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SYSTEMATIC REVIEW

Development of a Performance Concept in the Construction Field: A Critical Review

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Abstract:

The performance concept in the construction field is very broad, can occur within the project scope and building, suggesting effective ways to evaluate according to the activities involved. Although a large number of studies on construction project performance (CPP) and performance-based building (PBB) have been conducted in the last decade, there remains a lack of consensus among researchers and professionals regarding how to integrate PBB-related activities into the construction project phases (design, planning, construction and operation). After an in-depth analysis of hundreds of journal articles published between 2008 and 2018, this study provides a holistic understanding and critical reflection on the nexus between CPP and PBB, systematically illustrated by a "Performance information mapping" and a "Performance Taxonomy Framework" at each project phase in the strategic decision-making process. The results can help future researchers and professionals to conduct searches that are more relevant and to design, aiming at steps to ensure project success and building efficiency. A systematic review contributes to a better understanding of the performance concept in the construction field because it covers an unprecedented performance study of both stages, process management and product performance requirements in the construction industry. The review concludes by suggesting, as further work, a search for an integration tool.

Keywords: Performance-based building, Performance project construction, Flow information, Process, Product, Taxonomy.

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1. INTRODUCTION

Project success in construction companies is usually measured based on predetermined criteria or by comparing with other projects [1]. This is because the construction industry is constantly criticized for reasons such as inefficiency, low productivity, material waste, client dissatisfaction and delivery delays, resulting in investment projects that often fail to meet owners' expectations, and consequently requiring that the companies rethink their processes under an increasing competitive pressure [2 - 5].

The AEC industry differs from all other productive sectors for its peculiarity to build unique products; its prototyping requires a huge commitment of time and the involvement of many people with different professional profiles [6]. Product development is fundamental to a company's success, as new products provide a competitive advantage, requiring more guidelines and advanced management tools [7, 8].

The buildings are increasingly more complex, consisting of several processes, activities, stakeholders, resources, and information. Changing a single component of the design system can cause unforeseen changes in other elements [9]. Therefore, a project evaluation system needs to consider the unique investment project characteristics, the adequacy of the goals, and the changes that occur in the construction project environment [10].

Commitment to quality by the building companies tends to be more effective. Modernization makes the construction industry more versatile, expansive and complex, requiring further qualification of the specialists, so they are able to innovate in their projects. In addition, the clients demand better quality and durability, increasing the importance of continuous improvement in construction projects [11]. Achieving a quality project within a budget and planned schedule is the goal of all owners in the architecture, engineering and construction (AEC) industry [12].

For this reason, the performance question must be treated reliably from existing evidence, that is, must be an understandable baseline and with defined performance objectives, which can be comparable, derived from measurements, research, or evaluations [13]. Therefore, improving the efficiency of the building space has become a

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primary concern, especially those involving residential buildings, which are becoming larger and more complex, along with the rapid global urbanization [14, 15].

This "performance" is also used with several meanings in industrial and business activities [16]. The word "performance" is used informally and is associated with a level of quality. In fact, these and other terms like success, efficiency, effectiveness, goals, objectives, indicators, among others, are not always rigorously used in terms of conceptual precision and definition of operation [17].

Construction project performance depends on effective methods to manage the different stages of the construction project lifecycle measured against the successful results of the said project, such as meeting the time, cost and quality objectives [3, 18]. On the other hand, building performance can be defined as behavior in use, where the client, as a person, organization or representative, is an important success factor [19].

Mesa *et al*. [20] reported that the overall performance of a project represents the strategic decision-making process of the owner and the impact of those decisions on the supply chain, design processes, and product performance. To this end, the project must be evaluated based on its processes to improve the quality of the final product, in this case, the building.

While it is important to ensure quality during the construction phase and the final product, it is equally important to achieve quality in the early phases of the project, such as analysis, planning, and design [21]. Therefore, the project success depends heavily on the efficient management of the involved stakeholders, its interfaces and the effective risk management that may result from poor communication management throughout the project lifecycle [22].

The performance-based-building concept described by Foliente [23] is related to the integration between the construction process (a mutual agreement of interested parties), the construction product (the result of a construction project or process) and the service construction (business support resource).

It is known that building performances generally involve different criteria, such as functionality, environmental comfort, structural safety, durability, which can make the evaluation more complex. Göçer *et al*. [24] stated that the performance of the building varies according to the user expectations in a broader sense, such as occupation needs and surrounding community's needs.

Although the performance concept has been defended by its potential to support many requirements of the construction project and the building in recent decades, few literature reviews were conducted to outline the integration of PBB-related activities throughout the various stages of management of the construction project. Some important research questions about the performance concept were raised, such as 1) how the regulatory requirements may be managed within the processes throughout the construction project life cycle; 2) the extent to which this connection from the PBB to the CPP can be a guarantee for the project success.

In order to address the research questions mentioned above, this study conducts a critical review of the literature on the PBB and CPP connection based on academic research. Specifically, 139 articles from published AEC journals (2008 and 2018) were critically reviewed in 27 journals. When examining articles based on a rigorous taxonomy process in four stages, this study proposes a "Mapping of Performance Information" to categorize current DBE and DPC connection efforts across two levels: project phases and assessment performance.

The structure of the study is organized as follows. Section 2 discusses the research design of this study. Section 3 illustrates in detail the proposed Performance Taxonomy Framework, discussing performance factors in the "project phases". Section 4 identifies the knowledge gap and future directions of research, concluding this article.

2. METHODOLOGY

The systematic literature review approach was adopted in this work, considering a large number of works on the performance concept in the field of building construction. The purpose of conducting a systematic literature review is fundamental to examine the development of research on a specific discipline [25]. A four-stage literature review, from 2008 to 2018, was conducted to analyze article content and gain a more elaborate understanding of performance concepts at each project phase (design, planning, construction and operation) in the strategic decision-making process. To accomplish this objective, the keywords used as search terms were *performance evaluation (PE)*, *performance assessment (PA)*, *project performance (PP)* and *building performance (BP)*. The review process is presented in Fig. (**1**).

Bibliographical research was performed to search for the concepts related to performance in the construction field following the systematic mapping method of the literature used by Al-Sharif & Kaka [26], Hu *et al*. [27], Ke *et al*. [28] and Li *et al*. [25]. The selection processes adopted by these authors include several steps, such as defining the database and research rules, understanding of collected data and classification of the research. Based on this, the research framework comprises the following four stages:

2.1. Stage 1 – Research Rules

The first stage consisted of a comprehensive search conducted on the Scopus search engine to identify the journals that published most of the performance-related surveys between 2008 and 2018. A detailed search was conducted using "title/abstract/keywords", including *performance evaluation (PE)*, *performance assessment (PA)*, *project performance (PP)* and *building performance (BP)*.

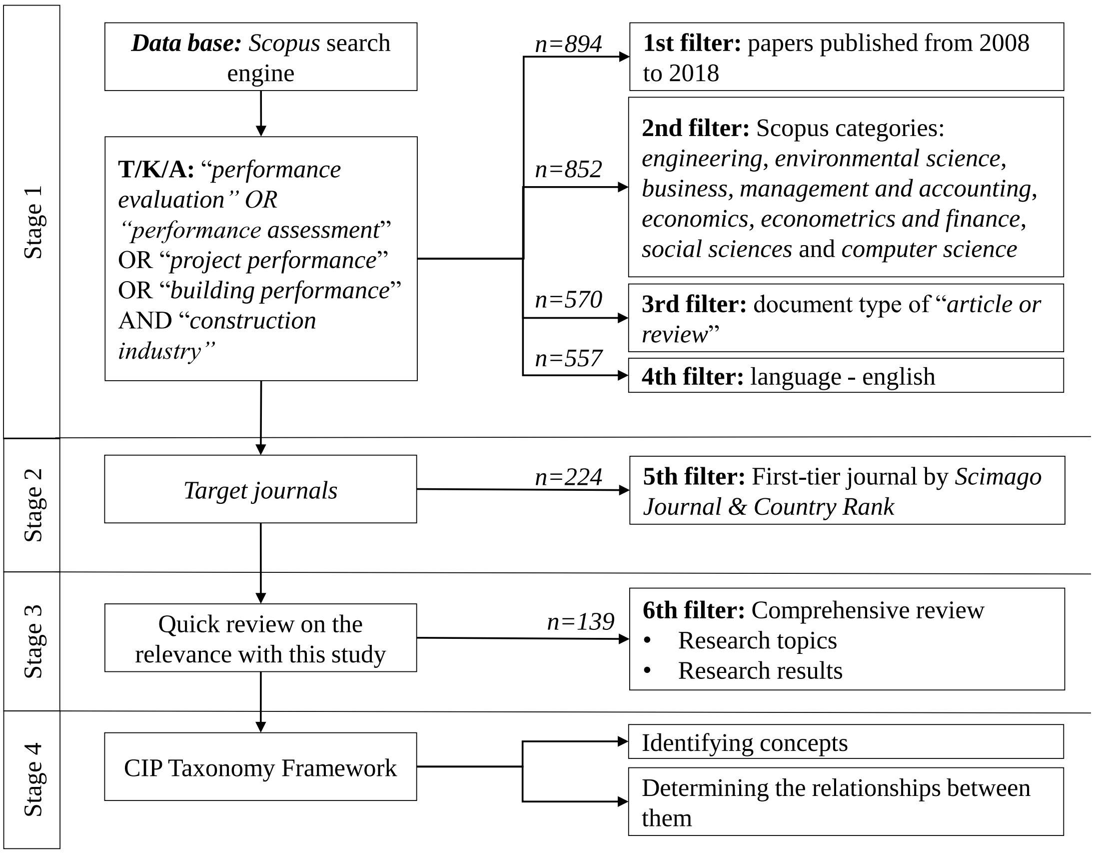

Fig. (1). Model of the factor extraction process.

Studies that included these specific terms in the title, abstract or keywords met the prerequisites. The research was still limited to studies using the term construction industry. Subsequently, filters were defined for the following field areas *engineering*, *environmental science*, *business, management and accounting*, *economics, econometrics and finance*, *social sciences* and *computer science*, and based on the study type, article or review. As a result of Phase 1, the total amount of articles that were identified by the Scopus search engine was 557, with an average of 50 articles per year in 158 different journals in the studied period.

2.2. Stage 2 – Select Target Journals

As the focus of the current study was to review the research on performance in the construction field, all selected journals have a great impact and a prominent position in the construction research community, thus ensuring the quality of the publications. Furthermore, the articles were selected from first-tier journals in the AEC areas, according to the ranking of *Scimago Journal & Country Rank*. A total of 224 articles were selected in 33 journals.

2.3. Stage 3 – Identify the Performance Application

At this stage, a comprehensive review of qualified content was realized in order to identify research interests, topics and project results, and then explore the research trend on performance in the construction field. Table **1** shows the number of articles published from 2008 to 2018; a total of 139 articles were selected in 27 journals. It is noteworthy that the following analyses are only based on the data collected by the specific sampling approach. The scope of this study is not to address the complete population articles, but only to look at the research trend in the AEC areas.

Table 1. Number of articles published between 2008 and 2018.

Year → / Journal ↓	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	Total
Alexandria Engineering Journal								1				1
Architectural Engineering and Design Management		1										1
Architectural Science Review				1								1
Archives of Civil and Mechanical Engineering					1							1
Automation in Construction		1		2		1		2	3	3	2	14
Building and Environment		1	1	1		1	2			1		7

(Table 1) contd.....

Year → / Journal ↓	2018	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	Total
Building Research and Information	3	1					1		2	1	2	10
Computer-Aided Civil and Infrastructure Engineering		1										1
Computers in Industry	1											1
Construction and Building Materials	1											1
Construction Innovation				1			1			1		3
Construction Management and Economics	1	1	1	1			5	1	2	3	2	17
Energy and Buildings	1				1			1				3
Engineering, Construction and Architectural Management	1	3				2	1	2	1			10
Expert Systems with Applications							1			2		3
Facilities							1					1
Informes de la Construccion				1								1
Journal of Architectural Engineering	1											1
Journal of Asian Architecture and Building Engineering				1								1
Journal of Building Engineering	1	2		1								4
Journal of Building Performance Simulation									1			1
Journal of Cleaner Production	1	1				1			1			4
Journal of Construction Engineering and Management	3	2	4	1	5	4	4	1	2	5	4	35
Journal of Management in Engineering	3		2	1		1	1	3			1	12
Production Planning and Control											1	1
Quality Engineering					1							1
Sustainable Cities and Society	2	1										3
Total	16	15	8	11	8	10	17	11	12	16	12	139

Table **1** shows that the *Journal of Construction Engineering and Management* (JCEM), *Construction Management and Economics* (CME) and *Automation in Construction* (AC) journals published the highest number of articles on performance in the construction field during the studied period. The JCEM published 35 articles, followed by CME (17 articles), and AC (14 articles). The higher number of articles published by the JCEM and CME indicates the most significant contribution to the subject by these two journals, representing together approximately 47% of the publications in the period. Therefore, these three journals can be considered as the most important sources for publishing and acquiring studies on performance in the construction field.

2.4. Stage 4 - Performance Taxonomy Framework

Based on the method used by Jabareen [29], which aims at the description of the data and the phenomenon targeted, the content analysis focuses on describing an approach rather than generating theorization. In this sense, the method described is appropriate and extremely useful for building conceptual frameworks from multidisciplinary texts.

The result of this rigorous review – based on the keywords of reviewed papers and their underlying theories – is the development of a taxonomy "Performance Taxonomy Framework" that synthesizes the connections of the performance study in three steps:

− Identification of process and product performance;
− Performance concept in connection with the "project phase";
− Performance concept in connection with the performance evaluation.

Specifically, project phases were identified based on project management theory; the performance evaluation was raised according to the objectives of each research.

3. PERFORMANCE CONCEPT

The bibliographic survey showed a great variety of research related to the study of performance in the construction industry, including the performance evaluation of both management process and product, which in this case is the building. Therefore, a critical review was conducted to include these variations.

The present work focused on the study of performance in the construction field. The selected papers indicated that performance in the construction field could be studied in the scope of the process and the product, suggesting effective ways to evaluate the performance according to the project activities.

The conceptual structures are products of qualitative processes of theorization [29]. The study of the performance in the construction field requires a multidisciplinary approach, therefore, it was necessary for a better understanding of such phenomena. On the other hand, the phenomena of taxonomy can be compared and contrasted with each other in several points, either as an individual species or as members of a larger division [30].

A construction project goes through a life cycle that involves the steps of initiation, planning, execution and operation. The product life cycle corresponds to "a series of phases through which a project goes, from the beginning to the conclusion" [31]. The project phases, in this case, are "a set of project activities logically related that culminates in the completion of one or more deliveries" [31]. The "project

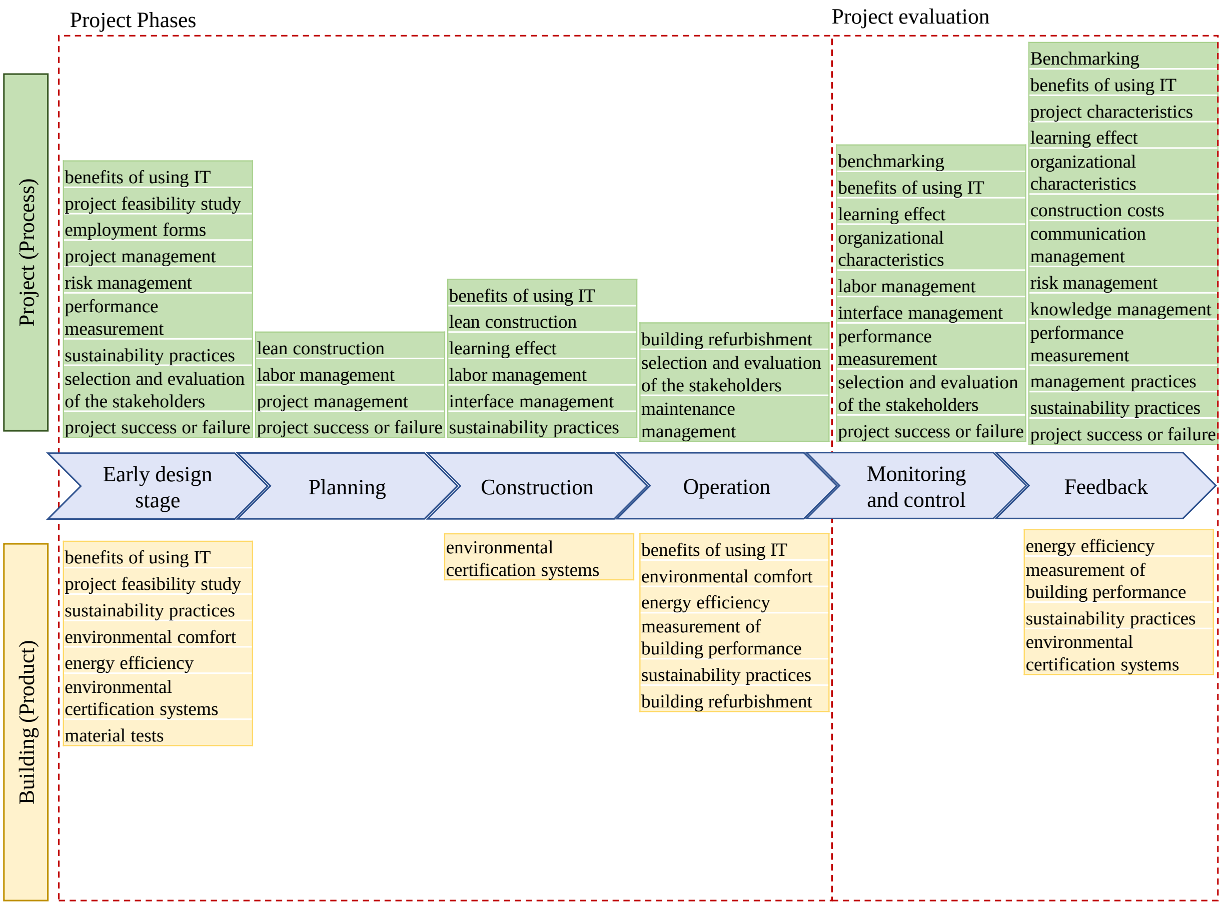

Fig. (2). Mapping of performance information for each project phase.

phase" dimension captures the project life cycle perspective. "Performance evaluation" refers to the monitoring and feedback phases of the process and product. This indicates that the planning, design, construction and maintenance procedures must be managed and executed properly to ensure that all performance variables can be anticipated [32].

As a result of the systematic analysis of the performance concept in the construction field, the articles were first classified as to the level of project (process) and building (product) and then as to the connection with the project phase, in order to understand how the performance concept in the construction has been used in the academic field, in which was mapped and listed the occurrences of the definitions used in the studies, as shown in Fig. (**2**).

A taxonomic conceptual framework was developed, composed of four levels:

- performance in the construction field;
- project phases;
- monitoring and control; and
- feedback.

Fig. (**3**) shows the structure proposed to enable the performance evaluation in the construction field over the entire lifecycle of a construction project. It shows how companies can integrate the implementation and evaluation of their processes and products. The framework is organized into four levels. In level 1, it presents the position of the performance in the construction field in the whole process; level 2 represents the "project phases" that involves the steps of the early design stage, planning, execution, and operation; levels 3 and 4, monitor, control and feedback correspond to the process of monitoring and evaluation of the project phases.

The following subsections address performance aspects throughout the lifecycle stages of the construction project.

4. PERFORMANCE CONCEPT IN THE PROJECT PHASES

4.1. Early Design Stage Performance

Several works related to the early design stage acknowledge that well-designed pre-project planning has a major impact on the project outcome [33 - 35]. Therefore, the performance concept in the construction field is applied to both process and product in the context of the early design stage.

The anticipated understanding of project conditions provides a valuable source of information to proactively

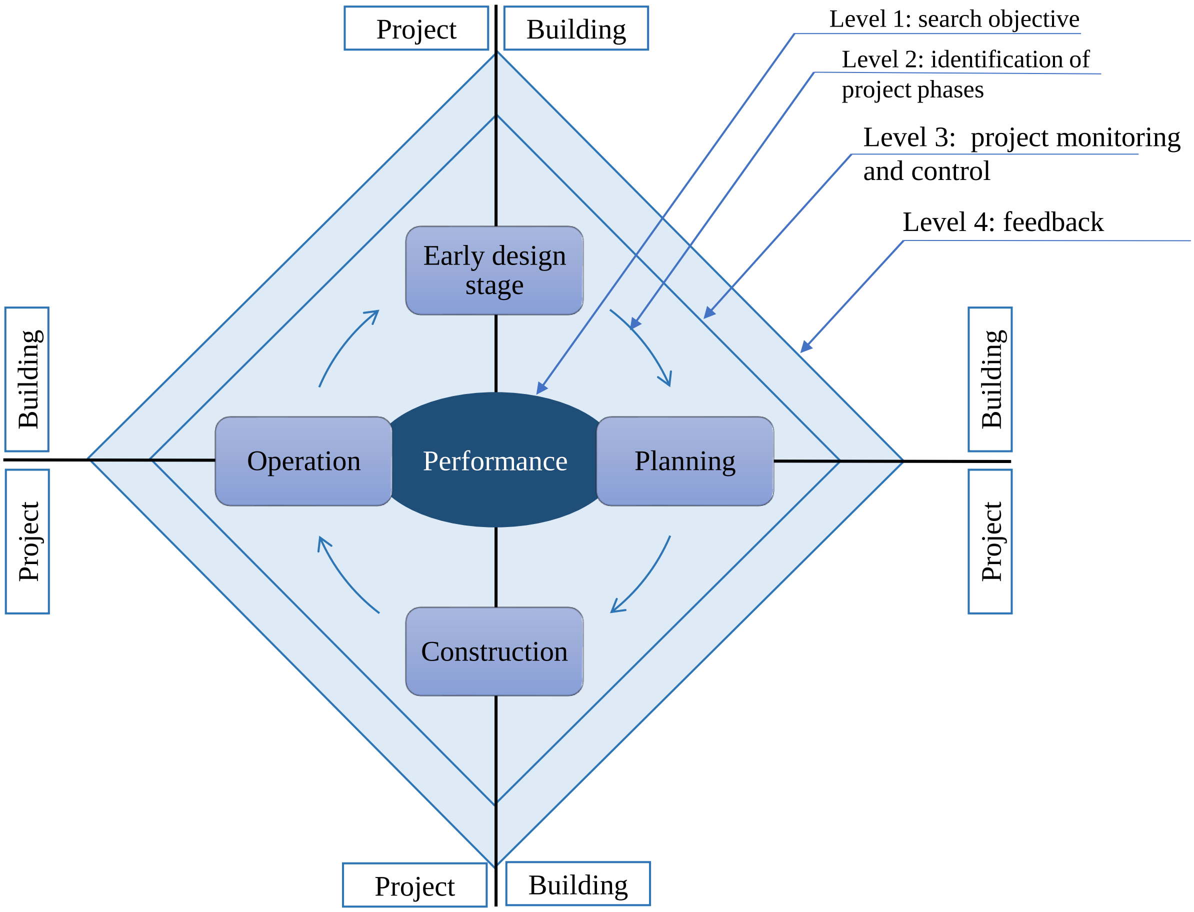

Fig. (3). Performance taxonomy framework.

respond to changing project situations and support better planning in the early stages of the project lifecycle, thus positively impacting the final project result [35, 36]. It is necessary to integrate the team and the project stakeholders to achieve successful results and greater value for the owner [37].

In addition, on the anticipated decisions affecting the performance of construction projects, Azambuja *et al*. [38] highlight the criteria for selecting suppliers in the initial stages of the project. More specifically, project success is reflected in the owner's perception of performance factors in the relation between the owner and any other participant, such as the contractor, designer, or project consultant.

It is in the early design stage that product performance is defined, in terms of standard, used materials, durability, and comfort, among others. Two lines of research were detected; one for the development of materials to improve thermal [39] and acoustic [40, 41] comfort, and another for computational simulation of light [42].

4.2. Planning Performance

Construction company planning can be defined as a business management system that integrates all company and business processes and data related to the project, including engineering/design, planning, acquisition, construction, and maintenance/operations [43]. Thus, for many authors, planning is often associated with a greater impact or a stronger relationship with the metrics that measure project performance [44, 45].

Jha and Chockalingam [46] identified aspects that significantly affect the planning performance of a construction project, such as competence of both, project manager and project owner; monitoring and feedback from project participants; commitment of all project participants; interaction among external project participants; and good coordination among project participants.

Therefore, construction project managers that aim at improving project performance in the planning phase should accurately identify all activities while developing a high-quality project plan that can be approved by key stakeholders [47].

The planning reliability at an operational level is a key factor for improving project performance [48]; on the other hand, variability is a well-known problem in construction projects, which leads to overall performance deterioration [49]. These two works used a production planning and control system based on the principles of Lean production and Last Planner System to improve planning reliability and reduce the negative impacts of variability.

Therefore, to improve the performance of the project schedule requires a decision support system that accurately monitors the activities and the corresponding progress, predicts potential resource conflicts and reallocates resources so that the negative consequences are minimized [50].

4.3. Construction Performance

According to Dulaimi *et al*. [51], "construction is a project-based activity that needs to be carried out by several parties. Each part is a separate organizational entity that has its own interests and final rewards expected from the project". The construction is the stage of realization of the parameters and the realized value may be different from what was projected.

According to Haponava & Al-Jibouri [3], a construction process begins still in the design phase with the production of detailed specifications for the steps to be followed and the restrictions to be observed during the execution of the work. The authors state that, once the specifications and contractual agreements have been established, the project manager's main task is to control the performance of the ongoing process by the specifications, the stipulated requirements and take corrective measures, if necessary, to ensure compliance with performance goals.

The construction is the parameters of the stage of realization and the realized value may be different from what was designed [52]. It is during this phase that projects are implemented as detailed planning in the previous phase, and construction has started, *i.e.*, the project is executed, so the execution process must be managed to ensure that the final product complies with the project specifications established in the design phase [3].

It is impossible to completely dominate the real conditions of the workplace in advance; this is not as easy as it seems due to the dynamic environment around the project during its execution [53, 54]. Therefore, it is necessary to process control on the conformity of the final work to the design specifications, as this directly affects the quality of the final product [54].

4.4. Operation Performance

Once the construction phase is completed, the building is delivered to the customer, starting the next stage of use and maintenance, which focuses on the building's lifetime operation [55]. The project success can also be evaluated by the performance of building post-occupation, which spans from meeting the client requirements to the follow-ups of the needed maintenance. Some authors highlight the lack of feedback on the functioning of buildings in order to close the project cycle and use the acquired information as feedback on new building projects [24, 56].

Over time, the building tends to deteriorate during building occupancy, "leading to a reduction in the value of the building until it is no longer suitable for occupants" [55]. Therefore, Vásquez-Hernández and Álvarez [56] stated that the post-occupation evaluation of buildings in real use conditions aims at determining building performance once they are inhabited. Effectively measuring and disseminating the impact of design on users requires an evaluative change in building performance measurement to account for the results experienced by the people living in the building [57].

In this sense, Straub [58] also highlights an important issue in the maintenance scenario, in which the builder must have complete knowledge of the building's degradation process, performing initial maintenance activities, as well as monitoring planned maintenance, especially satisfaction end customer during maintenance interventions.

Refurbishment with the objective of improving building performance seems to remain the most viable and efficient way to do so [59]. Juan [60] stated that the demand for refurbishing projects is increasing in the construction industry due to the emphasis on sustainability, highlighting the importance of properly selecting the stakeholders in the project, since most refurbishing work involves a higher risk and uncertainty, as well as more complex coordination than new buildings.

The improvement of the building performance after refurbishment presented benefits resulting from the interventions on energy consumption and carbon emissions [59]. On the other hand, Kyrö *et al*. [61] emphasize that even buildings having a good design will not perform as planned if not properly operated.

The authors Lowe *et al*. [62] gave a sociotechnical approach to evaluate the performance of the building. In other words, they took into account complex interactions between the social and the technical and thus allow a better understanding between the responsibilities of the designer, builder and user. They came to the conclusion that dialogue and communication between project teams and occupants throughout the retrofit process is the key to a satisfactory process and outcome.

To this end, the use of information technology (IT) highlighted in the work of Jiang *et al*. [63] and BIM Göçer *et al*. [24] shows how these tools can be useful for the different stakeholders in different processes as to involve all the collaborative effort towards improving building performance.

Building performance evaluation is a critical tool that solves this problem [64]. By giving a better understanding of factors dependent on user satisfaction and the relationship between user satisfaction and the quality of the internal environment, other deductions can be obtained, which helps increase work productivity and user creativity [24].

In summary, the pressure to improve the built environment, encourage economic activity and limit the environmental impact forced professional designers, builders and researchers to think about the post-occupation evaluation process [24].

5. PERFORMANCE CONCEPT IN CONNECTION WITH THE PERFORMANCE EVALUATION

5.1. Monitoring and Control Performance

Successful construction projects require that construction managers monitor and control continuously the factors critical to project success [65]. According to Ling and Ang [66], the most important control mechanisms are adequacy of project information to develop the schedule, adjustment of the oscillations in the schedule and quality of the techniques used to support risk identification.

The process monitoring allows decision-makers to understand the current situation more accurately in relation to each evaluated criteria and the whole figure [67]. To minimize disastrous consequences, management actions need to be carefully examined at the strategic and operational levels, since their effectiveness depends mainly on how the strategic perspectives and operational details of a project are balanced [68].

Project performance in the construction industry is often measured based on the conclusion within budget and schedule, and in compliance with quality standards and owner satisfaction [69]. However, the evaluation of project indicators during implementation is not easy due to the lack of updated data and indicators measurement problems [70]. The product performance is defined in the first stage of a construction project, so it clarifies the crucial steps needed to achieve successful results. This affects quality, communication between stakeholders and the final performance in terms of cost, time and quality [71].

The effective measurement of performance drives performance and supports the development of construction [72]. In this context, the indicators have been used as a basis for decision support by various sectors of the construction industry [67]. Project management needs to know what control within the process and how to control it in order to act, if and when necessary, to achieve the desired results [73].

5.2. Feedback Performance

Construction companies usually carry out multiple construction projects simultaneously that differ by complexity, duration, budget, variety of works and number of implementers. Therefore, project workflow indicators should be analyzed to determine the causes of success, lack of success, or partial success [70].

The act of systematically learn from previous projects is the key to improve building performances, resulting in a condition that better attends the costumer's needs, end-users, general community and the environment [74]. Communication plays an important role in the quality of the relationship, trust, and collaboration among the project building teams [75].

It is noteworthy that the lack of effective communication and poor knowledge of the activities to be developed in the project continue to affect the construction industry, especially with respect to the lack of management communication among project agents [76].

In this sense, Zhang and Ng [77] highlight the importance of sharing knowledge among members of the project team to improve project performance and successful delivery. In addition, best practices can be promoted among teams to increase buildability, which would increase performance [78].

In order to evaluate quantitatively the overall performance of a construction project, the main performance areas should be taken into account, which includes client satisfaction, time, cost, profit and communication, allowing that the industry not only compares one project with the other but also compare different used processes and technologies [79]. This requires that the selection of evaluation methods be made according to the purpose of the evaluation, the depth and nature of the study, the feedback public, and the resources available for evaluation [80].

Benchmarking systems are designed to deliver results based on key performance indicators (KPIs) [81]. Hwang *et al.* [82] identified that there are several reasons for the lack of applying benchmarking, such as the competitive nature of the industry and sensitivity issues that emerge with the project data sharing and performance across companies.

The use of IT to perform measurement can play an important role, according to Kang *et al*. [83]. They explored the view that the construction project performance can be improved by the use of industry best practices and the use of IT. Abdirad [84] emphasizes the importance of using BIM as it introduces new technologies, processes and interactions in practice, leading to the need for BIM implementation evaluation and improvement measurements.

Construction projects have in common a cast of key contract participants, consisting of clients, consultants (designers) and contractors [85]. Construction clients can choose to improve their processes of selecting agents involved by identifying and incorporating contractor input factors that influence performance outcomes [86].

6. DISCUSSION

A taxonomic conceptual framework was developed to collect performance information at the project and building level. The appropriate understanding of these factors in all phases of the construction project has the potential to contribute to the development of procedures to improve the flow of information or improve the decision-making process.

This research proposed that for a successful study, the performance concept in the construction field would be necessary a complete understanding of the product needs at all project phases, although this broadens the scope of the evaluation since no study has so far discussed the integration of product requirements into processes that aid in the development of construction projects. The following factors are also required for successful adoption of the performance aspects and can be explored in future research:

- Establish strategies for product evaluation and monitoring throughout all project phases;
- Develop strategies to improve the flow of information as a way to guarantee integrated performance in the four levels of study;
- Ensure the full commitment of all stakeholders throughout all stages;
- Ensure continuous performance feedback at each stage of the project.

These factors should be considered at the strategic level of the company. Further research should also be conducted to develop tools to help manage the flow of information about performance throughout the construction project. In parallel, BIM presents great potential to mitigate many of these factors.

The application of *Performance Taxonomy Framework* in current practice opens up opportunities for conducting additional (applied) research aimed at examining how performance information can actually help project managers to identify the potentialities of performance-based design and better manage the two components of the cycle (process and the product).

CONCLUSION

The performance has received considerable attention and discussion in the AEC industry with its recent developments. This study provides a review of the performance concept in the academic field based on reviewing journal articles and therefore has established a solid platform for academics and researchers to gain more useful information about performance concerns. This study proposes a taxonomic conceptual framework of performance in the construction field to conceptualize interactions between performance and the construction industry and provide insight into the advantages and challenges of implementing performance assessment.

Although much effort has been made to review the main developments in the performance research, it is recognized that this review is not exhaustive and is limited only to the construction industry. Identifying research trends in this area can enable professionals to appreciate key performance concerns and better manage construction projects. The main results of the research are listed as follows.

First, the applicability of the performance in each phase of the project was analyzed, and it was verified that although the concern with the performance is fundamental for the success of the project, there is still a knowledge gap that makes the connection between these matters. Establishing a flow of information with the aim of improving the communication and collaboration of all agents involved in the project can facilitate the exchange and integration of information.

Secondly, the difference between project performance and building performance was discussed in each phase of the project, and key performance requirements were identified and critically discussed. The performance evaluation aims to identify the critical factors that can support the integration of processes and products between the phases that have been studied, both in the management of the building's life cycle and strategic decision making.

The application of *Performance Taxonomy Framework* in practice opens opportunities to conduct additional research, aiming the development of a tool that directs the integration between the stages of design, construction, use and operation in construction companies, that helps the agents involved in the project to manage the information of construction and at the same time can feed information into new projects using BIM, for example.

Future research efforts should be directed toward performance in other industries. The performance research was conducted from different perspectives, such as design, monitoring and control phases, and process and product feedback. However, a mechanism that allows the integration of performance concepts at these different levels has not been fully discussed. Therefore, more research efforts must be made in this direction. The overall performance improvement cannot be achieved without the integrated efforts of all stakeholders at the industry, company and project team levels.

CONSENT FOR PUBLICATION

Not applicable.

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CONFLICT OF INTEREST

The author declares no conflict of interest, financial or otherwise.

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