

A Study of the Impact of the Organizational Purchasing Structure on Supplier's Performance in the Hospital Sector

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Abstract: The purchasing function plays a key role in the hospital sector. To achieve economies of scale in process costs, one of the questions that arises as a healthcare organization is whether to centralize or decentralize purchasing activities. Several managers of hospital systems mentioned the problem of choosing a better purchasing structure. In most cases, the choice of the organizational purchasing structure directly involves an impact on supplier's performance. However, this impact has never been considered in this decision. Organizational innovation is a major issue for the performance of hospitals, but the performance of suppliers also has a heavy impact on the improvement of health infrastructure. Nowadays supplier's performance is an essential element for improving the quality process of hospital care. In this context, we propose to analyse whether considering supplier's performance could affect the decision regarding the organizational purchasing structure in the hospital sector. We verify the influence of purchasing structures on both the objectives of the hospital purchasing process, as well as on the performance of suppliers, through a study-test carried out in CHIS Rabat-Morocco.

1 INTRODUCTION

In Morocco, the Ministry of Health has undertaken several actions to make medical products available and accessible to the population. It has a national list according to the last revision, which was carried out in 2011. The pharmaceutical products covered by this list benefit from an annual budget allocated by the Ministry of Health, to ensure their availability at the level of public hospitals and health care facilities. This budget increased by 67% between 2002 and 2012, reaching the sum of 1.6 billion dirham (Cheng E.W.L, 2001). Despite the efforts made by the ministry, access to medications and medical devices in hospitals remains insufficient (Charles Collins 1994). The main factor that reduces the availability of medical products is the inability to achieve good supplier performance. Experiences have shown that it is possible to improve access to these products by making the best use of resources, and by streamlining management processes (Modi,2007). Indeed, the choice of the purchasing structure could help to develop the performance of the supplier's supply chain. As it could also involve a variety of risks that harm this performance. This change itself leaves an indirect impact on the performance of the hospital's

supply chain. Choosing the right organizational purchasing structure is essential for improving the performance of the supplier's system. Therefore, our study aims to highlight the improvement of the organizational purchasing structure, and simultaneously evolve the quality of services and pharmaceutical products from suppliers. We propose to organize this paper as follows. We will detail the problematic in section 2. In Section 3, we will present the two scenarios: centralized and decentralized purchasing. In section 4, we will present the study-test framing, followed by a discussion and analysis of results. Finally, we will conclude with some perspectives.

2 PROBLEM DESCRIPTION

From 1980 there have been six changes made to the hospital purchasing system. Sometimes they are based on the centralized structure, sometimes on the decentralized structure, (see Table 1). After 2003, the choice was to take the centralized structure as the unique and stable choice. The application of each structure has generated advantages and disadvantages

for hospitals. The budgets allocated to the purchasing of pharmaceuticals products by the Ministry of Health are of the order of 2 billion dirhams annually. This budget has experienced a spectacular increase over the past 12 years, as the budget for 2003 did not exceed 300 million dirhams (Juran, J.M. 1990).

Table 1: A brief history of the health care supply system

1917	Centralization	Creation of the central pharmacy in Casablanca
1980	Decentralization	With many difficulties encountered by the central pharmacy, there was an introduction of the direct delivery system by manufacturers to health facilities.
1985-1986	Centralization	The aggravation of problems due to the small size of the premises and the storage spaces implies a return to centralization. They installed the new Berrechid unit for the storage and distribution of pharmaceuticals.
1994	Decentralization	Creation of the supply division under the general secretariat of the Ministry of Health.
1995	Centralization	Implementation of the Berrechid unit to centralize medical products purchases.
1997	Decentralization	Decentralization of purchasing
2001	Centralization	Centralization of supply (purchasing, storage, distribution) by the purchasing division.
2003	Decentralization	Decentralization of purchases in view of the difficulties of regular supplies.

In the face of all these changes and developments in the organizational purchasing structure, Moroccan hospitals continue to suffer from insufficient quality, unavailability of pharmaceuticals products and rising costs (Deming, W.E. 1950). Storage and distribution centers cost up to one billion Dirhams per year. In addition, the storage and distribution of medical products in Morocco costs the Ministry of Health over 30 million Dirhams per year (K. Jenoui, 2017; A. Abouabdellah, 2014). This shows huge costs due to the

poor performance of the supplier and the inappropriate choice of organizational purchasing structure. In this optic, we propose to study the impact of the purchasing structure on the supplier's performance through a study-test to validate the main causes of the variation in their performance and look for possible solutions. We set two main objectives:

- Simulation of both scenarios with suppliers: centralized structure, and decentralized structure, with studying the impact of each of them on the development of hospital objectives.
- Assessment of supplier performance in terms of total cost and delivery date and analyse the impact of implementing each purchasing structure on their performance.

3 SCENARIOS MODELING: CENTRALIZED AND DECENTRALIZED

We will propose a model, which allows us to make a comparison that relates to the differences between the results of both scenarios. According to the suppliers interviewed, we take stock of the costs, which are presented in two types:

3.1 Variable or Operational Costs

Variable costs are costs constituted only by charges that vary with the volume of activity of the company, for example, the quantities produced and/or sold, without necessarily being an exact proportionality between the variation in charges and the variation in the volume of products obtained.

3.2 Fixed Costs

Fixed costs correspond to the charges generated by administration or sustainable investments. They are not proportional to the quantities produced. To follow sales price creation, variable costs are considered one of the main issues for suppliers (A. Marie, 2006; D. Serrou, 2016). Although the production cost is the most important to indicate, it is often necessary to be able to break down the cost structure into several costs. In this study we have focused on the following types:

- The production cost, which consists of making all direct expenses that were made to produce a good, including the purchase and consumption of materials, labor, maintenance of equipment (J. Dumoulin, 2004).

- The distribution cost, which includes all the charges necessary for the distribution and sale of the product. It includes expenses due to the management of the stock of products, transport to sale, but also additional expenses directly linked to the distribution of products (P. Trouiller, 2013).
- The preparation cost, which is the cost associated to an order, includes all the expenses necessary to prepare an order, which depends of the number of parcels and the number of units of parts, such as the costs of handling, picking and packaging.

In our model, the notation used is shown in Table 2.

Table 2.

E: Central pharmacy		
H: Number of hospitals, each represented by the index i , where $i \in \{1, 4\}$		
S: Number of suppliers, each is represented by the index j , where $j \in \{1, 10\}$		
Q_j : Quantity of products ordered from each supplier j		
Dh_j : The requirement date imposed for each supplier j		
TCC _j : Total cost in centralization structure for each supplier j .		
TCD _j : Total cost in decentralization structure for each supplier j .		
GC _j : Gap time in centralization structure for each supplier j .		
GD _j : Gap time in decentralization structure for each supplier j .		
	Centralization	Decentralization
Unit price for each product j	U_{cj}	U_{Dj}
Distance covered	Distance between supplier j and central pharmacy D_{iE}	Distance between supplier j and hospital i D_{iH}

Preparation cost per product j	C_{cj}	C_{dj}
Delivery cost per product j	T_{cj}	T_{dj}
Labor cost for distribution per hour	P_{cj}	P_{dj}
Number of parcels delivered by each supplier j	N_{cj}	N_{dj}
The delivery date indicated by each supplier j	D_{cfj}	D_{dfj}
Number of hours for distribution	Distribution of product j to the central pharmacy d_{iE}	Number of hours for the distribution of product j to the hospital i d_{ij}
The time remaining to the start of the validity period indicated by each supplier j for each product i	T_{cij}	T_{dij}
Total cost	$TCC_j = Q_j * U_{cj} + Q_j * C_{cj} + P_{cj} * T_{cj} * D_{iE} + d_{iE} * P_j$	$TCD_j = Q_j * U_{Dj} + Q_j * C_{dj} + P_{dj} * T_{dj} * D_{iH} + d_{ij} * P_j$

4 STUDY-TEST FRAMING

The CHIS Ibn Sina Rabat is one of the most important hospital structures in Morocco. It brings together ten specialized hospitals with a multi-site platform created since 1954. The CHIS is implementing significant resources to improve its daily efficiency. In this context, our study aims to optimize logistics

activities. Currently, the hospital is leading a project to regroup pharmacies, which must consider the management of supplier performance. Consequently, activities are carried out in redundancy in several establishments and sometimes in several departments within the same hospital. The strategy of pooling resources was born because of several observations. In most cases, the aim of the consolidation is to reduce operating costs and increase the efficiency of the system. It is in this optic that we are interested in studying the impact of the organizational purchasing structure on supplier performance. To implement the test-study, we approached it by looking for 20 suppliers who would probably accept our test-study. We contacted them by email, explaining the objectives behind our study, and then we made several phone calls with several potential participants to discuss a short survey to assess needs. 80% of suppliers indicated that they are not satisfied with the organizational purchasing structure established by healthcare organizations, and 45% of them are interested in our test study, while 35% of suppliers do not care about any change. 20% of suppliers show interest in the hospital purchasing strategy, however, only 45% of them are interested in participating in this study, making a total of nine suppliers as indicated in figure 1. The major challenge is to clearly communicate the plan to each supplier, in a form that they can understand and put into practice (Figure 2).

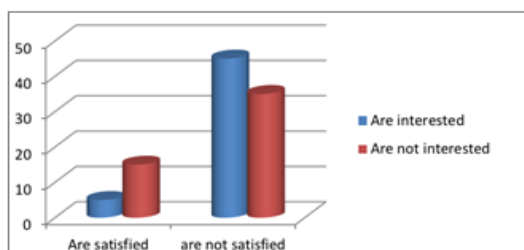


Figure 1 : Survey results

5 RESULTS ANALYSIS

Suppliers return responses to our study after three months. Each of them prepared answers to our test, using a team of experienced specialists in the medical field.

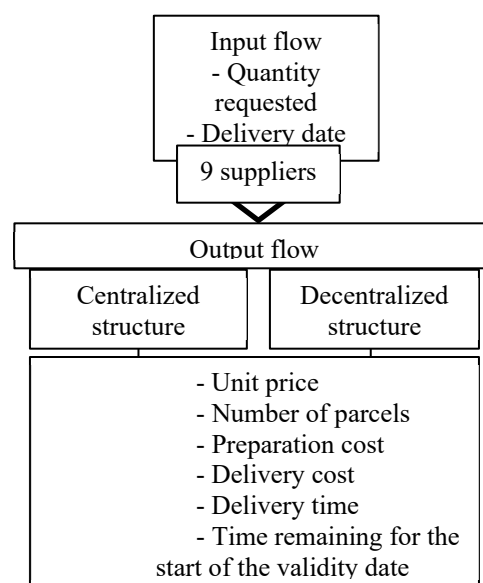


Figure 2 : Input and Output flow

5.1 Unit Price and Distribution Costs

As shown in figure 3 and table 3, the unit price increases in case of decentralization for most of suppliers except suppliers 5 and 9. To understand this behaviour, we show in figure 4 and 5, the details of each supplier. As for supplier 9, he meets the delivery time requirements for H3 and for the central pharmacy; he delays delivery eight days for H1, H2 and H4. While supplier 9 has only 40% of the order in the stock, either he will meet the delivery date for Hospital 3 and delay delivery for others while reducing the unit price, or he will deliver the central pharmacy on time, while keeping the same initial price and making urgent production. Following the previous case, with only 50% of order in stock, supplier 5 has two choices, either he delivers 30% to H4 and 20% to H2 on time with the initial price, and delays delivery for H1 and H4 while reducing the unit price, or he choose to deliver the central pharmacy on time with urgent production while keeping the initial price.

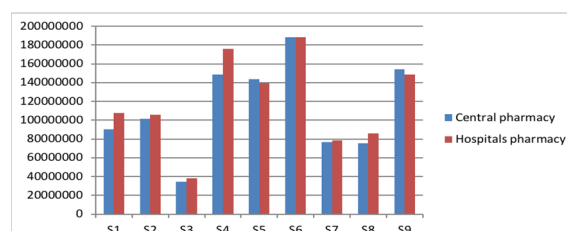


Figure 3: Comparison of unit prices in both purchasing structures

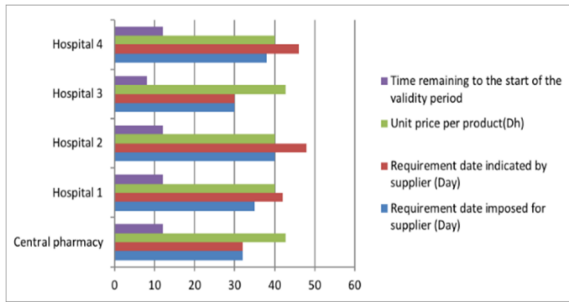


Figure 4: Results obtained for supplier 9

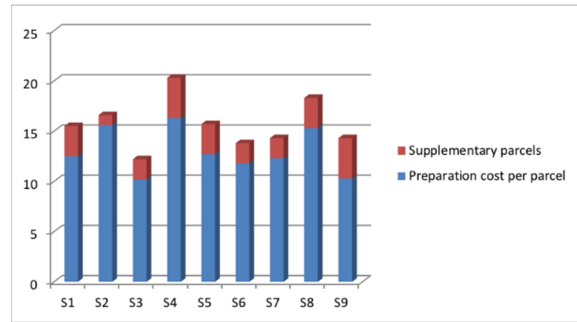


Figure 7: Additional parcels for each supplier

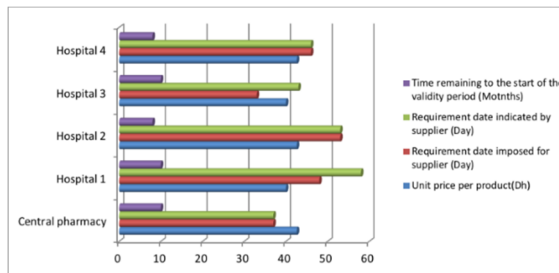


Figure 5: Results obtained for supplier 5

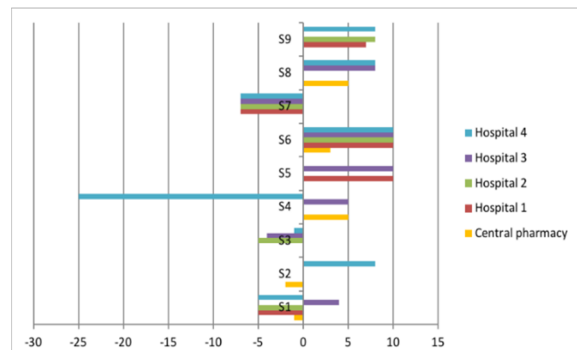


Figure 8: Delivery dates proposed by suppliers

5.2 Preparation Costs

As shown in Figure 6 and table 4, preparation costs are higher in the case of decentralization. The small difference is justified by the number of optimized parcels in the case of centralization. In addition, the preparation cost per parcel, which differs from one supplier to another.

Supplier 4 is distinguished by a maximum total preparation cost, and a considerable cost difference between both structures, which amounts to 0.07% of the total cost. This difference is justified by the additional number of parcels in the case of decentralization (figure 7), and a high preparation cost compared to other suppliers, which amounts to a 5.2% difference.

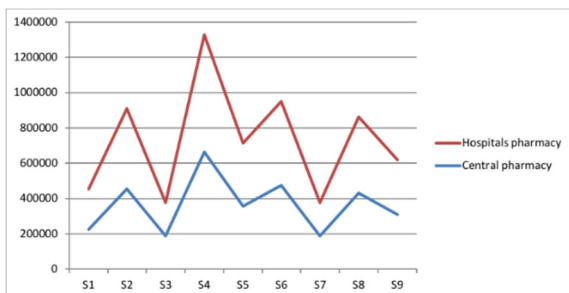


Figure 6: Comparison of preparation costs in both purchasing structures

5.3 Delivery Costs

As shown in Figure 9 and Table 5, the delivery costs incurred by suppliers in case of decentralization are much higher than in case of centralization. The increasing number of delivery costs has been realized due to the multiplication of possible routes to deliver to several dispersed points. A large difference in the delivery costs (up to 18%) is allocated to the delivery of the order between both structures, which is justified by the number of kilometers recorded by each supplier traveling to each hospital, and the unit cost delivery that differs from one supplier to another.

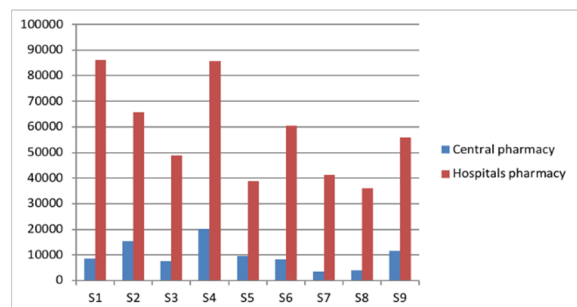


Figure 9: Comparison of delivery costs in both purchasing structures

5.4 Change in Variable Costs

The results generated on the variable costs, for different suppliers in both cases are indicated as follows:

- The variable costs are strictly higher in the case of decentralization:

In this case, the variable costs are higher for 55.6% of suppliers, this being due to the increase of preparation and delivery costs. The centralization system helps suppliers to manage parcels in a better way by enabling efficient optimization that can achieve savings of up to 2.7% of the total cost. It is a small gain, but still significant. In addition, most of suppliers offer lower prices to purchasers in case of centralized system, which is due to the large quantity, which motivate suppliers to make urgent production, to keep the market.

- The variable costs are higher or equal in the case of centralization:

The time remaining to the start of the validity period of medical products is imposed by hospitals to be at least 18 months at the time of delivery. 22.2% of suppliers respect this constraint for all orders, which pushes them to increase prices. Variable product costs are almost the same in both purchasing structures for 22% of suppliers.

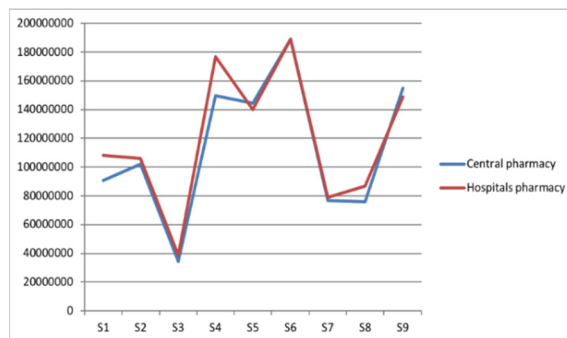


Figure 10: Comparison of variable costs in both purchasing structures

Table 3: Total order price generated in each structure

	S1	S2	S3	S4	S5	S6	S7	S8	S9
SC	90534912	101718468	34310016	148914420	143933472	188232432	76681296	75291936	154365624
SD	107945472	105563496	38332570	176011962	139541136	188232432	78520176	86227837	148509130
Gain (SC-SD)/SC	-0,1923	-0,0378	-0,1172	-0,182	0,0305	0	-0,024	-0,1452	0,0379

Table 4: Preparation costs in both structures

	S1	S2	S3	S4	S5	S6	S7	S8	S9
SC	226700	454412,4	187975,8	663198,1	357581,2	475823,2	188485,2	430480,8	310297,8
SD	226725	454428	187986	663230,7	357606,6	475846,8	188509,8	430511,4	310318,4
Gain (SC-SD)/SC	-0,00011	-0,00003	-0,00005	-0,00005	-0,00007	-0,00005	-0,00013	-0,00007	-0,00007

Table 5: Delivery costs values in both strategies

	S1	S2	S3	S4	S5	S6	S7	S8	S9
SC	8448,44	15224,22	7552,93	20107,2	9501,6	8168,5	3529,2	4017,9	11566,1
SD	86051,28	65862,72	48912,29	85768	38905,2	60341,5	41312,4	36093	55936,4
Gain (SC-SD)/SC	-9,1855	-3,3262	-5,4759	-3,2655	-3,0946	-6,3871	-10,705	-7,983	-3,8362

6 CONCLUSIONS

The hospital system must ensure an irreproachable quality of service and optimize its supply chain. Managers need to choose the most appropriate organizational structure that helps pharmaceutical suppliers improve their performance. Centralization is a system in which decision-making and

administrative acts are organized around a single center of power. In this study the centralized hospital system gave better results, it is more efficient in terms of variable costs, cost effectiveness and reduction of expired medical products. However, this study does not take into account the hidden costs generated by suppliers, which will be taken into account in our next study in which we will develop a decision-making

approach in the hospital sector for the choice of the organizational purchasing structure.

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