

Analysis of Factors Impacting Storage Costs in Beninese Companies

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Abstract : *This paper aims to analyse the effects of factors impacting storage costs in Beninese companies. We collected data on three (03) storage cost structures from 2019 to 2021. In addition, an interview was conducted with the staff in charge of stock management. We adopted a working methodology based on two approaches, namely the qualitative and the quantitative approach. The simple linear regression method used in this study allowed us to evaluate the determinants of the evolution of the storage cost. At the end of our analysis, we found that as the company's activity increases, the operational and handling costs evolve, leading to the evolution of the storage cost. The regression results also show that the handling and operational costs positively and significantly affect the storage cost. Operational recommendations were made based on the results of our analyses to control these costs in Beninese companies to achieve sustainable development objectives.*

Keywords: impacting factors, storage cost, Beninese companies.

Introduction

The enterprise is an economic entity, financially independent, bringing together means of production to create goods and services for the satisfaction of its customers and the realisation of a profit. Its growth depends on an organisation established on well-defined bases and clearly defined objectives, considering its environment and the rigorous management of its various functions. One of its main commercial functions is the "Distribution" (logistics) function. It includes storing products, providing customers with an assortment of goods or services and making the goods and services sold by the company available to the final consumer. The distribution policy consists of choosing the distribution channel and circuit. This is possible thanks to consistent stock management, which implies the continuous existence of products in stock for customer satisfaction. Whatever its activity, size and organisation, a company always has stocks to manage. According to (Bouami, 2019), inventories can represent 20 to 60% of the company's assets. They generate a significant need for investment and tie-up cash that could be devoted to developing profitable activities for the company. Therefore, business leaders must implement a policy of optimising or even eliminating the storage costs associated with the distribution of their products.

In economic terms, the stock is the totality of goods, purchases and products stored by a company and intended to be sold during a given period. It is, therefore, necessary for any private or public profit-making company or organisation to have a stock in order to meet its customers' orders and also unexpected and seasonal orders. Stock may protect against uncertainties in forecasting, production and supply, but having stock can be expensive, sometimes very expensive, for a company. According to (Bahloul, 2011), it is not widely known, but every dollar of inventory a company maintains above its ideal level generates additional costs of 20% to 30%. According to (Mocellin, 2019), as a logistics manager, reducing your operating costs and increasing your profits are among the primary objectives. In order to optimise the flows, there is a need to identify and reduce the main logistics costs, including those related to the transport and storage of goods. In Benin, many business entities exist, but not all may have a good grasp of storage costs. At the same time, with the evolution of technology, many companies have opted for the just-in-time policy. Just-in-time is a known effective method of limiting waste and reducing storage costs.

Indeed, the storage cost is deducted from the time the goods are received until they are taken out of storage. It is therefore becoming increasingly important to reflect on the cost of storage, as it is costly to the company and negatively affects its results. The company needs to identify the elements that enter into calculating storage costs or implement measures to optimise these costs.

Given the above, it is, therefore, necessary to look at the factors that can affect the cost of storage in Beninese companies. To do this, we formulated the following central question: What are the effects of the factors that explain storage costs? This question can be broken down into two specific questions:

What is the effect of handling cost on storage cost? What is the influence of operational cost on storage cost?

This article is organised into three parts. The first part presents the literature review and formulation of the research hypotheses. The second part deals with methodological aspects. The third part is devoted to the analysis of empirical results and discussions.

1. Literature review and formulation of research hypotheses

1.1 Conceptual clarification

The concept of cost in inventory management is, with some differences, the subject of consensus within the research community. (Hssini et al., 2019) Consider that order costs include the costs of preparing and processing the order and the costs of the goods. For their part, (Morana & Pinardi, 2003) consider ordering costs to include both the costs of preparing and processing the order and the costs of the goods themselves. In addition to the variety of definitions offered, let us briefly look at the constitution of each of the main costs in inventory management. Order costs are fixed costs (Armstrong, 2000). They include the costs of preparing the purchase order, information processing, postage, telephone, fax or e-mail. They also include the costs of receiving goods and following up on orders. Storage costs are caused by all the financial obligations that must be met to maintain stocks in good condition. In this case, we refer to the cost of fixed capital, the various costs associated with using the storage space (electricity, heating, insurance) and the costs involved in holding the items (insurance and risk of obsolescence). (Belin & Debrand, 2002) point out that: "The allocation of storage costs is often done on an approximate basis, as it is difficult to allocate to each item its fair share of costs related to energy, handling and property taxes, for example". Like storage costs, shortage costs are tricky to estimate. The concept of scarcity can be of two types: the first is recoverable (delayed sale), while the second is irrecoverable (total loss of sale). Shortage costs can be internal or external (Belin & Debrand, 2002). The enter alternative costs refer to idle labour, idle equipment, emergency procedures to speed up deliveries and supplies, and costs caused by changes in production scheduling. Cost externality includes costs related to loss of reputation, loss of orders, emergency procedures and additional subcontracting costs. The purchase cost is simply the money required to obtain the ordered items. Its importance varies when suppliers offer a price list based on quantities ordered (quantity discounts). (Lasnier, 2015) highlights the relevance of the costs associated with the inventory control system :

- The direct and indirect costs of managing the cost of storage are traditionally grouped into four categories :
- Inventory carrying costs (IC) ;

It is composed of the capital cost of the warehouse (rental or depreciation) and the cost of the storage equipment; Miscellaneous costs related to the warehouse: lighting, heating, insurance of the warehouse, but also insurance of the stock itself; Staff costs for putting the stock in and out of storage; Staff costs for working on the stock indirectly (e.g. management controller and accountant) and costs for carrying out an annual physical inventory, rotating inventories or a perpetual inventory; Cost of obsolescence of the products, as well as a risk of shrinkage and loss.

CP = possession rate x average stock

- The cost of acquisition

This cost is composed, for a purchased item, of the amount of the purchase invoices plus the costs of procurement, transport, handling and overheads;

- The cost of disruption

It is equal to the shortfall resulting from the non-fulfilment of orders, possibly increased by the costs of lost production, the cost of using urgent delivery means and the cost of changing the scheduling.

- The cost of transport :

According to (Tseng & James Goo, 2005), the critical element in a logistics chain is the transport system, which links different activities. The cost of transport occupies one-third of the amount in logistics costs. Transport is necessary for production processes and returns. Only good coordination between its components would bring financial benefits.

- Direct costs in the distribution chain :

In general, the cost elements directly related to the physical movement of goods are easily seen as part of the total distribution costs and are considered direct costs. The most appropriate method for determining direct costs varies according to the type of industrial activity. These are :

- direct transport costs ;
- international movements ;
- internal movements ;
- of the mode change ;
- handling activities ;
- Other distribution costs ;
- of the storage package ;
- of the logistics information system ;
- hidden costs in the distribution chain.

Indirect costs cannot be attributed directly to cost objects, meaning that the full resulting or 'absorbed' cost needs to be more accurate to an unknown extent (Armstrong, 2002) . A distinction is made between some indirect transport costs of stocks:

- Shipping costs (tolls, motorway)
- Customs and biosecurity
- Insurance
- Logistics carrying costs
- Storage cost structure

The storage cost structure summarises all the costs generated by the operation of the company's stock. The idea is to group the expenses incurred by type, function or allocation to offer managers a concrete and straightforward presentation of how the money was used over a given period or for a defined objective.

- Handling costs

Handling costs refer to all costs associated with the handling of goods. This includes the storage of goods, the means of transport and shipment using different delivery methods. Handling refers to the entire phase of transporting and moving goods.

- Operational costs

Incorporable costs related to the operations of the production tool existing in the company or one of its divisions. These costs are closely related to the entity under analysis. However, their evolution often remains complex.

- Supply costs

There are four (4) significant costs concerning procurement: - the purchase cost - the management cost composed of the cost of placing orders and the cost of holding stock - the total cost of procurement - the cost of breakage - The purchase cost. This includes the purchase price and incidental purchase costs.

Handling costs refer to all costs associated with the handling of goods. This concerns their storage and means of transport and shipment with the different delivery methods. Handling refers to the entire phase of transporting and moving goods. It is a task carried out by machines, equipment or workers, representing a financial cost. Indeed, the stock in the warehouse represents a high cost. There are also costs associated with delivery. The payment of handling personnel is also a wage cost. All of these elements together make up the handling costs. According to (Dubos, 2017), the stock is expensive at all levels in a company.

On the one hand, the stock must be stored. This implies premises, equipment, personnel, logistical equipment in greater or lesser quantities, insurance, heating (or refrigeration) and inventories. The storage cost is all the costs incurred due to the presence of stocks in the warehouse. From this, we can formulate our first hypothesis:

Hypothesis 1: Handling cost has a positive effect on storage cost.

Building up and maintaining stock is an activity that generates many expenses. In addition to the fixed costs (costs of available stocks, building costs, land costs), variable costs are associated with the various stock maintenance and replenishment operations. Managing the balance of a shop requires, first and foremost, that these various costs be controlled. Failed optimisation undoubtedly causes an imbalance, which in one way or another, generates either additional costs linked to stock shortages or an increase in financial assets due to overstocking. Operating costs are incorporable expenses related to the operations of the production tool existing in the company or one of its divisions. These costs are closely related to the entity under analysis. According to (Lasnier, 2015), the costs related to storage are deducted from the goods receipt operation to the goods issue operation. The storage of goods, therefore, entails the following main lines of expenditure :

- a) Personnel costs (warehouse workers, forklift operators, supervisory staff) :
 - Salaries and remuneration of staff in charge of stocks
 - Employer's expenses related to the staff in charge of the stocks.
- b) Logistics infrastructure costs :
 - Building rental costs ;
 - Insurance premiums (fire, burglary and similar risks) ;
 - Depreciation of storage facilities ;
 - Interest in capital invested in the project ;
 - Service and maintenance costs ;
 - Other: (heating, electricity, water, telephone).
- c) Expenses related to stored goods :
 - Damage, obsolescence, scrap associated with inappropriate treatment or prolonged storage
 - Insurance premiums (product liability) ;
 - Financial capital costs, interest on capital invested in goods (unproductive capital).

From this, we can formulate our second hypothesis;

Hypothesis 2: Operational cost positively influences storage cost

2. Research methodology

2.1 Data source

In order to analyse storage costs, we first consulted the various elements used to calculate storage costs. The primary data collected in our study were made available to us. This is information related to the structure of storage costs. This data is considered secondary, as it contains all the information to be used. The population consists of the storage cost structure, in this case, the monthly storage cost from 2019 to 2021, a total of 36 (thirty-six) storage costs. Both qualitative and quantitative analyses were used.

The analysis of the variables as well as the estimation of the model, was done using Excel and STATA 15 software. Multiple linear regression was used to estimate the dependent and independent variables.

$$\text{Storage costs} = \alpha_0 + \alpha_1 * \text{operational costs} + \alpha_2 \text{ handling costs}$$

Here we have two explanatory variables, operational and handling costs, and the explained variable, storage costs.

2.2 Choice and description of variables

The indicators considered for our study are storage, operational, and handling costs.

- The total storage cost (TSC)

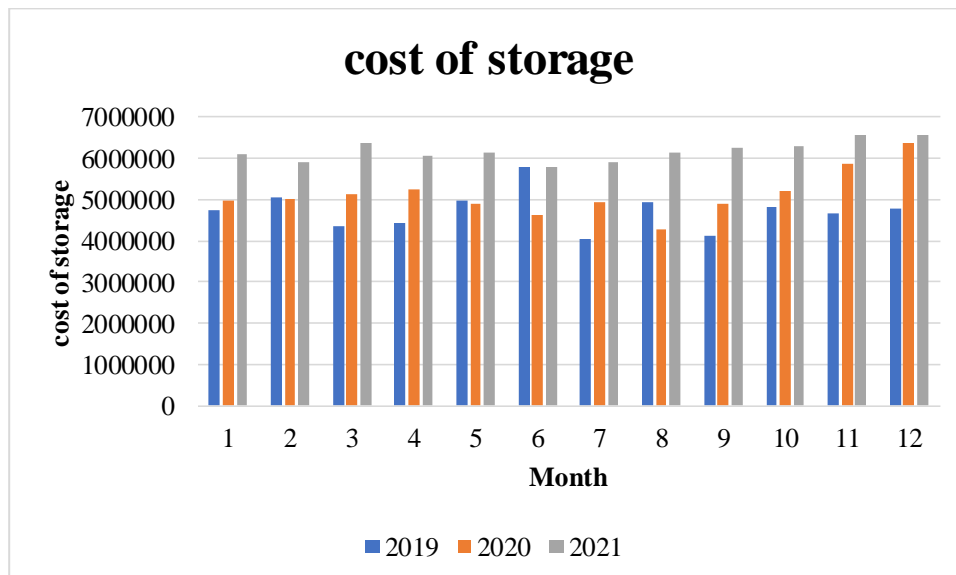
The cost of storage for each year was derived from the cost structure of the study period. To obtain the total amount, we summed up the handling and operational costs over the period.

$$\text{TCO} = \sum \text{ of monthly handling costs} + \sum \text{ of monthly operational costs}$$

3. Analysis of empirical results and discussion

3.1 Evolution of storage costs

Figure 1: Evolution of storage costs



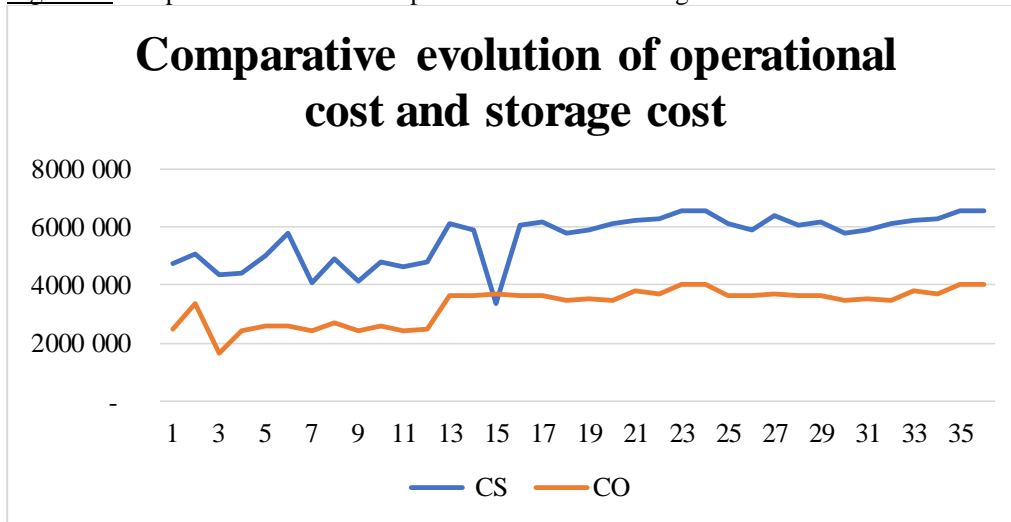
Source: Cost structure / Microsoft Excel database

Figure 1 above shows that the monthly storage cost for 2019 did not exceed the average, i.e. 5,338,056 CFA francs, except for the sixth month. In 2020, the same observation was made that the monthly cost for this year was at most the average except for the last

two months. In 2021, we found that this cost exceeded the average. This evolution of the storage cost can be justified by the losses linked to breakage and damage, the commissions of the commercial staff, the depreciation of the machines, the salaries of the permanent staff, the rental charges, the salaries of the labourers and the charges linked to the movement of the goods.

3.1.1 Comparative evolution of storage cost and operational cost

Figure 2: Comparative evolution of operational cost and storage cost

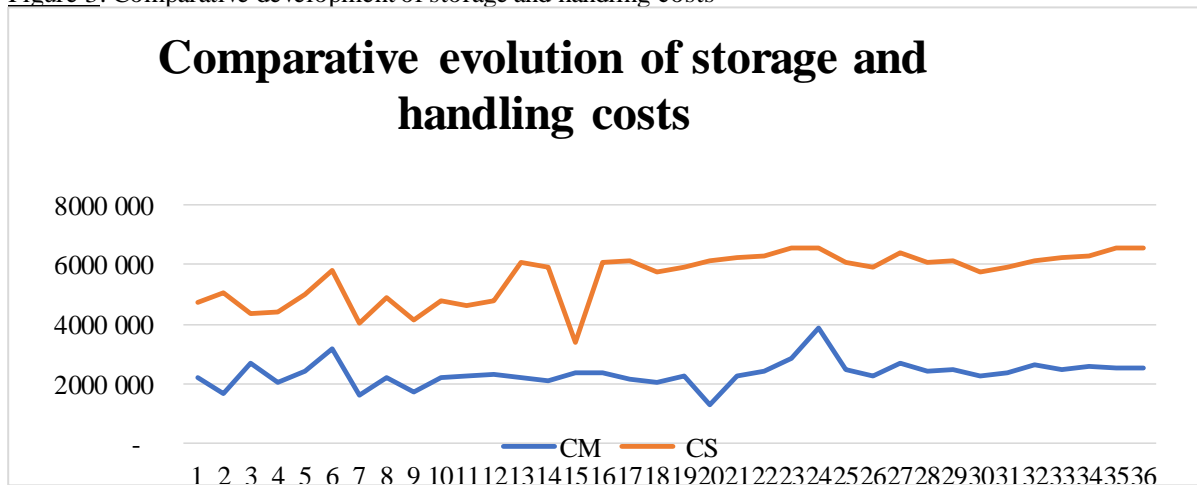


Source: Cost structure / Microsoft Excel database

Figure 2 above shows a growth in the operational and monthly storage costs from 2019 to 2021. It can be seen that the operational cost increases from 2,510,000 CFA francs to 4,035,000 CFA francs, i.e. 61% and that the storage cost increases from 4,740,000 CFA francs to 6,565,001 CFA francs, i.e. 39% over the study period. This is due to the poor maintenance of the bottles, which are broken every time, although these products should be a source of added value that will cover part of the costs. In addition, electricity costs have not ceased to evolve over the entire study period, rising from an average of 200,000 CFA francs per month to more than 500,000 CFA francs per month, not to mention the substantial fluctuations in these costs, which reach more than 600,000 CFA francs in some months.

3.1.2 Comparative evolution of handling and storage costs

Figure 3: Comparative development of storage and handling costs



Source: Cost structure / Microsoft Excel database

Figure 3 below shows a slight change in handling costs over the entire study period. This slight increase is reflected in a handling cost of around 2300,000 CFA francs on 31 January 2019, which will rise to around 2600,000 CFA francs on 31 December 2021, i.e. an increase of around 13%. Nevertheless, this slight increase implies a drastic evolution of storage costs, i.e. an increase of 39%. This situation is due to the poor control of other costs that can influence the cost of storage. Also, unnecessary and uncontrolled transport are considered in the handling costs.

3.2 Result of the descriptive statistics

Before presenting our econometric estimates, descriptive statistics is a crucial preliminary phase to give a global and general state of affairs on all the variables studied. Table 1 below provides the descriptive statistics for these different variables.

Table 1: Descriptive statistics of variables

Variables	Number of observations	Average	Standard deviation	Minimum	Maximum
Storage Cost	36	5254833	797806.1	3390000	6573051
Operating Cost	36	2989167	573544.5	1650000	4035000
Handling costs	36	2348889	433350.8	1315000	3850500

Source: Compiled by the authors, statistical data/processed in Excel 2019

From the results of the above table, from 01/2019 to 12/2021, the storage cost varies between CFAF 3390000 and 6573051 with a monthly average of CFAF 5254833. It should also be noted that during this period, the operational cost varies between CFAF 160,000 and 40,000,000, with an average of CFAF 29,891,677. The handling cost varies between 1315000 and 3850500 FCFA, averaging 2348889 FCFA.

From the analysis of the results obtained, we note that the company cannot control the minimum storage costs, i.e. CFAF 339,000 against CFAF 2965,000, representing the sum of the minimum storage cost elements; on the other hand, the company quickly managed to control the maximum storage costs. After comparing the three standard deviations, the standard deviation of the operational cost being 565522.462 and that of the handling cost 427289.605; they are all lower than that of the storage cost, i.e. 786647.398. This explains the poor dispersion of storage costs around the average: the company has a problem forecasting its storage costs.

3.3 Statistical test

This part presents, on the one hand, the analysis of the correlations between the explained variable and each explanatory variable and the correlation between the two explanatory variables to determine the existence of a linear regression between them. On the other hand, we have, utilising a multiple regression, confirmed or denied hypothesis 2.

❖ Test of correlation

In this section, we perform the correlation analysis between each variable. The objective is to see whether or not there is a linear relationship between the storage cost and each explanatory variable, as well as the relationship between the handling cost and the operational cost. In the case that a relationship exists, we specify the direction and intensity of the relationship.

Table 2: Correlation between variables.

Variables	Storage Cost	Operating Cost	Handling costs
Storage Cost	1		

Operating Cost	Correlation coefficient	0,6411	1	
	P-value	0,0000		
Handling costs	Correlation coefficient	0,5308	0,1002	1
	P-value	0,0009	0,5608	

Source: Compiled by the authors, statistical data / processed in Excel 2019

Table 2 shows a positive linear correlation between storage and operational costs ($p\text{-value} = 0.0000 < 0.05$). The intensity of this link is 0.6411, i.e. a moderate link. The same observation is made between the storage and operational costs ($p\text{-value} = 0.0009 < 0.05$). The intensity of this link is 0.5308, i.e. a moderate link. We, therefore, verify our hypotheses using a linear regression between the three variables.

Furthermore, we note that the correlation between the two explanatory variables is low (0.1002). This reflects the absence of autocorrelation between these explanatory variables.

❖ Discussion of results and testing of hypotheses

The purpose of this section is to quantify the effect of the handling cost and the operational cost on the storage cost. The results of this analysis allow us to confirm or refute our two hypotheses.

Table 3: Multiple regression results.

Explanatory variables	Coefficient	Error-Type	Statistics	Probabilities
Operating Cost	0,8260961	0,1478604	5,59	0,0000
Handling costs	0,8675832	0,1956948	4,43	0,0000

Source: Compiled by the authors, Statistical data / processed by STATA

▪ Testing of hypothesis 1

The results of the estimated model show that the coefficient of determination is 0.6 (see annexe). Thus, 60% of the cost variability is explained by the regression model found, i.e. by the handling and operational costs. The remaining 40% is explained by the other factors not considered in the model. The Fisher statistic calculated from our data is 28.20, and the associated p-value is below the 5% threshold, i.e. $0.0000 < 0.01$. The model is likely to estimate the cost of storage.

This result concludes that the storage cost is associated with handling costs, adjusted on the other variables.

Thus, the model is considered to be of good quality. In other words, this test allows us to test the overall contribution of the explanatory variable present in the model to explain the variation in storage costs. Specifically, we tested the significance of the model's coefficients using the Student's t-test. Indeed, when we consider the p-value, we realise that handling costs are high at the 5% threshold. An increase in handling costs of 1% leads to an increase in storage costs of 0.8676%. Given the regression results, **hypothesis 1 is confirmed.**

▪ Testing of hypothesis 2

The results of the estimated model show that the coefficient of determination is 0.6 (see annexe). Thus, 60% of the cost variability is explained by the regression model found, i.e. by the handling and operational costs. The remaining 40% is explained by the other

factors not considered in the model. The Fisher statistic calculated from our data is 28.20, and the associated p-value is below the 5% threshold, i.e. $0.0000 < 0.01$. The model is, therefore, likely to estimate the cost of storage.

From this result, we can conclude that the storage cost is associated with the operational costs, adjusted on the other variables. Thus, the model is considered to be of good quality. In other words, this test allows us to test the overall contribution of the explanatory variable present in the model to explain the variation of the storage cost. Specifically, we tested the significance of the model's coefficients using the Student's t-test. Indeed, when we consider the p-value, we realise that the operational costs are significant at the 5% threshold. An increase in operational costs of 1% leads to an increase in storage costs of 0.8261%. Given the regression results, **hypothesis 2 is confirmed.**

❖ Operational recommendations

- Implement a policy of optimising handling costs;
- Establish a procedure manual,
- Better check the cost drivers before allocating the handling cost;
- Keep and file receipts for fuel, electricity and gas expenses. This verification will allow the company to control the evolution and control of this handling cost.
- Implementing an operational cost optimisation policy
- Keeping and filing receipts for expenses related to renting, staff salaries and sales commissions
- To ensure a better distribution of the costs related to stock management.

Conclusion

The objective of this work is to analyse the determinants of storage costs. To achieve this, we studied the storage cost structure for 2019, 2020, and 2021. To verify our hypotheses, we used the simple linear regression method, which allowed us to evaluate the determinants of the evolution of the storage cost. At the end of our analysis, we found that the more the company's activity expands, the more its operational and handling costs evolve, leading to the evolution of storage costs. Companies must therefore seek to optimise their costs. To this end, we have made several suggestions and recommendations to help improve the storage cost optimisation policy. These include: establishing a rigorous and detailed policy on the structure of the storage cost of the warehouse and evaluating the elements that go into the calculation of the storage cost to facilitate regular monitoring of the evolution of turnover. Thus, to avoid jeopardising the continuity of the business, it is essential to manage the storage cost accurately, as poor monitoring of this element can directly affect the profitability or have harmful consequences in the long term. For our part, this work has been very edifying in that it has allowed us to discover and understand the problems and challenges that need to be faced.

These suggestions and recommendations are not a panacea but are intended to improve storage costs' monitoring and management.

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APPENDIX: Results of the linear regression and correlation test with STAT15

- **Descriptive statistics**

Variable	Obs	Mean	Std. Dev.	Min	Max
Coûttotald~e	36	5254833	797806.1	3390000	6573051
Coûtopérat~l	36	2989167	573544.5	1650000	4035000
Coûttotald~n	36	2348889	433350.8	1315000	3850500

- Correlation table

	Coûtto~e	Coûttop~l	Coûtto~n
Coûttotald~e	1.0000		
Coûtopérat~l	0.6411*	1.0000	
	0.0000		
Coûttotald~n	0.5308*	0.1002	1.0000
	0.0009	0.5608	

- Table of estimation results

Source	SS	df	MS	Number of obs	=	36
Model	1.4054e+13	2	7.0271e+12	F(2, 33)	=	28.20
Residual	8.2231e+12	33	2.4918e+11	Prob > F	=	0.0000
				R-squared	=	0.6309
				Adj R-squared	=	0.6085
Total	2.2277e+13	35	6.3649e+11	Root MSE	=	5.0e+05

Coûttotaldestockage	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
Coûtopérationnel	.8260961	.1478604	5.59	0.000	.525272 1.12692
Coûttotaldemanute~n	.8675832	.1956948	4.43	0.000	.4694392 1.265727
_cons	747637.8	610601.6	1.22	0.229	-494640.5 1989916