



Optimization of the internal procurement process at the world's leading producer of phosphate rock

H. Adlane*, M. Aouane

Biotechnology, Environment and Quality Laboratory (LABEC), Chemistry Department, UFR of Process Engineering, Faculty of Sciences, Ibn-Tofail University, Kenitra, Morocco

* Corresponding e-mail address: hamza.adlane01@gmail.com

ORCID identifier:  <https://orcid.org/0000-0001-5852-3777> (H.A.)

ABSTRACT

Purpose: This article discusses the results of a field study that was carried out over a 6 months period. The objective of this research aimed at studying the internal procurement system of one of the world's leading Moroccan companies that has a 4.3% contribution to the national GDP.

Design/methodology/approach: Our work, based first of all on the elaboration of an overview and then on the use of more than 6 methods and logistic tools, will allow this company to develop its own procurement method, adapted to its constraints and capacities.

Findings: In terms of figures, this company sources 157 items from several suppliers. These references are then stored initially in the company's store, and depending on the demand from internal customers, a distribution is subsequently planned. A shortage of stock on some items and overstocking on others is a blatant contradiction suggesting several paths for improvement. Ultimately, the results of our work have enabled us to reduce financial immobilization by 40%, as well as a considerable gain in storage space.

Practical implications: This paper shows the importance of responding to the problems of large companies with adapted and targeted methods.

Originality/value: This article presents an original parallel application of almost all conventional logistics methods, for a global and efficient optimization.

Keywords: Logistics, Procurement, Lean management, Costs

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INDUSTRIAL MANAGEMENT AND ORGANISATION

1. Introduction

Procurement is a very important part of every business. The term "procurement" means the action of making

operational, through the determination of needs, the flow of stocks and related activities inside and outside the company. This action favors the reduction of costs by using certain modes of economic control, with the objective of making the

product accessible according to the conditions of the various markets qualified as commercial, domestic, institutional and industrial [1]. Each year, the purchasing function has a foreign exchange budget for the purchase of products under a procurement plan developed jointly with the Concerned departments [2].

For the company we have chosen, there is what is known as a "framework agreement". This agreement sets out all the constraints and conditions linking the company to its suppliers. In particular, the price and the annual quantity that can be ordered. It also allows an increase in income and market share as a result of the flexibility and speed of reaction to market opportunities [3]. Once the purchaser (company representative) finalizes the agreement, he transfers it to the procurement department (head office store). The main mission of the store managers lies in the good mastery of the following equations: charges/capacities for a good optimization of the storage area as well as the offer/demand to meet all the demands of the company's internal customers. The diagram below Figure 1 clearly illustrates this process.

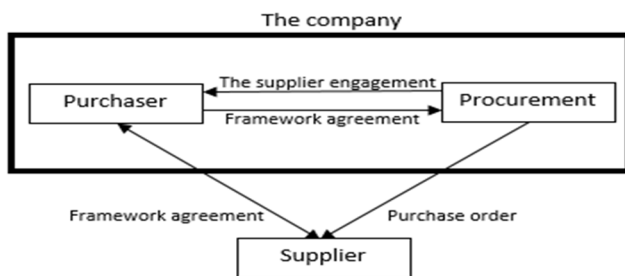


Fig. 1. Purchasing process

The questions that arise are the following: what are the methods and tools currently used by this world leader to carry out its procurements? This question is of a great importance because it is the basis on which a clear assessment will be established. Also, are there one or more management methods, which when used individually or in parallel with others, can lead to optimizations of this part of the supply chain?

Based on the role of logistics as an instrument of business performance on the market [3,4], our objective in this study is to first carry out an overview of the current situation, which will enable us to map and understand all the stakeholders in this chain. Then, a work plan based on logistics methods and technics will be initiated. Therefore, we will conclude in the last part with the outstanding results obtained.

2. Materials and methods

2.1. Materials

In general, the material used for our study is a set of databases collected either from the company's information systems; or through contracts established between the company and its suppliers.

Database of "completed procurement"

It is a file drawn from the Oracle ERP (Enterprise Resource Planning), which contains all the quantities ordered of each item during the last year with their delivery date, this file will be used to compare the orders made with the consumptions parameters.

Database of "consumption"

Gathers all the consumption of the items on the study site, classified by month and by customer.

Database of "stock"

It is a file grouping, which allows to see the evolution of the warehouse stock through time, in order to be able to quantify the global storage cost. Indeed, we call Stock the whole of the goods which intervene in exploitation's cycle of the company to be either sold in the current state or at the end of a production process to come or in progress, or consumed at the first stage [5].

Current stock status

It is a census of the physical stock at store level, concerning all the items in order to have a clear vision into our the operating system.

Brainstorming

It is an American method used in a multitude of companies around the world, which makes it possible to materialize the different ideas of a group of people in order to have a new overview on a given subject (Fig. 2). For our case, the team gathered all the members of the store. The subject chosen for this brainstorming is: The state of the stock in the store.

Two important observations were identified from this brainstorming session:

- If all the shelves are already full, and there are still goods without spaces, this can only be, according to the store staff concerned, due to overstocking.
- How much to order? And when to order? These are two questions that are of major concern to storekeepers because experience and databases show that they have

never been able to be safe from shortages or overstocking throughout the year.



Fig. 2. Brainstorming scheme

This brainstorming already highlights the need to consider a new method of supply.

Ishikawa

It is a diagram named after its creator Kaoru Ishikawa, whose main objective is to group and define the potential causes of a single effect, of which its other name "cause and effect diagram".

For our study, the chosen effect will be The inefficient management of the store. The work will be done in collaboration with the entire store's staff (Fig. 3).

The finding deduced from this diagram is once again related to the lack of an adequate procurement method, which generates for the storekeepers more manual work to do and therefore less time for the other activities of the store.

2.2. Methods

Chrono-analysis method

It is a method generally used in the calculation of standard production intervals of times, it consists of timing

the different stages of a process, and applying to the times obtained coefficients such as the rest coefficient, which depends on the position of the storekeeper to carry out the task; also the ambient coefficient which depends on the temperature and hygrometry of the workplace. All this in order to obtain standard times.

We will then use this method to time the different components of the store process.

Study of the store process

Every company, whatever its activity, has a multitude of departments, each of them has an appropriate way to work, this way is called process. The latter has an input, an output, and is itself composed of several tasks or activities.

For our study, we are going to elaborate the store process specifying the time consumed by each activity. The calculated times will be represented in green circles (see part 3.1).

The method used to calculate the time is the Chrono-analysis method. The unit of time chosen is "seconds".

3. Results

3.1. Initial results

After the development of a Brainstorming session as a first step, it became clear to us that the procurement 'method' used is a major handicap to performance and efficiency within the store. This finding is also supported by the results obtained in the cause-and-effect diagram.

In terms of figures, and in order to understand the different tasks and their impacts, we opted, as explained above, to map the store process; the results were as follows in Figure 4.

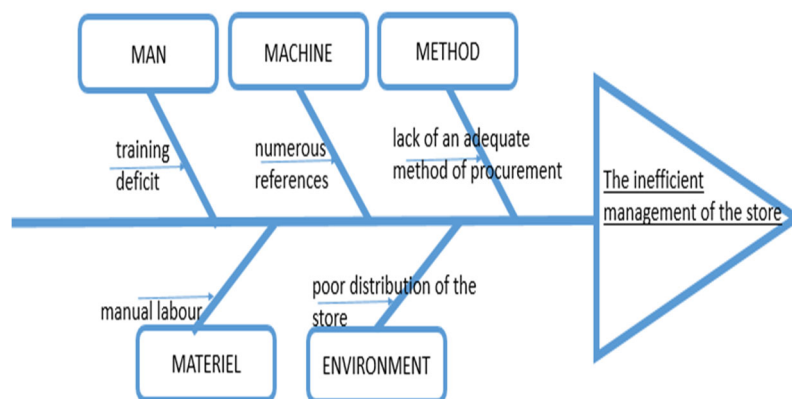


Fig. 3. Ishikawa diagram

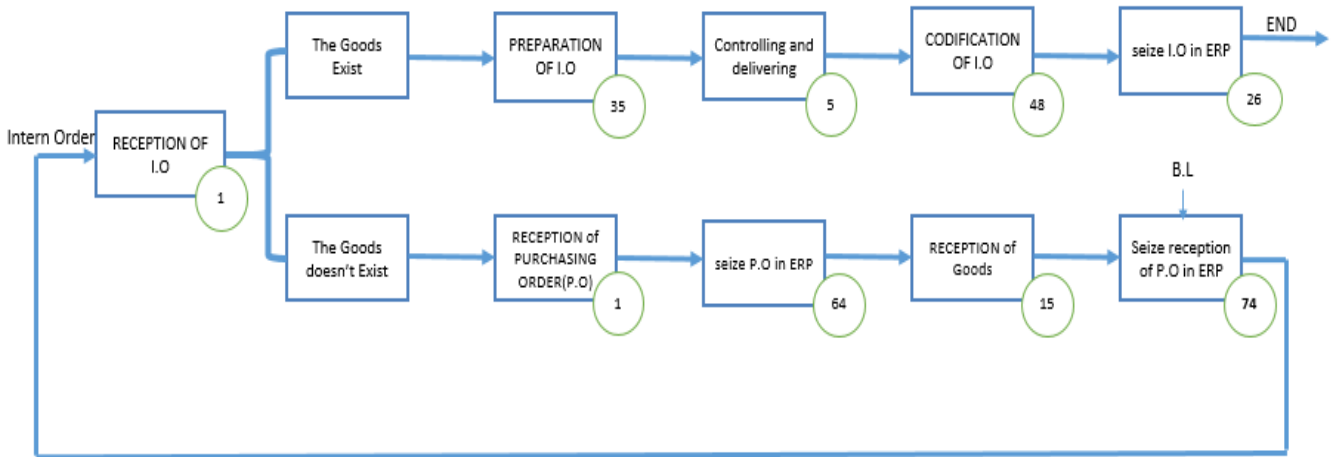


Fig. 4. Processes within the store

After the reception of an internal order, named here (I.O), there are two possibilities:

1) The goods are in stock:

This order is done according to process number 1. This is the standard process (1) which takes 115 seconds.

This process number (1) consists in preparing, checking and delivering the goods to the customer. After comes the stage of “The codification of the I.O” (Manual assignment of the corresponding ERP ORACLE reference to the item on the I.O paper) which allows the storekeeper to enter it later on the Oracle ERP computer platform in order to obtain a reliable image of his stock.

2) The goods are not in stock:

The time to be able to get supplies in this case requires a duration of:

- Duration of process 2, which is 155 seconds.
- Supplier's delivery time under the framework agreement which is 3 days.
- After completion of process 2. We return to process 1, which takes 115 seconds.

Process number 2 starts with the arrival of a Purchase order (P.O) to the purchaser, the purpose of this (P.O) is to place a new order from the supplier by the storekeeper; then we come back to process number 1 after receiving the order.

This has led us to look for the root causes that generate these out-of-stock situations. Referring to the previously mentioned databases of the last three years, we could see that it is mainly related to the following:

- 15% to requests for infrequently used articles.
- 38% to requests for products that are initially triggered by Intern internal order (I.O).
- 47% to shortages.

We can conclude from these two processes the true picture given by the lack of an adequate method of procurement.

Furthermore, a simple comparison between the two processes shows that:

Entire Process = Process (1) + Process (2) = 2.35 x Process (1)*
 (*) Excluding supplier delivery time.

This difference in time has a significant impact not only on the store's customers but also on the storekeepers, generating a significant workload for them.

3.2. Multi-criteria decision

After considering all the outcome from this study, it is now obvious that the choice of a new procurement method for the store is mandatory. We find that the multi-criteria decision method that is very often used by multinational companies, a good tool, because it consists in weighting the different potential choices by specific criteria.

For our study, the potential choices are the basic methods of procurement that are highly vital for the best conditions functioning of any company [6]. They are differentiated by two parameters: Quantity to be ordered and order Date (Tab. 1).

Table 1. Basic methods of procurement

		Date	
		Variable	Fix
Quantity	Variable	Just in time	Replenishment
	Fix	order point	Calendar

As mentioned above, for the multi-criteria decision, we will need to define the criteria, which are illustrated in Table 2.

Table 2.
Criteria and their weights

Criterion	Weight
Inventory shortage	2
Overstocking	2
Ease of use	1

We will assign each criterion a score from 0 to 10. The more we tend towards 10, the more important the method is, knowing that we cannot give the same score to two methods for each criterion (Tab. 3).

Finally, we will multiply the results obtained for each method by the weights of each criterion. The result is as in Table 4.

After applying the multi-criteria decision (Tab. 5), we can conclude that the most appropriate method for the store is: The reorder point method.

Table 3.
Assignment of scores to criteria

	Calendar	Replenishment	Order point	Just in time
Inventory shortage	4	5	7	2
Overstocking	2	5	8	8
Ease of use	9	5	5	2

Table 4.
Multi-criteria decision result

	Calendar	Replenishment	Order point	Just in time
Inventory shortage	8	10	14	4
Overstocking	4	10	16	16
Ease of use	9	5	5	2
Sum	21	25	<u>35</u>	22

Table 5.
Application of the order point method to references

Designation	Average annual consumption	Consumption daily average	Delivery time	Safety stock	Order point
Reference 1	5040	19	3	0	58
Reference 2	20000	77	3	0	231
...
Reference 157	9000	35	3	0	104

Application 1

Since the number of article references (ranges) exceeds 300. We will only take the example of one article family.

The reorder point method is based on two factors:

- WHEN to order?

$$\text{Reorder point} = (U \times D) + SS$$

U: the average rate of consumption per unit of time

D: the supplier's delivery time per unit of time

SS: the safety stock

- HOW TO ORDER?

The most efficient quantity to order is called the WILSON quantity: (determines the optimal reorder period of a production unit).

$$\text{Quantity} = \sqrt{\frac{2 * D * Cl}{P * T}}$$

D: Annual Demand

T: Possession rate

P: Purchase price

Cl: Start-up cost

Table 6.
Application of the order point method to references

Designation	Average annual consumption	Quantity of Wilson	Pack of	Quantity of Wilson round
Reference 1	5040	1237	250	1250
Reference 2	20000	1710	500	2000
...
Reference 157	9000	925	250	1000

Table 7.
Final result following combinations of all methods cited

Designation	Pack of	Stock	Order point	Quantity of wilson	Quantity of wilson round	Quantity to order	Quantity to order round
Reference 1	250	301	58	1237	1250	991	1000
Reference 2	500	231	231	1710	2000	1710	2000
...
Reference 157	250	340	104	925	1000	689	750

After the calculation of the reorder point, here is now the calculation of the quantity of Wilson (Tab. 6)

After applying the Order Point method, we can see that several products from the same family with the same supplier can reach their order points with differences of a few days. Therefore, to avoid making several orders with one supplier, we will combine the Order Point method with another basic method: Family Item Replenishment Method. This system is also called calendar control [7].

This will have two main objectives dealing with :

- Costs: Optimization of start-up costs.
- Environment: Reduction in the number of deliveries.

Application 2

This method has led to a 47% reduction in purchase orders, which represent 148 requests per year, as well as a reduction in the rate of stock shortages and overstocking.

The quantity ordered must never exceed the quantity fixed beforehand, i.e. the quantity of Wilson, so if an article must be ordered even if it has not reached its order point because of another member of its family, the Storekeeper must order a new quantity taking into consideration the packaging subscribed to in ? the framework agreement.

The formula is as follows:

$$\text{Quantity to be ordered} = \text{Quantity of WILSON} + \text{Order Point} - \text{Current Stock}$$

The result can be seen in Table 7.

3.3. Classification ABC

It is a method also known as "Pareto's Law", which classifies selected references into three classes: Class "A", "B" and "C". This method has convinced a number of practitioners by its intrinsic qualities[8].

The ABC classification means that one assigns:

- To the 20% of the most consumed items, class A, that counts for 80% of the total value;
- To the next 30% of the items, class B, that counts for 15% of the total value;
- To the 50% of the least consumed items, class C, that counts 5% of the total value [9].

Families from 1 to 5, alone represent 80% of the annual consumption, and belong to the class A family, they are the most used, so they will be placed as close as possible to the storekeepers.

The families from 6 to 15, are class B, they represent 15% of the annual consumption, they will be placed straight after the class A families, and finally the class C (families from 16 to 32) represent only 5% and will be placed at the back of the store.

This new organization of the references allowed us to reduce the preparation time from 35s to 19s, thus a gain of 46%.

This classification must be based on a criterion or rather a value, which can be either financial or other.

In our case, the value chosen is the annual consumption of the references.

Table 8.
Application of the ABC method to all references

Family	Average annual consumption	Cumulation	%
Family n°1	50195	50195	42.96%
....
Family n°5	4976	92914	79.53%
Family n°6	3309	96223	82.36%
....
Family n°15	1000	110481	94.56%
Family n°16	836	111317	95.28%
....
Family n°32	42	116836	100.00%

Application

The Table 8 shows the application of this method on families of items.

4. Discussion

The results obtained during this study allow us to assert our position on the fact that logistics is a very powerful instrument, and that despite the size of a company, we can always find areas for improvement. The key focus of this study was procurement, since "Continuous re-procurement is at the service of industrial networks"[10]. Indeed, the procurement function must adopt a more strategic and proactive role [11].

As for the results of our study, we were able to obtain:

- Reduction of 47% of purchase order, which represents an average of 148 purchase order per year thanks to the combination of two methods of procurement (Order Point + replenishment), thus an additional gain for the company of 18,500 MAD per year.
- Elimination of overstocking since the quantity ordered will never exceed the quantity of WILSON, which will prevent the articles processed in the store from deteriorating. Thus, internal customers will benefit from a product and a service that meet the required quality. Namely, the quality that aims to define and implement the means used by the project to create and verify products adapted to the needs of the customer [12].
- No overstocking means more shelf space, which means that the storage capacity of the store is now far greater than the load, as well as reducing the hidden costs caused by overstocking. Indeed, it is a set of expenses that are not recorded by the accounting system at the end of the period [13].

- Reduction of financial immobilization by 40.6% since the annual orders placed in the store went from 2,775,016.37 MAD to 1,127,048.88 MAD, representing a gain of 1,647,967.48 MAD.
- The load/capacity balance obtained from the methods used enabled the company to save an investment of millions of Dirhams in a new store.

Therefore, the study made during this period on a single axis of logistics, allows us to attest that this field is a lever of performance for any company aiming to a substantial development. Now imagine if we look at all the axes of this field: purchasing, transport or distribution ...; It will surely allow this company or another, to put all the cards on its side to achieve operational excellence.

5. Conclusions

The logistic organization of Moroccan companies generates, besides long delays, costs that penalize their competitiveness [14], it is for this reason why we opted for this subject. We have divided our work into several parts.

In a first part, we decided to establish an overview, and to do so, we started by using the American Brainstorming method. This was indeed a delicate phase of the study, as it consisted in putting all the stakeholders at ease and in confidence so that they would respond spontaneously, generously and in a transparent manner.

As soon as the results of the brainstorming were collected, we proceeded to put them on a cause and effect diagram. In the same way, and to understand the functioning of the tasks concerned by our study, we schematized all the processes in the store. And based on a scientifically approved method, we assigned to each task in the process the time it would take to be completed. It was clear to us,

based on the data collected and analyzed, that we needed to change the way in which we procured items.

In a second part, and with the help of a multi-criteria decision, we were able to implement a procurement method adapted to the company, essentially based on the combination of two basic procurement methods (the Order Point Method and the Replenishment Method).

The results were satisfactory; since storekeepers will make 147 fewer purchase order annually. In other words, a 47% reduction in the company's purchase order. In the same vein, we found that this new method of procurement ensured that the store was protected from overstocking and shortages. This also results in a remarkable reduction in costs due to non-quality and also a considerable gain in storage space.

In a last part, and given that we were convinced of the importance of reducing the times of the studied processes; We decided to set up an ABC classification of the items (the most used items will be stored in the front rows and thus the least used will be in the back rows) this allowed us to reduce the order preparation time from 35s to 19s, i.e. a gain of 46%.

In short, after 6 months of continuous work and a follow-up of the methods and indicators established that lasted during a year. It is very important to point out that despite the size of the structures, and despite their performance on a global scale. There are always improvements to be made ... gains to be reaped.

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