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RESEARCH ARTICLE

The Impact of Project Planning and Organizing on Construction Performance during the Covid-19 Pandemic: The Moderating Role of Human Resource Competence

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ABSTRACT

The Covid-19 pandemic has profoundly affected the construction industry, resulting in delays, budget overruns, and operational interruptions. Efficient project management techniques, especially in planning and organisation, are essential for sustaining construction performance throughout crises. This study seeks to examine the correlation between project planning and organisation on construction performance during the Covid-19 epidemic, with human resource (HR) competence as a moderating factor. A quantitative methodology utilising Structural Equation Modeling-Partial Least Squares (SEM-PLS) was applied to examine primary data gathered from project managers, contractors, and stakeholders within Bali's construction industry. The research examines the impact of excellent planning and organisation on construction performance results, specifically on cost, quality, and time efficiency, within the limits imposed by the pandemic. The findings demonstrate that project planning and organisation significantly enhance construction performance. Project planning, encompassing resource allocation, scheduling, and risk assessment, facilitates efficient project execution. Likewise, the organisation of processes, including team organisation and task delegation, enhances coordination and efficiency. The study emphasises that HR competence, which includes skills, adaptability, and decision-making ability, has a moderating function in strengthening these interactions. Initiatives spearheaded by proficient HR professionals exhibited enhanced resilience and performance results despite constraints associated with the epidemic. This research offers significant insights for construction industry practitioners, highlighting the necessity of combining effective planning and organisational strategies with proficient human resource management to alleviate risks during crises. Future research is advised to enhance this model by incorporating supplementary variables, including technological adoption and policy interventions, to tackle wider project management issues.

INTRODUCTION

The construction sector is essential to the advancement of the global economy, especially with its impact on urban infrastructure development (Fei et al., 2021; Awuah & Abdulai, 2022). The Covid-19 pandemic, because of travel restrictions and supply chain interruptions, devastated the sector,

leading to unprecedented issues like material shortages, project delays, and budget overruns (Sari & Suryan, 2021; Alsharef et al., 2021). Proficient project management, especially in planning and organisation, is crucial to alleviating risks and sustaining project performance amid crises (Kadenic & Tambo, 2023; Adegbite et al., 2023).

Project planning is a fundamental aspect of project management (Papke-Shields & Boyer-Wright, 2017; Darmawan & Yuwono, 2021). It encompasses the formulation of objectives, allocation of resources, and creation of a timeline to guarantee the project's timely completion. The pandemic impacted planning due to shifting material prices and limits on staff migration (Bereitschaft & Scheller, 2020; Sharifi & Khavarian-Garmsir, 2020; Jam et al., 2014). Effective planning strategies can substantially enhance project outcomes, especially in periods of uncertainty (Rani et al., 2022). Effective planning allows project managers to identify potential hazards, allocate resources appropriately, and adjust timelines to address unexpected situations (Olanrewaju et al., 2021; Secundo et al., 2022; Jam et al., 2013).

The implementation of technology like AI-driven project management software markedly improves planning and organisational efficiency (Hossain et al., 2024). Throughout the epidemic, these technologies facilitated remote oversight and instantaneous modifications to project timelines, alleviating the effects of physical limitations (Sepasgozar et al., 2023). Scenario-based project management techniques are superior in addressing uncertainty relative to conventional methods (Rani et al., 2022). These findings reinforce the assertion that adaptive planning and the cultivation of digital competencies are essential for project success (Blomster & Koivumäki, 2022).

The establishment of team structures, allocation of duties, and management of procedures are critical components of project organisation (Gemünden et al., 2018). Efficient project organisation is associated with enhanced communication and resource distribution, essential for attaining project goals. Organising guarantees that all components of the project operate cohesively, hence minimising inefficiencies and enhancing overall productivity (Pamidimukkala & Kermanshachi, 2021; Hindarto, 2023). The pandemic highlighted the essential function of organisation in adjusting to new work contexts, including remote collaboration and compliance with health regulations (Raoufi & Fayek, 2021; Kim et al., 2024; Qadri et al., 2024). Projects with well-organised teams demonstrated enhanced resilience and adaptability, allowing them to attain superior performance despite external pressures (Ogunnusi et al., 2021; Badi, 2024). This highlights the significance of explicit leadership and delineated responsibilities in sustaining production during crises (Zada et al., 2023).

The amount of knowledge possessed by human resources (HR) is a critical determinant of the effectiveness of planning and organising (Al-Bahussin & El-Garaihy, 2013; Christina et al., 2012). Proficiency in human resources, including talents, adaptability, and decision-making capabilities, is essential for effectively managing intricate project contexts (Harsch & Festing, 2020). During the epidemic, human resource competency served as a moderating variable that enhanced the relationship between management practices and successful project completion (Narayanamurthy & Tortorella, 2021). Efficient human resource teams facilitated rapid decision-making, good communication, and risk management, all of which were crucial in tackling the issues posed by the pandemic (Peli et al., 2022).

Limited research has examined the simultaneous effects of planning, organising, and human resource competency on construction performance. This occurs despite the growing body of studies on project management during the Covid-19 pandemic. Much of the prior research has concentrated on these variables in isolation, often overlooking their interrelationships (Rani et al., 2022). This disparity underscores the necessity for a more cohesive approach within the construction sector to understand the collective impact of these variables on construction performance during crises (Olanrewaju et al., 2021).

This study analyses the impact of project planning and organisation on construction performance during the Covid-19 epidemic, with human resource competency acting as a moderating variable. The findings highlight the effectiveness of integrated management solutions in enhancing resilience

and performance in the construction industry during global disruptions. The study underscores the critical significance of developing human resource capabilities to improve effective management and preparedness for future crises, hence addressing gaps in project management literature. The study offers practical insights for construction professionals to improve management techniques, emphasising the importance of flexible and skilled human resources in achieving project success. The results and discussion sections outline significant discoveries and implications, and the conclusion addresses contributions to both scholarly and practical understanding.

METHOD

Research Design

We applied a quantitative research design to investigate the influence of project planning and organisation on construction performance amid the Covid-19 pandemic, modulated by human resource competency. Structural Equation Modeling-Partial Least Squares (SEM-PLS) was employed to examine intricate interactions among variables and to assess the moderating effects. This methodology was chosen for its capacity to manage small sample groups and assess both reflective and formative components.

Study Area and Participants

The research was in Bali, Indonesia, concentrating on construction projects operational during the Covid-19 pandemic. Bali was selected for its vibrant building industry and the difficulties it had during the pandemic. We employed purposive sampling to select people directly engaged in project management tasks, encompassing planning and organisation.

One hundred fifty respondents participated in the survey, comprising project managers, contractors, and consultants. The sample size was established according to SEM-PLS criteria, which stipulate a minimum of 10 responses per indicator for dependable analysis (Wong, 2013). Participants were selected from both public and private construction projects, guaranteeing diversity in the acquired data.

Bali was chosen as the research location because of the distinctive dynamics of its building sector, which plays a substantial role in the local GDP (Priatmoko et al., 2021). Purposive sampling was utilised to guarantee the involvement of persons with firsthand expertise in project management during the pandemic. The questionnaire was developed from existing literature and was pilot tested with 10 participants to verify content validity and reliability. Data was analysed via SmartPLS 3.0, selected for its capacity to manage intricate models with rather small sample sizes.

Data Collection

We collected data through a structured questionnaire designed to capture relevant information on project planning, organizing, construction performance, and human resource competency. The questionnaire was distributed both online and offline to ensure accessibility and a high response rate. It consisted of three main sections: demographics (e.g., participant roles, experience, project types), management practices (e.g., resource allocation, scheduling, task delegation), and project outcomes (e.g., cost, quality, and time efficiency). Human resource competency was assessed through questions on workforce adaptability, skills, and decision-making abilities. All responses were measured using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A total of 150 valid responses were collected, representing a diverse range of construction stakeholders.

Data Analysis

Data analysis was performed using SmartPLS software, which is suitable for analyzing complex relationships in small sample sizes (Wong, 2013). Descriptive analysis provided an overview of participants' demographic profiles and summarized responses for each variable. For inferential analysis, we tested the measurement model to ensure the validity and reliability of the constructs through factor loadings, composite reliability, and average variance extracted (AVE). The structural model was analyzed to evaluate path coefficients and R^2 values, determining the strength of

relationships between variables. Moderation analysis was conducted to examine how human resource competency influenced the relationships between project planning, organizing, and construction performance.

RESULT

Descriptive Statistics and Respondent Profile

The dataset included 150 respondents, consisting of project managers (40%), contractors (35%), and consultants (25%). Most participants possessed more than 10 years of expertise in the construction business, with 60% engaged in private sector initiatives and 40% in public infrastructure projects (Table 1). These varied responsibilities offered a comprehensive perspective on the building industry's issues throughout the pandemic.

Table 1. Respondent Demographics

Characteristic	Frequency (n=150)	Percentage (%)
Role		
Project Manager	60	40
Contractor	52	35
Consultant	38	25
Years of Experience		
1–5 years	30	20
6–10 years	48	32
>10 years	72	48
Project Type		
Private	90	60
Public	60	40

Structural Model Analysis

The SEM-PLS analysis demonstrated substantial correlations among project planning, organisation, construction performance, and the moderating influence of human resource competency. The results of the measuring model show robust reliability and validity across all constructs. Composite reliability (CR) ratings varied from 0.89 to 0.92, surpassing the required threshold of 0.7, hence suggesting substantial internal consistency (Table 2). All Average Variance Extracted (AVE) values above 0.5, so affirming convergent validity and demonstrating that each construct accounted for over 50% of the variance in its indicators. Cronbach's alpha scores, ranging from 0.85 to 0.89, further corroborated the internal consistency of the constructs. The results confirmed the applicability of the measurement model in the ensuing structural analysis, guaranteeing that the indicators accurately represented the theoretical constructs of project planning, organisation, construction performance, and human resource competency. This solid measurement model foundation is essential for confidently interpreting the relationships examined in the structural model analysis.

Table 2. Measurement Model Results

Construct	Composite Reliability	Average	Cronbach's Alpha
Project Planning	0.91	0.65	0.88
Project Organizing	0.89	0.61	0.85
Construction Performance	0.92	0.67	0.89
Human Resource Competency	0.9	0.64	0.87

The findings of the structural model indicated that project planning ($\beta = 0.46$, $p < 0.01$) and project organising ($\beta = 0.38$, $p < 0.01$) exerted significant positive influences on construction performance. This highlights the crucial role that these two factors play in achieving project goals, particularly in the context of the Covid-19 pandemic (Table 2). The results of effective planning, which includes the allocation of resources, the scheduling of activities, and the management of risks, immediately

improve in terms of cost, time, and quality. Similarly, the use of principles such as task delegation and team architecture resulted in more efficient workflows and increased the overall productivity of the team. Furthermore, it is worth noting that human resource competency had a significant impact on these linkages. Teams with higher levels of expertise had a greater impact on the influence of planning ($\beta = 0.25$, $p < 0.05$) and organising ($\beta = 0.22$, $p < 0.05$) on performance. More specifically, they were able to facilitate adaptation and efficient execution, as demonstrated in Table 3. These findings highlight the importance of combining efficient management strategies with human resource development to improve the resilience of construction projects and the results they provide during times of crisis.

Table 3. Structural Model Results

Path	Coefficient (β)	t-Value	p-Value	Signif.
Project Planning → Performance	0.46	8.52	<0.01	Sig.
Project Organizing → Performance	0.38	7.24	<0.01	Sig.
HR Competency (Moderating)	0.25 (Planning)	3.19	<0.05	Sig.
	0.22 (Organizing)	2.98	<0.05	Sig.

DISCUSSION

Project Planning and Construction Performance

Effective project management necessitates meticulous planning, particularly during crises (Adegbite et al., 2023). The Covid-19 epidemic highlighted the necessity of comprehensive preparation because of issues such as supply chain disruptions, material shortages, and labour constraints (Zhu et al., 2020; Raj et al., 2022). Projects with rigorously designed planning frameworks demonstrated greater resilience, allowing them to anticipate and effectively address risks (Rani et al., 2022). Efficient planning facilitated resource optimisation and reduced delays, which were essential during disruptions caused by the pandemic (Fattahi et al., 2023).

This study highlights risk management as a crucial aspect of planning, ensuring that projects are prepared to address potential interruptions. Comprehensive risk identification and mitigation strategies are essential for project success, particularly in volatile environments (Abbas, 2023). Projects incorporating scenario planning have shown greater proficiency in navigating variations in material costs and restrictions on workforce movement (Oliver & Parrett, 2018). This underscores the necessity for adaptive solutions in planning to guarantee project resilience and continuity.

Furthermore, resource allocation emerged as a crucial sub-component of planning (Arbabi et al., 2020). Enhancing resource utilization—comprising labour, materials, and financial assets—significantly reduces delays and cost overruns (Olanrewaju et al., 2021). Projects with clearly articulated resource plans achieved superior outcomes, even in the face of pandemic-related constraints (Zhu et al., 2020). Moreover, effective resource management facilitated project continuity and minimised waste, which were essential during periods of resource constraints (Oliver & Parrett, 2018).

The findings underscore the imperative for adaptive planning, enabling real-time adjustments to schedules and resources. Traditional linear planning approaches sometimes proved inadequate during the epidemic, as rigid timeframes could not accommodate dynamic disruptions (Bozkurt et al., 2020). Adaptive frameworks, encompassing flexibility and contingency methods, enhance project resilience (Narayanamurthy & Tortorella, 2021). The findings of this study align with research demonstrating that dynamic planning methodologies markedly enhance project outcomes in times of crisis.

Project Organizing and Construction Performance

The organisation ensures that all project components function cohesively, which is particularly crucial during times of uncertainty. This study emphasises that clear job delegation and effective team organisation were essential for maintaining project momentum during pandemic-related challenges. Team organisation was crucial for ensuring responsibility and collaboration (Shahin et al., 2017). Projects that established clear roles and responsibilities had fewer delays and improved team morale. Well-structured teams demonstrate enhanced adaptability to remote work environments and social distancing protocols (Raoufi & Fayek, 2021), findings that align with our research.

Task delegation is a fundamental aspect of organisation (Bolden, 2016). Leaders who effectively assigned tasks reduced bottlenecks and accelerated decision-making. Delegation fosters empowerment and responsibility among team members, hence enhancing overall performance (Christina et al., 2012). This was observed in programs where managers permitted autonomy to their staff while maintaining oversight.

Leadership was crucial in facilitating achievement. Effective leaders facilitated communication, ensured stakeholder alignment, and motivated teams to achieve project goals (Butt et al., 2016). Leadership is crucial in crises, as it aids in managing uncertainty and maintaining team cohesion (Pamidimukkala & Kermanshachi, 2021; Khan, 2023).

This study theoretically contributes to the literature by highlighting the joint importance of adaptive planning and efficient organisation in improving construction project performance. It also underscores the moderating role of HR competence, which has been underexplored in project management research. These findings offer practical insights for project managers, emphasising the importance of concentrating on both technical planning and the cultivation of adaptive and risk management skills within teams. Human Resources training programs that utilise scenario-based simulations help equip teams for impending uncertainty.

Moderating Role of Human Resource Competency

The proficiency of human resources emerged as a crucial enabler of project success during the pandemic. Competent HR teams demonstrated the ability to adapt to evolving conditions, implement contingency plans, and leverage innovative solutions (Lengnick-Hall et al., 2011; Biron et al., 2021). Human Resource competency enhances organisational resilience and augments decision-making in high-pressure scenarios (Narayanamurthy & Tortorella, 2021; Nguyen et al., 2024).

Adaptability was one of the most highly regarded competencies identified (Kissi et al., 2024). Teams that rapidly adapted to remote work, revised safety protocols, and reacted to fluctuating project timelines were able to maintain productivity (Franken et al., 2021). Adaptability is a vital determinant of project performance in volatile environments, since it enables prompt responses to emerging challenges (Christina et al., 2012; Feng & Liu, 2024).

The capacity for decision-making significantly influenced outcomes. Leaders who made educated and timely decisions minimised disruptions and ensured project alignment with goals. Decision-making is crucial in managing resource constraints, as it affects the effectiveness of therapies in real-time (Rani et al., 2022).

Nonetheless, the poll also highlighted shortcomings in HR proficiency, particularly concerning technology implementation. Many teams had challenges in acclimating to digital technologies for distant collaboration and project management. Future investments in training programs focused on digital skills and crisis management may address these weaknesses, thereby improving the readiness of HR teams for impending challenges.

Practical Implications

The results emphasize the importance of integrating planning, organizing, and human resource expertise to develop resilient construction projects. Organizations should adopt flexible planning

frameworks, establish well-defined organizational structures, and invest in human resource development to enhance their ability to manage crises effectively (Cardoso, 2019). Leveraging technology, such as project management software and real-time communication tools, can further improve the efficiency of planning and organizing processes, with digital transformation playing a critical role in building project resilience (Raoufi & Fayek, 2021; Martínez-Peláez et al., 2023). Additionally, continuous training programs focused on adaptability, decision-making, and digital competencies are essential for equipping HR teams to navigate complex and dynamic project environments, ensuring better preparedness and performance in uncertain conditions (Christina et al., 2012).

CONCLUSION

This study highlights the significance of project planning, organisation, and human resource proficiency in enhancing construction performance, especially during difficult times like the Covid-19 pandemic. Efficient planning, marked by optimised resource distribution, risk mitigation, and flexible scheduling, was crucial for sustaining project continuity and attaining intended results. Likewise, the organisation of practices, encompassing task delegation, team organisation, and stakeholder coordination, was crucial in facilitating seamless workflows and enhancing team productivity. The proficiency of human resources further enhanced these benefits, as talented and adaptive teams allowed projects to surmount interruptions and manage uncertainty. The results underscore the necessity of combining effective management methods with ongoing investment in human resources development and technical tools to foster resilience and improve project outcomes. This study enhances comprehension of crisis management within the construction sector and provides pragmatic insights for refining project methodologies in volatile and uncertain contexts. However, this study possesses numerous shortcomings that warrant acknowledgement. Initially, data gathering transpired during the epidemic, potentially affecting respondents' opinions of project achievement metrics. The geographic emphasis on Bali restricts the applicability of the findings to areas with distinct construction industry characteristics. Third, although SEM-PLS is proficient for small sample sizes, it may inadequately represent non-linear relationships pertinent to pandemic scenarios. Future research should employ supplementary statistical methodologies, including Bayesian analysis or longitudinal investigations, to elucidate temporal dynamics.

AUTHORS' CONTRIBUTIONS

I Komang Agus Ariana conceptualized the research, developed the methodology, conducted the analysis, and prepared the manuscript draft. Ngakan Made Anom Wiryasa provided critical insights during the research design phase and contributed to the data interpretation. Ngakan Ketut Acwin Dwijendra supervised the study, ensuring the quality and validity of the research methodology, and reviewed the manuscript for intellectual content. Anak Agung Gde Agung Yana provided technical guidance, assisted in the literature review, and participated in manuscript editing. All authors read and approved the final version of the manuscript.

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