with the purpose of optimizing the material handling efficiency. The idea of the methodology consists on identifying the best place for products with certain characteristics such as; turns per month, volumes on storage, physical characteristics, ergonomics and load buildings on designed locations.

The Slotting method designed for manufactured products and not manufactured takes first into account the quantity of movements that all SKUs had in the year, taking this into account evaluates the average volume on stock on cubic meters and then as result of it determines the average volume per movement. After this, taking into account the stock policy of the company for the product, calculates the average quantity on inventory and then selects the method of storing required for the product (rack or shelf). The selection is made through a comparison of the volume on stock against the capacity volume of the rack ($1.5^3 mt$) and the shelves ($1.2 \times 0.7 \times 1.5 mt$), the methodology selects between these options checking if the volume on stock resulted of the previous stage is superior to $3.4 mt^3$, if that's the case selects the racks, if it is inferior to it selects the shelves. After selecting the method of storing it checks the total quantity of locations required and aggregates them to compare them to the number of racks units available, if the resulting number of units required is higher to the existing it starts placing products on shelves. Finally it compares the aggregated locations required with the number of racks available on first level (total number of racks divided by three levels), if the aggregated result is higher to the number of on floor positions it starts placing products into the second level of the

selected storing alternative and continues. On figure 17 an example of the slotting for NMP and MP is shown.

The slotting methodology for raw materials is basically the same, first the volume on stock is compared with the number of average movements of the SKU through the year, then based on the stock policy the stock on cubic meters is calculated. Once the volume is considered the quantity of pallets is calculated as result of the size of the pallet for each logistic unit. Per example the pallet size for PVC bags is $1.4 \times 1.2 \times 1.8 \text{ mt}$, a total of 3 cubic meters, this value is the one used to calculate the number of pallets required for the SKU, then this value is compared with the storing alternative, so finally the quantity of pallets is divided by the number of pallets per lane to obtain the quantity of lanes required. An example of this slotting methodology is shown of figure 18.

As appreciated both methodologies are mostly the same but differ because they have different objectives, in the case of finished products the idea is to optimize the dispatches through optimization of the movements required to complete an order. In the case of the raw materials the idea is to allocate the major volumes on stock through the quantity of movements per year to optimize the area utilization ratio in the macro positions defined.

Orig	SKU	Descp.	Type	Logistic uni	TOT Lin year	AVE Lin Month	TOT m3 year	AVE m3 month	m3 x Lin	Inv Φ (m3)	Inv Φ (m3)	Type	Inv Φ (Ubic)	Month INV	Months INV	SKU on Master	Q. locatio	Aggre locations	Level
CD	065466	ASSIA SUPRA NEGRO	PM	ROLLO	972	81	175,0	14,6	0,2	20,1	20,1	Rack	6	1	1,4	SI	6	6 Nivel 1	
CD	067218	PRANNA. NEGRO	PM	ROLLO	848	71	310,0	25,8	0,4	33,8	33,8	Rack	10	1	1,3	SI	10	16 Nivel 1	
CD	078843	CUEROTEX NEGRO	PM	ROLLO	838	70	185,5	15,5	0,2	14,5	14,5	Rack	4	1	0,9	SI	4	20 Nivel 1	
CD	075929	PISO CUADROS NEGRO	PM	ROLLO	608	51	59,5	5,0	0,1	4,5	4,5	Rack	1	1	0,9	SI	1	21 Nivel 1	
C1	0051365	PANO ABSORBENTE ESTAMPADO	PNM	ROLLO	249	50	25,6	5,1	0,1	5,1	5,1	Rack	2	1	1,0	SI	2	23 Nivel 1	
CD	074385	ARKANSAS NEGRO	PM	ROLLO	582	49	114,8	9,6	0,2	3,6	3,6	Rack	1	0	0,4	SI	1	24 Nivel 1	
CD	072276	PISO HARD 2093	PM	ROLLO	572	48	171,8	14,3	0,3	10,0	10,0	Rack	3	1	0,7	SI	3	27 Nivel 1	
CD	032863	PISO TOYOTA-RF 2093	PM	ROLLO	564	47	185,3	15,4	0,3	13,6	13,6	Rack	4	1	0,9	SI	4	31 Nivel 1	
CD	073725	VENTURA NEGRO	PM	ROLLO	519	43	170,2	14,2	0,3	10,3	10,3	Rack	3	1	0,7	SI	3	34 Nivel 1	
CD	081192	PRANNA. CHOCOLATE	PM	ROLLO	487	41	103,1	8,6	0,2	10,3	10,3	Rack	3	1	1,2	SI	3	37 Nivel 1	
CD	078841	CUEROTEX CAFE	PM	ROLLO	479	40	72,9	6,1	0,2	5,7	5,7	Rack	2	1	0,9	SI	2	39 Nivel 1	
CD	076600	PISO HARD POL 2093	PM	ROLLO	426	39	162,0	14,7	0,4	14,5	14,5	Rack	4	1	1,0	SI	4	43 Nivel 1	
CD	075257	CUEROTEX CAFE CLARO	PM	ROLLO	449	37	50,3	4,2	0,1	3,8	3,8	Rack	1	1	0,9	SI	1	44 Nivel 1	
CD	076812	ARKANSAS LISO NEGRO	PM	ROLLO	442	37	166,2	13,8	0,4	7,9	7,9	Rack	2	1	0,6	SI	2	46 Nivel 1	
CD	076583	LONA CARIBE BLANCO	PM	ROLLO	441	37	74,7	6,2	0,2	6,9	6,9	Rack	2	1	1,1	SI	2	48 Nivel 1	
C1	0029759	ARKANSAS LISO NEGRO	PM	ROLLO	183	37	23,9	4,8	0,1	4,8	4,8	Rack	1	1	1,0	SI	1	49 Nivel 1	
CD	079497	PRANNA. CAPUCHINO	PM	ROLLO	439	37	56,6	4,7	0,1	4,2	4,2	Rack	1	1	0,9	SI	1	50 Nivel 1	
CD	075930	PISO CUADROS AZUL	PM	ROLLO	393	33	33,3	2,8	0,1	3,7	3,7	Rack	1	1	1,3	SI	1	51 Nivel 1	
CD	064418	ASSIA SUPRA BLANCO 2	PM	ROLLO	382	32	32,6	2,7	0,1	4,3	4,3	Rack	1	2	1,6	SI	1	52 Nivel 1	

Figure 17: Slotting example table of MP & NMP

SKU	Desc.	Logistic Unit	TOT Lin Year	AVE Lin Month	TOT m3 Year	AVE m3 Month	m3 x Lin	Inv Φ (m3)	Inv Φ (pallet)	Inv Φ (Lane)	Month INV	Unit
008461	PVC 450	BOLSA	205	17	2.025,1	168,8	9,9	253,5	84	6	1,50 KG	
065828	PVC ECOLVIN G 74	BOLSA	257	21	2.363,4	196,9	9,2	356,1	118	8	1,81 KG	
008466	PVC 500	BOLSA	125	10	925,0	77,1	7,4	183,9	61	4	2,39 KG	
103298	PVC 550	BOLSA	32	4	228,7	25,4	7,1	47,5	16	1	1,87 KG	
008434	LACOVYL PE 1311-H	BOLSA	266	22	1.824,2	152,0	6,9	369,5	122	8	2,43 KG	
066031	PVC ECOLVIN E 67	BOLSA	153	13	917,9	76,5	6,0	145,3	48	3	1,90 KG	
107973	PVC ECOLVIN T 68	BOLSA	185	15	1.048,0	87,3	5,7	158,4	52	3	1,81 KG	
na31	LACOVYL PB 1704 GENERICO	BOLSA	1	1	5,1	5,1	5,1	0,4	0	0	0,08 KG	

Figure 18: Slotting example table of RW

4.5. *Service segmentation*

The final chapter of the paper consists on differentiate levels of service to be provided to customers of the distribution center. The importance of this segmentation is that by reducing the gap between the variations of the demand and the distribution flexibility a competitive advantage can be achieved.

As noted in Chapter 3.4.3 Proquinal has 213 clients with different purchasing behaviors. For example as shown in Table 7, the customer number 1, with a percentage of 23% of total sales, has a SKU ratio per number purchasing times of 0.03, this means that the distribution center performs many more preparing operations than those perform for client number 9 whose ratio is 10.77, this customer on contrary orders many more SKU per purchase but less times per year allowing the centre to plan then better. The above ratio will be the first variable to determine the service segmentation, the other variables to be taken into account are the strategic objectives defined by the commercial area and the competences of the DC derived from the slotting methodology.

The segmentation of the customers will be the result of the evaluation of the three aspects mentioned before into one single tier indicator.

The values derived from the assessment ratio related with the values of the margin of the customers whose performance was positive over the year are shown of figure 19. As appreciated on the figure there are several customers whose performance was over the average of the margin during the year but most of them are located in the zone where the logistic ratio is below 3, this means they purchase a lot of times small quantities of SKUs. This kind of service requires medium speed on the operation and large quantities of stock of the selected products. The strategy for these products consists on a joint work between

customers and the company, the main idea is to reduce the requirements on working capital represented in inventories through information sharing (replenishment plans and sales forecasts) these customers over the 50% of margin with ratios between 0 and 3 will be considered the company tier I segmentation.

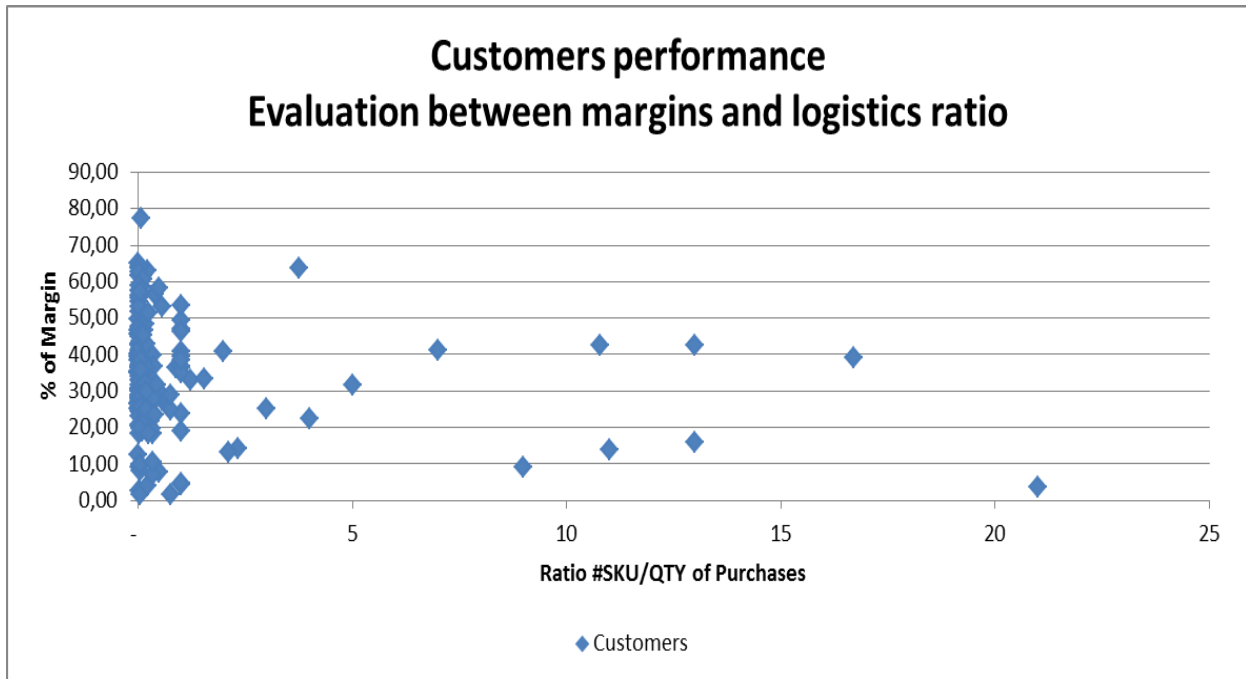


Figure 19: Relation between margin and logistic ratio of performance on dispatches

The middle tiers are conformed of those customers which ratio is between 0 and 1 and those higher than 3 all with margins between the average and 50%. The customers with ratios between 0 and 3 with lots of orders per year will have a special strategy where the company will offer discounts for full loads trucks in order to move them to higher ratios along with the others of the segment. The main idea of this tier is to increase the time between order cycles to reduce the amount of work dedicated to them on the D.C. by offering shorten delivery time promised.

The basic service tier is characterized by those customers with margins below the average and small ratios. These customers will have a standard delivery time and will follow the other tiers in which concerns to the priorities on the D.C..

5. Conclusions

The most important conclusion of this paper is the value of acknowledge the resources of a company when defining service strategies to increase the competitive advantages. As evidenced through the development of the different analysis of Proquinal's supply chain there are several variables that directly affect the company performance and its market scope. This alignment of the resources and the strategic perspective will allow the company to overcome its current success and support its continuing growing.

A lot of the conclusions of the paper are within the analysis performed of the operations, the summary of some aspects about the development of the layout definition are:

- The highest opportunity to increase the efficiency of the area usage was on organizing correctly the raw materials; the ratio was improved by defining storage options that fit the materials movements, stocks and turns and thus reducing the amount of aisles required.
- The slotting methodology allows the company to improve the efficiency on movements on the D.C. this decreases the operation costs and increases the customers satisfaction.
- One of the major drivers of the storing alternatives selection is the future perspective of the company, as the theory and history shown most of the long term forecasts are mistaken, the way how logistics solutions were

selected leaves a wide margin of flexibility for the company that allows changes in the environment and macrosystem to have less impact on the competitiveness of the company.

- The joint inventories solution proposed for customers in Bogotá does not involve a huge increase on the stock volumes but instead leads to reductions on the total stocks through the supply chain links of the company.

Finally, not all the work is done, now the company has to improve the methodologies proposed and implement new ways to reach those customers that nowadays are with our competitors or outside our global scope. An analysis on the operations equipment's is the following stage for the D.C., this surely will improve the current operations leading the company to its goal, be a world leader with world class pride of its supply chain.

6. References

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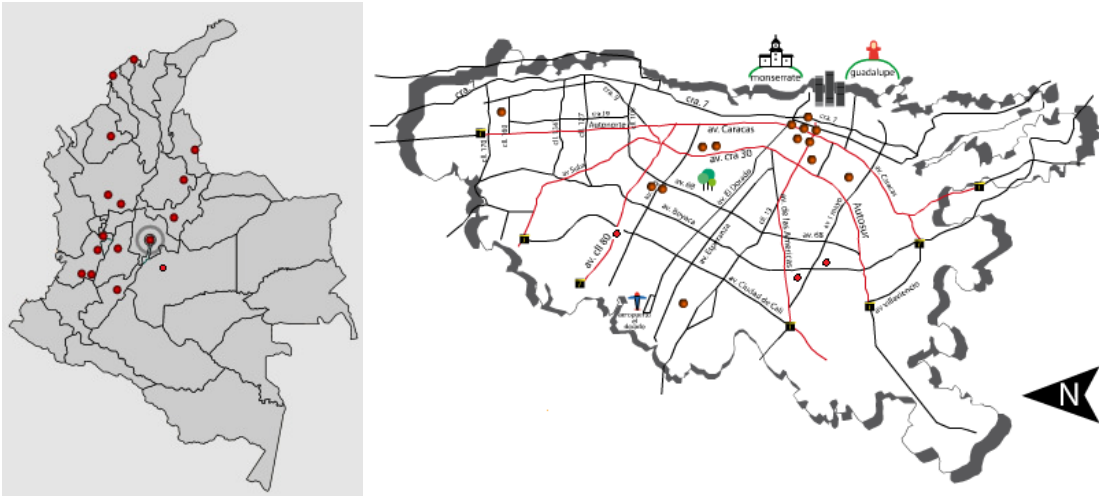
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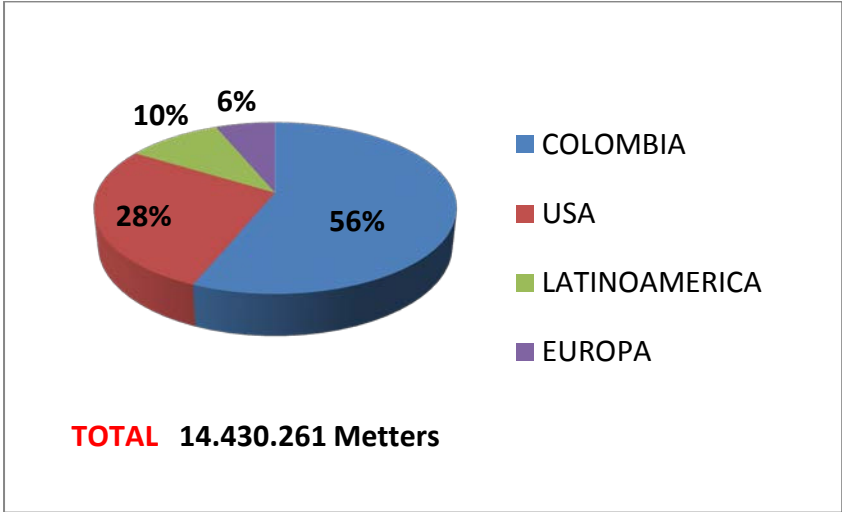
7. Exhibits

Exhibit 1.



Colombia and Bogotá distribution of the retailers sale stores.

Exhibit 2.



Sales participation per marketing locations in meters of finished product.

UNIVERSIDAD DE LA SABANA
INSTITUTO DE POSTGRADOS- FORUM
RESUMEN ANALÍTICO DE INVESTIGACIÓN (R.A.I)

No.	VARIABLES	
1	NOMBRE DEL POSTGRADO	Especialización en Gerencia Logística
2	TÍTULO DEL PROYECTO	REDESIGNING PROQUINAL'S DISTRIBUTION CENTER USING SERVICE LEVEL ORIENTATION
3	AUTOR(es)	BARACALDO APONTE JUAN CARLOS
4	AÑO Y MES	Febrero de 2013
5	NOMBRE DEL ASESOR(a)	N/A
6	DESCRIPCIÓN O ABSTRACT	<p>Purpose: Increase customer satisfaction, sales and cost optimization by redesigning Proquinal's distribution centre using a service level orientation</p> <p>Approach: Blending warehouse design methodologies, slotting layout definitions and customer segmentation to align physical resources with current assets.</p> <p>Findings: Deliveries typologies, entries and inventories seasonality, and product slotting are now aligned to match customer expectations by a new layout definition of the DC.</p> <p>Originality: Companies that define its service level strategy based "just" on commercial ratios, should look deeper into their physical resources and processes to include SCM and its clear understanding of the capabilities in order to exploit opportunities and increase competitive advantage from core business realities.</p>
7	PALABRAS CLAVES	Keywords: Warehouse design, service level segmentation.
8	SECTOR ECONÓMICO AL QUE PERTENECE EL PROYECTO	MANUFACTURA
9	TIPO DE ESTUDIO	TRABAJO APLICADO
10	OBJETIVO GENERAL	<p>The objective of this paper is to define and align Proquinal's service strategy for internal and external customers, taking into account the characteristics of their current resources, the resources required and the flow of operations with the recent acquisition of the retailers' chain in Bogotá. The main idea is to determine a layout for the D.C. that fits the service strategy, that is achievable and that takes into account the operational and tactical aspects that the company currently has.</p> <p>The importance of this work is that many companies currently determine strategies that are not supported by their resources and processes. Therefore it is vital to analyze the company's current operation in order to determine how far existing resources could go, which others are need, and from there, what can it be promised to customers and how to do it.</p>
11	OBJETIVOS ESPECÍFICOS	N/A
12	RESUMEN GENERAL	<p>Nowadays the company is facing problems in its supply chain because, as described before, it has acquired a retail stores chain that has particular characteristics (customer expectations, orders frequency, orders size, products variety, commercial negotiations, multiple locations, movements speed, information technologies, service promise, etc). These variables directly affect the current joint infrastructure in terms of human resources, facilities, equipment and strategy. Some examples of the issues the company is struggling are:</p> <ul style="list-style-type: none"> · Multiple repeated operations to reach the final customer · High joint inventory levels due nodes proliferation · High cost of distribution operations · Investment on multiple warehouses and inadequate use of fixed equipment <p>This actual distribution makes the logistics operations inefficient because in many cases the company is loading materials in the distribution center, transferring them to the city small warehouses called "lungs", once there, they are downloaded and then transferred to storage (5 levels/floors above the entries), there, they are stored and entered into the inventory systems manually and then finally they have to be released in order to be redistributed to retail outlets or customers.</p> <p>Within the operation of the company's distribution and service are other important variables as the market variation, this has increasingly shown that the counter sales are tending to decrease and the wholesale customers are constantly growing. Other fact is that current customer requires the product manufactured grouped with complementary products not manufactured that has changed the supply chain (distribution and delivery) in terms of costs, inventory planning and service performance. Based on the above issues the strategic model of supply it's not what the customer requires and what the company wants to have.</p> <p>So, based in the above Proquinal should analyze its current strategy and operations in order to redefine its goals, to accomplish better service and achieve synergies between the existing divided supply chains.</p>
		<p>The most important conclusion of this paper is the value of acknowledge the resources of a company when defining service strategies to increase the competitive advantages. As evidenced through the development of the different analysis of Proquinal's supply chain there are several variables that directly affect the company performance and its market scope. This alignment of the resources and the strategic perspective will allow the company to overcome its current success and support its continuing growing.</p> <p>A lot of the conclusions of the paper are within the analysis performed of the operations, the summary of some aspects about the development of the layout definition are:</p>

13	CONCLUSIONES.	<p>· The highest opportunity to increase the efficiency of the area usage was on organizing correctly the raw materials; the ratio was improved by defining storage options that fit the materials movements, stocks and turns and thus reducing the amount of aisles required.</p> <p>· The slotting methodology allows the company to improve the efficiency on movements on the D.C. this decreases the operation costs and increases the customers satisfaction.</p> <p>· One of the major drivers of the storing alternatives selection is the future perspective of the company, as the theory and history shown most of the long term forecasts are mistaken, the way how logistics solutions were selected leaves a wide margin of flexibility for the company that allows changes in the environment and macrosystem to have less impact on the competitiveness of the company.</p> <p>· The joint inventories solution proposed for customers in Bogotá does not involves a huge increase on the stock volumes but instead leads to reductions on the total stocks through the supply chain links of the company.</p> <p>Finally, not all the work is done, now the company has to improve the methodologies proposed and implement new ways to reach those customers that nowadays are with our competitors or outside our global scope. An analysis on the operations equipment's is the following stage for the D.C., this surely will improve the current operations leading the company to its goal, be a world leader with world class pride of its supply chain.</p>
14	FUENTES BIBLIOGRÁFICAS	<p>Frazelle, E. (2007). World-Class Warehousing and Material Handling.</p> <p>Stock, James R. (2001). Strategic Logistics Management. Boston. 872 P.</p> <p>Wouters, J. (2001). Customer service as a competitive marketing instrument: an investigation into the construction and measurement equipment supply chains.</p> <p>Bartholdi, J. J., and Hackman, S. T. (2011). Warehouse and Distribution Science, Version 0.95.</p> <p>Meller, R. D., and Gue, K. R., (2009). The Application of New Aisle Designs for Unit-LoadWarehouses</p> <p>Bossidy, L & Charan, R (2002). The Discipline of Getting Things Done.</p>