Investigation of the importance of performance indicators in the control of the supply chain of the Moroccan industrial sector

Naciri oumaima.*, Alami Ayoub. *. Herrou Brahim. **, El Hammoumi Mohammed. **

Abstract— This article presents the results of our questionnaire survey, which had as objectives to identify the most relevant performance indicators in the Moroccan industrial sector, which has been run since January 2013.

This work details the methodology and data collection. Thus, we approach, initially, the choice and presentation of the methods adopted. Then we present the sample selection phase, the development and mailing of questionnaires, and finally, data collection.

Index Terms— Questionnaire, industrial sector, methodology, performance indicators.

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1 INTRODUCTION

The evaluation of a supply chain is a major priority of enterprises, a task that remains difficult given the complexity of these systems. This assessment involves a selection of appropriate performance measurement indicators to management of this chain.

It is in the context of selection of relevant indicators in the industrial sector, we have conducted a first empirical study questionnaire with thirty agribusiness company that allows us to identify the most important indicators for measuring the main links of a supply chain.

2. THE IMPLEMENTATION OF THE EMPIRICAL STUDY

2.1 The methodology and data collection

This article details the method and data collection. Thus, we approach, initially, the choice and presentation of the methods adopted. Then we present the sample selection phase, the development and mailing of questionnaires, and finally, data collection.

2.1.1 Selection and presentation of methods adopted

In this research, we chose the questionnaire survey that seems most appropriate to our research question. A questionnaire is a tool that "allows individuals to directly query by defining in advance by a qualitative approach, the answers arrangements through so-called closed questions" (Baumard et al., 2003).

Several reasons justify this choice:

- The questionnaire survey to estimate the latent variables by a set of indicators, reflected in the questionnaire statements, to which respondents are asked their level of agreement (Quivy and Van Campenhoudt, 1995; et al Newsted ., 1998).

- The use of the questionnaire survey quantifies the results of research, through many rigorous statistical tests on data collected (Quivy and Van Campenhoudt 1995; Newsted et al, 1998; Palvia et al.. , 2003).

- The use of this technique offers a high degree of objectivity. Indeed, it is based on rigorous statistical analysis, which can test the research hypotheses and interpret the results objectively (Newsted et al., 1998; Baumard and Ibert, 2003).

- In our work, we want to study the degree of importance of performance indicators of industrial companies located in different geographical locations. In this case, the questionnaire survey is a technique that meets this objective (Igalens and Roussel, 1998; Newsted et al., 1998).

2.1.2 Sample Selection

Before tackling the field research it is necessary to also define population to which the inquiry is addressed. For this, we contacted several organizations (eg Chamber of Commerce, Ministry of Economy and Finance, General Confederation of Enterprises of Morocco, etc.) to get the size and business addresses in Morocco. Two criteria were used to define the companies constituting the base population.

- Specialty: companies must be included in the industrial sector.

- Geographical location: the study covers 14 regions composed of 59 Moroccan cities.

After specifying the criteria defining the population of our

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*Oumaima Naciri Doctorante, FST FES, Industrial technology laboratory, university SMBA; oumaima.naciri@usmba.ac.ma

*Ayoub Alami Doctorant, FST FES, Industrial technology laboratory, university SMBA; ayoub.alami@usmba.ac.ma

**Brahim Herrou Professor, EST FES, Industrial technology laboratory, university SMBA ; herroubrahim@yahoo.fr

**Mohammed El hammoumi Professor, FST FES, Industrial technology laboratory, university SMBA; m_elhammoumi@yahoo.fr

study, we have to select a sample from the companies present in the list in our possession. This brings us to specify the sampling method.

From a theoretical point of view, there are two types of methods:

- Probabilistic: the sample is obtained by a random selection process during which each element of the population has a known probability, not null, to be drawn;

- Empirical: in this case, the sample constitution is the result of a reasoned choice, selecting companies applying certain rules or selection criteria to make it look like the sample to the population from which it came (Evrard and Lemaire , 1976).

Because the criteria defined above, and also the objective of our study, both types of methods were needed to define our sample and the specific identification of the companies to which our questionnaires will be sent.

The empirical method has allowed us, at first, to extract from our list certified companies located in the month in different regions of Morocco.

Then the probabilistic method allowed us to randomize our core sample.

Table 1

Shows the distributions of shipments by size and region.

Area	City	By way Postal	By way electronic	Face to face	N Total
CHAOUIA-OUARDIGHA	BEN AHMED	1			1
	BEN SLIMANE	1	5		6
	BERRECHID	5			5
	KHOURIBGA	3	4		7
	SETTAT	1	2		3
DOUKALA-ABDA	AZILAL		2		2
	BENI-MELLAL	1	3		4
	El Jadida		3		3
	SAFI	4	2		6
	TADLA		2		2
FES-BOULMANE	BOULEMANE	1	2		3
	FES	10	4	11	25
	SEFROU		1		1
	MOULAY Yacoub				0
Gharb-Chrarda-Beni Hssen	KENITRA	5	4		9
	Sidi Kacem		1		1
GRAND CASABLANCA	CASABLANCA	12	20	3	35
	MOHAMMADIA	7	10		17
	Médiouna	1	2		3
	NOUACEUR		1		1
GUELMIM ES-SEMARA	ES-SEMARA		1		1
	GUELMIM	2	2		4
	TAN-TAN	1	2		3
	TATA				0
LAAYOUNE-BOUJDOUR-SAKIA HAMRA	BOUJDOUR	1			1
	LAAYOUNE		1		1
Marrakech-Tensift-AL HAOUZ	AL HAOUZ	1	2		3
	CHICHAOUA		3		3
	EL KELAA Sraghna				0
	ESSAOUIRA	1			1
	MARRAKECH	4	5		9

Area	City	By way Postal	By way electronic	Face to face	N Total
MEKNES-TAFILALET	MEKNES	4	5		9
	EL HAJEB				0
	ERRACHIDIA	1	1		2
	IFRANE				0
	KHENIFRA		2		2
RABAT-SALE-ZEMMOUR	KHEMISSET		1		1
	RABAT	6	5	9	20
	SALE	2	4		6
	SKHIRATE-TEMARA	11			11
REGION DE L'ORIENTAL	BERKANE	1	1		2
	FIGUIG		1		1
	JRADA		1		1

	NADOR	2			2
	OUJDA	3	1		4
	TAOURIRT		1		1
SOUSS MAS-SA DRAA	AGADIR	2	4		6
	AÏT MELLOUL	5	3	5	13
	OUARZAZATE		1		1
	TAROUDANNT	1			1
	TIZNIT		1		1
	ZAGORA		1		1
TANGER-TETOUAN	CHEFCHAOUEN	1			1
	LARACHE		2		2
	TANGER	4	3	3	10
	TETOUAN	1	2		3
TAZA-AL HOCEIMATA CEIMATA-OUNATE	AL HOCEIMA	2	1		3
	TAOUNATE	1			1
	TAZA	1			1
		110	125	31	266

After presenting our study sample, we present below the developed questionnaire method.

2.1.3 Development of questionnaires

As we have said before, we seek in this work firstly to study the importance of indicators in the performance management of industrial Moroccan companies and try to propose a typology.

To meet these two objectives, the conduct of the questionnaire development phase was done in three steps: literature review, the test of the questionnaire to a group of four people (a university professor of Research Methodology a quality manager and logistics manager) and testing the questionnaire to a group of six people (three controllers and three management company executives).

- A review of the literature to consolidate existing performance indicators in the literature for the main links of the supply chain (procurement, production, distribution).

Supply: collection of indicators based on the work (Michel et al.1989), (Valentine et al. 2007) and the referential of KPI's. (Seventy indicators).

Production: collection of indicators based on the work of Florence and Laurent Gillet-Goinard Maimi, 2007) demarcheiso, 2010, and the referential on KPIs, (Seventy-nine indicators).

Distribution: collection of indicators based on the work of Colin, J. and Paché, G. (1988), Morana, J. and G. Pinardi (2003), and the referential of KPI's. (Thirty three indicators)

- The test of the questionnaire: the questionnaire of the test is one of the important aspects of the quality of survey research (Pinsonneault and Kraemer, 1993). It has several objectives: it enables to test the form of questions and their scheduling, check understanding of the respondents to consider the relevance of the proposed response categories (Baumard et al., 2003) and finally check required response time. In our work, we tested the questionnaire with a group of six people: three management controllers and three company executives who are looking persons interviewed in the survey (Van der Stede et al., 2005).

The group checked the clarity and understanding of the issues. He also assessed the length of the questionnaire: a response time between 10 and 15 minutes was set.

In developing questions, two important distinctions can be observed: open questions and closed questions.

Open questions:

These are questions that offer the opportunity for the interviewee to speak several sentences. They allow deeper questioning and highlight unexpected views on what they sought. However, their disadvantage is that they are slow to process and difficult to codify.

Closed questions:

These are questions that provide specific answers proposed by the researcher. They have the advantage of facilitating the answers, codification and analysis.

Given the ease that they can give to the progress of the investigation, we decided in our questionnaire to closed questions in the majority. However, the use of open questions in this type of research seems inappropriate.

The first part includes questions on the characteristics of the company and the interviewee. The second part concerns the degree of importance of the selected performance indicators.

- First part: The first part of the questionnaire consisted of closed questions, which are general questions about the companies and on the respondent; they allow to collect data on the respondents, the type, size and sector of activity of firms in our sample.

- Part II: The second part concerns the importance of performance indicators is composed of questions to three choices, we associated to each indicator, a grid of answers that contains three columns corresponding to the following assessments: "important", "somewhat important "and" not important. " And we proposed a classification of indicators, according to the principles of the Balanced Scorecard Kaplan and Norton (1996).

After the survey, we drafted a cover letter stating the purpose, the goal, the interest of the investigation and the date of re-

turn. In addition, to ensure the respondents, we stressed the guarantee of anonymity and confidentiality of responses.

After presenting our questionnaire development method, we present below their method of sending.

2.1.4 Sending questionnaires

Because the goal of the research is to measure the degree of importance of performance indicators of industrial Moroccan companies, the need to collect sufficient data appeared important. For this, the questionnaire survey was sent by mail, electronically, face to face.

2.1.4.1 Questionnaire sent by post and electronically

This is the first step of sending our questionnaire. We sent 110 questionnaires by post.

For its part, the postal survey provides the following benefits:

- This eliminates the impact of the researcher and reduce response bias;

- This gives more credibility to the investigation.

One of the major drawbacks of the postal survey is the low response rate. To overcome this shortcoming, we phoned to targeted companies, one to several times, to improve our response rate.

In this first stage, we sent 126 questionnaires electronically, which has several advantages including:

- Email is a fast tool to send questionnaires;

- The consignment may be hundreds in seconds;

- The cost of sending is virtually zero.

The downside is that the handling is not always easy and the principle does not allow integrating features that gives the advantage of a HTML1 page. Thus, the ergonomics of the message is not always controlled by the researcher.

However, in this first stage, we collected 16 usable questionnaires by post and 13 electronically, either a real response rate of 14.54% for the post and 10.3% electronically. These rates are low; we had to go through a second step: sending love face to face.

2.1.4.2 Questionnaire face to face

One of the main advantages of this type is that it offers more opportunities to assess understanding of the interviewee and his interpretation of questions, as well as to clarify any ambiguity about the meaning of a question or an answer. During an interview, it is also possible to show the respondents documents or objects and to solicit their feedback.

This type has drawbacks including:

- The presence of the investigator, who can influence the answers given by the respondent;

- The cost of travel.

In this second stage, we have consulted on the spot 31, which allowed us to collect data from 11 companies that agreed to receive us, a real response rate of 35.48%.

A total of 266 questionnaires sent, 42 were returned completed, representing an initial response rate of 15.78%. Of the 42 responses, 12 questionnaires were unusable because of missing data, and therefore the effective response rate was 11.2%. Ultimately, data from 30 companies have been processed.

2.2 The analysis and evaluation of results

Inspired by the LAVINA questionnaire to each answer is respectively assigned a weighting factor 1 - 0,5 - 0. The choice of indicators in each axis is to calculate the sum of points obtained in the three columns.

We calculated the sum of the marks for each indicator by the weights and their percentage of importance, and we chose the indicators reached or exceeded 50% of importance for each process.

The tables below show the results of our method of analysis for the three main processes of a supply chain.

Table 2

Results and scores for Process Supply

Process Supply		Important	Somewhat important	Does not matter	Total	% Of importance
	FINANCIAL AXE					
1	Reduction of purchase price over historical price	22	5	3	24.5	82%
2	Cost of service / purchase managed by the CA Service	20	2	8	21	70%
3	Service cost / savings generated by the service.	26	4	0	28	93%
4	Average cost of placing an order	29	1	0	29.5	98%
5	Increased supplier payment time	18	2	10	19	63%
6	Average value of an order	13	5	12	15.5	52%

7	Value Annual purchase by supplier	27	3	0	28.5	95%
	CUSTOMER AREA					
8	Satisfaction rate	27	3	0	28.5	95%
9	Number of days of delay accumulated / number of late deliveries	28	2	0	29	97%
10	Actions affecting the market share	20	5	5	22.5	75%
11	Actions affecting customer loyalty	23	4	3	25	83%
	AXIS INTERNAL PROCESSES					
12	Average time for processing a Purchase Request	28	2	0	29	97%
13	Nb. lots not conforming / nb. lots received	22	5	3	24.5	82%
14	Number of control change classified by cause	19	8	3	23	77%
15	Nb. followed by active suppliers	28	1	1	28.5	95%
16	Inventory turnover by product type	28	2	0	29	97%
17	Rejection rate due to quality defects	25	3	2	26.5	88%
18	Average time for processing a Purchase Request	15	8	7	19	63%
19	Goodwill received / quantities amounts	14	4	12	16	53%
	AXE ORGANIZATIONAL LEARNING					
20	CA purchase covered by the service / sales total purchase	19	9	2	23.5	78%
21	Absenteeism rate	14	5	11	16.5	55%
22	Number of training hours	28	1	1	28.5	95%
23	CA purchase / effective	17	5	8	19.5	65%
24	Prime progress	22	5	3	24.5	82%

- Of the 70 proposed indicators, we selected 24 considered important indicators in the procurement process

Table 3:
Results and scores for Production Process

Production Process		Important	Somewhat important	Does not matter	Total	% Of importance
	FINANCIAL AXE					
1	Production cost vs last year vs budget	19	9	2	23.5	78%
2	Production costs Cost of sales ÷	20	2	8	21	70%
3	Costs associated with the machine stop	25	3	2	26.5	88%
4	Total production cost ÷ total number of units produced	22	5	3	24.5	82%
5	Cost of product defects due to the quality of raw materials Total cost ÷ defects	18	2	10	19	63%
6	Cost of products damaged due to staff errors ÷ total cost of damaged products	13	5	12	15.5	52%
	CUSTOMER AREA					
7	Satisfaction rate	27	3	0	28.5	95%
8	Number of customer orders per day (units / day) ÷ number of minutes worked per day (minutes / day)	23	4	3	25	83%
	AXIS INTERNAL PROCESSES					
9	Number of product defects due to the quality of raw materials ÷ total number of defects	28	2	0	29	97%
10	Actual production rate target production rate ÷	22	5	3	24.5	82%
11	Standard Cycle Time ÷ actual cycle time	18	2	10	19	63%
12	Actual cycle time ÷ ideal cycle time (minimum cycle time)	28	1	1	28.5	95%
13	(Actual Production - Production rejected) / Actual production	28	2	0	29	97%
14	Downtime for corrective maintenance	25	3	2	26.5	88%

15	Waste of time to return the production productivity x x Price	28	2	0	29	97%
16	Delay takes to return production ÷ number of returned parts in production	14	4	12	16	53%
17	Number of defects ÷ Product Size	22	5	3	24.5	82%
18	Number of defects ÷ number of units produced	19	8	3	23	77%
19	Number of finished Productions orders late ÷ Total Production Orders	15	8	7	19	63%
20	Availability ratio x Performance Rate x Quality Rate	14	5	11	16.5	55%
	AXE ORGANIZATIONAL LEARNING					
21	Stop production due to lack of staff training / Total production stoppages	26	4	0	28	93%
22	Nb. subscriptions to technical journals / data bases	29	1	0	29.5	98%
23	÷ total value produced Employees	28	1	1	28.5	95%
24	Monthly consumption energy	22	9	1	26.5	88%
25	Quantity of recycled waste	17	10	3	23	77%

- Of the 79 proposed indicators, we selected 25 indicators deemed important in the productive process

Table 4:

Results and scores for Distribution Process

Distribution Process	Important	Somewhat important	Does not matter	Total	% Of importance
FINANCIAL AXE					
1	Transport cost ÷ Cost of sales	25	5	0	27.5	91%
2	Cost of sales = Stock beginning + Purchases of goods - Stock end	18	2	10	19	63%
3	Transport cost subcontracted ÷ total transport cost	19	1	10	19.5	65%

4	Cost of hire or depreciation of trucks	16	8	6	20	66%
5	Shipping Cost Product	27	2	1	28	March 9%
6	Total transportation cost	26	4	0	28	93%
	CUSTOMER AREA					
7	Number of customer orders delivered per day per FTE	24	3	3	25.5	August 5%
	AXIS INTERNAL PROCESSES					
8	Annual number of deliveries (or tons, volumes delivered ...)	22	5	3	2 4.5	82%
9	The time associated with the receipt, entry and validation of a customer order.	20	10	0	25	83%
10	Used capacity (m3) ÷ capacity available (m3) during the same period	21	7	2	24.5	82%
11	Variances Delivery	28	1	1	28.5	95%
12	Time order fulfillment,	22	6	2	25	83%
13	Deliveries on time ÷ total number of deliveries during the same period	17	10	3	22	73%
14	% Orders shipped in full,	29	0	1	29	97%
15	The average time associated with shipping products	15	3	12	16, 5	55%
	AXE ORGANIZATIONAL LEARNING					
16	Amount of wages of drivers	16	8	6	20	66%
17	Number of drivers	18	2	10	19	63%
18	Absenteeism rate	20	3	7	2 1.5	72%

- Of the 33 proposed indicators, we selected 18 considered important indicators in the distribution process.

Interpretation:

Industrial companies selected as part of this research using a set of indicators, which aims to measure their performance across multiple dimensions. In this sense, these companies make a balanced use of performance indicators. The financial indicators are not the only ones considered. Staff monitoring indicators, internal process indicators, customer satisfaction also play an important role in these industries.

CONCLUSION

The empirical study conducted as part of this work has al-

lowed us to select the most important indicators of the main processes of the supply chain. This work will serve as a source facilitating the choice of indicators for Moroccan industrial companies aiming to measure their performance.

In addition, the result of our investigation is considered a support for an upcoming work proposes a methodology for measuring performance of key processes of internal supply chain of a Moroccan agribusiness company.

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