JCE-PIM | JOURNAL OF CIVIL ENGINEERING AND PUBLIC INFRASTRUCTURE MANAGEMENT

# The Effect of Workforce Motivation and Skills on Construction Project Productivity

Alfaro Trapinta Mora Sihombing*[1], Indra Jaya [1], Syahrizal [1] ,Rezky Ariessa Dewi [1] Andy Putra Rambe [1], Gea Geby Aurora Syafridon [1], Gina Cynthia Raphita Hasibuan [1]

[1] *Department of Civil Engineering, Faculty of Engineering, Universitas Sumatera Utara, Medan, 20155, Indonesia*

*Corresponding Author: alfarohom@gmail.com, indrajaya80@usu.ac.id, syahrizal@usu.ac.id, rezky.ariessa@usu.ac.id, geasyafridon@usu.ac.id, gina.hasibuan@usu.ac.id

**ARTICLE INFO**

**Article history:**
Received 28 March 2026
Revised 14 April 2026
Accepted 17 April 2026
Available online 29 April 2026

E-ISSN: -
P-ISSN: -

**How to cite: A. T. M. Sihombing, I. Jaya, Syahrizal, R. A. Dewi, A. P. Rambe, G. G. A. Syafridon, dan G. C. R. Hasibuan, "The Effect of Workforce Motivation and Skills on Construction Project Productivity," Journal of Civil Engineering and Public Infrastructure Management, vol. 01, no. 02, 2026.**



**ABSTRACT**

In the construction industry, productivity issues often arise, usually caused by various factors, one of which is workforce. Workforce is a major concern because it can directly affect the time, cost, and quality of a construction project. This study aims to analyze the effect of workers' motivation and skills on the productivity of construction projects. This research was conducted in Karo District Hospital's Outpatient Department Development Project. This study used a quantitative approach with a survey and questionnaires given to workers directly involved in the construction project. The data was processed using multiple linear regression analysis to determine the influence of each variable, namely motivation and skills. The results showed that the motivation factor had an influence of 58.4%, and the skill factor had an influence of 26.2%, with the remaining factors being other factors that were not examined. This result indicates workers' motivation and skills having a significant influence on the productivity of construction projects.

**Keywords:** *Workforce, Construction, Motivation, Productivity, Skills*

## 1. Introduction

The construction industry plays an important role in economic development because it contributes to infrastructure growth and public service improvement. However, construction projects frequently experience productivity problems that can affect project performance, particularly in terms of time, cost, and quality. One of the most influential factors affecting productivity in construction projects is the workforce. Labor productivity is one of the most important factors determining the success of construction projects because it reflects the efficiency of workers in completing tasks within a certain period of time [1, 2].

JCE-PIM | JOURNAL OF CIVIL ENGINEERING AND PUBLIC INFRASTRUCTURE MANAGEMENT

In recent years, the construction industry has faced significant global challenges related to labor productivity, workforce shortages, and increasing project complexity.[3][4] Compared with other industrial sectors, productivity growth in construction has remained relatively slow, particularly in developing countries where limitations in workforce skills, management practices, and technological adoption often affect project performance. These challenges are particularly important in infrastructure development projects, where labor productivity directly influences project efficiency, cost control, and the timely delivery of public services. Therefore, improving workforce productivity has become a key concern for construction project managers and infrastructure stakeholders.

Modern construction practices have increasingly adopted various management approaches and digital technologies to address productivity challenges. The implementation of Building Information Modeling (BIM), lean construction principles, and construction automation has been recognized as an effective strategy to improve coordination, reduce waste, and enhance workforce efficiency during project execution [5, 6].

Improving labor productivity is also essential for infrastructure project performance. Efficient workforce management can minimize project delays, reduce construction costs, and improve the quality of infrastructure facilities delivered to the public [7]. Therefore, understanding factors that influence workforce productivity is important for improving infrastructure project management. Although a number of studies have examined productivity factors in construction projects, there remains a gap in understanding the relative influence of motivation and worker skills on labor productivity within specific project contexts [8, 9]. Many studies tend to focus on general productivity indicators without quantitatively analyzing the contribution of these two variables simultaneously. Furthermore, empirical studies focusing on hospital infrastructure development projects at the regional level are still limited.

In the context of infrastructure development in Indonesia, improving workforce productivity is essential for ensuring successful project delivery and sustainable infrastructure management [10, 11]. Efficient workforce performance can help reduce project delays, optimize resource utilization, and improve the quality of infrastructure services delivered to the public [12]. Although this study focuses on a hospital construction project, the findings may also provide insights applicable to other civil engineering and infrastructure projects where workforce productivity plays a critical role in determining project performance.

Based on these conditions, this study aims to analyze the influence of worker motivation and worker skills on labor productivity in construction projects. The research was conducted on the Outpatient Building Construction Project of RSUD Kabupaten Karo. A quantitative approach was employed through a questionnaire survey distributed to construction workers directly involved in the project. The collected data were analyzed using multiple linear regression to determine the effect of each independent variable on labor productivity.

The results of this study are expected to provide both practical and academic contributions to construction management and infrastructure project management. Practically, the findings can assist project managers and construction stakeholders in identifying key human resource factors that influence labor productivity and in developing strategies to improve workforce performance. Academically, this study contributes to the development of knowledge in construction management, particularly regarding the role of motivation and worker skills in enhancing productivity in construction projects.

Therefore, further research is needed to examine the role of human resource factors, particularly worker motivation and skills, in influencing labor productivity in construction projects.

JCE-PIM | JOURNAL OF CIVIL ENGINEERING AND PUBLIC INFRASTRUCTURE MANAGEMENT

## 2. Method

This study uses a quantitative approach with a survey method. Data collection was carried out by distributing questionnaires to workers directly involved in the construction project. The location of the study was the Karo District Hospital Road Maintenance Project located in Karo District, North Sumatra. The respondents in this study were workers who had experience working on construction projects. The research sample consisted of 10 respondents selected based on certain criteria, namely workers who had worked on the project for at least one month or had at least three years of work experience. The variables studied in this research consisted of two independent variables and one dependent variable. The independent variables include work motivation (X1) and work skills (X2), while the dependent variable is construction project productivity (Y). The variables were measured using a five-point Likert scale, namely strongly agree, agree, neutral, disagree, and strongly disagree.

Each variable consists of 5 statements to be answered by the respondents.

Table 1. Questionnaire Criteria

| Variable | Item | Criteria |
|---|---|---|
| Motivation (X1) | X1.1 | Salary |
| | X1.2 | Relation with management |
| | X1.3 | Management motivational skills |
| | X1.4 | Work Bonuses |
| | X1.5 | Commitment |
| Skills (X2) | X2.1 | Project Procedures |
| | X2.2 | Project Standard |
| | X2.3 | Using Construction Tools |
| | X2.4 | Adaptability |
| | X2.5 | Responsibility |
| Productivity (Y) | Y.1 | Punctuality |
| | Y.2 | Compliance With Standards |
| | Y.3 | Quality |
| | Y.4 | Project Success |
| | Y.5 | Performance |

The data obtained was then analyzed using statistical analysis with the help of IBM SPSS Statistics version 26 software. The analysis stages included validity testing, reliability testing, classical assumption testing, and multiple linear regression analysis. This analysis aimed to determine the extent of the influence of worker motivation and skills on the productivity of construction projects.

## 3. Result and Discussion

### 3.1. Data

The data used in this study were obtained through questionnaires distributed to workers involved in the Outpatient Building Construction Project of RSUD Kabupaten Karo. The respondents consisted of workers who were directly involved in construction activities, including field workers and supporting

JCE-PIM | JOURNAL OF CIVIL ENGINEERING AND PUBLIC INFRASTRUCTURE MANAGEMENT

construction personnel. The respondents represent the workforce responsible for implementing project activities; therefore, their responses are considered capable of describing the actual conditions related to work motivation, skills, and productivity on the project.

Based on the collected questionnaires, all responses were declared valid for further analysis. The respondents generally had experience working in construction projects, which indicates that they possessed adequate knowledge to assess factors affecting productivity in the project environment.

### 3.2. Validity Test

Table 2. Validity Test Results.

| Variable | Item | R Count | R Table | Description |
|---|---|---|---|---|
| Motivation (X1) | X1.1 | 0,841 | 0,6319 | Valid |
| | X1.2 | 0,772 | 0,6319 | Valid |
| | X1.3 | 0,880 | 0,6319 | Valid |
| | X1.4 | 0,695 | 0,6319 | Valid |
| | X1.5 | 0,860 | 0,6319 | Valid |
| Skills (X2) | X2.1 | 0,923 | 0,6319 | Valid |
| | X2.2 | 0,731 | 0,6319 | Valid |
| | X2.3 | 0,916 | 0,6319 | Valid |
| | X2.4 | 0,769 | 0,6319 | Valid |
| | X2.5 | 0,917 | 0,6319 | Valid |
| Productivity (Y) | Y.1 | 0,648 | 0,6319 | Valid |
| | Y.2 | 0,763 | 0,6319 | Valid |
| | Y.3 | 0,711 | 0,6319 | Valid |
| | Y.4 | 0,670 | 0,6319 | Valid |
| | Y.5 | 0,830 | 0,6319 | Valid |

The validity test results indicated that all questionnaire indicators for the variables of motivation, worker skills, and productivity had correlation values higher than the critical value, meaning that all indicators were valid and could be used in the analysis.

### 3.3. Reliability Test

Table 3. Reliability Test Results

| Variable | Cronbrach's Alpha | Minimum Value | Description |
|---|---|---|---|
| Motivation (X1) | 0,864 | 0,6 | Reliable |
| Skills (X2) | 0,906 | 0,6 | Reliable |
| Productivity (X3) | 0,765 | 0,6 | Reliable |

The reliability test was conducted using Cronbach's Alpha to measure the consistency of the questionnaire. The results showed that the Cronbach's Alpha values for all variables were above the acceptable threshold, indicating that the questionnaire items were reliable and consistent in measuring the research variables.

### 3.4. Classical Assumption Test

JCE-PIM JOURNAL OF CIVIL ENGINEERING AND PUBLIC INFRASTRUCTURE MANAGEMENT

In this study, the research method chosen by the author is the linear regression analysis method. Therefore, a classical assumption test must be carried out first. The classical assumption test in linear regression analysis aims to ensure that the regression model used meets the basic rules required for the research results to be valid and reliable.

### 3.4.1. Normality Test

Table 4. Normality Test Results

| | | Unstandardized Residual |
|---|---|---|
| N | | 10 |
| Normal Parameters | Mean | 0.0000000 |
| | Std. Deviation | 0.59145195 |
| Most Extreme Differences | Absolute | 0.137 |
| | Positive | 0.093 |
| | Negative | -0.137 |
| Test Statistic | | 0.137 |
| Asymp. Sig. (2-tailed) | | 0.200 |

Based on the One Sample Kolmogorov-Smirnov test table, it can be seen that the normality test for the above data shows that the multiple regression model follows a normal distribution. This can be seen from the Asymp sig (2 Tailed) value of 0.200 > 0.05, which can then be concluded that the data used in this study is normally distributed.

### 3.4.2 Multicollinearity Test

Table 5. Multicollinearity Test Results

| | Collinearity Statistics | | Description |
|---|---|---|---|
| | Tolerance | VIF | |
| Motivation (X1) | 0.744 | 1.344 | Meets the Criteria |
| Skills (X2) | 0.744 | 1.344 | Meets the Criteria |

Based on the results of the multicollinearity test processed through the SPSS application, we can see the tolerance and VIF values. For the multicollinearity test, the test is considered passed if the tolerance value is greater than 0.1 and the VIF value is less than 10. If this is the case, then it can be concluded that the multicollinearity test has been passed.

### 3.4.3 Heteroscedasticity Test

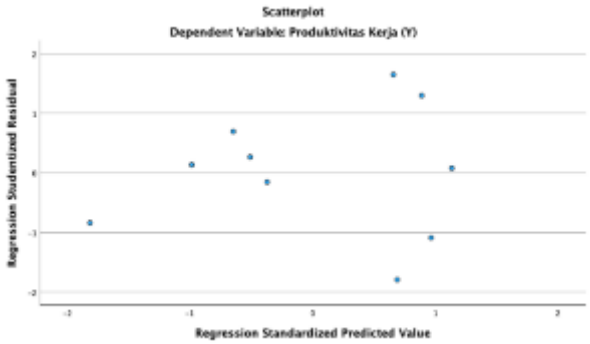


Figure 1. Scatterplot Test

A scatterplot showing data points scattered randomly on both sides of the value 0 on the Y-axis and X-axis can indicate that there is no systematic pattern in data heteroscedasticity. Symptoms of heteroscedasticity occur when the variability of model errors is not constant across independent values. In the heteroscedasticity test, the purpose of data analysis using a scatterplot is to examine whether there is a

JCE-PIM JOURNAL OF CIVIL ENGINEERING AND PUBLIC INFRASTRUCTURE MANAGEMENT

certain pattern in the distribution of residuals. Thus, no symptoms of heteroscedasticity were found in the regression model in this study.

## 3.5. Multiple Linear Regression Analysis

Table 6. Multiple Linear Regression Test Results

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 2.649 | 2.160 | | 1.226 | 0.260 |
| | Motivation (X1) | 0.584 | 0.106 | 0.719 | 5.520 | <0.001 |
| | Skills (X2) | 0.262 | 0.95 | 0.362 | 2.776 | 0.027 |

The linear regression equation based on the beta value output is Y = 2.649 + 0.584 X1 + 0.262 X2 + e. This equation can be seen as follows: The beta coefficient value of X1 is 0.584, which means that if other variables remain constant and variable X1 increases by 1 value, then variable Y will increase by 0.584, and vice versa The beta coefficient value for X2 is 0.262, which means that if other variables remain constant and variable X2 increases by 1 unit, then variable Y will increase by 0.262, and vice versa.

## 3.6. T-test (Partial Test)

| dk | α untuk Uji Satu Pihak (*one tail test*) | | | | | |
|---|---|---|---|---|---|---|
| | 0,25 | 0,10 | 0,05 | 0,025 | 0,01 | 0,005 |
| | α untuk Uji Dua Pihak (*two tail test*) | | | | | |
| | 0,50 | 0,20 | 0,10 | 0,05 | 0,02 | 0,01 |
| 1 | 1,000 | 3,078 | 6,314 | 12,706 | 31,821 | 63,657 |
| 2 | 0,816 | 1,886 | 2,920 | 4,303 | 6,965 | 9,925 |
| 3 | 0,765 | 1,638 | 2,353 | 3,182 | 4,541 | 5,841 |
| 4 | 0,741 | 1,533 | 2,132 | 2,776 | 3,747 | 4,604 |
| 5 | 0,727 | 1,476 | 2,015 | 2,571 | 3,365 | 4,032 |
| 6 | 0,718 | 1,440 | 1,943 | 2,447 | 3,143 | 3,707 |
| 7 | 0,711 | 1,415 | 1,895 | 2,365 | 2,998 | 3,499 |
| 8 | 0,706 | 1,397 | 1,860 | 2,306 | 2,896 | 3,355 |
| 9 | 0,703 | 1,383 | 1,833 | 2,262 | 2,821 | 3,250 |
| 10 | 0,700 | 1,372 | 1,812 | 2,228 | 2,764 | 3,169 |

Figure 2. T-table

Table 7. T- Test Results

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | t | Sig. |
| 1 | (Constant) | 2.649 | 2.160 | | 1.226 | 0.260 |
| | Motivation (X1) | 0.584 | 0.106 | 0.719 | 5.520 | <0.001 |
| | Skills (X2) | 0.262 | 0.95 | 0.362 | 2.776 | 0.027 |

For a t-test, a hypothesis is considered to have passed the t-test if a variable has a p-value less than 0.05 and a calculated t-value greater than the critical t-value of 2.306. Based on the test results table, it is concluded that it passed the T-test.

## 3.7. F- Test

| df untuk penyebut (N2) | df untuk pembilang (N1) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 1 | 161 | 199 | 216 | 225 | 230 | 234 | 237 | 239 | 241 | 242 | 243 | 244 | 245 | 245 | 246 |
| 2 | 18.51 | 19.00 | 19.16 | 19.25 | 19.30 | 19.33 | 19.35 | 19.37 | 19.38 | 19.40 | 19.40 | 19.41 | 19.42 | 19.42 | 19.43 |
| 3 | 10.13 | 9.55 | 9.28 | 9.12 | 9.01 | 8.94 | 8.89 | 8.85 | 8.81 | 8.79 | 8.76 | 8.74 | 8.73 | 8.71 | 8.70 |
| 4 | 7.71 | 6.94 | 6.59 | 6.39 | 6.26 | 6.16 | 6.09 | 6.04 | 6.00 | 5.96 | 5.94 | 5.91 | 5.89 | 5.87 | 5.86 |
| 5 | 6.61 | 5.79 | 5.41 | 5.19 | 5.05 | 4.95 | 4.88 | 4.82 | 4.77 | 4.74 | 4.70 | 4.68 | 4.66 | 4.64 | 4.62 |
| 6 | 5.99 | 5.14 | 4.76 | 4.53 | 4.39 | 4.28 | 4.21 | 4.15 | 4.10 | 4.06 | 4.03 | 4.00 | 3.98 | 3.96 | 3.94 |
| 7 | 5.59 | 4.74 | 4.35 | 4.12 | 3.97 | 3.87 | 3.79 | 3.73 | 3.68 | 3.64 | 3.60 | 3.57 | 3.55 | 3.53 | 3.51 |
| 8 | 5.32 | 4.46 | 4.07 | 3.84 | 3.69 | 3.58 | 3.50 | 3.44 | 3.39 | 3.35 | 3.31 | 3.28 | 3.26 | 3.24 | 3.22 |
| 9 | 5.12 | 4.26 | 3.86 | 3.63 | 3.48 | 3.37 | 3.29 | 3.23 | 3.18 | 3.14 | 3.10 | 3.07 | 3.05 | 3.03 | 3.01 |
| 10 | 4.96 | 4.10 | 3.71 | 3.48 | 3.33 | 3.22 | 3.14 | 3.07 | 3.02 | 2.98 | 2.94 | 2.91 | 2.89 | 2.86 | 2.85 |

JCE-PIM | JOURNAL OF CIVIL ENGINEERING AND PUBLIC INFRASTRUCTURE MANAGEMENT

Figure 3. F-table

Table 8. F- Test Results

| Model | | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 32.452 | 2 | 16.226 | 36.076 | <0.001 |
| | Residual | 3.148 | 7 | 0.450 | | |
| | Total | 35.600 | 9 | | | |

Based on the f test results, a calculated f value of 36.076 was obtained, meaning that fcount > f table. It can therefore be concluded that all independent variables (X) simultaneously affect the dependent variable (Y).

3.8. Coefficient of Determination Test

Table 9. Coefficient of Determination Test Results

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | 0.955 | 0.912 | 0,886 | 0.67064 |

Based on the results of the coefficient of determination test, it is known that the variables of work motivation and work skills simultaneously have an influence on the variable of construction project productivity of 91.2%, while the remaining 8.8% is influenced by other variables that were not examined.

## 4. Conclusion

Based on the analysis of the tests conducted, it can be concluded that worker motivation and skills in construction projects have a significant impact on construction project productivity. Simultaneously, these two variables—worker motivation and skills—account for 91.2% of the effect, while the remaining 8.8% is attributed to other factors not examined in this study. Partially, worker motivation accounts for 58.4% of the effect, which means that if other variables remain constant and variable X1 increases by 1 value, then variable Y will increase by 0.584, and vice versa**.** While worker skills account for 26.2%, which means that if other variables remain constant and variable X2 increases by 1 unit, then variable Y will increase by 0.262, and vice versa. It can also be concluded that worker motivation has the greatest impact on construction project productivity compared to other variables

Through this study, to enhance worker motivation and skills, project owners and contractors can improve project productivity by providing appropriate wages, performance-based bonuses, a positive work environment, and training for workers regarding the upcoming project, such as occupational safety and health (OSH) training.

This study also has limitations in its implementation, as it involved only 10 respondents; it is recommended that future research increase the number of respondents to ensure greater precision.

## 5. Acknowledgements

The author would like to express sincere gratitude to all parties who have provided support and assistance in the completion of this research.

JCE-PIM | JOURNAL OF CIVIL ENGINEERING AND PUBLIC INFRASTRUCTURE MANAGEMENT

First and foremost, the author would like to express deepest gratitude to his beloved parents for their endless prayers, encouragement, and moral support throughout the process of completing this research and academic study. The author would also like to express sincere appreciation to the thesis supervisor for the guidance, valuable suggestions, constructive criticism, and continuous support provided during the research and writing process. The author is also grateful to the thesis examiners for their insightful comments and suggestions that helped improve the quality of this research. Special appreciation is extended to the lecturers of the Construction Engineering Management (MRK) field at the Department of Civil Engineering for their knowledge, guidance, and support during the author's academic journey. The author would also like to thank the Department of Civil Engineering, Faculty of Engineering, Universitas Sumatera Utara for providing academic facilities and an environment that supported the completion of this research. Finally, the author expresses appreciation to all individuals who have contributed directly or indirectly to the completion of this research.

## 6. Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this paper. The research was conducted independently for academic purposes and was not influenced by any financial, commercial, or personal relationships that could potentially bias the results or interpretation of the findings. All data presented in this study were obtained and analyzed objectively in accordance with academic research standards.

## References

[1] N. Kadu, S. Ganiga, J. Mistry, G. Chaurasiya, and P. Yadav, "Construction labour productivity – A review," *International Journal of Engineering Research & Technology*, vol. 9, no. 3, 2021.

[2] R. Pradhana, A. Trianto, and M. H. Fansuri, "Literature review: Factors affecting labor productivity in the construction sector," *Journal of Civil Engineering and Planning*, vol. 6, no. 1, 2024.

[3] K. Usman and S. N. Mufidah, "Enhancing workforce productivity in reinforced concrete construction: An integrated relative importance index analysis and Monte Carlo approach," *Fondasi: Jurnal Teknik Sipil*, 2023.

[4] A. Enshassi, S. Mohamed, Z. A. Mustafa, and P. E. Mayer, "Factors affecting labour productivity in building projects in the Gaza Strip," *Journal of Civil Engineering and Management*, vol. 13, no. 4, pp. 245–254, 2007.

[5] A. M. Jarkas and C. G. Bitar, "Factors affecting construction labor productivity in Kuwait," *Journal of Construction Engineering and Management*, vol. 138, no. 7, pp. 811–820, 2012.

[6] S. Johari and K. N. Jha, "Impact of work motivation on construction labor productivity," *Journal of Management in Engineering*, vol. 36, no. 5, p. 04020052, 2020, doi: 10.1061/(ASCE)ME.1943-5479.0000824.

[7] O. J. Adebowale and J. A. Fapohunda, "Effects of workers' motivation on construction productivity," *Built Environment Journal*, vol. 11, no. 1, pp. 29–35, 2014.

[8] D. K. Sunarjo and M. Amin, "Occupational safety health and work motivation on worker performance construction projects," *Astonjadro: Journal of Civil Engineering*, vol. 14, no. 2, 2024.

[9] A. M. Jarkas, "Factors influencing labour productivity in Bahrain's construction industry," *International Journal of Construction Management*, vol. 15, no. 1, pp. 94–108, 2015, doi: 10.1080/15623599.2015.1012143.

[10] H. Doloi, A. Sawhney, K. C. Iyer, and S. Rentala, "Analyzing factors affecting delays in Indian construction projects," *International Journal of Project Management*, vol. 30, no. 4, pp. 479–489, 2012, doi: 10.1016/j.ijproman.2011.10.004.

JCE-PIM JOURNAL OF CIVIL ENGINEERING AND PUBLIC INFRASTRUCTURE MANAGEMENT

[11] O. Alnajjar, E. Atencio, and J. Turmo, “A systematic review of Lean Construction, BIM and emerging technologies integration: Identifying key tools,” *Buildings*, vol. 15, no. 16, 2025.

[12] E. Yigitbas, A. Nowosad, and G. Engels, “Supporting construction and architectural visualization through BIM and AR/VR: A systematic literature review,” 2023.