

PERFORMANCE MEASUREMENT OF PORTUGUESE CONSTRUCTION COMPANIES

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Abstract: The construction industry has run into a deep crisis during the last decade. This led to a significant reduction in demand for construction services when compared with the existing supply. Thus, there is currently a lack of projects for the number of construction companies operating in the Portuguese market, which has resulted in an environment of intense competition among construction firms. Through performance measurement, companies can improve their productivity and also compare it with their competitors, as well as identifying their weaknesses. This information enables companies to make better strategic decisions, in order to gain competitive advantage and be better prepared to deal with these adverse situations. This study, not only describes the process of choosing the performance indicators, but also proposes a list of these indicators, for construction companies, with all the necessary information for their use. Furthermore, the most widely used performance measurement systems are described, as well as some alternative ones. It is also formulated a system of aggregate performance indicators, which is applied to a group of Portuguese construction companies, in order to obtain a ranking of their performance. Finally, all the advantages and limitations of implementing a performance measurement system are pointed.

Keywords: Aggregate indicators; Benchmarks; Construction Industry; key-indicators; Measurement; Performance.

1. INTRODUCTION

After the entrance to the European Union, in 1986, the Portuguese economy grew significantly, among other factors, due to the increase of the construction industry. In spite of that, during the year of 2001, the investments in the construction industry had a tremendous decrease, and along with this, Portugal began to suffer an economic crisis. This situation got even worse in 2008, when the bankruptcy of the Lehman brothers bank, started the fall of the global markets. To compensate these facts, Portugal has asked for loans from the European countries and today, the national debt is higher than the gross domestic product itself (FEPICOP, 2007). These facts led to a depression in the production index in practically all the areas of the construction sector. Currently, in order to stimulate the industry, public institutions make investments in the non residential construction, which is, the only area of construction industry that has a positive balance.

In economic context of today, the markets work globally, which had the effect of making the enterprises living in a very competitive environment.

Therefore, the companies, in order to survive, have to use sophisticated methods that allow them to make the best decisions possible to face the challenges of current society. To become competitive, the Portuguese companies had to implement new strategies that helped them to minimize their exposure to the business with low returns such as construction in Portugal, and to run their businesses in more lucrative sectors, as well as, in countries with positive perspectives of economic growth. According to the study made by Deloitte. with Associação Nacional de Empreiteiros de Obras Públicas (ANEOP), 70% of the biggest fifty construction enterprises in the country have affairs in foreign territories such as: Africa, Eastern Europe and Latin America (Deloitte./Aneop, 2010).

Beyond this, to fight the ups and downs of construction demands, some of the strategies adopted were beginning new business related to construction, where the respective performances were not compromise because of the variations of demand. By analysing nineteen websites of Portuguese construction companies, it was reached that, currently, 83% of the construction enterprises have business related to “services and concessions, 72% have business related with energy and industry and 89% have business in real state.

Despite the recession observed, Portuguese construction enterprises have achieved a positive performance by applying these strategies, not only in the Portuguese economy, but also in the construction industry (Sequeira, 2006).

The structure of this paper is divided by six chapters:

- Introduction, where it is explained the motivation, objectives, structure and methodology in a very light way;
- Construction Industry. Here it is made a description about Portuguese economy and the characteristics of the construction sector;
- Performance measurement, where all the important concepts of performance are exposed, as well as presented the current systems.
- Case study, where the KPIs are chosen and the performance measurement system is applied.
- KPIs proposal description, where all the information relative to the chosen KPIs is presented.
- Conclusions. Here all the conclusions of the paper are presented, as well as, the contributions, limitations and suggestions for future work.

In summary, the facts presented show the enormous concern that Portuguese enterprises have in keeping themselves competitive.

2. PERFORMANCE MEASUREMENT

Any action that implies managing and controlling also implies the absolute knowledge about its state. So, it is legitimate to say that, since the existence of the concept management, the concept measure has also been being developed.

Nowadays, the companies have recognized the needs of implementing systems that are able to manage their performance. However, it is only possible to manage something if that is also measurable. Then, we must first know what measurement is. According to Lebas, (1995), measurement is “the transformantion of a complex reality in a limited sequence of symbols that can be comunicated and repeated in similar circunstances”, and performance are the results of all activities considered relevant, that allows to evaluate the effectiveness in accomplishing the predefined objectives. Thus, performance measurement can be defined as the process that determines the success of an organisation in achieving their objectives.

By using a performance measurement system, the enterprises can set their vision in a long term basis, instead on focusing only in the actions that come next. Such system gives information about the past of the organizations, as well as, it allows them to define their objectives and evaluate their behaviour in achieving them, by making a comparison with the plan or benchmarks that were first established.

At the beginning of the 20th century, the performance measurement was based only on financial measures, however, nowadays, it is unanimous that those measures are not sufficient to estimate the right performance of an organization. This fact leads to a very important question:

what to measure? This can be relevant because, the consequences of measuring the wrong actions can be, receiving the wrong information, which can lead to wrong decisions.

So, in order to answer that question, a set of activities are usually chosen a set of activities to cover all the aspects that can contribute to performance improvements. Then, there are assigned indicators that measure the performance of those activities, which are called key performance indicators (KPI).

According to Neely, (1999), KPIs are used to quantify the effectiveness and efficiency of the process on which they are applied. In what concerns to efficiency, it manages the economical use of the resources and, in what concerns to effectiveness, it gives information about the accomplishment of the clients requests.

After having a group of KPIs established, a company is able to implement a performance measurement system, based on that set of indicators.

3. PERFORMANCE INDICATORS

Among the universe of relevant activities to measure the performance of a company, there are those easily measured and those that are not. Considering this, Cox, *et al.*, (2003), divided the indicators in two groups. The first group is based on quantity measures, which use mathematical expressions to obtain a result. The second one is composed by quality measures which are descriptions that people make of, for example, situations, experiences and thoughts. These two groups fit in every business field, and construction industry is no exception.

The construction industry can be characterized as a traditional sector and as an industry that requires a huge number of human resources with low academic education. Besides, it is composed by extraordinarily complex and non standardized processes that make each new project looks like a prototype. As a consequence, there is scepticism in construction in matters related to changes. These facts make the choice of KPIs to construction enterprises very difficult because there is a certain tendency to measure the performance of the projects, instead of doing it for the company as a whole. So, one important thing to consider, when choosing the KPIs, is to reach a perfect balance between the operational and organizational sides of a company.

It is also imperative that a performance measurement system is practical. This means that the information it provides should be, not only explicit with calculation methods predefined, but also succinct so that it leads to a quick understanding, which in turn, leads to a fast decision making. To achieve this, the number of KPIs chosen plays an essential role. On one hand, it should not be low because it must include all the relevant aspects of a company but, on the other hand, it should not be also high, otherwise dealing with a large number of KPIs can become an extremely complex process.

In the choice of KPIs, it is important to assure that they are good representatives of the activities they measure, as well as independents. This means that two different indicators cannot measure the same activity because, that could lead to a wrong measurement of the overall performance.

Another important aspect is the accessibility of the information. Such information should be available to those that have the power to influence the decisions, in order to decentralize the decision-makings.

The process of collecting data to use in KPIs should be included in daily routine procedures. By doing so, the managers make the best use of information, once they have access to it on a

regular basis. That helps them to control the actions that occur everyday, and to know when and where they should interfere in case of a weak performance.

After obtaining the results of KPIs, an organization should try to understand them. To do that, a company should analyse the factors that can influence those indicators. There are two kinds of factors: those that can be controlled and those that cannot. An example of a factor that can be controlled is the concentration or dispersion of the sales for the clients. On contrary, a factor that cannot be controlled is, for example, the weather that, sometimes, can influence the performance of a construction company.

After analysing these factors, the results from the indicators should be compared to the goals that were initially defined, as well as, to the benchmarks from the best practices known in the industry. It is important to mention that, the same indicators should only be compared among companies with similar characteristics, such as dimension. Otherwise, the same KPIs can translate different levels of performance for each company.

Finally, the facts presented show that the implementation of KPIs can be a positive contribution for a company, not only because they help to know better the company itself, but also because they give useful information to the managers that can make a huge difference in strategy and controlling. The figure 1, presents a scheme with the implementation of the kpis.

4. PERFORMANCE MEASUREMENT SYSTEMS

In this study, some of the most famous performance measurement systems were exposed, such as: the key performance indicators systems; the balanced scorecard (BSC); the french tableau de bord; the European Foundation for Quality Management (EFQM) and the benchmarking models. As well as some other alternative ways of measuring performance such as: the ranking, the aggregate indicator and the data envelopment analysis (DEA). Finally, there were also exposed some of the current platforms used to compare companies performance and to evaluate them such as: the portuguese platform of ICbench.

With these descriptions of the system, the reader is able to learn about the way these models operate of operating of these models, as well as, to know about their strengths and weaknesses.

Later in this report, was explained and applied a system that measures performance. That system uses the KPIs and aggregates them into a new global indicator. This aggregate indicator system can be done with two purposes: measuring the performance to controlle it and measuring the performance with the objective of compilling a ranking list.

5. METHODOLOGY

5.1. Introduction

First, to elaborate this model, the KPIs were chosen by using the considerations mentioned before. The group selected was composed by twenty six indicators, which was considered a reasonable number to implement in a performance measurement system.

Those indicators are presented in table 1.

The main difficulty in elaborating a model that combines many different KPIs is to establish the contribution of each performance indicator in the overall performance. In order to know the influence of each KPI, a survey was created and sent to many managers of construction enterprises.

The referred survey was constituted by twenty six multiple choice questions, where the respondents had to evaluate each KPI by selecting a number from the scale presented. The scale was constituted by seven numbers starting on (1), that means “not influent” to (7), that means “very influent”. The reasons to use this scale were mainly because it is constituted by an odd number of choices, which allows the respondent to consider a KPI as “middle influent” by choosing the number (4) and, because it is more rigorous than the scale that goes from (1) to (5).

In addition to these questions, the survey also included two more requests. The first proposed to the respondent was to order by influence the top ten KPIs. This request was made to prevent a situation in which a respondent could answer (7) in all the kpis. In that case, the first twenty six questions would lose their contribution to the report.

Secondly, the respondent had to write the name of the company, which had the purpose of knowing the dimension of it.

Table 1: Selection of Indicators

No.	Indicators
1	Collaboration of the client
2	Satisfaction of the client
3	Payments availability
4	Concentration /Dispersion of sales
5	Contribution to economy
6	Productivity
7	Return on sales
8	Return on investment
9	Sales growth
10	General liquidity
11	Financial autonomy
12	Costs deviations
13	Time deviations
14	Projects with costs deviations
15	Defects on delivery
16	Economic value of defects
17	Economic value of extra work hours
18	Work accidents
19	Staff turnover
20	Employee satisfaction
21	Outsourcing costs
22	Staff formation
23	I.T. investments
24	Diversification in industry
25	Diversification outside the industry
26	Internationalization

The sample obtained was constituted by seventeen enterprises. From these, four were presented in the ranking of the biggest companies, made by the *Exame* magazine (Maiores & Melhores , 2009). It means that only four companies of the sample were considered big. That was an important fact to have in consideration because the same KPI can have different contributions to companies with diverse dimensions.

After having the answers of the survey, the results were analysed, and it was verified that the average of the answers could represent the sample. So, the average of each KPI was calculated, as well as its sum. Then, each average was divided by the total of the averages and multiplied by 100. The result, presented in percentage, shows the contribution of each KPI to the global performance.

It is relevant to mention that the choice of the KPIs was well succeeded because only one KPI had his average lower than (4).

After having the respective contributions, two separate methodologies were used to aggregate the KPIs. One that gives results with the purpose of controlling and knowing the performance, and the other one, with the purpose of doing a ranking, where the results only show the relative position ordered by the performance of each company.

5.2. Aggregate indicator to know the performance

To aggregate the different kpis into one, were used three distinct groups related to three different measuring procedures

The group A included all the kpis in which the highest results correspond to the best performances. First, benchmarks were established for each indicator. In this group, each benchmark correspond to the highest possible contribution established for the performance of that indicator. After knowing the benchmark, it is possible to calculate the contribution of an indicator in the aggregate indicator, by using a direct proportion. It is important to refer that, if a company has one KPI with better performance than the benchmark and another has an KPI with the same performance as the benchmark, both are aggregated do the overall indicator, with the highest contribution possible for that KPI. The same thing happens with companies that have KPIs with negative values. In these cases, if an enterprise has one negative KPI and another has a KPI which its performance is zero, both are aggregated to the overall indicator with the same performance established in the model, which is zero. The reason for doing this is to keep always the same contributions that were previously established with the survey, otherwise, everytime there was a negative indicator or an indicator higher than the benchmark, the contribution would change.

In the group B are included all the indicators in which the highest results correspond to the worst performance. One example of these indicators is the frequency of work accidents, where the highest number represents the worst security performance. Here, were also established benchmarks for each indicator, but unlike the group A, each benchmark represents the lowest contribution possible for each indicator, which is zero. After knowing the benchmark, every company can calculate their performance by aplying an inverse proportion. Once again, it is important to refer that indicators with negative values or above the benchmark, will have in the aggregate indicator the maximum or minimum values possible for that contribution.

Finally there is the group C. Unlike the last two groups described, in group C are included all the indicators based on qualitative measures. These indicators are evaluated by doing some surveys that, in this paper, were not possible to deliver to the enterprises. In this case, the benchmarks used are the highest score possible to obtain in the survey. After knowing this value, the contribution of each indicator is easily calculated by applying a direct proportion.

With these three groups, it was possible to gather all the indicators into one aggregate indicator that represents the overall performance of a company.

5.3. Ranking indicator

The procedures used to achieve an aggregate indicator, with the purpose of doing a ranking, are similiar to the last version presented. However, instead of setting benchmarks based on the industry and on the best practices applied (both inside and outside the sector), they should be defined according to the best results achieved for each indicator, by the sample of companies included in the ranking. The reason for this difference is that the ranking is obtained by comparing only the enterprises that belong to the ranking, unlike the first version presented.

So, to the groups A and C, the companies that have the highest results, will have the maximum contribution in those indicators, for the overall performance. In what

Table 2: Contribution of the ranking indicators

Indicator	Contribution (%)
Collaboration of the client	5,56
Satisfaction of the client	6,50
Payments availability	5,80
Return on sales	6,26
Return on investment	5,68
Sales growth	5,39
Cost deviation	5,39
Time deviations	5,74
Projects with costs deviations	5,85
Sales growth	5,68
Defects on delivery	5,62
Economic value of defects	5,62
Work accidents	6,15
Employee satisfaction	5,68
Staff formation	5,44
Diversification in industry	4,68
Diversification outside the industry	3,92
Internationalization	5,04

concerns to the indicators of group B, the best contributions possible, to the overall performance, are achieved by the companies that have the lowest results.

Another difference from the last measurement performance method is the number of indicators used. In order to reduce the complexity of this ranking, a selection of the most influential indicators was made. This selection was made by calculating the average of all the averages previously obtained with the answers of the first survey, which had a result of 5,4. Thus, just the indicators with higher average than this value were selected. With this procedure 15 indicators were selected. However, after observing the chosen indicators, it was noticed that some important indicators were missing. Those indicators had, in fact, a lower average that can be explained by the small size of the majority of the companies that were part of the sample of the survey. So, in order to adapt this model to bigger companies, three more indicators that were considered very relevant to the biggest enterprises of the country, were included. These indicators are: diversification in industry; diversification outside the industry and internationalization. Table 2, shows the contribution of each indicator chosen to calculate the ranking list.

This ranking version was experimented in forty enterprises mentioned in the Exame magazine. However, some information required for the calculus of the indicators was not as accessible as wished, so that, the ranking obtained is based on only four financial indicators which are: return on sales, return on investment, sales growth and general liquidity.

The table three, presented next, shows the results of the final ranking mentioned before:

Table 3: Final ranking

Ranking	Name	Contribution	Ranking	Name	Contribution
1	Conduril	16,85	21	CME	5,72
2	Avelino Farinha e Agrela	12,38	22	Casais	5,67
3	Vestas (Portugal)	11,76	23	Edivisa	5,49
4	Bento Pedroso Construções	10,92	24	Construções Gabriel A.S. Couto	5,48
5	Manuel Rodrigues Gouveia	10,79	25	FDO	5,32
6	Hagen Engenharia	10,56	26	Eusébios e Filhos	5,05
7	Zagope	9,15	27	Obrecol	4,98
8	Domingos da Silva Teixeira	9,10	28	Atlindo Correia & Filhos	4,82
9	Ferrovial Agroman	9,07	29	Construtora Abrantina	4,72
10	Alves Ribeiro	8,71	30	Edifer	4,34
11	Contacto	8,40	31	Alexandre Barbosa Borges	4,19
12	Ensul Meci	8,12	32	Viatel	4,15
13	Opway	8,01	33	Teixeira Duarte	3,21
14	Ramos Catarino	7,12	34	MSF	3,21
15	Mota - Engil	6,93	35	Teodoro Gomes Alho	3,05
16	Soares da Costa	6,66	36	Lena	3,00
17	Construções Amândio Carvalho	6,31	37	Tecnasol - FGE	2,69
18	Efacec	6,28	38	Somague	2,47
19	Monteadriano	6,21	39	Alberto Martins de Mesquita & Filhos	2,30
20	Constructora San José	6,07	40	NovoPCA	2,19

By analysing the results, it is possible to observe that the enterprise that came on first place, had the indicators “return on sales” and sales growth” extremely high. The sales growth can be explained by the strong international activity that this company has, and simultaneously, due to the increase of demand for transport infra-structures that happen in the foreign countries, where Conduril, (an enterprise dedicated to that specific segment of the sector), is strongly present (Maires & Melhores, 2009).

It was curious to notice that two big companies that, despite their huge dimension, were in the 33th and 38th positions. This fact can be explained by the negatives results of the indicators “return on sales” and “return on capital” that both had, and also the negative sales growth that Somague presented.

6. Conclusions

6.1. General conclusions

With this investigation report it is possible to conclude that a performance measurement system is an essential tool for every competitive enterprise.

Although it is vital to improve the performance of a company, it can be also responsible for taking the wrong decisions, if the wrong KPIs are chosen. In order to avoid that, it is essential to choose appropriately the correct indicators, according to the characteristics of the company. This plays an extremely important role in the performance measurement of a company and so, they should be chosen, for each case in particular.

The explicative factor is also something that must be mentioned. In this report, it is possible to conclude that these factors can change every little aspect in the performance measurement of a company. By regarding the survey sample, it is verified that the same indicators differ, when used in enterprises with different dimensions. Another remark about these factors is the sales growth of the first place of the ranking presented, which was influenced by the demand that suddenly appeared in a country where that enterprise was present.

According to literature, the indicators: “diversification in the sector”, “diversification outside the sector” and “internationalisation” is essential to the companies in general with the globalization of economy, but mainly in Portugal, where the economic situation of construction industry is fragile.

The opinion of the construction companies managers show that the main concerns of construction enterprises should be the satisfaction of their clients, the workers safety and the return on sales.

The set of twenty six indicators was, according to the general opinion of the managers addressed during the elaboration of the report, well chosen, once the majority of the indicators have averages higher than (4).

In general, and according to literature, the Portuguese construction companies do not take all the advantages of using a performance measurement system. Despite of this fact and the complexity of construction industry, there is still a lot to improve in matter related to performance.

6.2. Limitations

The major limitations in this study were the lack of available information of the companies and the small size of the sample achieved.

An obligation that must be met by all the companies is the expose of financial information. The bigger companies in the country also expose information about sustainability and frequency of work accidents. Yet, it was not found any information about operational indicators, fact that can be explained by the existence of such competitive environment where the companies of today live.

Furthermore, the organizational disposal of information of each company is very diversified, which increases the difficulty of making a search for the same information of different companies.

To the sample used in this paper were sent a lot of surveys, however, only 15% to 20% of the companies that received, answered to it. Therefore, the sample was constituted by seventeen companies of which, only four were consider as big companies. This fact could have had some influence in the results of the contributions of the KPIs.

6.3. Future work

In future possible papers about this subject, it is suggested to use a sample in the application of a model where it is possible to apply all the selected indicators.

In order to have a more precise methodology, it is suggested to separate the enterprises into distinct groups. Those groups should be divided by the amount of sales.

Finally, it is purposed to explore more accurately the operational side, when the meaning of the paper is measuring the performance of this type of companies. Nevertheless, it is very difficult to obtain information about that, because some enterprises do not expose it, in order not to lose competitive advantage.

6.4. Contributions

The present paper contributes to an exposure of the existing information about performance measurement of construction companies. It allows the reader, not only, to learn the concepts related to this matter, but also to know the models that are, currently, applied in the industry, as well as, their strengths and weaknesses. As an alternative, the reader can also apply and adapt the model presented in this paper to his enterprise or project.

With this paper were described some procedures that can be very handfull, not only in the construction industry but also in other sectors.

Finally, the material presented in this report has still much to improve, because the solutions already achieved in this matter are not consensual among the experts.

7. References

Cox, R. F., Issa, R. R., & Ahrens, D. (1 de April de 2003). Management's Perception of Key Performance Indicators for Construction. *Journal of Construction Engineering and Management* , Vol. 129, No. 2, pp. 142-151.

Deloitte./Aneop. (2010). *Empresas de Construção continuam a apostar na internacionalização ediversificação*. Lisboa: Edições Profissionais Sociedade Unipessoal, Lda.

FEPICOP. (2007). *Um novo ciclo na Construção, mais dinamismo para o país*. Lisboa: FEPICOP.

Lebas, M. J. (1995). Performance Measurement and Performance Management. *International Journal of Production Economics* , pp. 23-35.

Maiores & Melhores . (2009). *Exame* , 90-109.

Neely, A. (1999). The performance Measurement Revolution: Why Now Whats Next? *International Journal of Operations & Production Management* , Vol. 19, No. 2, pp. 205-228.

Sequeira, M. d. (2006). *Construção & Desenvolvimento: o compromisso inadiável*. Lisboa: ANEOP.