Barragán-Landy, Milton
Romero, Fernando Carlos Cabrita
Sousa, Sérgio Dinis Teixeira de

Evaluation of performance measurement proposition in the construction sector : perspectives from managers and customers

http://hdl.handle.net/11067/7362
https://doi.org/10.34628/qrta-ap17

Data de Publicação 2023

Resumo Performance Measurement Propositions (PMP) can be considered as suggestions or ideas to improve the performance of firms in dynamic and turbulent environments. The aim of this paper is to present the perceptions of managers and customers about PMP identified in the Construction Sector, in the specific context of Ecuador. Twelve managers were interviewed. Seven PMP were identified and assessed through surveys with 273 customers and 230 managers. Results suggest that the perception on the importan...

Tipo bookPart

Editora Universidade Lusíada Editora

Evaluation of performance measurement propositions in the construction sector: Perspectives from managers and customers

Milton Barragán-Landy[1], Fernando Romero[2], Sérgio Sousa[3*]

[1] Department of Applied Chemistry and Production Systems, Faculty of Chemical Sciences, University of Cuenca, Cuenca, Ecuador
mfrancisco.barraganl@ucuenca.edu.ec

[2] ALGORITMI Research Centre/LASI, School of Engineering, University of Minho Campus de Gualtar, 4710-057 Braga, Portugal
fromero@dps.uminho.pt

[3] ALGORITMI Research Centre/LASI, School of Engineering, University of Minho Campus de Gualtar, 4710-057 Braga, Portugal
sds@dps.uminho.pt

DOI: https://doi.org/10.34628/qrta-ap17

Abstract. Performance Measurement Propositions (PMP) can be considered as suggestions or ideas to improve the performance of firms in dynamic and turbulent environments. The aim of this paper is to present the perceptions of managers and customers about PMP identified in the Construction Sector, in the specific context of Ecuador. Twelve managers were interviewed. Seven PMP were identified and assessed through surveys with 273 customers and 230 managers. Results suggest that the perception on the importance level of each PMP is not different between customers and managers. Budget control, construction goals, and results observation are, according to managers and custom-

* Corresponding author

ers surveyed, the most important PMP. These could help organisations to discover new ways to measure their performance and take actions in the value creation process, aiming to improve customers' satisfaction.

Keywords: Innovation; Performance measurement; Service quality; Survey.

1. Introduction

Organisations try to improve their performance to satisfy customers' needs through the offering of goods, services, and ideas. A process of design, monitoring, control, and evaluation is necessary to improve the performance evaluation systems and the design of key measurements in dynamic and turbulent environments in the value creation process, aiming to improve customers' satisfaction.

According to [1], Performance Measurement (PM) is defined as "the process of quantifying effectiveness and efficiency of action". Lohman et al. [2] state that PM is the activity of measuring performance using performance indicators, which are variables that express quantitatively the effectiveness or efficiency or both, of a part or a whole process, or system, against a given norm or target. Also, according to [3] PM is "vital in strategy formulation and communication and in forming diagnostic control mechanisms by measuring actual results".

Volatility, Uncertainty, Complexity and Ambiguity (VUCA) in the environment are transforming to the organizations [4, 5]. Thus, possible procedures to measure organizational performance should be considered, and establishing agile planning processes can help to improve their performance.

Construction Sector (CS) could have two parts in relation with the International Standard Industrial Classification of All Economic Activities: (i) Construction that cover the physical outputs of construction activities (e.g., buildings or civil engineering works); and (ii) Construction services that cover services provided in constructing these objects [6]. Thus, CS could be considered as a complex sector with multiple variables around it.

The paper goal is to present the perceptions of managers and customers about PMP identified in the CS in a specific context in Ecuador. Also, this document shows the relationship between PMP.

2. Literature Review

2.1. Performance Measurement

It is important to measure the performance with the purpose to establish a continuous improvement process in organizations [7]. Therefore, PM is a tool that contributes to improve efficiency and effectiveness within organizations. So, PM helps to develop the quality control process and to do the quality improvement process in relation to Juran trilogy [8]. PM has an important objective, which is to establish a process control within the organization in relation to a target and a strategy, typically including achieving customer satisfaction. According to [9] "satisfaction is a function of the disconfirmation of performance from expectation". If customers' expectation is not fulfilled through product and service quality, dissatisfaction will arise [10].

2.2. Performance Indicators

Performance Indicators are variables that express quantitatively the effectiveness or efficiency or both, of a part or a whole process, or system, against a given norm or target [2]. A classification of performance measures was proposed by [1] such as financial; productivity; quality; service; innovation; and employees measures. Then, the following dimensions were defined: quality, time, cost, and flexibility with their corresponding variables aiming to improve the performance of an organization. Thus, PM needs deep study to reduce the gap in dynamic environments as an important challenge [4, 11].

According to [12] the traditional performance indicators are widely used by firms (i.e., financial indicators) and they recognize that non-financial measures, namely the customer satisfaction index, employee satisfaction, internal customer satisfaction index, and the training of employees are increasingly important for the success of firms. Important research about PM in the CS was made [12–14]. The results could help to identify other performance indicators in specific contexts [14], such as: safety, environment, cost, profitability, scheduling, productivity, sustainability, quality, client satisfaction, and team satisfaction.

2.3. Performance Measurement Propositions in the Construction Sector

The term "proposition" can be defined as "an offer or suggestion, usually in business" or "an idea or opinion" [15]. That is, a proposal that could be obtained from a research process. In this work, PMP were investigated, identified, and developed through a rigorous and detailed research process. PMP represents the systematization of several ideas that are grouped by affinity [16]. In addition, they represent a

first approach to the definition of performance indicators in dynamic and turbulent environments. A turbulent environment is in a state at the "edge of chaos" or in a "deterministic state of chaos" [5].

The CS is a complex sector because it is made up of several elements that interact with each other and with the environment that is constantly changing and requires agile and integral actions [17]. It is important to guarantee the quality of products and services offered in this sector, often through specific projects with requirements changing during project execution, to face unique and dynamic environments.

3. Methodology

3.1. Interviews Development

The methodology adopted was based on exploratory and descriptive multiple-cases studies, involving managers from the CS. The snowball technique (is used commonly when it is difficult to identify members of the desired population) within the category of volunteer sampling in the non-probability sampling technique [18] was adopted to select 12 managers. The research method used in this work has seven phases: (i) semi-structured interview instrument development; (ii) Spanish translation process; (iii) instrument validation process; (iv) interview's execution process; (v) interview transcription process; (vi) systematization and analysis of information; and (vii) analysed results writing.

The instrument was developed to identify PMP which organizations could use in dynamic and turbulent environments. The semi-structured interview instrument had questions about general information of the interviewee and to understand the manager experience in projects within the CS. After the Spanish translation process was made, a validation process with three managers within the CS was performed. Semi-structured interviews were based on developed questionnaires. A detailed transcript of interviews was made to analyse the qualitative information from the customers and the managers, through qualitative analysis techniques. Every question was analysed with detail to obtain information. Later, an English translation process was made.

3.2. Survey Development

This work uses a descriptive study to clarify the PMP established through data collection [18]. The survey included a presentation of topics, meetings with managers and customers of the CS to assess their perception related to PMP in dynamic environments and an online questionnaire was used to facilitate this process. The research method used in this work has six phases. (i) develop the instrument (survey for

managers and customers); (ii) Spanish translation process; (iii) instrument validation process; (iv) survey execution and data collection; (v) systematization and analysis of information; and (vi) analysed results writing.

A structured questionnaire with similar questions for customers and managers with the purpose to assess their perception on the importance of each PMP. A Spanish translation process was done to adapt the instrument to the context of Cuenca, Ecuador. Later, the instrument was validated with five customers and five managers within the CS to assess the understanding of terms used [18]. The survey execution was done in Cuenca city for five months considering a sample of customers and managers. Equation (1) was used to calculate the representative sample size [19]:

$$n_i = \frac{z_{(1-\alpha)}{}^2 p(1-p)}{e^2} \quad (1)$$

where: n_i is the sample size, $z_{(1-\alpha)}$ corresponds to the desired confidence level, p is the estimated proportion of an attribute that is present in the population (usually equal to 50% as an estimative of p giving the maximum sample size), and e is the desired level of precision (the risk the researcher is predisposed to accept). According to the context and the availability of customers and managers where this study was made some parameters were considered for n_1, customers (z=1.65, p=0.5 and e=0.05); and for n_2, managers (z=1.51, p=0.5 and e=0.05). The assigned values for z are different. They were selected for the availability and accessibility of information with customers and managers within the CS. The z value used for n_2 was assigned due to information limitations. A final sample of n_1 = 273 customers and n_2 = 230 managers were obtained through a simple random sampling technique.

4. Results

4.1. Managers Interviews

The information collected in the managers' interviews was analysed. Firstly, a set of PM assumptions (which can be seen as benefits) were identified: (i) PM processes generate opportunities for improvements; (ii) PM helps to know where the weak point of the worker potential is; (iii) PM helps managers to take decisions during the work; and (iv) PM helps to know the results of the tangible and intangible value creation. Secondly, it was possible to identify procedures or PMP which organizations can use to measure their performance in dynamic environments. These PMP were identified through a deep analysis considering qualitative research with affinity aggrupation of the propositions. PMP are explained below:

- **PMP1. Holistic planning:** It is important to generate a holistic planning with preventive actions considering changes in the environment for the process of quantifying effectiveness and efficiency of action. In this case, it is not necessary to establish a detailed planning, but it is related with requirements' management.
- **PMP2. Indicator validation:** it is related with the definition of key performance indicators, based on the *holistic planning (PMP1)* to use in each dynamic and turbulent environment. The indicators should be calculated in real-time with continuous monitoring (see *PMP4 use of technology tools*).
- **PMP3. Decision-making through assessment:** it is oriented to generate a decision process to guarantee the service and product quality with short measuring times, based on previously *validated performance indicators (PMP2)*.
- **PMP4. Use of technology tools:** the use modern tools to measure performance (e.g., automatic measurements, real-time, or video monitoring), supporting *PMP3, PMP6* and *PMP7*.
- **PMP5. Construction goals:** based on *holistic planning (PMP1*), it is related with the establishment of employees' challenges and project goals to support outcomes' assessment.
- **PMP6. Results observation:** it is related with measuring through a visual approach (i.e., visual management of the work progress focussing comparing outcomes/results with *construction goals (PM5)* focussing on time to verify through the *use of technology tools* (*PMP4)* the activities carried out, the facts and, above all, analyse the activities that have yet to be done.
- **PMP7. Budget control:** it is related with the establishment of a control process, particularly if the work budget is big; also, to continuous analyse the cash flow and determine future scenarios. This includes to establish a project-oriented payment process based on *results observation (PM6)*.

4.2. Survey Respondents' Profile

General aspects from customers and managers were identified. On the one hand, customers have different professions (teachers, students, private employee, doctors, taxi drivers, lawyers, and others). They have interacted with the CS in the following areas, 28% through Housing Remodelling, 15% through Housing Construction, 8% through Professionals (architects, mechanical & engineering services, civil engineering, etc.), 8% through Design & Build and the rest in other areas. Thus, diverse

customers have interacted in diverse areas in the CS. On the other hand, managers have different positions in the company, 42% are managers, 19% are managers and architects, 10% are managers and civil engineers and the rest are owners and managers at the same time. In addition, in relation to the interaction areas in the CS, 7% in Design & Build, 7% in Housing Remodelling, 7% in Housing Construction and the rest in other areas.

Overall, 51% of customers are female while 80% of managers are male; 74% of customers have graduate or postgraduate education compared with 92% of managers. Thus, managers seem to have more formal education. In relation with the variable of age, 52% of customers and 51% of managers are in the category of less than 35 years old and 28% of managers and 19% of customers are in the category of 35 - 45 years. Thus, customers and managers are relatively young. Finally, related to the experience in the CS, 62% of customers and 20% of managers have less than 2 years of experience in the CS and 36% of managers and 12% of customers have more than 10 years of experience. Therefore, there is little experience in customers and great experience with the managers surveyed in the CS.

4.3. Perceptions on Performance Measurements Propositions

A question was defined: "What is your perception about the importance of each PMP in dynamic and turbulent environments?" A Likert scale was used (ranging from 1, very low, to 10, very high, and 0 is "I do not know / I do not have an opinion"). Figure 1 shows the results of customers and managers perceptions related to the each PMP.

Considering the three upper levels of the scale (8, 9 and 10) the ones with greater importance, for PMP1, 78% of managers and 75% of customers consider important the integral analysis of the project before the implementation. Similarly, these results for PMP2 are 76% from managers and 67% from customers; for PMP3, the results are 80% from managers and 75% from customers; for PMP4, the results are 75% from managers and 70% from customers; for PMP5, the results are 85% from managers and 82% from customers; for PMP6, the results are 85% from managers 82% from customers; and for PMP7, the results are 85% from managers and 79% from customers.

Statistical tests of hypotheses to compare the results obtained by PMP from customers and managers within the CS were made. Being ordinary qualitative variables and being data oriented to knowing the perception, the U Mann Whitney test was applied as a non-parametric statistical test in two independent samples (from customers and managers) [18]. In addition, each PMP perception was compared between customers and managers, considering H_0: the PMP importance level is not different between customers and managers; and H_1: the PMP importance level is different between

customers and managers. Results suggest, based on the p-value calculated (*p-value* > *α= 0.05 in all the cases*) that the importance level perception of each PMP is not significantly different between managers and customers (in all the cases the H_0 was not rejected).

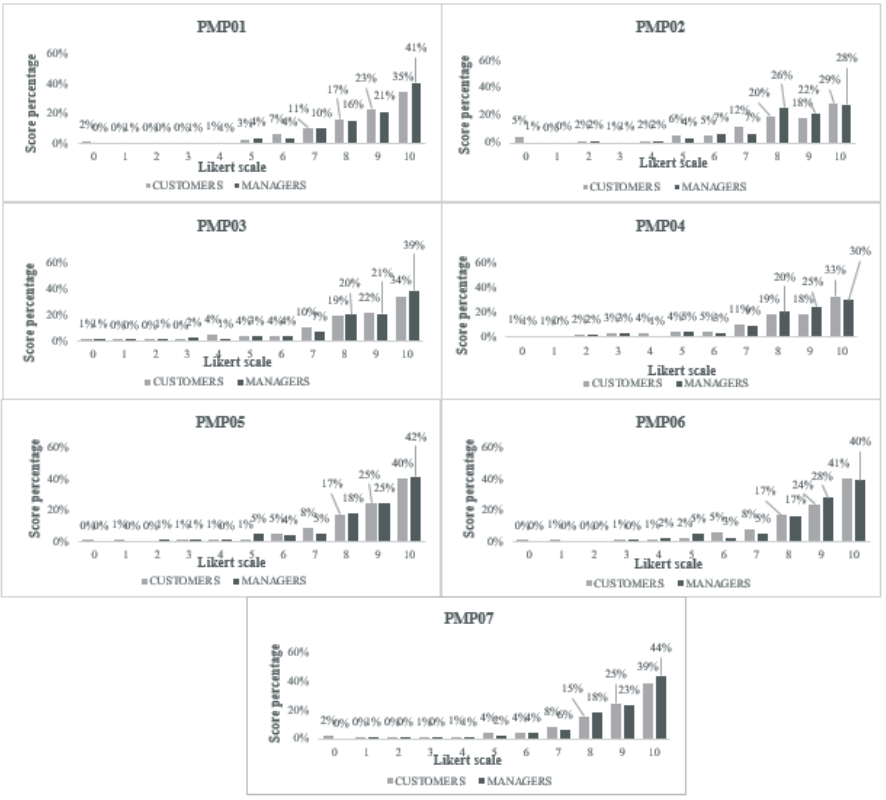

Figure 1. Survey Results on Perceptions of Performance Measurement Propositions

Table 1 shows a comparison between PMP from managers and customers by priority (i.e., highest average of importance). For managers, PMP7 *budget control*, PMP6 *results observation*, and PMP5 *construction goals*, represent the three most important PMP. For customers, these are also the three most important PMP.

Table 1. Perceptions from Managers and Customers of Performance Measurements Propositions

Managers				Customers			
Priority	**PMP**	**Average**	**Standard Deviation**	**Priority**	**PMP**	**Average**	**Standard Deviation**
1	PMP7	8.77	1.63	1	PMP5	8.63	1.77
2	PMP6	8.70	1.57	2	PMP6	8.62	1.73
3	PMP5	8.70	1.64	3	PMP7	8.44	2.05
4	PMP1	8.54	1.85	4	PMP3	8.25	2.05
5	PMP3	8.40	2.02	5	PMP4	7.95	2.34
6	PMP4	8.13	2.13	6	PMP2	7.73	2.55
7	PMP2	8.12	2.00	7	PMP1	5.18	3.47

5. Discussion and Conclusion

This work studied PMP in the CS of Ecuador, which can be considered a dynamic and turbulent environment due, amongst others, to the dual nature of products and services that these companies provide, and to the fact that each costumer may have different needs in terms of products and services required, resulting in a competitive sector project oriented. Based on the interviews with 12 managers of companies of the CS, seven PMP were defined. These perceptions were then evaluated through a survey of 273 customers and 230 managers to assess the level of importance of each PMP, based on each respondent perception.

Overall, all seven PMP were rated as important, both by managers and customers. Statistical tests did not find significant differences between their responses. Nevertheless, *PMP7 budget Control, PMP6 results observation,* and *PMP5 construction goals*, represent the three PMP with highest average level of importance perception, and the majority of respondents assessed each PMP with a high rating on the Likert scale (8, 9 or 10); both by managers and customers. The focus on these PMP could help the firms to face dynamic environments [20]. Also, *PMP5 construction goals* (the establishment of employees' challenges and goals to support outcomes' assessment) and *PMP6 results observation* (establish visual monitoring processes as important strategy to measure the performance in the CS) represent an eclectic approach to measure the performance in dynamic environments because use the common sense to evaluate it [21–23]. The *use of technological tools (PMP4*) should help to see in real-time *results observation (PMP6)* and support *data based decision-making (PMP3)* [24]. The *PMP1 holistic planning* and *PMP2 indicator validation*, establish the service quality requirements to be met and performance indicators to track them.

One limitation of this work is related to the development of the instruments used (interviews and surveys). They were made in the context of Cuenca city in Ecuador and the Spanish translation, and its validation was made in the same context. The research identified seven PMP based on managers perceptions, but their relevance in other contexts needs more study.

Acknowledgements

This work has been supported by FCT – Fundação para a Ciência e Tecnologia within the R&D Units Project Scope: UIDB/00319/2020.

References

1. Neely A, Gregory M, Platts K (1995) Performance measurement system design: A literature review and research agenda. International Journal of Operations & Production Management 15:80–116. https://doi.org/10.1108/01443579510083622
2. Lohman C, Fortuin L, Wouters M (2004) Designing a performance measurement system: A case study. Eur J Oper Res 156:267–286. https://doi.org/10.1016/S0377-2217(02)00918-9
3. Wouters M (2009) A developmental approach to performance measures—Results from a longitudinal case study. European Management Journal 27:64–78. https://doi.org/https://doi.org/10.1016/j.emj.2008.06.006
4. Millar CCJM, Groth O, Mahon JF (2018) Management Innovation in a VUCA World: Challenges and Recommendations. Calif Manage Rev 61:5–14. https://doi.org/10.1177/0008125618805111
5. Mack, O., Khare, A., Kramer, A., & Burgartz T (Eds.) (2015) Managing in a VUCA World. Springer
6. United Nations (2015) Central Product Classification (CPC) Version 2.1. New York
7. Höber A, Pergler E, Weitlaner D, Grahsl H-P (2015) Performance journey mapping: a service performance assessment framework. The TQM Journal 27:231–246. https://doi.org/10.1108/TQM-12-2014-0112
8. Defeo JA (2017) Juran's Quality Handbook: The Complete Guide to Performance Excellence, Seventh Edition, Seventh. McGraw-Hill Education, New York, NY, USA
9. Moyes D, Cano-Kourouklis M, Scott J (2016) Testing the three Rs model of service quality. The TQM Journal 28:455–466. https://doi.org/10.1108/TQM-02-2015-0026
10. Onubi HO, Yusof N, Hassan AS (2020) How environmental performance influ-

ence client satisfaction on projects that adopt green construction practices: The role of economic performance and client types. J Clean Prod 272:122763. https://doi.org/https://doi.org/10.1016/j.jclepro.2020.122763
11. Frynas JG, Mol MJ, Mellahi K (2018) Management Innovation Made in China: Haier's Rendanheyi. Calif Manage Rev 61:71–93. https://doi.org/10.1177/0008125618790244
12. Barros A, Sousa S, Nunes E (2020) Performance indicators in the construction industry: a study with Portuguese companies. IOP Conf Ser Mater Sci Eng 800:12008. https://doi.org/10.1088/1757-899x/800/1/012008
13. Horta IM, Camanho AS, Moreira Da Costa J (2012) Performance assessment of construction companies: A study of factors promoting financial soundness and innovation in the industry. Int J Prod Econ 137:84–93. https://doi.org/10.1016/j.ijpe.2012.01.015
14. Moradi S, Ansari R, Taherkhani R (2022) A Systematic Analysis of Construction Performance Management: Key Performance Indicators from 2000 to 2020. Iranian Journal of Science and Technology, Transactions of Civil Engineering 46:15–31. https://doi.org/10.1007/s40996-021-00626-7
15. Cambridge Dictionary (2018) Cambridge Dictionary. In: University of Cambridge. https://dictionary.cambridge.org/dictionary/english/performance#dataset-british. Accessed 27 Jun 2018
16. Megawaty, Aminuddin Hamdat, Makkulawu Panyiwi Kessi A, Panus (2022) Application Of The Balanced Scorecard As A Measurement Model Of The Balance Of Stakeholder Value Proposition. International Journal of Science, Technology & Management 3:394–402. https://doi.org/10.46729/ijstm.v3i2.466
17. Klosova D, Kozlovská M (2020) Innovation in construction: trends and obstructions of adoption and implementation. IOP Conf Ser Mater Sci Eng 867:12019. https://doi.org/10.1088/1757-899x/867/1/012019
18. Saunders M, Lewis P, Thornhill A (2016) Research Methods for Business Students, Seventh Ed. Pearson Education Limited, Edinburgh Gate
19. Israel GD (1992) Determining Sample Size. University of Florida, Florida Cooperative Extension Service, Institute of Food and Agriculture Sciences, EDIS, Florida 2–7
20. Pekkola S, Saunila M, Rantanen H (2016) Performance measurement system implementation in a turbulent operating environment. International Journal of Productivity and Performance Management 65:947–958. https://doi.org/10.1108/IJPPM-01-2015-0018
21. Aliakbarlou S, Wilkinson S, Costello SB (2018) Rethinking client value within construction contracting services. International Journal of Managing Projects in Business 11:1007–1025. https://doi.org/10.1108/IJMPB-07-2017-0076
22. Robert M, Giuliani P, Gurau C (2022) Implementing industry 4.0 real-time per-

formance management systems: the case of Schneider Electric. Production Planning \& Control 33:244–260. https://doi.org/10.1080/09537287.2020.1810761
23. Wziątek-Kubiak A, Pęczkowski M (2021) Strengthening the Innovation Resilience of Polish Manufacturing Firms in Unstable Environments. Journal of the Knowledge Economy 12:716–739. https://doi.org/10.1007/s13132-021-00725-w
24. Aluko OR, Idoro GI, Mewomo MC (2021) Relationship between perceived service quality and client satisfaction indicators of engineering consultancy services in building projects. Journal of Engineering, Design and Technology 19:557–577. https://doi.org/10.1108/JEDT-03-2020-0084