

Bibliometric Analysis of Project Management Evaluation in Construction Industry

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Abstract

The research on project management conducted around the world is massive. Nevertheless, a robust knowledge of project management is lacking, especially a map of project management evaluation articles and a comprehensive typology of those evaluation. This research aims to reveal project management evaluation and to categorize the evaluation based on the papers issued in the Scopus™ Preview bibliography from 1986 to 2021. We investigated and classified 118 papers using the descriptive and content analysis approaches. The examination categories were the issued year, writers, country, keywords, and the title. The result showed that from a total of 118 papers on project management evaluation, there were six typologies of the project management evaluation in the construction industry. The authors conclude that the previous study is most concerned about information and technology adoption, risk management and safety, and human capital as the primary critical factors affecting project performance. Then, there should be more exploration other than primary critical factors, such as lean construction, waste, and the environmental impact.

Keywords

Project Management, Evaluation, Construction Industry, Project Performance, Systematic Literature Review (SLR)

1. Introduction

There was enormous research on project management conducted worldwide, significantly maximizing its effectiveness (Emuze 2012) and minimizing waste (Dallasega et al. 2018). Many factors affect the project performance, such as reducing material waste (Aziz and Hafez 2013) and the lean production strategy (Al-Aomar 2012; Ansah and Sorooshian 2017; Sarhan et al. 2017). In addition, those factors affect the inefficient project (Hussin et al. 2013; Olanrewaju and Abdul-Aziz 2015) and harmful waste (Ola-Adisa et al. 2015) globally (Ayalew and Dakhli 2016; Johansen and Walter 2007).

Various researchers investigated numerous enhancements in the procedures, approaches, and organization of the project management in the construction industry (Ajayi et al. 2015, 2017; Cheng and Mydin 2014; Dallasega et al. 2018; Lu and Yuan 2011). Nevertheless, some researchers (Ijaola et al. 2021; Pan and Zhang 2021; Zhao and Wang 2012) claimed that the research on the project management evaluation (PME) was still limited due to the lack of the

knowledge of its typology and actual usage in the construction industry. The previous research (Chan et al. 2015; Chien et al. 2014; De Vasconcelos et al. 2015; Liao et al. 2015; Omar and Fayek 2014; Orgut et al. 2016; Rashvand et al. 2015; Saad 2014) have tried to investigate project management evaluation, with no robust identification and classification of the variety and fitness of project management evaluation.

We conduct this research to fill the research gap of a project management evaluation map and a comprehensive typology of those evaluations. Consequently, this research is conducted to find out and classify the variety of PME in the construction industry and investigate those approaches' capacity by a systematic review of papers published in the Scopus™ Preview. The research questions of this study were:

- a. How many articles of project management evaluations in construction industry are presented in the literature database?
- b. What are the specifications of the various project management evaluation in the construction industry?

This research contributes to the knowledge by investigating and classifying the current project management evaluation and drawing those findings with a particular specification of each evaluation approach. The result would be a project management evaluation typology. This typology will enhance the knowledge of the current project management evaluation practices, which have a practical implication that leads the entities in the construction industry to decide the project implementation. Besides, this research is also beneficial in improving project performance.

2. Literature Review

Project management was such an enormous project due to its tremendous investment. Project management played a crucial point in certifying the project effectiveness, implementation procedure, and safety. Regarding the requirement of the project quality, the project manager should make sure that the effect of the project meets the project's goal. The project's effect would affect the provider and the construction industry (Zhao and Wang 2012).

Project management evaluation was a very crucial element to enhance project effectiveness. The evaluation got the attention of all stakeholders due to the enormous risk in the project. The project performance evaluation was an approach of the preliminary project, execution, and finishing based on the conducted parameters and procedure evaluation approach. Commonly, project performance evaluations were based on the budget. The assessment not only assessed the personal project execution method but also focused on enhancing the future project execution performance. Consequently, the assessment of the project would be such a continuous approach. The evaluation process should meet the goals of achieving project improvement on its effectiveness.

The previous study was conducted on the topic of project management evaluation. The previous research were on the planning phase of the project (Saad 2014), risk factors (Chien et al. 2014), the fitness and performance parameters (Omar and Fayek 2014), the usage of information technology, the provider of the project (Rashvand et al. 2015), project management (Chan et al. 2015), the lean and impact toward the environment (De Vasconcelos et al. 2015), CRS (Liao et al. 2015), and progress of the project (Orgut et al. 2016). That previous research was spread into many varieties of the research on the evaluation with no robust examination. Since there was no consensus on the standard of project management evaluation, this research tried to investigate project management variety and each capacity in asses the project, especially in the construction industry.

3. Methods

This research applied a systematic literature review of the articles published in the Scopus™ Preview database. The systematic literature review is a method to review, conclude and share the results and consequences of numerous academic papers on a specific topic. There are five phases in conducting this approach. They are (1) construction of the objectives of the research, (2) examination of the academic papers, (3) investigation of the articles, (4) finalization of the data analysis, (5) creation of the result based on the literature (Laryea and Ibem 2014). The data analysis was based on the papers on the Scopus™ Preview database. The bibliography selection is due to the logic that Scopus™ Preview database has comprehensive research of globally issued papers that meet the scholars' qualifications. The Scopus™ Preview database is also accessible in other bibliographies and is credible in its database standard (Ferdilan et al. 2021). In conducting the review of the papers in the Scopus™ Preview database, "project management evaluation" was chosen to find out the papers with the keywords "project management evaluation," "construction," and "project performance," of the heading, synopsis, or the author's keywords. The selection was conducted on the papers issued

between 1986 to 2021. The result shows that papers were published in various forms, such as articles, books, and other formats. There were 118 published papers of “project management evaluation” in the Scopus™ Preview Database.

4. Data Collection

This research concerned the project management evaluation, thus, and selected the papers that contain rich material of empirical evidence of project management evaluation. Regarding this idea, the preliminary selection of the papers was conducted to detect the papers with the keywords mentioned in their articles. The preliminary selection brings about the 118 articles, conference papers, books, business reports esteemed as suitable material to review.

Afterward, there was the selection of the selected papers conducted to the screening of the abstract of the papers to limit their relevancy to the research questions and the quality of the papers. Three inclusions and exclusions parameters were conducted in the screening of the papers analyzed. First, the papers were selected regarding on those scale of significance to the research questions with the degree of “1” for the not vital significance, “2” for solid significance, and “3” for the extreme significance. The literature stated that the relevance of each document was accessed due to their approach rigor and results (Hassan Ibrahim 2013; Laryea and Ibem 2014). Therefore, all papers with the components relevant to the project management evaluation in the construction industry were scaled “3” and involved in the analyses. The following criterion applied was the citations of the papers. The application of this criterion, the main concern was conducted to the manuscripts with the high citations. In addition, the manuscripts chosen were already peer-reviewed articles and written in English.

Four hundred thirty-nine papers taken from the Scopus™ Preview database (118 papers) were used for the investigation. Those manuscripts were chosen due to their relevance and quality. The researchers analyzed the chosen papers to find the project management evaluation discussed in each paper. The analyses were by frequencies, percentage, and content. The findings were shown using tables, diagrams, and transcripts for a simple explanation and to figure out the conclusions.

5. Results and Discussion

5.1 Mapping the Research of the Project Management Evaluation

Figure 1 revealed the spreading of the 118 articles found in the explorations of the Scopus™ Preview bibliography by their number of publications per year. Figure 1 showed an insignificant number of project management publications every year—the peak number of publications was just fourteen in 2021. Even though the first article was published in 1986, the research on project management evaluation remained thin. In addition, the evaluation research needs to explore due to the limited numbers of the studies. The growth of the research began in 2003.

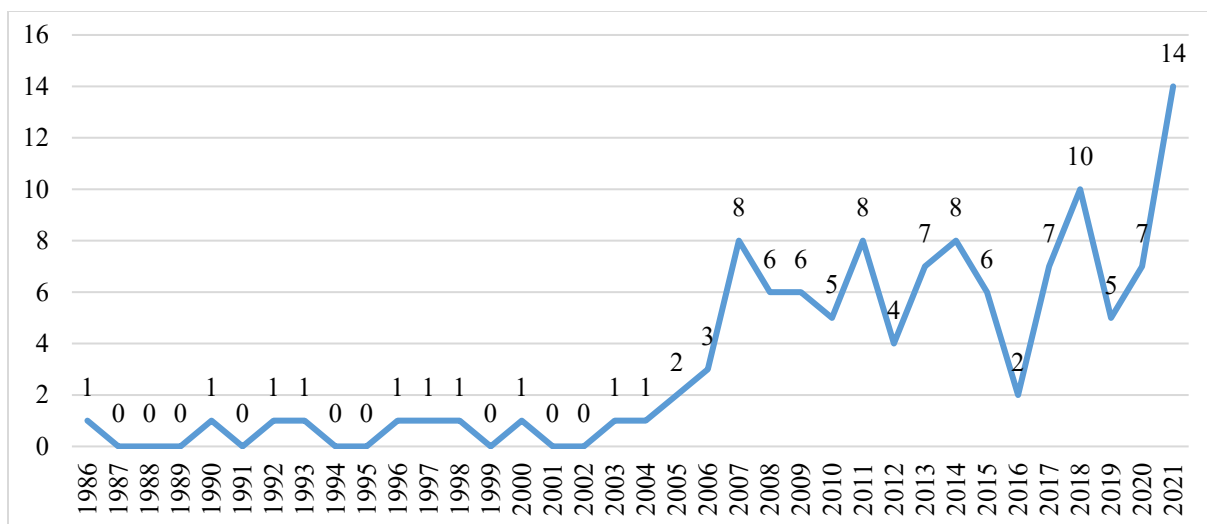


Figure 1. Manuscripts issued yearly

Table 1 revealed top keywords used in the 118 articles of project management evaluation constructed on the Scopus™ Preview bibliography. VOSViewer version 1.6.16 shows a map of the connection between keywords in the project management evaluation. Concurrences of the papers were investigated to study the connection between keywords. The review of the author keywords was conducted of the "author keywords". The selection of the concurrence was based on the minimum number of occurrences: two. The results were twenty most keywords, of a total of 439 keywords. Figure 2 mapped the network among authors' keywords. As fig 2. revealed that the "construction management," "evaluation," "construction industry," and "project performance" were the core of the map. Interestingly, the keywords also discussed "risk management," "developing countries," "sustainability," "lean construction," and "circular economy."

Table 1. Top Keywords

Author Keywords	Frequency
Construction management	10
Risk management	9
Construction industry	9
Project management	7
Evaluation	5
Project performance	4
Developing countries	4
Prefabrication	3
Performance evaluation	3
Project success	3
Sustainability	3
Construction	3
Lean construction	3
Concrete construction	2
Construction methods	2
Risk	2
Benchmarking	2
Key Performance Indicators (KPIs)	2
Building performance	2
Circular economy	2

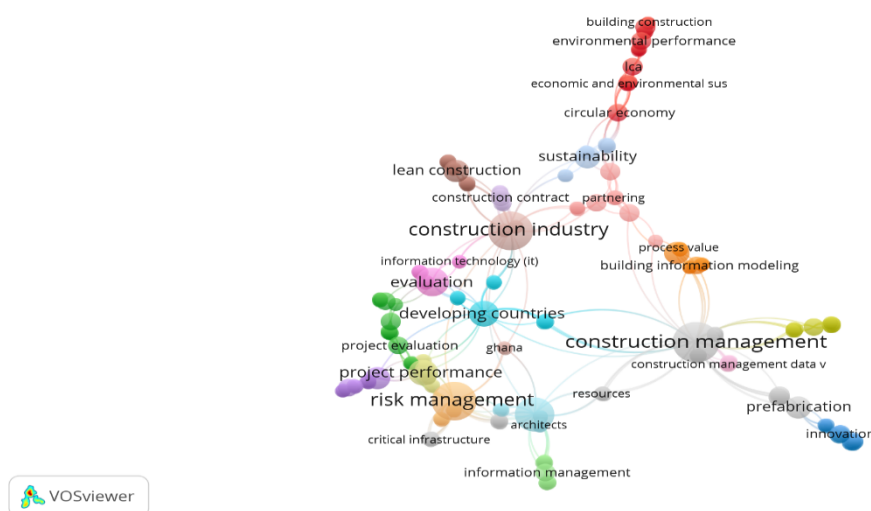


Figure 2. The connection among the author keywords.

Table 2 explored the documents based on the countries produced to the research on the topic of project management evaluation. Forty-three countries produced the research. Interestingly, the project management evaluation research has already spread into developing countries, such as China, Egypt, Iran, South Africa, Malaysia, Nigeria, and Saudi Arabia.

Table 2. Top countries published the research

Countries	Frequency
United States	29
China	19
United Kingdom	10
South Korea	9
Hong Kong	8
Taiwan	7
Australia	6
Canada	4
Egypt	4
Iran	4
South Africa	3
New Zealand	3
Spain	3
Finland	2
France	2
Italy	2
Malaysia	2
Nigeria	2
Saudi Arabia	2
Singapore	2

Table 3 explored the documents based on the contributors of the papers. The most productive writers in table 3 revealed that the most productive researchers on this topic write a maximum of two papers. In addition, mostly the researchers of this theme wrote a paper. This evidence shows that the research on project management evaluation needed to explore.

Table 3. The most productive researchers

Researcher	Frequency
Birgonul, M.T.	2
Chan, A.P.C.	2
Chan, D.W.M.	2
Chen, Y.	2
Dikmen, I.	2
Fang, D.	2
Lee, D.E.	2
Liao, P.C.	2
Nutakor, G.	2
Okudan, G.E.	2
Riley, D.R.	2
Russel, A.D.	2
Teizer, J.	2
Abadie, C.	1
Abd Majid. M.Z.	1

Researcher	Frequency
Abdel Aziz, A.M.	1
Aboelmagd, Y.M.R.	1
Abuddayeh, O.	1
Adafin, J.	1
Adamtey, S.	1

Table 4 explored the documents based on the journal publishers of the papers. The most productive publisher on this topic in table 4 revealed that most journal publishers were “Automation in Construction,” “KSCE Journal of Civil Engineering,” and “Journal of Engineering Design and Technology” with 24, 11, and 10 publications, respectively. Interestingly, there was a journal publication with a non-English title. “Jurnal Teknologi” was affiliated with the University of Technology Malaysia. In addition, there was also the Chinese Journal of Mechanical Engineering English Edition that a Chinese Journal with English Edition. This publisher tried to get knowledge globally.

Table 4. The most productive researchers

Publisher	Frequency
Automation in Construction	24
KSCE Journal of Civil Engineering	11
Journal of Engineering Design and Technology	10
Transportation Research Record	9
Building	4
Journal of Infrastructure Systems	4
Advance in Civil Engineering	3
Alexandria Engineering Journal	3
Cost Engineering Morgantown West Virginia	3
Building Research and Information	2
Building Services Engineering Research and Technology	2
Energy and Buildings	2
Journal of Safety Research	2
Jurnal Teknologi	2
Open Construction and Building Technology Journal	2
Advanced Materials Research	1
Achieves of Civil and Mechanical Engineering	1
Asian Journal of Civil Engineering	1
Assembly Automation	1
Chinese Journal of Mechanical Engineering English Edition	1

Table 5 and Table 6 explored the paper's affiliation and funding sponsor. The most productive affiliation on this was Asia country affiliation: "Hongkong Polytechnic University," "Tsinghua University," "National University of Taiwan." In addition, the top two funding sponsors were also from Asia: "National Natural Science Foundation of Korea" and "Ministry of Science and ICT, South Korea." This evidence showed that research on this topic was spread in Asia countries, i.e., South Korea and China. Besides, those countries prepared the budget and resources to promote the project management evaluation articles.

Table 5. The affiliations

Affiliation	Frequency
Hongkong Polytechnic University	5
Tsinghua University	5
National University of Taiwan	3
University of Illinois Urbana-Champaign	2
Pennsylvania State University	2

Affiliation	Frequency
Middle East Technical University METU	2
Iowa State University	2
Southeast University	2
Kyungil University	2
The university of Auckland	2

Table 6. The affiliations

Funding Sponsor	Frequency
National Research Foundation of Korea	5
Ministry of Science and ICT, South Korea	4
National Natural Science Foundation of China	4
National Science Foundation (USA)	4
China Scholarship Council	4
Innovate UK	2
Ministry of Education of the People's republic of China	2
National office for Philosophy and Social Science	2
American Institute for Sri Lanka Studies	1
Auckland University of Technology, New Zealand	1

5.2 Project Management Evaluation

This research tried to analyse the project management evaluation based on the three categories: year of publication and the relevance with the topic. This research analysed 118 articles published in the Scopus™ Preview database on project management and classified that evaluation. The conditions were that the publication should be published in the last ten years and relevant to the topic. Regarding 118 articles: 64 articles discuss the antecedents of the project performance in the construction industry. Afterward, those findings were classified based on their correlations with each other. Those critical factors that affected the project performance could be classified into six categories: (1) Information modelling adoption and technology; (2) Risk management and safety; (3) Human capital; (4) Lean construction; (5) Waste; and (6) Environmental impact.

Table 7. Typology of project management evaluation

Typology	Number of papers	Authors
Information modelling adoption and technology	14 papers	(Aboelmagd 2018; Ahn et al. 2020; Chien et al. 2014; GhaffarianHoseini et al. 2019; Hwang et al. 2011; Ji et al. 2019; Jing et al. 2019; Kabir et al. 2011; Kim et al. 2020; Love et al. 2015; Oti et al. 2016; Pan and Zhang 2021; Xu et al. 2018; Zahraee et al. 2014)
Risk management and safety	9 papers	(Adafin et al. 2021; Al-Kasasbeh et al. 2021; Amoah and Pretorius 2020; Chileshe and Boadua Yirenkyi-Fianko 2012; Chockalingam and Sornakumar 2011; Eom and Kim 2018; Hamzeh et al. 2020; Li et al. 2018; Yildiz et al. 2014)
Human capital	7 papers	(Al-Salahi et al. 2020; Asgari et al. 2018; Eom and Kim 2018; Ijaola et al. 2021; Kwofie et al. 2018; Lee et al. 2011; Muhammad et al. 2015)
Lean construction	4 papers	(Asgari et al. 2018; Aziz and Hafez 2013; Koch and Bertelsen 2014; Santoso et al. 2020)
Waste	5 papers	(Asgari et al. 2018; Ijaola et al. 2021; Oregi et al. 2017; Park et al. 2019; Santoso et al. 2020)
Environmental impact	3 papers	(Hong et al. 2021; Kokkaew and Rudjanakanoknad 2017; Zou and Moon 2014)

The findings above were divided into two sections: the articles of project management evaluations and the antecedents of the project performances. The articles of project management evaluation were produced since 1986 and interested many stakeholders' intentions. Nevertheless, the research on project management evaluation were not grown significantly. There was a need for researchers' support in researching this topic and spreading the knowledge globally. Interestingly, based on the most used keywords, the keyword of "developing countries" was on the rank seventh. It means the knowledge of this topic has already been spread from developed countries to developing countries—China as the developing country as the runner-up of the most productive country on the research. China also supports the research by providing the publishers such as particular journal "Chinese Journal of Mechanical Engineering English Edition," affiliations and funding. These findings revealed that the government as policymakers supports this theme's research. As the source of knowledge, the university is also concerned with supporting the research of the project management evaluations.

We can learn their varieties regarding the typology of the project management evaluations. The projects in the construction industry were very complex due to their length, funding, work assortment, and several contractors. That variety produced a varied outcome of the projects. Some of the projects reached the goals, and the others ended with losses or even accidents. The analysis needs to conduct the antecedents to determine the cause of the project's effectiveness and efficiency. The evaluation was not accessible due to the lack of up-to-date data, technology information adoption, measurement, and incompetence of human resources that led to the problems. Based on the literature review, the critical factors that influence the project performance were: 1) Information modeling adoption and technology; (2) Risk management and safety; (3) Human capital; (4) Lean construction; (5) Waste; and (6) Environmental impact. We proposed those six antecedents of project performance as the critical factors to evaluate in the construction industry. Findings showed that most concern on the information and technology adoption; and risk management and safety, and human capital as the primary critical factors affecting the project performance.

6. Conclusion

This study revealed that the articles of the project management evaluation in the construction industry with a systematic review of the literature. The findings show that this research topic has spread globally, especially in developing countries. The reasoning for spreading the knowledge is because of the government's support as a policymaker and the university as the source of knowledge.

In addition, there were six antecedents as critical factors of the project performance—even the more complex the antecedent, the more comprehensive the results. Nevertheless, the research source will also be more significant than the research just on one critical factor.

The limitation this research is on the database. The database of this research is only based on the Scopus™ Preview database. The future research could be broader than the bibliography. There could be research on this topic with the Scopus™ and Web of Science as the database source. In addition, there should be more exploration on the other than primary critical factors, such as lean construction, waste, and the environmental impact.

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