POLITECNICO DI TORINO

Master of Science in Engineering and Management

Master of Science Thesis

Sizing, shelving and flow optimization of a warehouse

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October 2021

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Introduction

The following report is aimed at describing the project activity relating to data analysis and sizing of a warehouse. The goal of the internship was the application of lean methodologies to the logistics system with the aim of improving its operational efficiency in terms of safety, quality and productivity. The work deals with the methodologies and aspects to be considered that underlie the choice, design and construction of a warehouse, highlighting all the factors that contribute to its sizing. The main problem to be faced in the sizing of a warehouse consists in the optimal use of the available surface in order to ensure the efficiency and effectiveness of the operations that take place there.

In this regard, the thesis has been divided into a series of chapters, each dedicated to the development and deepening of a specific theme.

The first chapter briefly describes the company, its peculiar characteristics, products and work environment.

Then, the second chapter describes the "As-is" situation of the warehouses, and so the issues that have made some improvement actions necessary and some theoretical hints of the methodology used.

The document continues with the third chapter, which illustrates the measures taken for the sizing of the final warehouse, starting with the data collection, passing through the offers of suppliers up to the final layout.

Starting from Grom's needs, we came to the design of a layout, a product allocation policy, the definition of the critical activities to be implemented and the suggestion of some development guidelines to improve product management.

1. GROM – Il gelato come una volta

1.1 The company

Gromart s.r.l. – best known as GROM – is an Italian company dedicated to the production of ice cream. Its manufacturing plant is based in Mappano (Turin) and it has more than 50 shops all over the world. Grom's story begins in 2003 with a small ice cream shop in the center of Turin, two friends and a dream: trying to make the best ice cream in the world. "Our products are made with care, choosing the best that nature has to offer, with no tricks or shortcuts.". The company has always defined their ice cream with the simple claim "as it once was" because it is produced without the use of dyes, emulsifiers and aromas and, for this reason, it derives its taste and its color only from the raw materials used, according to seasonality and availability.

After some months from the inauguration of the first shop, the two owners Federico Grom and Guido Martinetti opened new stores both in Turin and in Italian cities; in addition to that, the company set up branches abroad, starting in 2007 in New York, followed by shops in Dubai, Paris, Hong Kong. The diffusion of the stores worldwide was possible thanks to the centralization of the production. In the only laboratory in Turin they prepare liquid mixtures, which are distributed, thanks to a careful management of the cold chain, to individual ice cream shops, where they are whipped fresh for customers. The centralization of the first phase of production (the mixing of ingredients) helps Grom to maintain constant production rigor and allows them to purchase certain types of fruit available only at the respective consortia and not at the general markets of each city.

In 2015 the company was acquired by Unilever, one of the largest multinational food corporations. In 2020, there was a change in the vision, projecting it over the medium and long term. Indeed, Grom decided to explore new channels, aiming at the large-scale distribution. Initially conceived as ice-cream shop, Grom now competes both at local level with its *gelaterie* and internationally with its packaged products. The following paragraph provides a list and description of the different goods sold by the company.

1.2 The products

Grom's products range consists of ice creams, ice sticks and packaged products (see Figure 1). In the following list, all products are briefly described:

- *Pint* - This product can be found in the ice-cream shops, in supermarkets and in some bars. It is a packaged ice cream jar made with the same liquid mixture delivered to the shops, but it already has the inclusions in it and is ready to be consumed.
- *Minipot* - It is the small version of the pint. They are sold in bars and tourist resorts.
- *Back of house* – It is a large version of the pint (more than 1 kg of weight); they are intended for hotel and restaurants.
- *Ice stick* - Made simply with a mixture of fruit, sugar and water, they are sold in the ice-cream stores, in the supermarkets and in bars.
- *Mixture Bags* – They are products for the ice-cream shops that receive the liquid mix of the ice cream in special plastic bags. Once bags are delivered to

the shops, the semi-finished products are mixed, and inclusions are added in order to obtain the final products.

- *Biscuits* - This category includes different formats (single-serve packs, small or big packages) and flavours; in addition, some of them are used as inclusions for the ice cream.
- *Prepackaged ice-cream cones* – The new entry in stores, supermarkets and bars. They are made with the same mixture used for pints.

Figure 1 – Some of Grom's products: Tiramisù pint; ice sticks; prepackaged ice-cream cone

In addition, Grom sells other finished goods, as milkshakes, jams, pralines, hot chocolate, ice cream sandwiches.

1.3 The work environment

The work environment is the place where most of the day is spent and for this reason it must guarantee every professional livability and comfort, with spaces suitable to meet everyone's needs. This would in fact allow the development of creativity, organization, order and planning.

Being Grom a Small-Medium sized business, all the employees of the company know each other, facilitating communication among different departments. Management offices are close to the production plant, so engineers, managers and workers can have a direct contact. From the first moment, Grom's workers try to get you into their ecological, qualitative and continuous improvement perspective. For example, they are very sensitive and strict about not using gluten within the plant. In this way it is easy to perceive the passion and seriousness in the workplace. In my period as a trainee in Grom, I found a friendly, helpful and professional work environment, where everyone makes themselves useful and where it is possible to learn easily.

2. Need for a new warehouse

This chapter analyses the current situation of inventory flows in Grom production plant. The analysis was carried out in direct contact with Grom's personnel; in particular, it was very important to interact with line operators and warehouse workers.

2.1 The warehouse

Each industrial and commercial reality dedicates a special space for the containment of raw materials, semi-finished and finished products: the warehouse. It is the place where orders and shipments are managed, strictly connected to the production activities and the receipt of the products themselves; it is one of the primary sources of physical and information flows. However, the warehouse should not be seen uniquely as a place to store goods, but as a well-balanced system of people, infrastructures, technologies and means. For these reasons, the warehouses deserve an in-depth study that allows us to investigate the organization, management and processing of the data and information that are generated and that flow into this place.

It is important to keep in mind that warehouses can have different sizes, depending on the company activities, the volumes produced and handled, the stock of goods and therefore the company strategy adopted.

The main objective of the storage activity is to satisfy the customer by minimizing costs for the company, by keeping the right quantities of products (to promptly respond to customer requests), in the most appropriate place for both management and size. According to the Toyota Production System, "The virtuous company is the one that is able to manage its business by zeroing stocks"; this purely theoretical consideration indicates how it is necessary to keep the level of stocks under control and reduce it to a minimum. Despite this, there are several reasons why the company finds benefits in having a warehouse: first of all, it allows you to manage the unpredictability of events that often causes production blocks or customer dissatisfaction due to delivery delays; secondly, it makes it possible to manage fluctuations in demand due to seasonality, trends or causes that are not easily identifiable and therefore not manageable, making it possible to cope with sudden requests, therefore dampening irregularities; it also protects the company from suppliers who do not respect delivery dates and allows you to manage the procurement of those rare or difficult to find raw materials/products; it protects against fluctuations in the price of products; finally, it allows you to purchase larger quantities of goods and thus take advantage of quantity discounts. Food companies of seasonal products, such as the one analysed in this text, are particularly affected by fluctuations in demand and prices, as well as the unreliability of suppliers of sought after and not very widespread products, here is that the warehouse allows to cushion the possible negative effects of these issues.

The goal of minimizing operating costs means that an accurate and always careful management of the following cost items is implemented:

- Economic costs: these are those that arise from the immobilization of capital.
- Reception activities: the operators assigned to storage tasks take care of stocking, picking, packaging, shipping.
- Surface: each square meter of occupied surface represents a cost in terms of maintenance and infrastructure (depreciation, energy, taxes, etc.).

- Loss of value: the value of the goods in stock may vary over time, because it is subject to deterioration, obsolescence, damage, theft.

2.1.1 Types of warehouses

There are several criteria to classify the different types of warehouses:

1. Categories of units to be stored: loading units, packages, special materials;
2. Automation level: manual, semi-automatic, fully automatic;
3. State of material: raw material, semi-finished or semi-assembled, finished product.

The term “loading unit” refers to containers of various shapes and materials, loaded with products destined for storage, handling and shipping. These can be wooden or plastic pallets (in various forms from the EPAL 800x1200 Europallet to the 1000x1200 "Philips" or square plan) (Figure 2.1.1), metal cages with or without wheels, plastic or metal crates, metal baskets. A common feature is the collapsibility, i.e. the ability to occupy a small space when the load unit is empty, thanks to the geometry designed to make it removable or stackable. The storage of the load units can provide for the overlapping of the same for light materials that do not risk being damaged, or the presence of shelving if the shape, weight or picking strategies require it. Items that cannot be grouped into load units due to the variety or nature, method or frequency of handling, are placed in the warehouse inside packages, i.e. cardboard or thermoplastic boxes (Figure 2.1.2); these can be arranged in stacks without the need for supporting structures or in shelves served by humans or by means of transport such as conveyors. Finally, special materials have weight, shape or dimensions that cause particular storage problems; such materials are for example tubes, profiles, bars, rolls, coils, etc. and it is often convenient to use external storage.

Figure 2.1.1 – Examples of loading units: EPAL (Europallet) and Pallecon

Figure 2.1.2 – Cardboard boxes

The differentiation with respect to automation involves the assessment of the level of support for manual activities by autonomous systems that can be controlled through logic circuits or computers, thus reducing the need for human intervention. We start from a zero degree of automation with the manual warehouse that can present mechanized tools; when only some activities are carried out automatically by computer-controlled machines, we speak of a semi-automatic warehouse, therefore man and machine work in parallel within the same space. Finally, a fully automatic warehouse is defined as that which does not involve human intervention in any activity carried out within the warehouse: picking, refilling, storage, palletizing, etc. do not require the presence of the operator.

A further criterion that allows to classify the warehouse is the state of the material; therefore there are warehouses for the storage of raw materials or parts to make semi-finished or finished products, warehouses for semi-finished products that are temporarily stopped waiting for the next processing, warehouses for finished products ready to be sold to the customer.

This thesis work will deal with manual warehouses for the storage of finished products on *Euro-pallets*.

Manual warehouses for load units have a distinct subdivision of different functional areas:

- *Area of receipt and acceptance of the goods*, where raw materials and incoming products are unloaded, accompanied by the Transport Document (DDT) containing the details of the transported material. During the unloading phase, a first quick check takes place which allows to verify that the delivery is correct;
- *Quality control area*, where a representative sample of the goods is checked with greater accuracy: if the products meet the specifications they are stored and will go into production, otherwise they are placed in a special shelving to be returned to the supplier by activating the procedure non-conformity of the goods;
- *Storage area*, which is the main area where the material is placed, with or without shelving, where the inventory is made and the inventory of the goods is checked, comparing it with the computer data present in

the company. Shipments of entire load units of the same code and lot can start from this area;

- *Picking area*, is the term used to indicate the area intended for the picking of individual packages. This area is fed by the storage area with the entire load units; when the customer's order is confirmed, the warehouse worker, equipped with the corresponding picking list, starts his picking mission from the various single-product loading units. The picking activity is always associated with that of refilling, i.e. the restoration / replenishment of the loading units where the picking took place;
- *Packaging and shipping area*: this is the space dedicated to the weighing, filming and labelling of the pallet. Once the pallet is ready, the transport documentation is drawn up here and the goods are sent to the recipient of the goods via the loading docks.

2.1.2 Picking models

Among all the activities inside the warehouse, picking is the one to which the most attention is paid for a number of reasons: first of all it is a process that directly reflects on the service offered to the customer and therefore on the level of satisfaction. of the same, it is then responsible for 60-70% of the total costs of the warehouse because it occupies resources and requires large amounts of time.

Each employee is given a list with which he/she leaves for the picking mission. Alternatively, the information system collects a certain number of orders and evaluates their similarities; then creates a single list and the operator proceeds to collect the items. Once the collection is complete, the codes are taken to a specific area where the division by single order is made, called ventilation. This system is called Batch Picking, or cumulative picking. Depending on one's needs, these two techniques can be combined. Another technique involves zone picking, in which the picker is responsible for an area of the warehouse and only the products that lie in his control area are listed in the picking documents delivered to him.

Depending on whether the warehouse is manual or automatic, picking can foresee in the first case that the operator moves towards the materials, in the second that it is the materials, with conveyor systems, that go to a fixed workstation of the picker, called precisely picking bay. If the operator is moving, if the warehouse is small, the light and manageable products and orders consisting of a few lines will move with a manual trolley where he will place the items picked; if on the other hand the distances to be covered are important and the orders show high quantities of products to be handled, the picker is equipped with rapid trolleys suitable for picking missions: the transpallets.

Before defining the correct crossing and withdrawal system, it is important to consider several aspects:

- Product characteristics: dimensions, weight, fragility, difficulty in handling, need for auxiliary lifting systems, etc.;
- Orders to be processed daily;
- Lines for each order;
- Withdrawal quantity for each code.

To optimize the picking missions, three factors are acted on simultaneously: the layout of the shelving, the path policies and finally the mapping of the product codes.

There are two types of shelving configuration: longitudinal and transversal (Figure 2.1.3). The first allows for more intensive picking with a lower risk of congestion of the vehicles in the warehouse head; the second ensures greater compactness and therefore a better surface saturation.

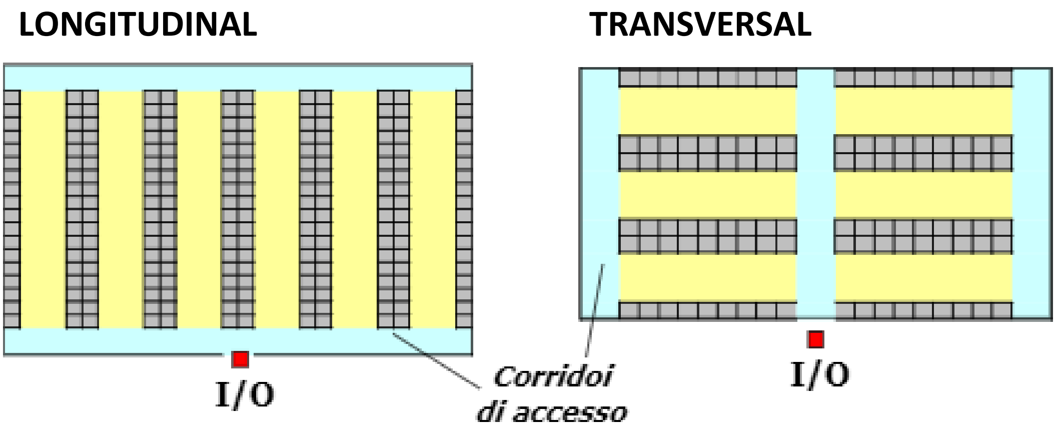

Figure 2.1.3 - Shelving configurations

2.2 AS-IS Situation

The company has two warehouses: the first (Warehouse A) is in Via Reisina street - just next to the Mappano plant – and contains materials, ingredients, and semi-finished products for the daily production only. The second warehouse (Warehouse B) is in Via Galvani, approximately 1.4 kilometres away from the first warehouse, here mostly items for ice-cream shops are stocked in it. Warehouse A has no shelves, so pallets are just stocked on the ground at the moment.

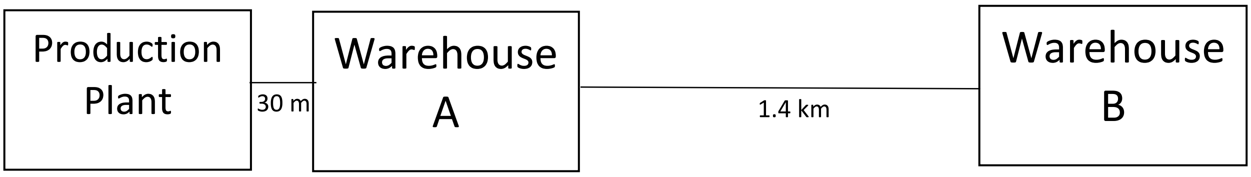

Figure 2.2 – Scheme of plant and warehouses distances

2.2.1 The current flows

With two warehouses available, there are several types of physical flows:

- The movement from warehouse A to the production line (for example pints, semi-finished products, ingredients, etc.).
- The movement from warehouse B to ice cream stores (for example biscuits, cups, ingredients, etc.).
- The movement from warehouse B to warehouse A (for example pints, ingredients, semi-finished products, etc.)
- The movement from warehouse B to the production line (for example spare parts for machinery, pints, etc.)

Clearly, the last two types - even if less frequent - represent important critical issues, due to the distance that separates the warehouses. The absence of shelves in warehouse A does not allow to adequately fill the spaces, therefore some orders are often delivered by suppliers to warehouse B.

2.3 The problem analysis

Any unnecessary handling is a cost that the customer is not willing to pay as it relates to an inefficient internal system. Most of the improvements that a production manager can achieve in a company are based on minimizing non-value-added times in the production cycle, for the benefit of those that create value for the customer in terms of the final product.

We can distinguish:

- *Value-added activities*: the only ones that the customer is willing to pay and that lead to an increase in the value of the asset that will then be delivered or offered to the customer.

- *Activities with no added value, but necessary*: these are activities that inevitably exist within a production flow, but which cannot be eliminated. An example is the transport of goods to the final destination of the customer.
- *Non-value-added and unnecessary activities*: these are activities that do not create value for the customer and that at the same time are not necessary. These types of activities must be eliminated or minimized as they are an expression of inefficiency.

A good organization of the layout makes it possible to facilitate the elimination of inefficiencies both in terms of internal handling of semi-finished products (not excessive empty handling), and in terms of operator movements and workbench equipment (reducing inefficient operator activities).

2.3.1 Lean techniques

A technique that is linked to the possibility of managing and breaking down the occurrence of the phenomenon of waste is called *5S*.

The 5S methodology contains in five steps a systematic and repeatable method for the optimization of work standards and therefore for the improvement of operational and qualitative performance. Born from the Japanese tradition of eliminating all that is waste ("muda"), the goal is to eliminate everything that is not strictly functional to the activity carried out, regardless of the activity itself.

The five fundamental concepts of this methodology are:

1) *Seiri* (separate): to separate what is needed from what is not functional to the activity and which therefore creates disturbances, disorder and more generally waste of time or resources.
2) *Seiton* (rearrange): arrange everything that is useful, as in the old motto "everything in its place and a place for everything".
3) *Seiso* (clean): keep this order constant and clean. A clean and tidy environment is an environment that "does not hide" inefficiencies.
4) *Seiketsu* (systematize or standardize): define repetitive and canonized methodologies to be used to continue these activities of rationalization of resources and workspaces.
5) *Shitsuke* (disseminate or support): to make this way of thinking and acting pervasive in all company activities.

This methodology makes sense if inserted in a context of continuous improvement as the 5 concepts previously described can be evaluated as a sort of step to be followed whenever there is a change (even minimal) in the company.

Alongside a 5S methodology, it is possible to apply the “5 Whys” technique. It is a method that allows to explore the cause-and-effect relationships of a problem by asking yourself a simple question. The purpose of the five questions is to determine the root causes of the defect. The number "five" indicates the number of questions that normally need to be answered to solve the problem. This technique was created by Sakichi Toyoda on the same basis discovered by the English writer and philosopher Chesterton who stated:

"The problem is not that the solution is not identified, it is that the problem is often not focused" (Chesterton, 1930).

For the Lean philosophy it is fundamental to be able to solve problems at the root rather than at the superficial level, so you never accept "only" the first reason given. However, it is a technique that requires attention in its use and great participation on the part of all those who find themselves applying these cyclical questions (Bicheno and Staudacher, 2009).

Moreover, another tool that is very useful to use within manufacturing production plants is the "Spaghetti Chart" diagram.

The term "Spaghetti Chart" indicates a Lean manufacturing tool, with which it is possible to highlight information that are connected to each individual procedure linked to the transport flows and the layout of a company. Thanks to this technique it will be possible to create a mapping through which to improve and optimize performance. So, the physical arrangement of the equipment, workstations, stocks in the warehouses and the relative movements made by the workers are optimal.

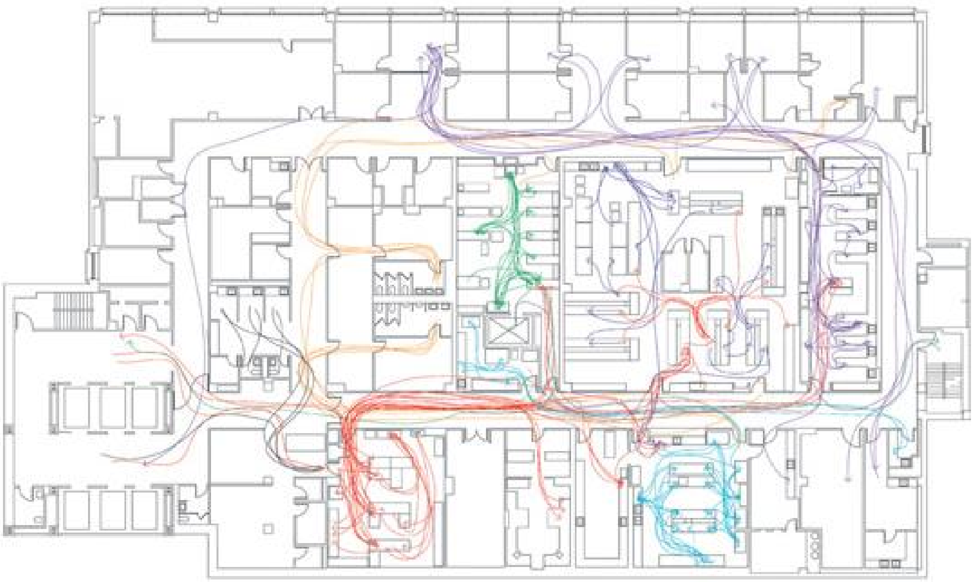

Figure 2.3: Example of making a Spaghetti Chart (Rother and Shook, 1998)

Indeed, this technique focuses on the cost determined by the continuous movement of goods, people, and tools within the company. To correctly apply this mapping, it is necessary to carry out a logistical analysis of the production reality by identifying and tracing, through lines, all the types of movement that goods and people can carry out. (Figure 2.3)

The final result will be a map in which each type of movement is indicated with a specific line and in which the internal flows are clearly highlighted.

Once the scheme of the entire plant has been obtained, it will be possible to implement the possible considerations to make the production flows more efficient, eliminating any waste. The goal indeed is to minimize internal paths and intersections between flows/lines in order to ensure a simpler layout and make production fast, simple and "streamlined".

Engineers Goyal and Verma (2019) underlined, in their study of optimization of the company layout in a manufacturing context, how the correct application of the Spaghetti Chart is significantly important to obtain a reduction in the distances of goods handling and consequently of transport costs. They also pointed out that only by relocating some workstations there was a recovery of previously wasted space. The procedure they have implemented is the "Systematic Layout Planning" (SLP) (Muther, 1973), a technique to better plan the workspaces in the plant, locating the areas with logical relationships, as close as possible. The goal is to obtain an optimal configuration capable of minimizing transport, costs and handling times in compliance with certain constraints imposed.

As can be seen from the diagram in Figure 2.4, the SLP procedure starts from the analysis of the data collected on products (P), quantity (Q), routes or routing (R), assistance (S) and times (T) for the entire productive activity.

Step 2 shows the intensity of the flow of all the materials that will be grouped through the determination of a "weight" of importance.

In the third step, a qualitative analysis of the proximity relationships between the different elements of the system highlighted in step 1 is carried out.

In step 4 the elements are spatially arranged and those who appear to have strong interactions are positioned in proximity.

Steps 5 and 6 are important for the determination of the space needed from each department and the relative footprint.

Step 7 introduces further information on the dimensions that add up to those already entered in step 4.

We reach step 10 in which, after having entered and considered the constraints and limitations in place in the current system (steps 8 and 9), it is possible to define and hypothesize different alternative types of layouts.

Subsequently in step 11 an evaluation will be carried out to determine the preferable configuration.

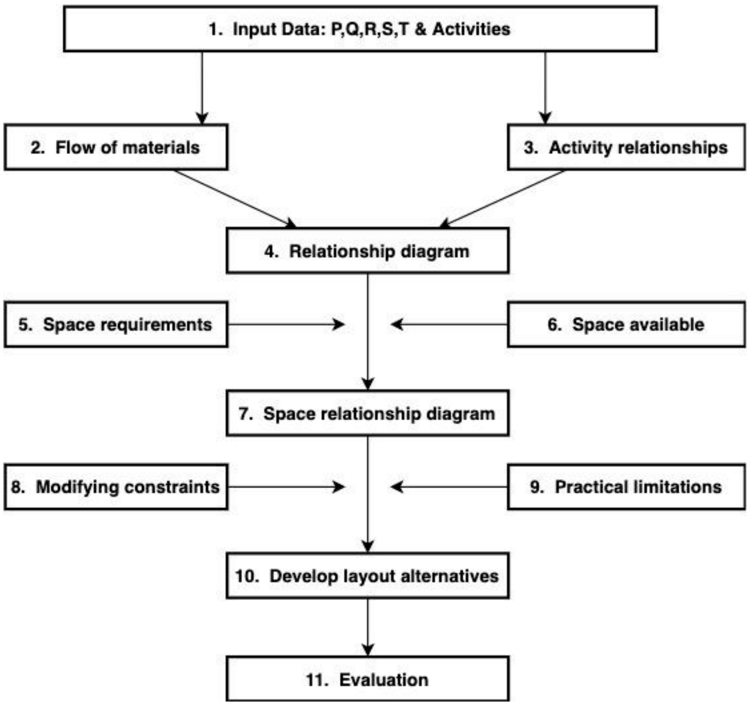

Figure 2.4 – Systematic Layout Planning (Yang et al., 2000)

2.3.2 VSM – Value Stream Mapping

Value Stream Mapping (VSM) is a tool that sets up a comparison between a current state (Current State Map) and a future one (Future State Map). The primary purpose of mapping is to have a

Excessive inventory and waste are detrimental to productivity. One of the main benefits of implementing VSM is identifying potential opportunities for improvement and priorities for action. It's necessary to perform a comprehensive analysis aiming to recognize and understand the entire process for optimization, to solve problems by studying root causes, not just eliminating symptoms, using for example the 5S, 5Whys, SLP.

The primary purpose of mapping is to have an overall view of the times during the various internal phases. The construction of a VSM requires the implementation of six steps (Lean Company - Q&O consulting, 2018):

1) Draw the current state (Current State Map) focusing on the families of products that have working phases in common and differentiate the flows of materials from the flows of information.
2) Identify waste/problems in the flow by collecting data and information directly where operations take place. Among the most important information to be recovered is the cycle time, the setup time and the lot size.
3) Draw the future state (Future State Map) underlining the "value" time contained in the overall lead time.
4) Plan and define actions to move from the current state to the future.
5) Implement the actions, focusing on the elimination of "no added value" times.
6) Monitor the results and restart if necessary.

The main purpose of this procedure is to think of the production activity according to a flow logic. In this way, the efficiency and effectiveness of the interventions will be clear to everyone and will no longer be observed on the individual workstation but in overall terms. Once this is done, the objectives and performances to be achieved are defined and the areas that are most critical are evaluated. The final result obtained is to have a schematic drawing, as seen in the example in Figure 2.5, in which all the references in terms of process and time used/employed by the supplier to the end customer are entered.

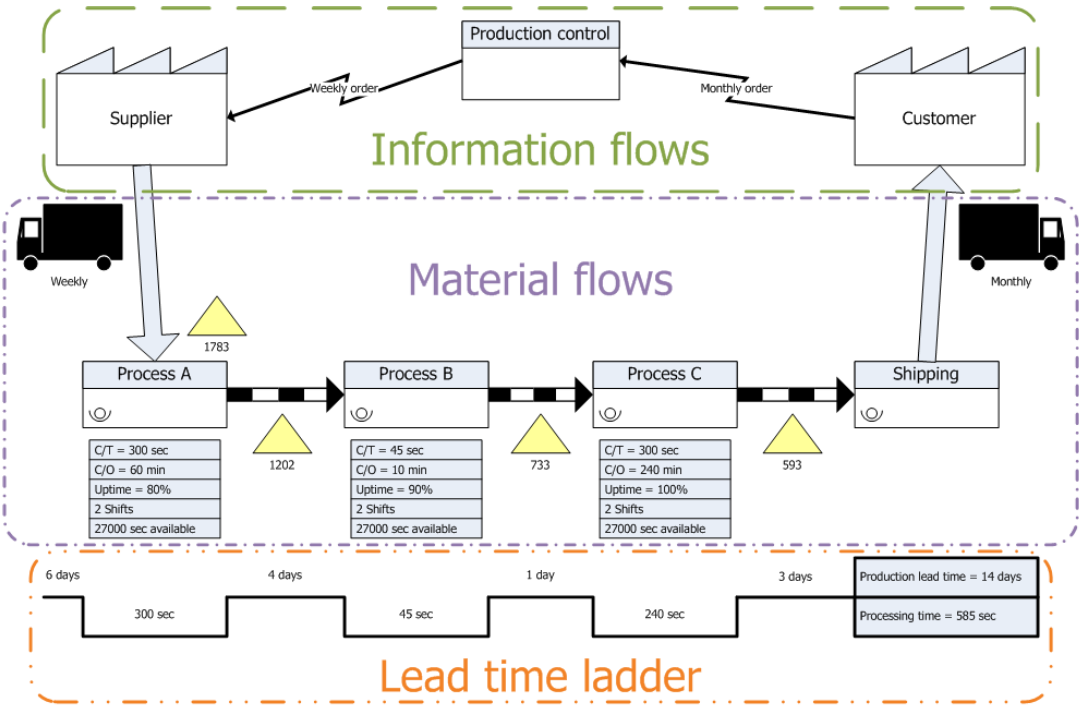

Figure 2.5 - Example of a mapping within a Value Stream Mapping (VSM) activity (Kumar, et al., 2018)

VSM also facilitates the possibility to have a responsible attitude towards the entire supply chain. As Martin Christopher, a scholar and professor of marketing and logistics at Cranfield University, states, "Nowadays it is the Value Chain that competes, not the companies taken individually" (Christopher, 2004). This reflection is concretely applied if we consider that the great operational efficiency of a company requires a similar attitude both upstream and downstream so that the final customer can understand the real value generated; therefore, everybody must collaborate for the same final purpose.

In this analysis, I expanded the boundaries of the study because I had to consider the two different warehouses in the Current State Map (Figure 2.6). Generally, the VSM focuses on the mere production activities, aiming to identify the non-value-added and unnecessary ones. But this is not what the present thesis wants to study, we need to look at the problem from a different perspective. Indeed, as already mentioned at the beginning of this chapter, we have some critical flows already in the warehouses path. So, the "load and transport" from Warehouse B can be seen as an activity in the Current Stream Map. Currently, each Grom's warehouse has 3 workers, for a total of 6. Moreover, the time spent to load a truck plus the transportation time to Warehouse A. These factors represent a huge waste of resources. In our example I considered 25 pallets of pints and so 25 minutes to load them on the truck (it takes approximately 1 minute to load 1 pallet) plus 5 minutes to travel 1.4 km.

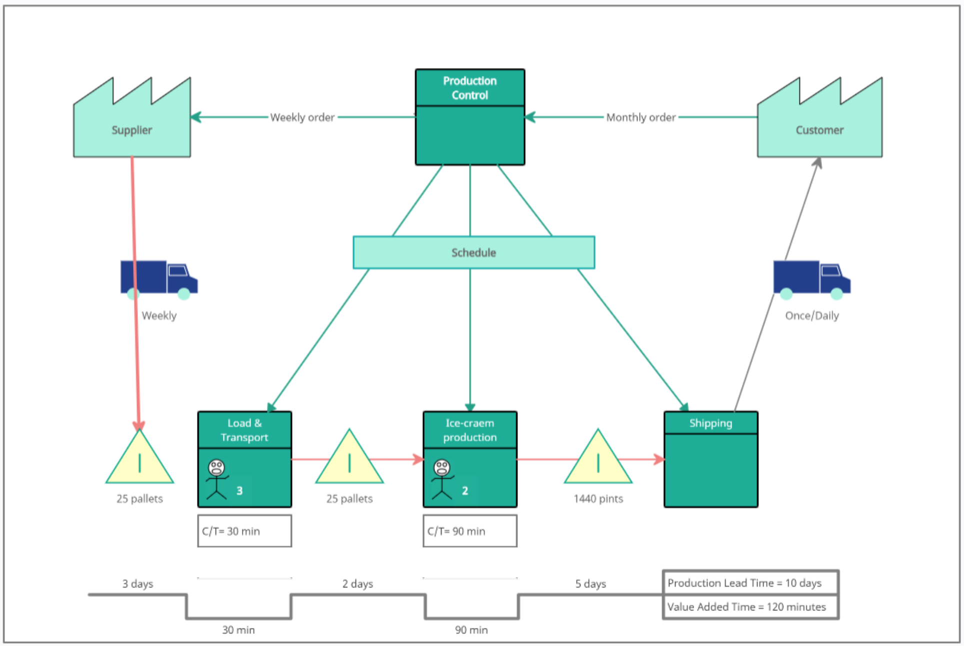

Figure 2.6 – Current State Map

It is immediate to notice the time savings in the value chain in the Future State Map (Figure 2.7). This configuration provides the dismission of the Warehouse B in Via Galvani, which will be sold, and the displacement of all the stored items in Warehouse A, which will be equipped with shelves. Moreover, one could think about the use of less human resources in the single warehouse. Six workers won't be needed anymore, four is a more realistic number of people who can manage the new deposit.

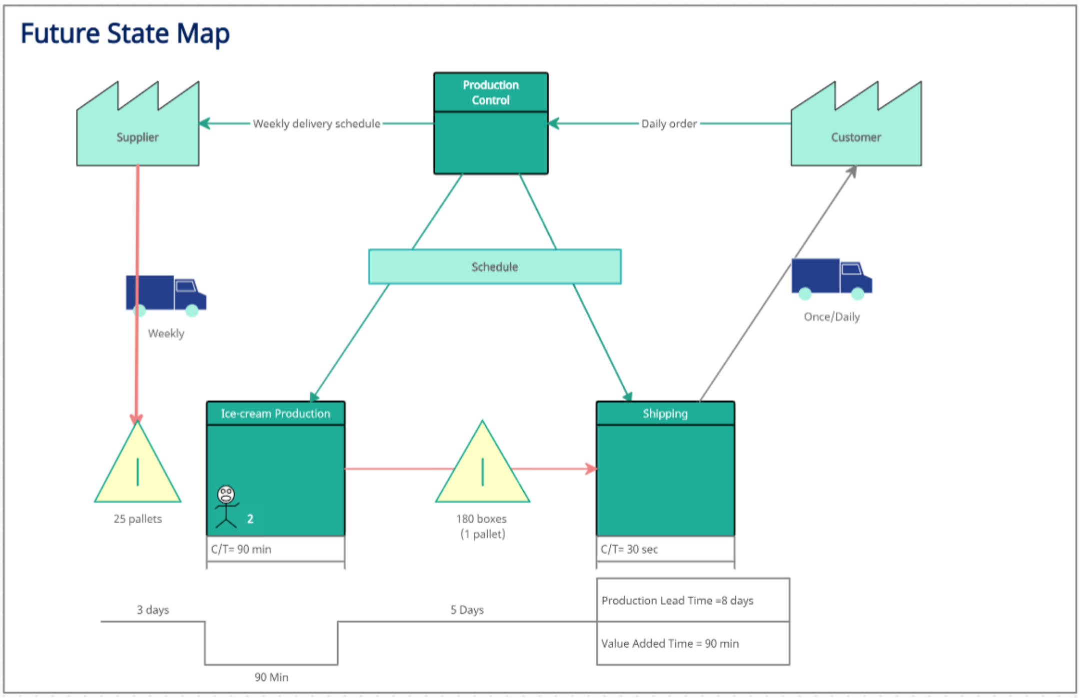

Figure 2.7 – Future State Map

3. The design of the warehouse

Once the criticalities of the current logistics system have been highlighted, the most important improvement actions undertaken are illustrated. The shelving project of warehouse A started in about mid-April and consists of various precise steps that foresee a conclusion with the warehouse ready in November 2021. After the careful feasibility analysis by the company managers, I was involved first in the collection of data on both warehouses' stock to be presented to suppliers, then in the actual sizing and improvement of flows on the layout of the future warehouse, up to the drafting of the final plan with allocation of materials with a view to optimization.

3.1 Measurements and data collection

Grom produces, as seen previously, dozens of different types of products. The finished products are obviously stored in cold rooms to maintain a temperature suitable for the company's quality standards. These products are therefore not subject to the sizing study, as there is no finished product warehouse for ice cream. Other products that are not stored in the warehouse are some ingredients such as milk, cream, egg yolk, hazelnut paste, pistachio paste, because they too need a cool temperature to keep them at their best. In addition to the so-called "primary" and fresh ingredients, which are frequently and directly delivered to the cold rooms, there are the ingredients that must be kept at room temperature and therefore can be stored in the warehouse. These are, for example, cocoa, chocolate chips, grains, flours, condensed milk, biscuits, bottles of water. They take up considerable space, as they are delivered in large quantities on pallets. In addition to these ingredients, in the warehouse we find jars of all sizes, their caps, boxes, films for the mixture, labels and so on.

The first task in terms of data collection was to measure all the pallets present in warehouses A and B, so as to realize the dimensions, weight and quantities to be reported to the shelf manufacturers. The data were collected and clustered for various height ranges in an Excel file (Figure 3.1, 3.2, 3.3). Just over 770 pallets were counted, adding those of both deposits, of which 330 only in warehouse B in Via Galvani. This means that we will need a warehouse with at least 800 pallet spaces, but we'll get to that later.

	Pallet	H [cm]	W [cm]	L [cm]	Units	Weight [kg]			
Via Galvani	Prodotto1	225	80	120	5				
	Prodotto2	225	80	120	23				
	Prodotto3	200	80	120	35				
	Prodotto4	190	80	120	50		abbassabile		
	Prodotto5	180	80	120	2				
	Prodotto6	180	80	120	64				
	Prodotto7	160	80	120	16				
	Prodotto8	160	80	120	24				
	Prodotto9	146	80	120	11				
	Prodotto10	140	80	120	62				
	Prodotto11	120	80	120	38			***Total Units Via Galvani***	***330***

Figure 3.0.1 – Warehouse B products

	Pallet	H [cm]	W [cm]	L [cm]	Units	Weight [kg]			
Via Reisina	Prodotto31	160	100	120	1				
	Prodotto32	143	80	115	1				
	Prodotto33	142	80	120	43	58,2			
	Prodotto34	142	80	120	64	61,7			
	Prodotto35	140	100	120	3	1000			
	Prodotto36	140	90	120	1				
	Prodotto37	140	80	120	1				
	Prodotto38	140	80	120	1				
	Prodotto39	140	80	120	1				
	Prodotto40	140	80	120	1				
	Prodotto41	140	80	120	1				
	Prodotto42	140	100	120	5				
	Prodotto43	135	100	120	36	84,2			
	Prodotto44	135	90	120	2				
	Prodotto45	135	93	120	5				
	Prodotto46	135	100	120	2				
	Prodotto47	135	90	120	6				
	Prodotto48	130	80	120	30				
	Prodotto49	130	80	120	12				
	Prodotto50	130	100	136	1				
	Prodotto51	130	120	138	1				
	Prodotto52	130	110	120	4				
	Prodotto53	125	80	120	14				
	Prodotto54	120	100	120	15	1000			
	Prodotto55	120	110	110	10	1000			
	Prodotto56	120	80	120	4		abbassabile		
	Prodotto57	120	80	120	17	143,7			
	Prodotto58	115	80	120	16		abbassabile		
	Prodotto59	113	115	115	10	1300			
	Prodotto60	112	80	120	11	360			
	Prodotto61	110	85	120	6	700			
	Prodotto62	105	80	120	2				
	Prodotto63	90	80	80	2				
	Prodotto64	84	80	120	17				
	Prodotto65	80	80	120	1			***Total Units Via Reisina***	***444***

Figure 3.2 – Warehouse A products

TOTAL UNITS	774

Height	Units	Percentage (Cumulative)	Difference with previous level
140	338	43,7%	
150	457	59,0%	119
160	498	64,3%	41
170	522	67,4%	24
180	623	80,5%	101
190	673	87,0%	50
200	735	95,0%	62
210	736	95,1%	1
220	737	95,2%	1
230	765	98,8%	28

Figure 3.3 – Clustering of items for height ranges

3.2 The sizing of the warehouse

Considering the constraints, we proceed with the sizing of the warehouse, considering that length or width of the Warehouse A building can be project variables to adapt to needs.

The parameters from which the sizing begins, in addition to the available storage area, are three:

1) The *dimensions*, the tip or side allocation, the weight of the Load Unit that will be stored.
   These data are fundamental to establish the dimensions of the compartment: the width and height of the shelving are linked to those of the pallet, the weight of the pallet itself affects the width of the compartment, as for high weights a span of 2 places is foreseen while for Units of Light load the places available can also be 3 or 4. The weight of the stored unit also conditions the thickness of the shelving uprights. Pallet allocation is also an important decision: the top solution allows to increase the volumetric yield and to use less expensive shelves but makes the picking activity more complex, the side solution on the contrary improves the gripping of heavy packages

or very small but takes up more space and worsens the volumetric efficiency.

2) The *type of forklift* that will be used in the warehouse activities.
   It is essential to establish from the beginning which model of forklift the operator will use as the size of the aisles depends on this; those with 4-wheel front forks require a maneuvering space of 3300 mm, while the same with 3 wheels require 3100 mm to operate. The model with retractable forks, in addition to allowing to serve greater heights, thanks to the retractable system needs a 2700 mm wide aisle. If the number of pallets to be stored is high and operational flexibility is required, forklift drivers can use trilateral or bilateral forklifts, which require a 1700 mm and 1500 mm wide aisle respectively.
3) The *receptive potential* of the project.
   The number of pallets that must necessarily be stored is calculated starting from the historical stocks or from the forecast of the demand and therefore of the warehouse unloading.

A further parameter to consider is selectivity, i.e. the ease of refueling or withdrawing a Load Unit without moving others.

3.2.1 Proposals from suppliers

The collection of data on pallets was useful to present the state of the warehouses and the needs of the company to the shelf builders. In this section the technical details and the problems to overcome when creating a layout together with the supplier will be discussed.

Three different suppliers were selected to discuss ideas for the new warehouse with them. The purpose of these meetings is to align on:

- Compliance with the SHE (Safety Health and Environment) regulations of the establishment
- The correct location of the items according to the type of material, the type of storage, any preservation needs
- The correct use of instrumentation, equipment, and machinery necessary to carry out the warehouse functions
- Compliance with procedures and work instructions by warehouse operators.

These preliminary discussions are preparatory to the drafting of the Request for Proposals (RFP). A Request for Proposal is a document that solicits proposal, often made through a bidding process, by an agency or company interested in procurement of a commodity, service, or valuable asset, to potential suppliers to submit business proposals. It is submitted early in the procurement cycle, either at the preliminary study, or procurement stage. It took several weeks to analyze the different bids and to make a technical-economic comparison. Some layouts were discarded because they did not comply with the company requirements and Unilever safety standards (Figures 3.4, 3.5).

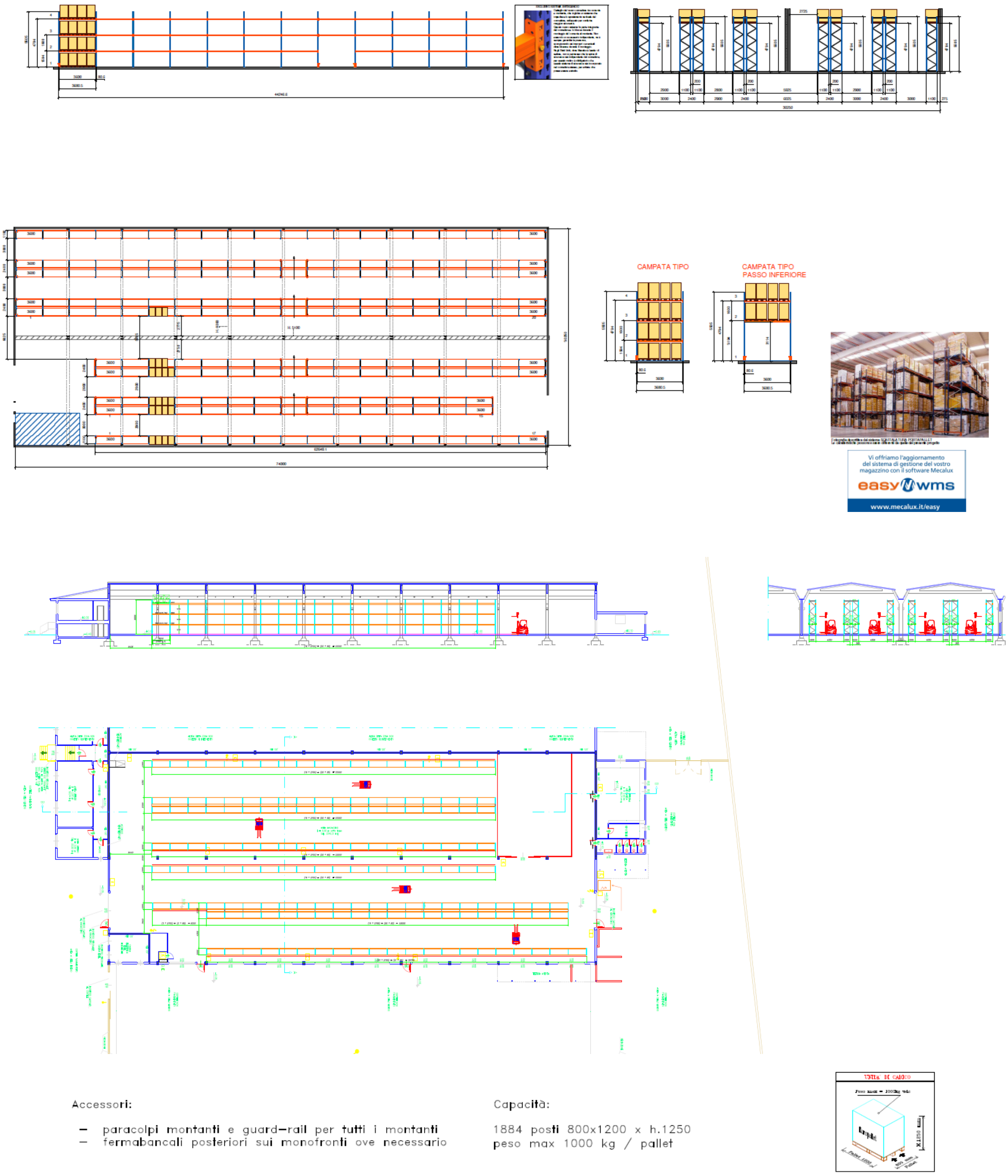

Figure 3.4 – Longitudinal configurations of warehouse A from different suppliers (discarded options)

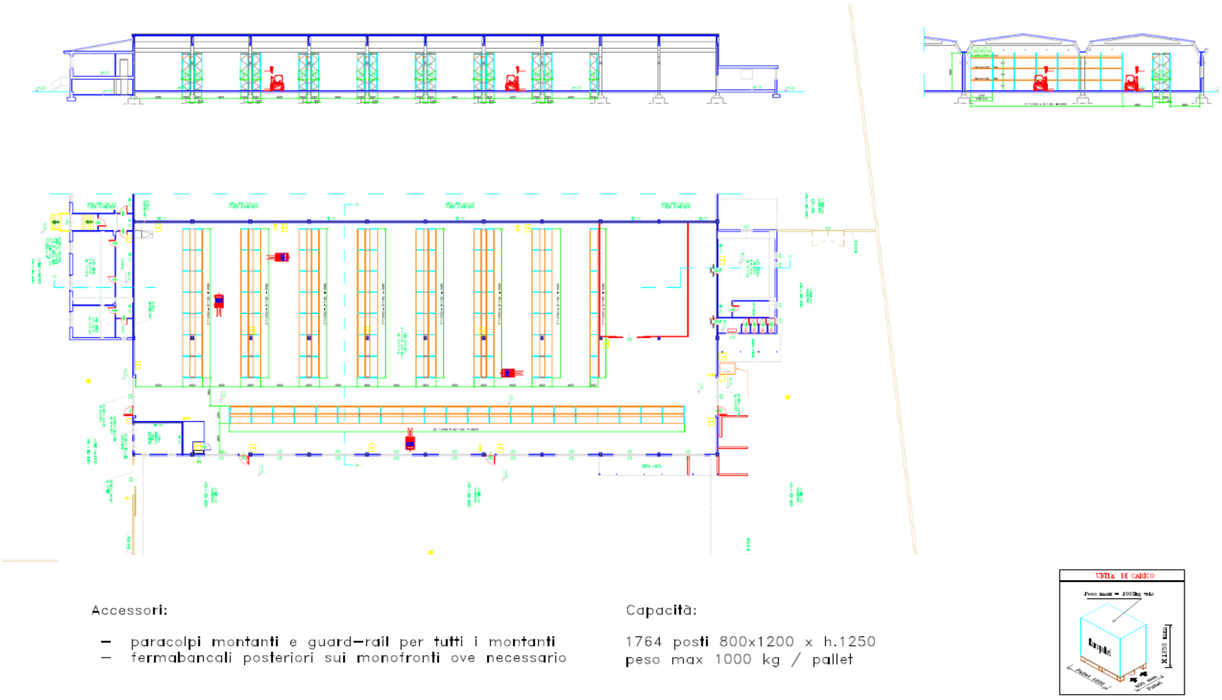

Figure 3.5 – Hybrid solution from the same supplier (discarded option)

In fact, the company was looking for a transversal shelving configuration, with the main aisle aligned with the warehouse entrance. In addition, an area near the entrance was requested to compose mixed orders. In fact, it often happens that the production team needs several packages (for example a single roll of labels, a bucket, spare parts) that can be picked up by hand, without necessarily having to use the forklift. So, this empty space without any shelf can satisfy this eventual need.

3.2.2 Layout of the selected shelving

After a period of technical discussions and negotiations, the ordering of the shelves from the chosen supplier was finally reached. The offer, the layout of which is shown in Figure 3.6, provides for the installation of metal shelving with a work aisle and with an elevation height at the last level of 4094 mm.

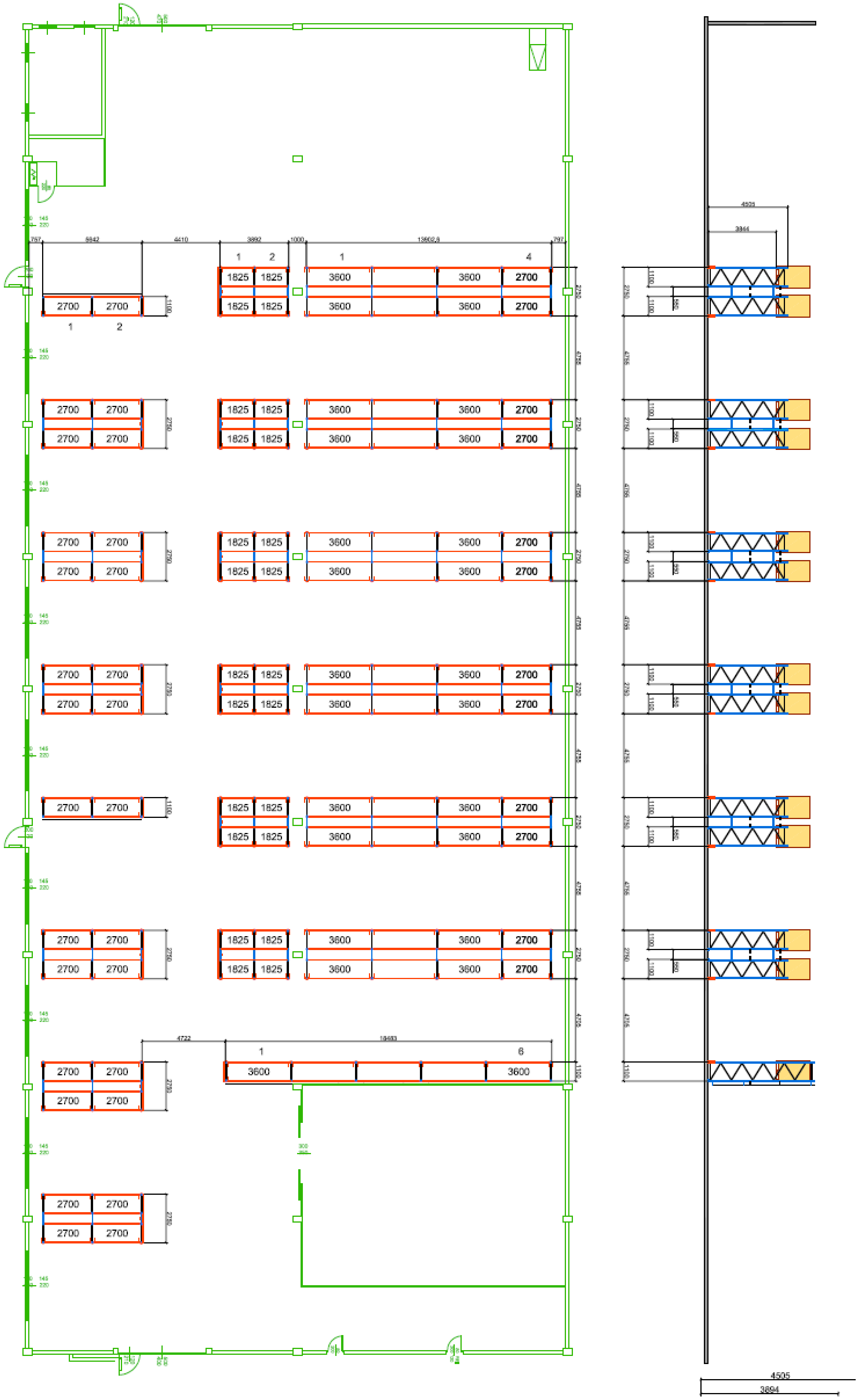

Figure 3.6 – Layout of the selected offer

The maximum number of stored load units is 996 pallets (as already mentioned, the load units referred to for the project are Europallet type). Not all loading units are suitable for storage on metal racks. Given the great variety of supports (wood, plastic, metal) the various bodies have developed standards in this regard, in order to establish minimum quality specifications. For wooden pallets of size 800 mm x 1200 mm and 1000 mm x 1200 mm, for example, there are standards EN-13698 and EN-13698-2 respectively. The customer must ensure that the load units he will store comply with these minimum quality requirements to allow their storage; otherwise, he will be required to purchase the auxiliary elements that allow, if possible, their storage on the metal racks.

Figure 3.7 – Shelving preview

3.2.3 Description of the components

The *shoulders* are the vertical elements of the shelving. They include two uprights joined by crossbars and diagonals. The union of the crosspieces and diagonals with the uprights is carried out using bolts of different metrics. The *beams* are the horizontal and resistant elements of the shelving, on which the loads are positioned. The interlocking of the currents in the shoulders is carried out through 2 connectors, of studied design, which guarantee their safety and ease of placement; these connectors are "L" shaped and are equipped with 4 hooks, with a pitch between them of 50mm (Figure 3.8). An Anti-fall net is used for the single-sided shelves to limit the risk of accidents due to an accidental fall of the goods in the corridor or in another area close to the shelving. It is a net manufactured with 30.5x30.5x2 corners on which a 90 x 50 mm mesh net is fixed by welding. This net is fixed to the shelving by means of connectors joined to the uprights. The fall protection net must be positioned at the rear of the shelving. It will be installed from the ground at a height of 5500 mm on the rows indicated in the lay-out (Figure 3.9).

Figure 3.8 – Shoulders and Beams

Figure 3.9 – Anti-fall net

3.2.4 The arrangement of the shelves

The arrangement of the shelves can be resumed in the following tables:

Table 1

Shelf	Quantity	Length (mm)	Depth (mm)
Single-sided	3	See Lay-out	1100
Two-faced	12	See Lay-out	2750

The single-sided shelves are a smart solution for leaving emergency exits free and optimizing the use of space.

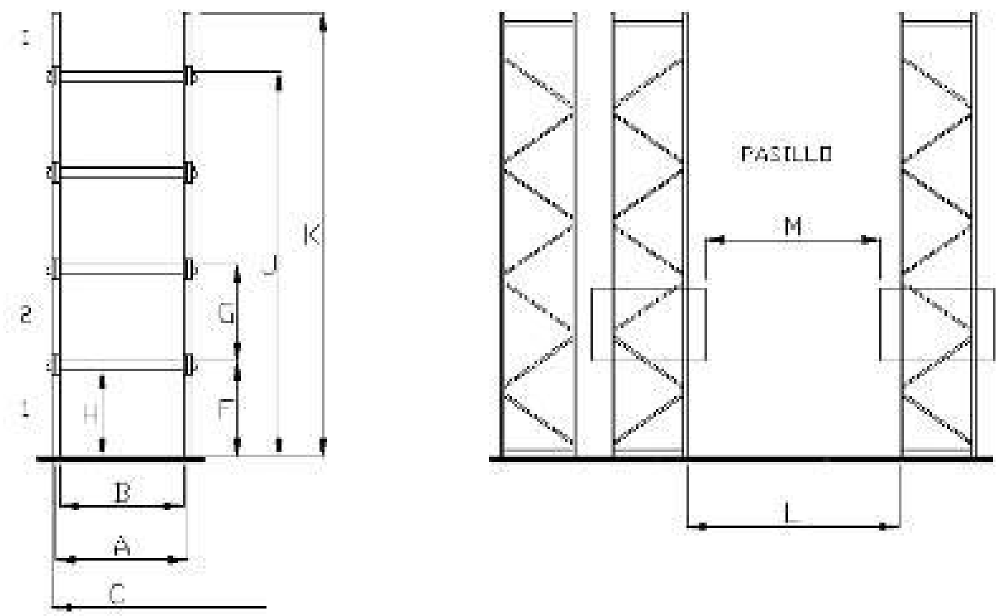

Figure 3.10 – Shelves distances

Table 2

A (mm) span center distance	B (mm) Space length between uprights	C (mm) No. of spans in length	D (mm) No. of pallets per level	E (kg) Flow rate solicited by level	F (mm) Ground clearance on the first level	G (mm) Height between load levels	H (mm) Free space
3680.5	3600	See Layout	4	1500	2144	2144, 1750	2024, 1630
2780.5	2700	See Layout	3	1125	2144	2144, 1750	2044, 1650

Table 3

I (mm) No. of load levels (including soil)	J (mm) Height from the ground at the last level	K (mm) Overall height	L (mm) Aisle width between racks	M (mm) Aisle width between loads
3	3844	4000	4755	4655

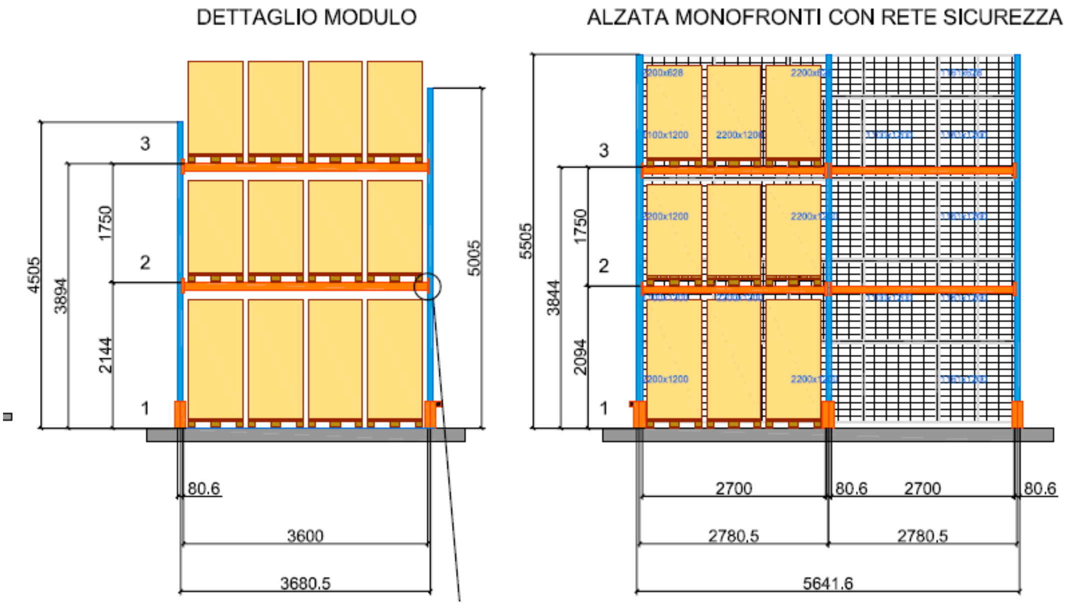

Figure 3.11 – Shelves measures

This configuration (Figure 3.10, 3.11) will allow Grom to store any type of load unit according to the various height ranges previously specified in the clustering. The next step is the flow optimization of the new Warehouse A, that will be discussed in the following paragraph.

3.3 Warehouse flow optimization

Now that we have the final layout and therefore the arrangement of the shelves, we need to understand how to best position the warehouse stocks to considerably reduce the waste of resources, that is minimizing non-value-added times in the value chain. It is clear that, by eliminating warehouse B which was 1.4 km away from the factory, there is already a considerable time saving, because now all the stocks are in warehouse A. But in order to minimize travel times, there is a need to strategically position the load units. To do this, an in-depth analysis of deliveries, accesses and movements was carried out.

3.3.1 Warehouse allocation criteria

The criteria with which the items are stored in the different areas of the warehouse play a very important role as they influence the warehouse indices and service levels, since space required and average cycle times also vary according to these criteria.

The allocation policies are based on a series of parameters called the *movement index*; they are necessary to establish a hierarchy among the stored codes. Among the most used there are:

- *Rotation index (IR)*, defined as the ratio between the flow of product leaving the system in a given period T expressed in load units and the average stock of the same period; indicates how many times stocks turn over in a defined period of time:

$$IR_i = \frac{Fout_i}{AS_i}$$

- *Movement index (MI),* is defined by the number of units of the i-th item handled in period T:

$$MI_i = \frac{M_i}{T}$$

- *Access index (IA),* represents the average number of accesses in a given period of time in relation to the locations dedicated to the i-th item:

$$IA_i = \frac{MI_i}{No.loc}$$

In addition to the indexes, it is important to consider the criterion with which a certain location is assigned to each code. The main ones are the *Random Storage* with allocation of the Loading Unit on the first available free place, the *Dedicated Storage* which provides for the placement of packages in a specific area according to their type (level of picking indices or the characteristics of the unit to be stored) and finally the *Class-based Storage* which consists in identifying classes of homogeneous products with respect to the movement or access index. Currently in the Grom warehouse the Dedicated Storage criterion is adopted in an area still without shelving and therefore organized in a stack on a single level (many products in fact do not allow stacking because they are light and therefore subject to crushing); the warehouse worker who receives the goods from production positions the pallets wrapped in stretch film paying attention to two parameters: the weight of the single product and the package and the number of times an item is picked up. In the two phases of deposit and withdrawal, the times are lengthened considerably, worsening the performance and efficiency of warehouse management.

In addition to the shelving layout, a new allocation system is proposed with the Dedicated Storage method and a more precise and studied goods allocation system obtained with the ABC analysis of access and movement indices.

3.3.2 ABC Analysis

Organizing goods with the logic of the fixed position requires a precise location to be assigned to a given item, this position never changes, if not following a reassignment of the rooms. To do this, the Movement Index is observed: the products that are most often moved according to historical data are those to which the rooms that can be reached more quickly are assigned. The aim is always to reduce the crossing times of the picking warehouse, to increase the level of service and productivity of the warehouse worker. It was decided to observe the trend of movements from March to May 2021, which can be considered the period with the greatest demand and therefore with the greatest amount of work. These data have been sorted in descending order. The cumulative handling curve was then constructed, thanks to which the products that are most often unloaded can be immediately identified. It is possible to divide the area under the curve into 3 bands: A, B and C. Each band corresponds to a set of codes: band A groups the busiest items, B those that are on average, finally band C contains the products that remain in stock for the longest time. Considering what has just been described, the choice of locations will be made by favoring references A first, then references B and lastly C.

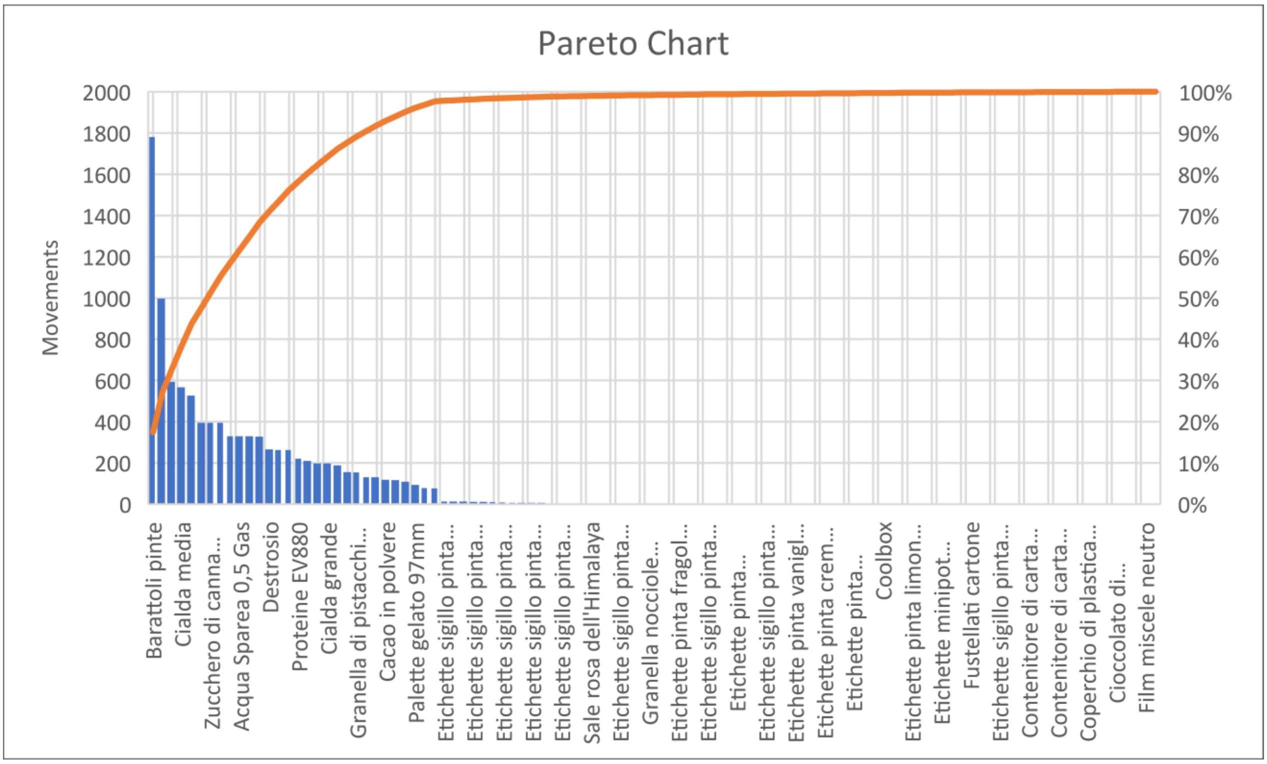

Figure 3.12 - Cumulative curve of movements from March to May 2021

1	Product	Movements
2	Barattoli pinte	1782
3	Coperchi pinte	998
4	Cialda piccola	594
5	Cialda media	567
6	Granella di cioccolato fondente F60 Ecuador 3mm	528
7	Cioccolato fondente 70% Ecuador	396
8	Zucchero di canna bianco	396
9	Vaschetta classic-gel 500	396
10	Vaschetta classic-gel 1000	330
11	Acqua Sparea 0,5 Gas	330
12	Acqua Sparea 0,5 Nat	330
13	Destrosio	267
14	Acqua Sparea 1,5 Nat	264
15	Granella di cioccolato fondente F60 Ecuador 6mm	264
16	Granella di cioccolato fondente F60 Venezuela 3mm	264
17	Proteine EV880	222
18	Zucchero caramello	210
19	Granella di pistacchio 8mm	198
20	Cialda grande	198

Table 4 – Item class A: the 20 busiest continuous products, responsible for 85% of total warehouse

3.3.3 Drafting of the final plan

After having classified the codes into types A, B and C, we focus on the first class, which, as mentioned, represents 85% of inventory flows, while class C includes items that remain stored for longer.

Through the use of the *Spaghetti Diagram*, the flows of material, information and the movements of the operator were then highlighted, respectively in the Inbound cycle:

- unloading and quality control
- moving to the sorting area
- receiving goods
- real time system update
- anomaly management
- shelf *put-away*

and in the Outbound cycle:

- arrival move order
- order composition
- real time system update
- pallet storage in a special staging area awaiting delivery

The put-away operations on the shelf are performed with simple cycles, i.e. the operations provide for an empty return, while the picking operations can be carried out with simple cycles or follow the logic of combined cycles or multiple withdrawals.

It is clear that the duration of a simple cycle is given by two components: the fixed times and the variable times. The fixed times are the same times for each cycle, regardless of the location of the space. For example, data receipt and fork cycle times are fixed (for picking up or entering the load unit). The variable times are those that instead depend on the location of the room. For example, the times related to the outward path, to lifting and lowering the forks, and to the return path are variable times.

Below are all the travel times of the pallets handled belonging to class A. Note that the data is missing for the names highlighted in yellow, as they are items belonging to warehouse B and intended for ice cream shops (such as ice cream cones, bottles water, biscuits), not to the daily production.

1	Product	Average travel time (sec)
2	Barattoli pinte	235
3	Coperchi pinte	247
4	Cialda piccola	
5	Cialda media	
6	Granella di cioccolato fondente F60 Ecuador 3mm	203
7	Cioccolato fondente 70% Ecuador	200
8	Zucchero di canna bianco	185
9	Vaschetta classic-gel 500	
10	Vaschetta classic-gel 1000	
11	Acqua Sparea 0,5 Gas	
12	Acqua Sparea 0,5 Nat	
13	Destrosio	183
14	Acqua Sparea 1,5 Nat	
15	Granella di cioccolato fondente F60 Ecuador 6mm	210
16	Granella di cioccolato fondente F60 Venezuela 3mm	210
17	Proteine EV880	198
18	Zucchero caramello	195
19	Granella di pistacchio 8mm	220
20	Cialda grande	

Table 5 - Travel times for Warehouse A products

In this table a small inefficiency is already noted, because the more handled items take longer to travel the way to the production plant. Even some items in classes B and C are closer to the exit than the pints are. With a view to optimizing the flows in the new warehouse, by choosing the travel time as KPI, we can take as the most striking example of inefficiency the delivery of a pallet of pints from warehouse B to warehouse A. As already mentioned above, when the warehouse in Via Reisina it is close to saturation, the suppliers deliver to the other warehouse. When the production needs the items stored in Via Galvani, the forklift drivers will have to travel 1.4 km to fetch the goods and move them to warehouse A: a considerable waste of time and resources. The travel time of a truck that goes to load a batch of 10 pallets and return to unload them in the warehouse is about 30 minutes, if we count the outward journey, the minutes to load the pallets (it has been measured that to put a pallet on a truck takes about a minute), the return and unloading of goods. If instead the pallets of pints were placed near the warehouse entrance, there would be a huge saving of time and resources: the measurements indicate that the travel time of a forklift driver who leaves

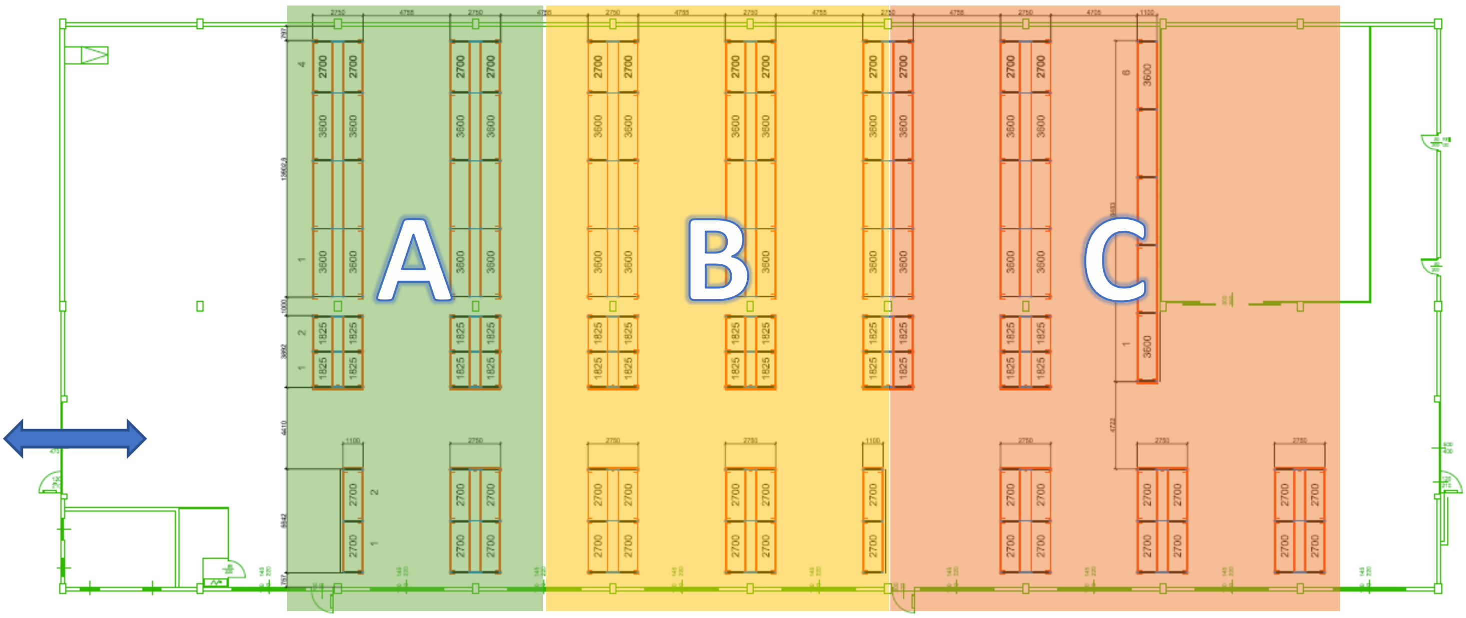

Figure 3.13 - Final plan with allocation of materials according to bands A, B and C.

the factory, arrives at the station, loads the pallet and back to the factory equals 175 seconds, which is 90% less time.

There are some considerations and constraints that have conditioned the positioning of the items:

1. The total number of codes subject to picking is approximately 750, which means that an equal or greater number of spaces must be taken into consideration;
2. The movement data indicate that there are 3 product ranges: the first, range A (indicated in green on Figure 3.13) includes the codes that require 85% of the movements; B (in yellow) includes the items responsible for 10% of the movements; finally, band C (in red) is made up of the least handled goods, in fact it implies only 5% of warehouse discharges;
3. As the pallets of pints are 140 cm high, it is possible to store them on all three levels of the shelves, also because their weight is very low (net weight about 58 kg) and therefore there are no safety problems. Only powders such as milk proteins, carob flour, sugar, cocoa have a very high weight (up to 1000 kg per pallet) which does not allow them to be stored at the highest level of the shelves.
4. As for the biscuits and other packaged products described above, even though they are among the busiest, it's not important for them to be in area A, since they're not intended for the production plant, they are just loaded on trucks and delivered to ice cream shops.

4 Conclusions

With this work, which ends here, I set out to conduct an analysis that would allow us to evaluate, among various options, the design and management project of a newly built warehouse for the storage of products of a small and medium-sized food company in the Turin area, Gromart S.r.l. The discussion aimed at first framing the broader aspects concerning internal logistics, in order to understand one of the issues that every company has to deal with on a daily basis: the warehouse with its organization and management. The main objective was to propose solutions applicable to the business context, considering the needs and main constraints, aware that good warehouse management is one of the factors directly involved in determining the success of the company. The result of Grom's work is a food product that, given its quality and sensory characteristics, falls within a niche *luxury* market. Moreover, ice creams are the desserts of summer, and therefore subject to high seasonality. The knowledge of these peculiarities is one of the starting points with which various solutions for the optimization of the new building dedicated to storage have been evaluated; the need to address a problem of time and space was kept in mind, which made it essential to expand the storage space, to quantify the units to be stored, and the complete change of the old storage system. The procedures that best fit the characteristics of the products, processes, orders and flows of goods have been defined, in order to establish the methods of deposit, withdrawal and handling.

The result of this work is a project under construction which aims to obtain, in the future, an effective and efficient warehouse, which simplifies, speeds up and supports internal company activities, to reduce waste and continuously and incrementally improve customer service.

4.1 Limitations

The paper found some limitations relating in particular to technical and time constraints found in the company. First of all, it was not possible to monitor the warehouse performance as it is still under construction due to delays. Furthermore, the huge amount of data in the company's databases has made it difficult to collect information on deliveries, as different suppliers arrive almost daily. Therefore the analysis was made taking into consideration only the transport documents (delivery notes) of the months of internship I spent in Grom. This could be seen as a limitation given the strong seasonality of the ice cream market, but since these are the months with the highest production, the amount of data was sufficient to make a credible and useful study for the sizing of the new warehouse.

4.2 Future developments

First of all, in the future it will be necessary to evaluate the performance of the new warehouse A, with a careful analysis of the travel times of each item. A Spaghetti Chart that represents the new flows and the definition of new KPIs in addition to the travel time will help to reach the company's targets from the perspective of Lean Manufacturing. Furthermore, a greater amount of data distributed in the long term can lead to more truthful results regarding frequencies and movements, in order to possibly change the arrangement of the pallet places.

In addition to the continuation and improvement of this thesis work, innovative measures could be adopted to obtain greater timeliness and traceability of information. Some technological solutions that improve the efficiency and quality of the distribution process are:

- *Smart glass* - Glasses equipped with augmented reality lenses that can be used both in the transport sector and within distribution centers;
- *RFId* (*Radio Frequency Identification*) - Systems inserted on the single handling unit to make receiving or shipping activities more efficient, or inserted on the ground and/or on the shelf to optimize the activities of the forklifts during storage or picking;
- *Document dematerialization and digitization for transport* - Electronic data flow and digital storage of documents in parallel (or alternatively) to paper mode;
- *Logistics APP* - Applications for mobile devices (e.g. smartphones and tablets), integrated with TMS (the transport management system) and/or collaborative platforms, which support the relationship with carriers (real-time confirmation of goods delivery, georeferencing of means, management of disputes thanks to the visual proof of the state of the goods, management of payments on delivery).

Appendix 1 – Dashboard on Delivery Notes in Warehouse B

	A	B	C	D	E	F	G	H	I	J
1	Numero bolla	Fornitore	Articolo	Colli	Totale colli	Peso netto	Peso lordo [kg]	Numero pallet	Totale numero pallet	Data di emissione bolla
14			Coperchio di plastica cupolino 9C	32		144	169,6			
15	397	Ibiplast	Sacchi MB 45X55	37	73		900		2	13/04/2021
16			Ecobag 120LT	36						
17	C/21006259	Coopbox	Vaschetta classic-gel 500	90	90		225,7			23/04/2021
18	C/21005386	Coopbox	Vaschetta classic-gel 500	108	180		528,048			08/04/2021
19			Vaschetta classic-gel 1000	72						
20	C/21005213	Coopbox	Vaschetta classic-gel 500	36	72		218,88			07/04/2021
21			Vaschetta classic-gel 1000	36						
22	C/21004730	Coopbox	Vaschetta classic-gel 500	72	144		437,76			29/03/2021
23			Vaschetta classic-gel 1000	72						
24			Vaschetta 350	12						
25	C/21003772	Coopbox	Vaschetta classic-gel 500	72	120		348			12/03/2021
26			Vaschetta classic-gel 1000	36						
27	C/21003208	Coopbox	Vaschetta classic-gel 500	108	144		399,456			03/03/2021
28			Vaschetta classic-gel 1000	36						
29			Acqua Sparea 0,5 Gas	128				2		
30	2021-1EV-0006834	Pontevecchio	Acqua Sparea 0,5 Nat	315	527			5	8	03/05/2021
31			Acqua Sparea 1,5 Nat	84				1		
32			Acqua Sparea 0,5 Gas	63				1		

Via Galvani | Via Reisina | Movimentazioni

Appendix 2 – Dashboard on Delivery Notes in Warehouse A

1	Numero bolla	Fornitore	Articolo	Colli	Totale colli	Peso netto	Numero pallet	Data di emissione bolla
26	583	Crea	Cioccolato fondente 70% Ecuador		214	1368		03/03/2021
27	630	Crea	Granella di cioccolato fondente F60 Ecuador 3mm	300	300	1500		08/03/2021
28	564	Crea	Cioccolato fondente 70% Ecuador		354	648		02/03/2021
29	564	Crea	Granella di cioccolato fondente F60 Ecuador 6mm			1500		02/03/2021
30	529	Crea	Granella di cioccolato fondente F60 Ecuador 3mm			50	1	01/03/2021
31	136	Pinin Pero	Zucchero caramello	126	126	3150	5	03/05/2021
32	183	Pinin Pero	Zucchero di canna bianco	12	12	12000	12	23/04/2021
33	1520	Pinin Pero	Destrosio	440	440	11000	11	12/04/2021
34	153	Pinin Pero	Zucchero di canna bianco	11	11	11000	11	08/04/2021
35	110	Pinin Pero	Zucchero caramello	112	112	2800	4	08/04/2021
36	1121	Pinin Pero	Zucchero caramello	24	464	600	1	12/03/2021
37	1121	Pinin Pero	Destrosio	440		11000	11	12/03/2021
38	2021 Y 63	Packlist	Etichette sigillo pinta crema grom	2	2			20/04/2021
39	2021 Y 63	Packlist	Etichette sigillo pinta cioccolato	2	2			20/04/2021
40	2021 Y 63	Packlist	Etichette sigillo pinta pistacchio	4	4			20/04/2021
41	2021 Y 63	Packlist	Etichette sigillo pinta caffè	1	1			20/04/2021
42	2021 Y 63	Packlist	Etichette sigillo pinta lampone	2	2			20/04/2021
43	2021 Y 63	Packlist	Etichette sigillo pinta fragola	1	1			20/04/2021
44	2021 Y 63	Packlist	Etichette sigillo pinta stracciatella	1	1	323		20/04/2021

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