

The Relationship of Total Quality Management Practices and Project Performance with Risk Management as Mediator: A Study of East Coast Rail Link Project in Malaysia

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Abstract:- The study's main aim is to investigate the relationship between the influence of effective risk management as a mediator among the relationship of Total Quality Management (TQM) practices and project performance in the East Coast Rail Link (ECRL) project in Malaysia. The problem statement on the implementation and barriers of TQM practices with risk management as a mediator would affect the project performance in terms of cost, delay, safety issues, QAQC, and project sustainability. The Multivariate Analysis was performed using SPSS ver27 software. Results of hypotheses indicated that relationships between human resource management and service quality were insignificant while relationships between process management, technology, leadership, and strategic planning were significant to project performance. Furthermore, risk management as a mediator was found to influence the relationships. The results indicated that adopting relevant dimensions of the TQM practices can enhance the project performance in construction projects.

Keyword:- Total Quality Management Practices, Tunnel Construction, Project Performance, Risk Management, Sustainability, Digital Transformation.

I. INTRODUCTION

The influence of TQM in the Malaysian construction industry, particularly in tunnel construction management is relatively new in the industry, thus its scarcity has contributed to the formation of the gaps in my research. China advanced tunnel construction methods are adopted and explored in East Coast Rail Link (ECRL) project (Shi et al., 2014; Qiu et al., 2020; Hernández et al., 2019; Song et al., 2020). From the journal articles presented by Huang et al. (2021) and Sharafat et al. (2020) a gap exists whereby the latest process management and technological technique of adopting the latest digital transformation in NATM construction in Malaysia is limited and not being fully explored. The limited knowledge on risk management as a mediator on the relationship of TQM practices and project performance is another gap for my research (Javaid et al., 2022).

Findings from the journals indicated the lack of TQM implementation in the Malaysian construction industry will result in a slowdown in the industry and causes huge implications to the project performance in the country. Disastrously, such shortfalls will lead to rework, safety, quality, delay in project handover and cost overrun as reported in the articles of (Ramli et al., 2018; Yap & Tan, 2021; Indhumathi et al., 2018).

As cited in Myers (2022) construction is one of the important industries which contributes to the economic growth in Malaysia GDP from construction ranging from 4 to 5% (Department of Statistic, Malaysia. 2022).

In Malaysia the scarcity of rework study prompted Yap & Tan (2021) to investigate and found that the leading causes of rework are poor quality management, improper planning, lack of communication, design changes and poor subcontractor management. Research studied by Indhumathi et al. (2018) illustrated the importance of TQM that rework sources comprising changes, errors and omissions in Malaysian construction industry can affect project performance.

Othman et al. (2020) highlighted risk management as mediator is a gap and it could be considered for future studies, and as cited in Javaid et al. (2022) and Joslin & Müller (2015).

The main objective is to set out research framework on project performance leading to project success is an important factor in Malaysian construction industry. Hence, the study of relationship of TQM practices and project performance with risk management in ECRL project is warranted to achieve the research objectives identified in the study.

➤ Problem Statement

There is a dispute and change of ECRL project alignment due to the change of Malaysian government ruling parties. The dispute is between the federal and state government on package 3 and package C. The project started on July 2017 was once suspended in 05.07.2018 and work resumed in 25.07.2019 (Malaymail 2019). The ECRL

project is further scheduled to complete in December 2027 instead of original plan in December 2026 (Sulhi Khalid, 2021). According to Danker (2021), the essence of the issue is which alignment can give the most economic and social effect while minimising environmental degradation, as noted in the most recent social media in Malaysia dated October 2021. The change in alignment seriously affecting the progress and causes further delay to the project due to additional feasibility study and Environmental Impact Assessment (EIA) report on changed alignment. The change in project alignment seriously affect the implementation of TQM practices. It affected Strategic planning for land acquisition, delayed and interrupted logistic problems from the transportation of the tunnel boring machine (TBM) from China where the sequence of work was greatly affected. The change in project alignment seriously affected the design change process management where more tunnels construction involving high technological input are introduced in compliance with the ESG policy (Aziz, 2020).

The shortage of labourers during Covid-19 where CIDB imposed stringent conditions to recruit foreign workers especially from China where tunnelling experience is crucial to carry out the necessary works where local workers are not experienced and reluctant to work under 3 D, dirty, dangerous, and difficult conditions with low pay reward, and the workers' safety and health welfare. This form another problem statement and there is a labour demand of 1.255 million overall and a shortage of 21,000 in Malaysian construction industry (1st qtr. 2021-DOSM). This created HRM problem in talent management for shortage of experienced and skilled workers, and service quality on ECRL project performance (Zhong et al., 2021; The Edge Markets, 2021).

The importance of the implementation and barrier of leadership is considered as part of the problem statement. The top management commitment and leadership in ensuring ECRL project success was important to reflect the Engineering Procurement Commissioning Contract (EPCC) contract between Malaysian and China government under one belt one road concept (Ho, 2019). The proper process management and technology implementation to improve risk management for the ECRL tunneling drilling and balsting works are complex and need to encounter the identical geotechnical problems along the alignment similar as highlighted on numerous published research journal articles (Taofeeq et al., 2022; Qiu et al., 2020). Generally, in Malaysia, well developed TQM practices in construction industry is relatively new and not being fully practiced and poor-quality rework cost of 6% reported in recent articles, beside safety, scope, and time by Yap & Tan (2021).

Systematic literature reviews conducted previously revealed limited informations and knowledge on the study influence of TQM practices and project performance with the mediating effect of risk management. Hence the main purpose of this ECRL project incorporates a mediator variable of risk management in forming a comprehensive research. The major problem statements encountered in ECRL project are summarised as the implementation and

barriers of TQM practices with risk management as mediator because of the suspension of project and change of project alignment, and the shortage of experienced and skilled workers during Covid-19 pandemic.

➤ *Research Objectives*

The research objectives are as shown:

- To identify the practices of TQM that drive project performance in ECRL project
- To investigate the mediating impact of risk management between TQM practices on project performance in ECRL project
- To analyse the variables that influence TQM practices and project performance in ECRL project

➤ *Research Questions*

The research questions are developed:

- What are the TQM practices that drive project performance in ECRL project?
- Does risk management mediate the impact between TQM and project performance in ECRL project?
- How are the variables influence TQM practices and project performance in ECRL project?

II. LITERATURE REVIEW- FUNDAMENTAL THEORIES

➤ *TQM theory/philosophy*

Total quality management (TQM), according to Bathaei et al. (2021), comprises of senior management support, employee participation, continual improvement, focus on customer satisfaction and innovation. Product, process, organization, leadership, and commitment are the five pillars of TQM. According to Tamimi & Gershon (1995), Deming's work is best known in Japan, and it created a revolution in quality, operationalized his theory of management for quality in terms of 14 points which are still applicable in construction industry. In 1970s and 1980s, the United States (and the rest of the world) faced stiff competition from Japan, and the solution was the introduction of TQM to improve production and recapture market share.

➤ *Service Quality theory*

Parasuraman et al. (1988) created a measure of service quality (SERVQUAL) basing on 5 dimensions namely: tangibles, reliability, responsiveness, assurance, and empathy. According to Zygiaris et al. (2022), their study examined the relationships between service quality and customer satisfaction using the SERVQUAL framework and concluded tangibles, empathy, reliability, assurance, and responsiveness have a significant positive relationship with customer satisfaction in Saudi auto care industry. According to Landy et al. (2020), the future trend of service quality in construction sector emphasised on new success factors such as aesthetic quality, design, attention in task execution, and innovation, beside tangibles, reliability, responsiveness, assurance, and empathy.

➤ Gaps in the Literature

Limited knowledge is available in the Malaysian tunnel works; the tunnelling method adopted for the ECRL project follows the traditional method of construction. The more advance techniques using the advanced process management and technology were not applied in the ECRL tunnelling construction. As a result, the purpose of this research project is to learn more about the novel tunnelling approach using modern technology and methods. The journal articles in tunnel construction are also available especially in China where substantial amount of works adopting the New Austrian Tunnelling Method (NATM) techniques are engaged in the activities. From the journal articles presented by Huang et al. (2020) and Sharafat et al. (2020) a gap exists whereby the latest process management and technological technique of adopting the latest digital transformation in NATM construction in Malaysia is limited and not being fully explored. Through various systematic literatures review on TQM practices/ CSFs implementation, there is limited investigation knowledge on the moderating/mediating effect of risk management on TQM practises and

project performance. Jong et al. (2019) studied the link between TQM and project performance in the Malaysian construction industry and recommended future research to be conducted in the role of mediating factors and to expand the sample size. Permana et al. (2021) conducted a systematic literature review on TQM implementation in the organisation from many industries sectors and recommended future research gap on digital technology set ups. According to Javaid et al. (2022) and Joslin and Müller (2015), both have suggested the literature gaps of exploring the mediator variable of risk management in construction project management methodology. Hence supported the idea of research study in ECRL project on the relationship of TQM practices and project performance with risk management as mediator.

III. CONCEPTUAL FRAMEWORK FOR TQM PRACTICES AND PROJECT PERFORMANCE WITH MEDIATING EFFECT OF RISK MANAGEMENT

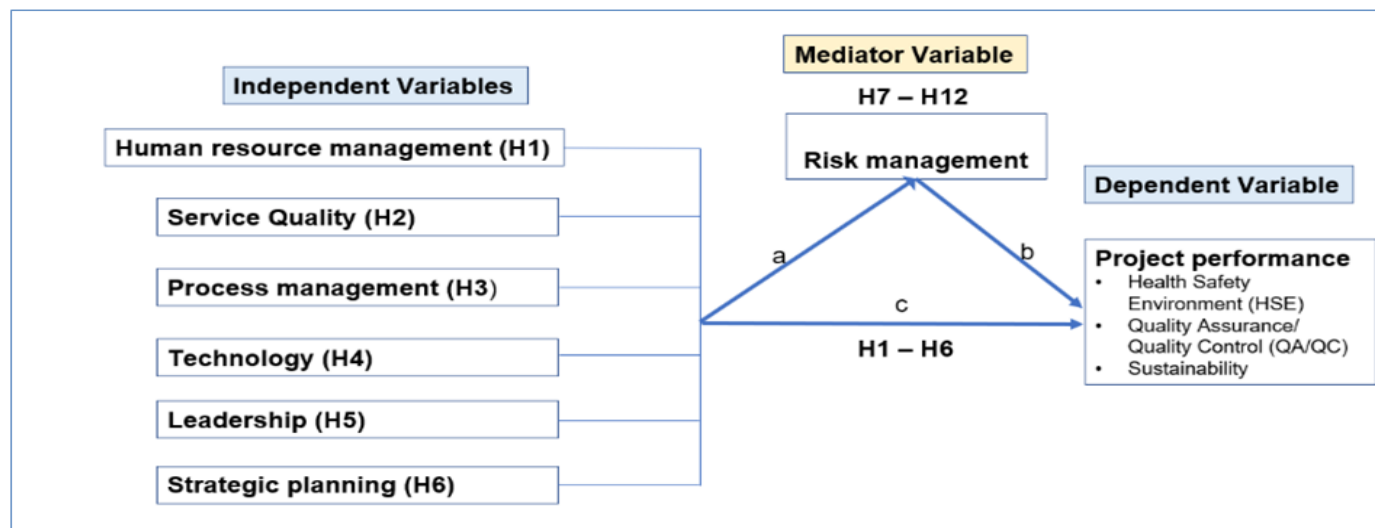


Fig 1 Conceptual Framework

➤ Hypotheses

The impact of Total Quality Management (TQM) practices on project performance

➤ Human resource management

Melhem (2021) revealed that human resource in Malaysia is important for company to achieve its aims, with the impact on risk management and total performance. Zainon et al. (2020) examined the factors of HRM practices that affect the organization performance with staff training, performance appraisal, rewards, and recognitions. Sulaiman et al. (2021) analysed the Malaysian construction industry demand and concluded that need for manpower are still lacking. Hamidah & Adam (2021) explored the status and key factors of green HRM practices in Malaysia to mitigate the increased risk of climate change and global warming. Ajibike et al. (2021) found that coercive pressure helps to mediate, enable, and impacts the complementary roles of social responsibility and environmental sustainability in the Malaysian construction business.

Susilowati et al. (2020) found that Indonesian construction companies remained project oriented and lacking in term of operation management and indicated that the implementation of HRM is not optimal. Talent management to manage human resource through employees competency (Rosita et al., 2020; Ganesh & Tyagi, 2021; Smith, 2020; Panday & Kaur, 2021; Jia et al., 2021). Bullock (2018) worked on Human Resource Outsourcing (HRO) to lower operating costs while maintaining the efficacy of human resources (HR).

The relationship of human resource management with the project performance are explored.

- *H1: Human resource management is significantly positive related to project performance*

- *Service quality*

Many construction-related disciplines have examined service quality, but little is known to understand how it affects customer satisfaction throughout the day-to-day dynamics of onsite construction services (Forsythe, 2015). According to Parasuraman et al. (1988) and Zygiaris et al. (2022), that service quality dimensions (tangibles, reliability, responsiveness, assurance, and empathy), are closely related to customer satisfaction. Beside that Landy et al. (2020), added the newly recognised criterias, such as aesthetic quality, design, attention in task execution, and innovation. Algahtany (2018) assessed all other risks out of their control as extra service quality. In China, Zhen et al. (2018) and Lu et al. (2019) explored the relationship between service quality and customer satisfaction and ESG sustainability. Luo et al. (2021) explored the gap of applying service-oriented technology in the construction labour resource management in China. Yang Yingfei et al. (2022) demonstrated that service quality and company performance are important factors in improving service trade in China. Saeed et al. (2021) studied the use of Mobile Application Technology (MAT) in Iraqi construction industry found that extra expenditures connected with technology are the largest limiting barrier, followed by the lack of government control for use. Atmaja & Sfenrianto (2021), emphasised that digitised E-procurement in the construction industry might result in net benefits to Quality System, Information Quality, and Service Quality.

A lack of awareness of the relationship between Corporate Social Responsibility (CSR) and design, according to Capomaccio et al. (2021), prevents the Design for Sustainability (DFS) techniques from integrating sustainability issues into the design process aligned to a company's CSR strategy.

The relationship of service quality with the project performance are explored.

- *H2: Service quality is significantly positive related to project performance*

- *Process management*

Process management is a concept which incorporates quality/performance excellence into an organization's strategic management. The design changes can be eliminated through collaboration amongst stakeholders during the design process and to reduce design errors (Aslam et al., 2019; Guadalupe, 2020). Lean management optimises safety, cost, and eliminate waste that leads to more sustainable and productivity (Moaveni et al., 2019; Waite, 2020; Tzourmakliotou, 2021; Yu et al., 2018). Safety and economy are fundamental issues in underground excavations, where the New Austrian Tunnelling Method (NATM) must be determined accurately during design and construction stages (Özgür & Tamer, 2020; Shi et al., 2014; Qiu et al., 2020; Hernández et al., 2019; Song et al., 2020). nintex (2022) stressed on digital transforming of business, and keeping up with avalanche of change.

The relationship of process management with the project performance are explored.

- *H3: Process management is significantly positive related to project performance*

- *Technology*

The impact of technology in the era of industry revolution IR 4.0 has greatly changed the business model in global business and to create competitive advantage to maintain sustainability leading to the emergence of the Internet (cyber physical systems, network, artificial intelligence). Automation in construction 4.0 with people-process-technology and with AI towards sustainability (Manzoor et al., 2021; Karmakar & Kumar Delhi, 2021). The analysis results of BIM with IoT and/or BD provide significant benefits such as improved real-time monitoring, data exchange and analysis, construction planning, and modelling primarily in the Construction 4.0 preconstruction phase (Begi and Gali, 2021; Roslan et al., 2022; Rao et al., 2022; Garyaev and Garyaeva, 2019).

The challenges facing Construction 4.0 are impact on workers, start-up costs, training requirements, and increased awareness due to change resistance. The adoption of digital transformation to reshape itself with new business model and growth areas along with innovative products and services is necessary in firms on Environmental, Social and Governance (ESG) completeness (AECOM, 2022). Digital tools allow a broader range of stakeholders to navigate a scheme's proposals with greater ease, visualise its most challenging and complex aspects, and better appreciate its potential interactions with the environment, communities, and people (Stewart, 2021; Singh, 2021; Tanga et al., 2020; Bettels, 2020; Sharafat et al., 2020). Quality 4.0 is the practice of Quality Management (QM) in industry 4.0 with digital technology toward operational excellence (de Souza et al., 2021; Juran, 2019). According to Basak Ozturk (2021), the Digital Twin permitted the virtual representation of the physical asset's. With three elements of people, process, and technology, Musa (2019) established a framework for intraorganizational knowledge exchange techniques for efficient BIM adoption in Malaysia. Upeksha Hansini Madanayake (2019) found that despite increasing awareness of digital transformation but the effect on construction project is still disappointing. A lack of knowledge and training was found to be the main barriers to construction stagnating productivity.

The relationship of technology with the project performance are explored.

- *H4: Technology is significantly positive related to project performance*

- *Leadership*

Rabia Bashir et al. (2021) examined leadership, communication, planning, innovation, motivation on project managers' competencies in international development projects. Jong et al. (2019) concluded important relationship between leadership and project performance in Malaysia are customer focus, workforce focus, and operation focus. Khwae & Amoozega (2021) concluded organisational culture, employee commitment and leadership influence the project performance. According to Al-Subaie et al. (2021) transformational leadership and project governance are positively significant to mega project performance. According to Shoshan & Celik (2018) leadership leading to customer satisfaction but lack of top management was regarded as critical barrier. Xiong Zheng et al. (2022) provided insights to leadership humor and employee bootleg innovation in China with moderated mediation model. Marlene Sousa et al. (2021) analysed and confirmed the impact of authentic leadership on resilience, directly or when mediated by humility and validated that employees are resources that help face competitive challenges. Aboramadan (2021) investigated the servant leadership indicated climate of creativity as a partial mediator in their relationship and recommended servant leaders as a recruitment agenda. Kanwal Iqbal Khan et al. (2021) examined the impact of ethical leadership and the silent behaviour of project team to prevent project team silent behaviour. Waxman (2021) defined resilient leadership as "The ability to lead oneself and inspire others to act in the face of challenge and change, with clarity of mind, body, and spirit to create good in the world.". Ali Ahmed Alsaedi et al. (2022) indicated importance of inclusive leadership in creating innovation and collaboration in organisations. Muhammad Abbas & Raja Ali (2021) suggested transformational leadership had a stronger relationship on project success than transactional leadership. Umer Zaman et al. (2022) concluded a high degree of self-confident leadership contributed to self-efficacy. AECOM (2022) AECOM's Think and Act Globally strategy is the roadmap to achieving business goal, and outlines the foundation of the capabilities of AECOM leaders.

The relationship of leadership with the project performance are explored.

- *H5: Leadership is significantly positive related to project performance*

- *Strategic planning*

Strategic management literature reveals that strategic planning as one of the most important aspects for project success. Planning does not guarantee project success, but a lack of planning will almost certainly result in failure (Jong et al., 2019; Hwang et al., 2020). At the same time, Yousef (2019) affirmed that strategic planning aids in crisis management, increases the ability to deal with external threats, establishes a shared vision and purpose for all employees, and increases the level of devotion to the organisation and its goals. The integration of crisis management into strategic planning provides a more inclusive approach to the strategic planning process

(Mudalal, 2021). According to Almansoori et al. (2021), they confirmed that there is a positive impact of strategic planning on the performance of organizations, besides the moderating role of entrepreneurship and sustainability. Samada and Ahmed (2021) investigated and confirmed that both transformational leadership and strategic planning significantly influence the organisational performance. Strategic planning is long term planning that gives direction and action plan with vision statement to achieve project objective (Jhaveri 2020; Martins 2021; Pandey 2021). Strategic planning, according to Abdul Malik (2019), clearly defines the vision and goals, and provides information to senior management to assist them to make better decisions. Ahmed (2021) investigated the performance due to lack of strategic plan, and no innovative leadership which are veritable tools in effective management. Majed Rashed Mohamed Azair Almansoori et al. (2021) investigated and confirmed the positive impact of strategic planning (finance resource, management skills, Information systems, organization culture and innovation) on performance of organisation in Department of Economic Development in Malaysia.

The relationship of strategic planning with the project performance are explored.

- *H6: Strategic planning is significantly positive related to project performance*

- *Risk management*

Risk management is a new field and extremely risky in Pakistan construction industry as it was lacking a good reputation in handling risks to improve on project success in term of schedule, cost, and quality (Ahsan Nawaz et al., 2019; Tahir et al., 2019). Haider (2021) studied the software development sector in Pakistan and concluded that participating leadership would enhance project performance in line with coworker knowledge sharing with project risk management acts as moderator and mediator respectively. Alsaadi & Norhayatizakuan (2020) concluded practicing of risk management improves project performance and recommend project manager with risk management experience is essential.

Risk management entails risk identification, risk analysis, risk evaluation, and risk response, that all of which have a positive impact on performance in terms of cost, time, and quality in construction projects (Shirinda, 2019; Urbański et al., 2019).

PESTLE analysis involved financial and economic risks, contractual and legal risks, design-related risks, political risks, cultural risks, technical associated risks, fraudulent practises linked risks, and health-related risks (Dandage et al., 2021; Gholizadeh and Moradinia, 2021). Ali & Wali (2020) found that there is no reasonable risk management system in Iraq, but just only construction management system depending on experience of project staff which is not skilful to curb the risk control and management in tunnel construction.

The service quality usage of digital mobile phone to assist the implementation of safety requirement as risk management during day-to-day construction stage should be explored hand in hand with safety software to reduce the occurrence of fatality on site (Saeed et al., 2021). Rane et al. (2019) built a project risk management (PRM) framework based on IR 4.0 technology, emphasising on IoT technology on heavy equipment breakdown that delay in construction project. Lombardo (2020) reported in North America that 90% of the contractors surveyed do not have the budget for innovation in using technology to improve risk management in construction. Songling Yang et al. (2018) concluded top management should have sufficient financial knowledge to perform risk management practices in Pakistan. Kanu (2021) investigated and concluded that ERM must be embedded in a risk culture and integrated with strategic planning in order to improve organisational performance. In the construction business in the United States, Obondi and Christopher (2020) investigated risk reassessment, risk audits, contingency reserves analyses, and risk status meetings are all found to be positively associated to project success. Block et al. (2021) revealed that Chief Technology Officer (CTO) leadership was statistically significant to information risk security management (ISRM), but not in relation to big data governance alignment. Biira et al. (2021) examined and concluded top management leadership should have a comprehensive understanding of the risks associated with failing to collect credit transactions in their firm and find solutions to mitigate those risks. Sospeter and Chileshe (2021) investigated both contractors and consultants placed project safety and assuring quality in terms of construction as shared risk duties. Rehman and Ishak (2022) studied the impact of cultural factors on risks management with the mediator of government policies, laws and Acts in Saudi Arabia construction industry, concluded strong culture for project accomplishment.

The relationship of risk management with the project performance are explored.

- *H7: Risk management will mediate the relationship of Human resource management and project performance*
- *H8: Risk management will mediate the relationship of Service quality and project performance*
- *H9: Risk management will mediate the relationship of Process management and project performance*
- *H10: Risk management will mediate the relationship of Technology and project performance*
- *H11: Risk management will mediate the relationship of Leadership and project performance*
- *H12: Risk management will mediate the relationship of Strategic planning and project performance*
- *Project performance*

The impact of Project Management (PM) identified by Jenny and Arnesh (2019) concluded cost overrun fall into four categories: political, technical, economical, psychological. Bazama and Azam (2021) emphasised the importance of project quality in Libyan project management and its role in the process of planning, implementing,

monitoring, and evaluating projects. The study by Unegbu et al. (2021) findings encourage more emphasis on training on project management certifications and practices. Yap and Tan (2021) through their study in Malaysian construction practitioners involving contractors, consultants, and clients, discovered that rework caused delays and cost overrun, high wastage and hinder productivity through bad quality management, lack of good planning, lack of communication, design modification, and poor outsource management. Asadi et.al (2020) identified the stages of design, procurement, and construction are key elements of project life cycle, and identified knowledge gaps between contracting and construction rework. The findings revealed that combining Define, Measure, Analyse, Improve and Control (DMAIC) with appropriate tools and an occupational safety and health (OSH) programme significantly reduces industrial accidents (Ani & Akmal, 2020). The research by Rukmunnisa & Kumar (2020) evaluates the security management to curb the safety and health of construction workers. Taofeeq et al. (2019) investigated risk attitudes in the Malaysian construction industry, concluded that government policy and individual factors have a positive and significant impact on contractor risk attitudes. In Pakistan construction industry, Afzal et al. (2022) explored the impact of TQM initiatives on project performance and found that operation focus, management commitment, and employee involvement were dominant factors significantly related to project performance. Khan et al. (2020) study of psychological empowerment found a positive link between psychological empowerment and project success, as well as significant mediation of knowledge sharing. According to Mahalingam (2022) quoted in the Star newspaper that the real estate players are acknowledging and embracing the importance of environmental, social and governance (ESG) practices in gaining customers satisfaction and requirement with new residents. The main purpose of sustainable construction is to reduce impact on environment through using renewable and recycle materials to reduce energy consumption and waste (Gatley, 2019). McKinsey Global Institute (2022) reports the insights on sustainability looking at the economic and societal impact of transition to net-zero carbon emissions by 2050 and research into climate risks with actions to be taken on ESG premium. Tzourmakliotou (2021) emphasised the importance of research that emphasised the economic, environmental, social, and technical benefits of modular building. According to Li Hongyan et al. (2022) finding, calculative and relational trust significantly impact project performance, with relational trust having a slightly more substantial impact.

IV. RESEARCH METHODOLOGY

➤ Research Design

The quantitative method was chosen based on the research objective. The questionnaires were distributed through email with a Goggle form. A total of 394 responded and the respond rate of 94%. The time horizon adopted was the cross-sectional type and the study on the phenomena and data was collected at a single point of time. The Statistical Program for Social Science (SPSS) package was used as the method and strategy for data gathering and analysis.

➤ *Unit of Analysis*

The individual respondent in the ECRL project study is the unit of analysis comprising the client, designers, supervision consultants, contractors, and subcontractors as well as suppliers. The project is an Engineering Procurement Commissioning Contract (EPCC) contract.

➤ *Sampling Design*

The cluster sampling (probability sampling) technique was used to select respondents for the targeted research population. The sample size is 385.

➤ *Data Collection Methodology*

Table 1 Research Instrument with Questionnaires Structure

PART	VARIABLE	TOTAL QUESTIONS	ADOPTED SOURCE
I	Respondent's profile	17	ECRL project staff
II	TQM Practices		
A	Human resource management	6	(Jia et al., 2021; Zainon, 2020; Yap et al., 2021)
B	Service quality	5	Sunindijo et al. (2014)
C	Process management	5	(Yu et al., 2018; Guadalupe, 2020)
D	Technology	6	(Manzoor et al., 2021; Begic and Gali, 2021)
E	Leadership	6	Jong et al. (2019), MBNQA
F	Strategic planning	6	Jong et al. (2019), MBNQA
G	Project performance	9	(Rukmunnisa & Kumar, 2020; Manzoor et al., 2021; Yap et al., 2021)
H	Risk management	6	Shirinda (2019)
Total		66	

➤ *Model Specification*

A significant level of 5% was employed in the research and a P-value of less than or equal to 0.05 constituted in a significant result for the study.

Table 2 Model Specification

Relationship	Model
The relationship between TQM practices and project performance	$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \varepsilon$
The mediator effect of Risk Management on the relationship between TQM practices and project performance	$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 (M) + \varepsilon$

Where

Y = Project performance

X₁ to X₆ = Independent variables

M = Mediator – Risk Management

β₀ = The Constant

β₁, β₂, β₃, β₄, β₅, β₆, β₇ = Coefficients of the independent variables

ε = The error term

V. RESULTS AND FINDINGS

➤ *Demographic Information (N=381)*

The demographic profiles indicated the respondents are highly qualified, experience, young and dynamic, and most of them (76.4%) are involved in operation and QAQC management. The health safety and environmental team occupied 9.2% which is considered well-structured for such mega project. The salient of the companies involved were aware of TQM practices, ESG salient, energy saving, practising digital and real time monitoring in area of safety that could help in the smooth running of the project.

Table 3 Summary of Univariate Analysis and ANOVA

Respondent profile	Project performance score	Remarks
Age group	$F(3,377) = 1.220, p = .302$	Insignificant
Education group	$F(2,378) = 2.121, p = .121$	Insignificant
Years of experience group	$F(3,377) = 2.139, p = .095$	Insignificant
Job level group	$F(7,373) = 1.242, p = .279$	Insignificant
Job function group	$F(8,372) = 3.816, p < .001$	Significant
Industry group	$F(4,376) = 3.51, p = .008$	Significant
Employee group	$F(4,376) = 8.116, p < .001$	Significant
TQM group	$F(4,376) = 60.286, p < .001$	Significant
Real time monitoring group	$F(4,376) = 68.401, p < .001$	Significant
ESG legacies group	$F(4,376) = 69.002, p < .001$	Significant
Energy saving group	$F(4,376) = 74.539, p < .001$	Significant
Digital workforce group	$F(4,376) = 70.437, p < .001$	Significant

➤ Descriptive Statistic

Table 4 Descriptive Statistic

	N	Minimum	Maximum	Mean	Std. Deviation
Independent variables					
Human Resource management	381	2	5	4.0188	0.68591
Service quality	381	1.8	5	4.1076	0.69545
Process management	381	2	5	4.1192	0.72211
Technology	381	1.67	5	3.9191	0.74148
Leadership	381	2	5	4.1531	0.71259
Strategic planning	381	2	5	4.0809	0.722
Risk management	381	2	5	4.1234	0.70697
Dependent variable					
Project performance	381	1.56	5	4.1904	0.70106
Valid N (listwise)	381				

➤ Factor Analysis

Table 5 KMO and Bartlett's: Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.98
Bartlett's Test of Sphericity Approx. Chi-Square	22144.486
df	1176
Sig.	.000

Table 6 Total Variance Explained

Initial Eigenvalues			
Component	Total	% of Variance	Cumulative %
1	31.65	64.592	64.592
2	1.73	3.53	68.122
3	1.331	2.716	70.838 > 50

Table 7 Component Correlation Matrix

Component	1	2	3
1	1	0.774	0.691
2	0.774	1	0.639
3	0.691	0.639	1

Extraction Method: Principal Component Analysis.
Rotation Method: Promax with Kaiser Normalization.

➤ Correlation Analysis

Table 8 Correlation Analysis

Independent variables	Pearson's correlation
Risk management (RM)	0.903**
Strategic planning (SP)	0.881**
Process management (PRM)	0.861**
Leadership (LS)	0.853**
Technology (TECH)	0.82**
Service quality (SQ)	0.818**
Human resource management (HRM)	0.78**

** Correlation is **significant** at the 0.01 level (2-tailed).

Dependent variable: Project performance (PP)

➤ Validity and Reliability Tests

Table 9 Validity and Reliability Tests

Variables	Cronbach's Alpha α	Interitem correlation (range)
Human Resource Management (HRM)	.911	.548 to .801
Service quality (SQ)	.917	.585 to .739
Process Management (PRM)	.931	.687 to .785
Technology (TECH)	.917	.582 to .759
Leadership (LS)	.947	.653 to .832
Strategic Planning (SP)	.956	.736 to .848
Project Performance (PP)	.953	.597 to .835
Risk Management (RM)	.943	.662 to .830
ALL	.988	.404 to .848
Requirement	.70	.30-.85

➤ Multicollinearity Test and Durbin-Watson Statistic Test Result

Table 10 Multicollinearity with Tolerance and VIF

Coefficients ^a												
Model		Unstandardized Coefficients		Standardized Coefficients		95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance VIF
1	(Constant)	.275	.086		3.207	.001	.107	.444				
	HRM	.016	.043	.016	.372	.710	-.069	.101	.780	.019	.007	.209 4.779
	SQ	-.067	.053	-.067	-1.257	.210	-.172	.038	.818	-.065	-.024	.133 7.532
	PRM	.169	.047	.174	3.574	.000	.076	.262	.861	.182	.069	.158 6.346
	TECH	.098	.037	.104	2.656	.008	.025	.170	.820	.136	.051	.246 4.068
	LS	.119	.051	.121	2.333	.020	.019	.219	.853	.120	.045	.140 7.153
	SP	.184	.055	.190	3.340	.001	.076	.293	.881	.170	.065	.116 8.638
	RM	.437	.047	.441	9.370	.000	.345	.529	.903	.436	.181	.169 5.924

a. Dependent Variable: PP

Table 11 Durbin-Watson Statistic Test Result

Model Summary ^b										
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.928 ^a	0.861	0.858	0.26414	0.861	329.12	7	373	0	1.909

a. Predictors: (Constant), RM, HRM, TECH, LS, PRM, SQ, SP

b. Dependent Variable: PP

➤ Multiple Regression Analysis

Table 12 Multiple Regression Analysis - Estimated Model Coefficients

				Coefficients ^a					
		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Remarks
		B	Std. Error	Beta			Lower Bound	Upper Bound	
	(Constant)	-0.63	0.02		-32.49	<.001	-0.67	-0.59	
H1	sqrt HRM	0.01	0.03	0.01	0.28	0.78	-0.05	0.07	Not supported
H2	sqrt SQ	-0.03	0.04	-0.05	-0.87	0.39	-0.10	0.04	Not supported
H3	sqrt PRM	0.12	0.03	0.19	3.76	<.001	0.06	0.18	Supported
H4	sqrt TECH	0.07	0.03	0.10	2.63	0.01	0.02	0.12	Supported
H5	sqrt LS	0.07	0.03	0.11	2.06	0.04	0.00	0.14	Supported
H6	sqrt SP	0.12	0.04	0.19	3.30	0.00	0.05	0.19	Supported
H7	sqrt RM	0.28	0.03	0.43	9.17	<.001	0.22	0.34	Supported

a Dependent variable: log PP

➤ Mediator Analysis

Table 13 Summary of Risk Management as Mediator between Independent Variables and Dependent Variable

IV	Direct effect (IV – DV)	Indirect effect (IV – MV – DV)	MV - DV	Remarks
HRM (H7)	(B = .54, t = 24.74, p < .001)	B = .12, t = 5.13, p < .001 (95% CI .07 to .18)	(B = .49, t = 21.40, p < .001).	Supported
SQ (H8)	(B = .55, t = 28.73, p < .001)	B = .16, t = 6.01, p < .001 (95% CI .10 to .21)	(B = .46, t = 18.06, p < .001)	Supported
PRM (H9)	(B = .55, t = 33.83, p < .001)	B = .22, t = 8.44, p < .001 (95% CI .15 to .28)	(B = .40, t = 15.03, p < .001)	Supported
TECH (H10)	(B = .53, t = 28.39, p < .001)	B = .17, t = 7.17, p < .001 (95% CI .12 to .21)	(B = .45, t = 19.08, p < .001)	Supported
LS (H11)	(B = .55, t = 32.19, p < .001)	B = .20, t = 7.79, p < .001 (95% CI .014 to .27)	(B = .42, t = 16.03, p < .001)	Supported
SP (H12)	(B = .56, t = 36.39, p < .001)	B = .24, t = 8.74, p < .001 (95% CI .17 to .32)	(B = .37, t = 12.98, p < .001)	Supported

➤ Theoretical Implications

The results for this research regarding the relationship between independent variables and dependent variables was described and the mediator effect that influenced the outcome.

From the multiple regression analysis validated the hypotheses as shown in Table 13, it was noted that the risk management when treated as independent variable before the effect as mediator, indicated as the top highest priority with ($\beta = .43$, $p = < .001 < .05$), followed by strategic planning ($\beta = .19$, $p = .001 < .05$) and process management ($\beta = .19$, $p = < .001 < .05$), the leadership with ($\beta = .11$, $p = .04 < .05$), and the technology with ($\beta = .10$, $p = .01 < .05$). Hence, H3, H4, H5, H6 & H7 were supported. The multiple regression analysis also concluded human resource management and service quality were not positively significantly related to project performance with ($\beta = .01$, p

$= .78 > .05$), and ($\beta = -.05$, $p = .39 > .05$) respectively. Hence, H1 and H2 were rejected.

From the theoretical perspective, the results of this research was supported by the findings that TQM practices were consistent predictors of project performance. According to Shirinda (2019) and Urbański et al. (2019), they investigated the relationship between risk management and performance success and concluded that knowledge of risk management could save cost, time and quality. According to Jong et al.(2019), strategic planning is regarded as one of the most important aspects for project success and a lack of planning will almost certainly result in failure. According to Aslam et al. (2019) and Guadalupe (2020), they supported the process management indicating collaboration among stakeholders during design process could reduce design error during construction. Guadalupe (2020) stressed on process management importance in

tunnel construction to achieve safety. According to Al-Subaie et al. (2021), they found that transformational leadership positively significantly related to mega project performance. According to Karmakar & Delhi (2021) and Roslan et al. (2022), they concluded people-process-technology and digital transformation improved sustainability, site safety and reducing risks. The human resource management analysed was insignificant could be an isolated case as journal articles stated in contrast citing Dandage et al. (2021) that Project risk management (PRM) and human resource management (HRM) are two critical success factors (CSF) that had a great influence on the international project management leading to project success and performance. The insignificant result of the service quality from the analysis was supported by Forsythe (2015) where little had been done to understand how it affected customer satisfaction during construction stage. Al-Momani (2000) emphasised that poor performance was caused by a lack of attention paid to the satisfaction of the owners when he examined factors that could influence project success in contractor service quality.

The mediator analysis as shown in Table 14, indicated that risk management as mediator significantly mediated the relationship between the independent variables and dependent variable indicating independent variables had direct and indirect effect on project performance. Hence, supported the hypotheses H7 to H12. According to Kallow et al. (2022), they examined the effects of risk management practices on project success and found that risk coping capacity mediated the relationship between risk management practices and project success.

The analysed results from the multiple regression analysis indicated that both the Human resource management (HRM) and service quality (SQ) are not significant as the p values for both exceeded .05. The analysed results for mediator analysis when risk management being treated as a mediator indicated that both the HRM and SQ are significantly positive.

The contradiction among the analysed results could be of a subject of interest for future studies. The reason that can be traced lied on the fact that when risk management being treated as independent variable while performing the multiple regression analysis, the r value for correlation indicated 43% at which was considered as high value when compared with other independent variables. The mediator analysis with risk management indicated both direct and indirect relationship, hence indicating partial mediation. From both the analyses, risk management shown high influence on the relationship of independent variables and project performance. Hence, the risk management with PESTLE analysis on mega project should be carefully analysed to maintain compliance of Health Safety and Environment (HSE), Quality Assurance Quality control (QAQC), profitability and sustainability with competitive advantages.

The above-mentioned journal articles emphasised on the importance of TQM theory and service quality theory to explore on the implementation and barriers of TQM practices. The TQM practices like the HRM being explored and noted that it is insignificant but is in general contradicting to Dandage et al. (2021) finding where project risk management (PRM) and human resource management (HRM) are two critical success factors that have great influence on mega project success. Similarly, the service quality indicated insignificant but is contradicting to Al-Momani (2000) finding where customer satisfaction is important to contractor service quality. Forsythe (2015) supported the fact that little knowledge to understand customer satisfaction during construction stage.

The literature reviews supported and in line with the fundamental theories of TQM. As stated by Bathaei et al. (2021) TQM theory comprises senior management support, employee participation, continuous improvement, focus on customers satisfaction, and innovation. The five pillars of TQM regarded as product, process, organisation, leadership, and commitment which is equivalent to IR4.0 as people, process, and technology. The service quality theory stated by Parasuraman et al. (1988) on tangibles, reliability, responsiveness, assurance, and empathy together with Landy et al. (2020) and Zygiaris et al. (2022) emphasis on new success factors with aesthetic quality, design, attention in task execution, and innovation beside what stated by Parasuraman et al. (1988) is in line with the above stated literature reviews. It is concluded that the adopted fundamental theories do apply the relevancy of the philosophies to the related subject elements.

➤ *Managerial Implication*

Using the SPSS ver27 software, univariate analysis as shown in Table 4, indicated the results of age group, the education group, and years of experience were statistically insignificant with relationship on project performance. The current job function groups indicated with significant relationship with the project performance. The above analysis results indicated that practically if project teams with relevant years of experience and qualification and with knowledge base of the job categories would not pose any problem to the project performance. From the findings, it was clear that respondents' personal qualification and status were not the contributing factor, but the team effort was obviously the most prominent contribution toward project performance success. Result from different industry group had significant relationship on project performance mainly on trading, construction, and design consultant group, others were insignificantly related. The results of the project performance from real time monitoring data group, the ESG legacies group, the energy saving group, and the digital workforce group as shown in Table 4, were statistically significant on project performance. The results indicated that team awareness on TQM practices, real time monitoring, ESG salient, energy saving, and digital transformation were essential and would lead to project performance.

It is interesting to note that for ECRL mega project, in the multiple regression analysis the risk management, r for correlation (43%) was the most important subject that should be seriously emphasised in agreement with journal articles that emphasised on risk management according to Kallow et al. (2022).

Project risk management (PRM) and human resource management (HRM) were two critical success factors (CSF) that had a great influence on the international project management leading to project success and performance according to Dandage et al.(2021). Risk management as indicated played an important role in ECRL mega project which could be affected by Political, Environmental, Social, Technological, Legal and Economic (PESTLE). The suspension of the project (Malaymail, 2019) in 05.07.2018 and work resumed again in 25.07.2019 were obvious signs of political and legal risks whereas the shortage of skilled labourers during Covid-19 pandemic were due to social and environmental risks. The chances of tunnel collapsed during construction stage due to unpredicted terrain was the technological risk. The rise in construction material and consumption usage of fuels during construction stage caused by unforeseen circumstances recently example the Russia and Ukarian war and the impact of US-China trade tensions (Eugenio 2019) were another economic risk faced by ECRL project. The above indicated the importance of risk management with PESTLE analysis in mega project performance could lead to compliance of Health Safety and Environment (HSE), Quality Assurance Quality control (QAQC), sustainability with competitive advantages, and profitability.

The Process management and strategic planning both with (19%) each were equally important especially in the construction of tunnelling. The right and improved process management in QAQC procedure and design process control during design and construction stage, and proper strategic planning on equipment selection and usage for example the tunnel boring machine (TBM), and experienced and well-trained manpower for such categories of works should be adopted. Leadership and technology each contributed roughly 10% of the effects were mainly on the management and backup services with the latest technology. The human resource management and service quality were insignificant and completely not contributing could be an isolated case and oversized as journal articles stated in contrast citing Dandage et al. (2021) and (Forsythe, 2015). The contradiction of the results from multiple regression analysis and the mediator analysis with risk management was explained above where risk management was of high influence on mega project performance. The insignificant results on the human resource management and service quality did not necessary mean that they were not important. Analysis of the result indicated not significant but practically, they could lead to unforeseen circumstances. Fatality on construction sites and public complaints on environmental issues indicating customer dissatisfaction were examples that could affect human resource management and service quality where continuous training and improvement to meet customers satisfaction were

essential. Further, managerial commitment to empowerment, incentives, awards, and compensation should be strengthened in ensuring service quality delivery.

VI. LIMITATION AND FUTURE RESEARCH

The unit of analysis adopted only covered certain sections might not truly represent the actual trend and larger sample size could be adopted. The delimitation also because of practical reasons, such as lack of time or financial resources to carry out a more thorough investigation. The other independent variables like Corporate Social Responsibility (CSR), managerial attitudes, and coercive pressures on environmental sustainability performance should be considered (Ajibike et al., 2021; Karunathilaka et al., 2021; De Koker, 2020). The consideration of importance of environmental green strategies as independent variable (Marguerite Nyhan et al., 2019; O'Mard, 2020). Another limitation is the avoidance of the ethical and contractual issues as this is still an on-going mega project between bilateral governments.

Future research could base on the organizational culture as a qualitative study which had great influence especially for international organization. This study was conducted in Malaysia could not be generalized for other regions; therefore, future researchers could explore other regions. The time horizon adopted was the cross-sectional type and the study on the phenomena and data was collected at a single point of time. Future research could adopt a longitudinal study of TQM practices at the end of construction period. The dependent variable, project performance concentrated mainly on Health Safety Environmental (HSE), Quality Assurance Quality Control (QAQC), and sustainability but only the project performance as a unit was analysed. This ECRL project study could be adopted for further study on other discipline and even for smaller construction projects.

VII. RECOMMENDATIONS

The results from the multiple regression analysis and mediator analysis with risk management indicated that risk management top the priority and had high influences in the relationship between TQM practices and project performance, hence due consideration should be addressed to PESTLE analysis on this mega project. The human resource management and service quality were indicated as not significantly but there were signs of complaint from public on the environmental issues and fatality cases that happened. It is recommended that proper continuous training and improvement on human resource management and service quality are essential to improve customers satisfaction. It is also recommended that corporate social responsibility (CSR) especially on Environment Social and Governance (ESG) legacies to promote sustainability on such mega project. It is recommended that improvement to Quality Assurance Quality Control (QAQC) process management, design process management during design and construction stage, and Health Safety and Environment (HSE) awareness training and improvement are adopting the

digital technology transformation. The digital technology transformation in tunnel management instead of traditional method should be adopted. The ECRL project processes can be recommended for national policy improvement especially on the ESG concept adopted on the alignment with minimum disturbance to environment.

VIII. CONCLUSIONS

In general conclusion, the study has revealed the relationship between TQM practices and the project performance with the mediator of risk management in the ECRL project.

In respond to the research questions RQ1, Multiple regression analysis as shown in Table 13, indicated the influence of the TQM practices; process management, technology, leadership, and strategic planning were found to be positively significantly related to project performance except the human resource management and service quality which were found to be insignificant. Hence, H1 & H2 were rejected. H3, H4, H5, H6 were accepted. The study findings indicated that risk management (43%) when treated as independent variable initially had the greatest influence on project performance, followed by strategic planning (19%) and process management (19%), leadership (11%), and technology (10%). The findings also indicated that human resource management (1%) and service quality (-5%) were not significantly related to project performance.

In respond to research question RQ2, Mediator analysis as shown in Table 14, indicated that risk management did mediate the impact between TQM practices and project performance in ECRL project. The confidence interval for the indirect effect did not straddle a zero in between, this supported the presence of mediation effect (Memona et al., 2018). The regression weights for the all the six independent variables reduced but remained significant conforming partial mediation. The independent variables had direct as well as indirect effect on project performance through risk management as mediator. Hence, H7- H12 were supported based on the findings.

In respond to research question RQ3, Summary of Univariate Analysis and ANOVA as shown in Table 4, indicated the companies were aware of TQM practices, ESG salient, energy saving, practising digital and real time monitoring in area of safety that could help in the smooth running of the project. The results from age group, education group, years of experience group, and job level group indicated that they are all insignificant implying that they are not the contributing factors to the succes of project performance. Whereas the other groups like the job function, industry, employee, TQM, real time monitoring, ESG legacies, energy, and the digital workforce group are significant to the success of project performance. In general the above information implied that personal profile are not the critical part for project success but the awareness of the role of teamwork and knowledge of environmental sustainability with digital transformation in collaboration

with stakeholders on ESG and safety issues are the contributing factors.

Theoretical implications and the Managerial implications indicated that results were in concurrence with relevant journal articles and supported the findings that TQM practices were consistent predictors of project performance. It is to be concluded that risk management should be considered as top priority in PESTLE analysis for mega projects. Finally, the researcher concluded that the results from findings fulfilled the indicated research objectives and answered the research questions developed in the study.

REFERENCES

- [1]. Aboramadan, M. (2021). *Servant leadership and followers' creativity does climate for creativity matter*. Emerald Publishing Limited, DOI 10.1108/EBHRM-01-2020-0012.
- [2]. AECOM. (2022). *Digitally-enabled, people-centric is the second of our four-part series on Digital Cities*. AECOM - Digital Cities, 2.
- [3]. AECOM. (2022, Jan 12). *What makes a great leader at AECOM?* Retrieved from AECOM.
- [4]. Ahmed, M. (2021). *THE ROLE OF STRATEGIC PLANS AND INNOVATIVE LEADERSHIP IN EFFECTIVE MANAGEMENT PERFORMANCE*. International Research Journal of Modernization in Engineering Technology and Science, Volume:03/ Issue:11/November-2021.
- [5]. Ahsan Nawaz, A. W. (2019). *An Innovative Framework for Risk Management in Construction Projects in Developing Countries: Evidence from Pakistan*. MDPI Risks, Risks 2019, 7, 24; doi:10.3390/risks7010024.
- [6]. Ajibike, W. A., Adeleke, A. Q., Mohamad, F., Bamgbade, J. A., Nawi, M. N. M., & Moshood, T. D. (2021). *An evaluation of environmental sustainability performance via attitudes, social responsibility, and culture: A mediated analysis*. Environmental Challenges, 4. <https://doi.org/10.1016/j.envc.2021.100161>
- [7]. Algahtany, M. (2018). *Assessment and development of contractors' mitigation practices towards risks out of contractors' control in the Saudi Construction Industry*. [Doctoral dissertation, Arizona State University]. <https://www.proquest.com/pqdtthss/docview/2054019366/9EDEF205B04A4BF1PQ/1?accountid=146023>
- [8]. Ali Ahmed Alsaedi, O. B. (2022). *Impact of Inclusive Leadership on Team Voice and Innovation: The Role of Performance Pressure in Iraq Refineries*. International Journal of Knowledge Processing Studies, DOI: 10.22034/kps.2022.350284.1029.
- [9]. Ali, A. S., & Wali, K. I. (2020). *Investigating the status of risk management system in tunnel construction projects*. Journal of Global Scientific Research, 6, 655-666.

- [10]. Almansoori, A. (2021). Effects of suitable sustainability practices on firms' performance.1. Research Gate.
- [11]. Almansoori, M. R. M. A., Al-Tahitah, A. N. A., & Battour, M. M. K. M. (2021). The impact of strategic planning on the performance of Economic Governmental Organizations: The moderating role of organizational leadership and sustainability. *International Journal of Contemporary Management and Information Technology (IJCMIT)*.
- [12]. Al-Momani, A. H. (2000). Examining service quality within construction processes. *Technovation*, 20(11), 643-651.
- [13]. ALSaadi, N., & Norhayatizakuan, N. (2021). The impact of risk management practices on the performance of construction projects. *Studies of Applied Economics*, 39(4). <https://doi.org/10.25115/eea.v39i4.4164>
- [14]. Al-Subaie, A. A., Faisal, M. N., Aouni, B., & Jabeen, F. (2021). Investigating the role of leadership styles and governance on project performance in megaprojects. *Polish Journal of Management Studies*, 23(1).
- [15]. Andony, B. (2022, August 16). The Cost of Rework in Construction (and How to Avoid It). Retrieved from myComply: <https://mycomply.net/info/blog/cost-of-rework-in-construction/>
- [16]. Ani, M. N. C., & Akmal, M. S. A. (2020). Application of the Six Sigma principles in the construction industry to solve workplace accidents: A case study. *International Journal of Six Sigma and Competitive Advantage*, 12(4), 369-388. <https://doi.org/10.1504/IJSSCA.2020.112366>
- [17]. Asadi, R., Wilkinson, S., & Rotimi, J. O. (2020). Rework Management in Life Cycle of Project: An Outline for Construction Contracts. 6th New Zealand Built Environment Research Symposium (NZBERS 2020), <http://nzbers.massey.ac.nz/index.php/2020-symposium/>.
- [18]. Aslam, M., Baffoe-Twum, E. E., & Saleem, F. (2019). Design changes in construction projects - causes and impact on the cost. *Civil Engineering Journal*, 5(7), 1647-1655.
- [19]. Atmaja, R. A. & Sfenrianto. (2021). An evaluation the implementation of e-procurement application at contractor company. *Journal of Theoretical and Applied Information Technology*, 99(8).
- [20]. Aziz A. (2022, October 18). Selangor to defend its stand on ECRL alignment. the Maaysian Reserve, pp. <https://themalaysianreserve.com/2021/03/22/selangor-to-defend-its-stand-on-ecrl-alignment/>.
- [21]. Aziz, A. (2020, July 17). Selangor objects reversal of ECRL alignment. Retrieved from Economy News: <https://themalaysianreserve.com/2020/07/17/selangor-objects-reversal-of-ecrl-alignment/>
- [22]. Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology*, 51(6), 1173-1182.
- [23]. Bathaei, A., Awang, S. R., & Ahmad, T. (2021). An overview of organizational performance and total quality management. *Journal of Review in Science and Engineering*, 2021, 1-7.
- [24]. Bazama, N. A. H. and Azam, S. M. F. (2021). Project delay and managing project performance among construction companies. *International Journal of Multidisciplinary Research and Publications (IJMRAP)*, 4(2), 63- 71.
- [25]. Begic, H., & Galic, M. (2021). A Systematic Review of Construction 4.0 in the Context of the BIM 4.0 Premise. *Buildings* 2021, 11, 337.
- [26]. Bettels, L. (n.d). Many tunnel operators do not yet know what benefits a digital twin offers. https://www.tunnel-online.info/en/artikel/tunnel_Many_Tunnel_Operators_do_not_yet_Know_what_Benefits_a_Digital_Twin_Offers_3471796.html
- [27]. Biira, J. K., Tukei, J. M. O., Tukei, L., & Mboma, F. (2021). Risk Avoidance Strategies and Performance of Total Uganda Limited. *International Journal of Technology and Management*, 6(1), 1-6.
- [28]. Block, S., Munkeby, S., & Sambasivam, S. (2021, June). An Empirical Examination of the Effects of CTO Leadership on the Alignment of the Governance of Big Data and Information Security Risk Management Effectiveness. In *InSITE 2021: Informing Science+ IT Education Conferences* (p. 006).
- [29]. Bullock, M. L. (2018). Successful human resource outsourcing strategies. [Doctoral thesis, Walden University]. <https://www.proquest.com/pqdthss/docview/2158003664/60504AF8BED645D6PQ/1?accountid=146023>
- [30]. Capomaccio, A. L., Carrillo, R. T., & Garcia, J. (2021). Construction of the mapping of corporate social responsibility issues that can be managed during the design process application in the automotive industry. *International Conference On Engineering Design*. DOI:10.1017/pds.2021.75.
- [31]. Dandage, R. V., Rane, S. B., & Mantha, S. S. (2021). Modelling human resource dimension of international project risk management. *Journal of Global Operations and Strategic Sourcing*, 14(2), 261 -290. <https://doi.org/10.1108/JGOSS-11-2019-0065>
- [32]. Danker, S. (2021, October 12). ECRL northern alignment, more than meets the eye. FMT. <https://www.freemalaysiatoday.com/category/opinion/2021/10/12/ecrl-northern-alignment-more-than-meets-the-eye/>
- [33]. De Koker, C. R. (2019). Evaluation of factors influencing environmental sustainability performance of construction projects in South Africa. University of Johannesburg (South Africa).
- [34]. de Souza, F. F., Corsi, A., Pagani, R. N., Balbinotti, G., & Kovalski, J. L. (2021). Total quality management 4.0: adapting quality management to Industry 4.0. *The TQM Journal*, 34(4), 749-769.
- [35]. Deming, W. (1982). Quality, productivity, and competitive position. Center for Advanced Engineering Study, MIT.

- [36]. Department of Statistics, Malaysia. (2022). Malaysia GDP From Construction. Trading Economic. <https://tradingeconomics.com/malaysia/gdp-from-construction>
- [37]. Eugenio Cerutti, G. G. (2019, May 23). The Impact of US-China Trade Tensions. Retrieved from IMFBlog: <https://www.imf.org/en/Blogs/Articles/2019/05/23/blog-the-impact-of-us-china-trade-tensions>
- [38]. Forsythe, P. (2015). Monitoring customer perceived service quality and satisfaction during the construction process. *Construction Economics and Building*, 15(1), 19-42.
- [39]. Ganesh, R., & Tyagi, R. (2021). Managing the shortage of skilled construction workers in India by effective talent management in new normal–technology perspective. *International Journal of Management (IJM)*, 12(5). 10.34218/IJM.12.5.2021.021
- [40]. Garyaev, N., & Garyaeva, V. (2019). Big data technology in construction. *E3S Web of Conferences* (Vol. 97, p. 01032). EDP Sciences.
- [41]. Gatley, N. (2021, July 16). What is sustainable construction and why is it important. British Assessment Bureau. <https://www.british-assessment.co.uk/insights/what-is-sustainable-construction-and-why-is-it-important/>
- [42]. Guadalupe, H. (2020). Safety design management processes to mitigate design errors (Doctoral dissertation, Walden University). ProQuest Dissertations & Theses Global.
- [43]. Haider, S. F. (2021). The impact of participative leadership on project success with mediating role of coworker knowledge sharing and moderating role of project risk management [Doctoral dissertation, Capital University]. <https://thesis.cust.edu.pk/UploadedFiles/Syeda%20Farwaa%20Haider-MEM183011.pdf>
- [44]. Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2010). *Multivariate data analysis* (7th edition). Pearson Prentice Hall.
- [45]. Hair, J. F., Harrison, D., & Risher, J. J. (2018). Marketing research in the 21st century: Opportunities and challenges. *Brazilian Journal of Marketing-BJMkt*, Revista Brasileira de Marketing-ReMark, Special Issue, 17.
- [46]. Hernández, Y. Z., Farfán, A. D., & de Assis, A. P. (2019). Three-dimensional analysis of excavation face stability of shallow tunnels. *Tunnelling and Underground Space Technology*, 92. <https://doi.org/10.1016/j.tust.2019.103062>
- [47]. Ho, W. F. (2019, April 16). New ECRL deal may become a case study for others. *The Star*. <https://www.thestar.com.my/news/nation/2019/04/16/new-ecrl-deal-may-become-a->
- [48]. Huang, M. Q., Ninić, J., & Zhang, Q. B. (2021). BIM, machine learning and computer vision techniques in underground construction: Current status and future perspectives. *Tunnelling and Underground Space Technology*, 108, 103677.
- [49]. Indhumathi, S. R., Kothai, P. S., & Janani, S. (2018). Study on scope variances in construction projects. *International Research Journal of Engineering and Technology*, 5(12).
- [50]. Javaid, M., Sajid, M., Masood, K., & Khan, Z. (2022). Examining the impact of project management methodology on construction project success. Using risk management as a mediator and organizational culture as a moderator. *Sustainable Business and Society in Emerging Economies*, 4(1), 151-166.
- [51]. Jenny, O. and Arnesht, T. (2019). Factors that contribute towards cost overruns in an African Mega-project. *Proceedings of the International Conference on Industrial Engineering and Operations Management*, 23-25. <http://ieomsociety.org/toronto2019/papers/117.pdf>
- [52]. Jhaveri, K. (2020, Feb 7). Why Strategic Planning Is Important In Any Project Before Starting It. *smart Task*, pp. <https://www.smarttask.io/blog/strategic-planning>.
- [53]. Jia, J., Jiao, Y., & Han, H. (2021). Inclusive leadership and team creativity: A moderated mediation model of Chinese talent management. *The International Journal of Human Resource Management*, 1-24.
- [54]. Jong, C. Y., Sim, A. K., & Lew, T. Y. (2019). The relationship between TQM and project performance: Empirical evidence from Malaysian construction industry. *Cogent Business & Management*, 6(1), 1568655.
- [55]. Juran. (2019, June 15). Quality 4.0: The future of quality? <https://www.juran.com/blog/quality-4-0-the-future-of-quality/JurnalKemanusiaan>, 6,(1).
- [56]. Jusoh, A., Yusoff, R. Z., & Mohtar, S. (2008). Determining TQM practices in university R&D activities using factor analysis: Research experience of Malaysian universities.
- [57]. Kallow, M. A., Bodla, A. A., Ejaz, A., & Ishaq, M. R. (2022). How do risk management practices lead to project success in the construction industry? The mediated moderation of risk coping capacity and risk transparency. *International Journal of Construction Management*, 1-9. <https://doi.org/10.1080/15623599.2022.2095719>
- [58]. Kanu, M. S. (2021). A theoretical framework for enterprise risk management and organizational performance. *International Business Research*, 14(5), 63. DOI: 10.5539/ibr.v14n5p63
- [59]. Kanwal Iqbal Khan, S. S. (2021). BREAKING_SILENCE_AND_IMPROVING_PERFORMANCE_HOW_SUBORDINATES_FEELING_TRUSTED, AND LOYALTY_TOWARDS_SUPERVISORS_MEDIATES_THE_RELATIONSHIP_BETWEEN_ETHICAL_LEADERSHIP_AND_PROJECT_TEAM_MEMBERS_SILENCE'. *Academy of Strategic Management Journal*, Volume 20, Special Issue 6, 2021.

- [60]. Karunathilaka, H. L. P. U., Devapriya, K. A. K. and Shanika, V. G., 2021. Effect of social and environmental factors on expressway construction in Sri Lanka. In: Sandanayake, Y.G., Gunatilake, S. and Waidyasekara, K.G.A.S. (eds). Proceedings of the 9th World Construction Symposium, 9-10 July 2021, Sri Lanka. [Online]. pp. 280-289. <https://doi.org/10.31705/WCS.2021.24>. Available from: <https://ciobwcs.com/papers/>
- [61]. Khan, J., Malik, M., & Saleem, S. (2020). The impact of psychological empowerment of project-oriented employees on project success: A moderated mediation model. *Economic research-Ekonomska istraživanja*, 33(1), 1311-1329.
- [62]. Khwae, G. B., & Amoozegar, A. (2021). Examining the importance of organisational culture, employee commitment and leadership on project performance of organisations in Malaysia. *Journal of Economics, Finance and Management Studies*, 4(8), 1450-1457. <https://doi.org/10.47191/jefms/v4-i8-23>
- [63]. Landy, M. F. B., Sousa, S., & Romero, F. (2020, March). Service quality factors in the construction sector: A literature review. In *IOP Conference Series: Materials Science and Engineering* (Vol. 800, No. 1, p. 012035). IOP Publishing.
- [64]. Li Hongyan, F. J. (2022). An empirical study on the formation mechanism of trust between the owner and the PMC contractor under the PMC model. *Ain Shams Engineering Journal*, <https://doi.org/10.1016/j.asej.2022.101974>.
- [65]. Lombardo, J. (2020, June 15). Three keys to technology adoption in the construction industry. For Construction Pros.com. <https://www.forconstructionpros.com/construction-technology/article/21115716/three-keys-to-technology-adoption-in-the-construction-industry>
- [66]. Lu, W., Li, Z., & Zhang, H. (2019). Total Quality Management and evaluation: A study of the Coastal Highway System. *Journal of Coastal Research*, 98(SI), 407-413. <https://doi.org/10.2112/SI98-092.1>
- [67]. Luo, H., Sheng, D., Zhong, B., Chen, K., Sepasgozar, S. M., & Xing, X. (2021). Conceptual Framework for the Service-Oriented Management of Construction Labor Resource. *Engineering Management Journal*, 1-16.
- [68]. Mahalingam, E. (2022, April 02). ESG in real estate. *The Star*. <https://www.thestar.com.my/business/business-news/2022/04/02/esg-in-real-estate>
- [69]. Malaymail. (2019, July 25). ECRL works officially back on track after year-long suspension. *Malay Mail*. <https://www.malaymail.com/news/malaysia/2019/07/25/ecrl-works-officially-back-on-track-after-year-long-suspension/1774678>
- [70]. Manzoor, B., Othman, I., Durdyev, S., Ismail, S., & Wahab, M. H. (2021). Influence of artificial intelligence in civil engineering toward sustainable development—a systematic literature review. *Applied System Innovation*, 4(3), 52.
- [71]. Marguerite Nyhan, B. O. (2019). Connecting People to Climate Change Action: Informing Participatory Frameworks for the National Dialogue on Climate Action (C-CHANGE). Ireland: ENVIRONMENTAL PROTECTION AGENCY.
- [72]. Marlene Sousa, J. M. (2021). AUTHENTIC LEADERSHIP IN SMALL BUSINESSES: THE IMPORTANCE OF HUMILITY AND RESILIENCE. *Academy of Entrepreneurship Journal*, Volume 27, Special Issue 5, 2021.
- [73]. Martins, J. (2021, April 16). New to strategic planning? Start here. Asana, pp. <https://asana.com/resources/strategic-planning>.
- [74]. McKinsey Global Institute. (2022, January). The net-zero transition: What it would cost, what it could bring. McKinsey & Company. <https://www.mckinsey.com/~media/mckinsey/business%20functions/sustainability/our%20insights/the%20net%20zero%20transition%20what%20it%20would%20cost%20what%20it%20could%20bring/the-net-zero-transition-what-it-would-cost-and-what-it-could-bring-final.pdf>
- [75]. Melhem, I. I. (2021). Impact of the Human Resources on the Risk Management and the Company Performance. *International Journal of Economics & Management Sciences*, <http://dx.doi.org/10.4172/2162-6359.1000320>.
- [76]. Memon, M. A., Jun, H. C., Ting, H., & Francis, C. W. (2018). Mediation analysis issues and recommendations. *Journal of Applied Structural Equation Modeling*, 2(1), i-ix.
- [77]. Moaveni, S., Banihashemi, S. Y., & Mojtahedi, M. (2019). A conceptual model for a safety-based theory of lean construction. *Buildings*, 9(1), 23. <https://doi.org/10.3390/buildings9010023>
- [78]. Mudalal, M. W. (2021). Examining the Moderating Effect of Geopolitical Environment on Crisis Management and Strategic Planning. *International Journal of Academic Research in Business and Social Sciences*, 11(9), 1025–1041.
- [79]. Muhammad Abbas, R. A. (2021). Transformational versus Transactional Leadership Styles and Project Success: A Meta-Analytic Review. *European Management Journal*, <https://doi.org/10.1016/j.emj.2021.10.011>.
- [80]. Musa, S. (2019). A framework of intra-organisational knowledge sharing practices in implementing BIM within the Malaysian construction industry. [Doctoral thesis, The University of Salford]. <https://www.proquest.com/docview/2411812974?pq-origsite=gscholar&fromopenview=true>
- [81]. Myers V. (2022, August 14). The Importance of Construction Industry on the Economy. *MALAYSIA TIMES*, pp. <https://www.malaysiatimes.my/the-importance-of-construction-industry-on-the-economy/>.
- [82]. nintex. (2022, March 28). 5 key processes that companies are automating now. Retrieved from nintex: <https://www.nintex.com/resources/5-proceses-companies-are-automating-now/>

- [83]. O'Mard, J. S. (2020). Green innovative strategies construction business leaders implement to increase organizational performance (Unpublished doctoral dissertation). Walden University.
- [84]. Obondi, K. C. (2020). The relationship between project risk monitoring, control practices, and project success in construction projects. [Unpublished doctoral thesis]. Northcentral University.
- [85]. Othman, I., Ghani, S. N. M., & Choon, S. W. (2020). The total Quality Management (TQM) journey of Malaysian building contractors. *Ain Shams Engineering Journal*, 11(3), 697-704.
- [86]. Ozturk, G. B. (2021). Digital twin research in the AECO-FM industry. *Journal of Building Engineering*, 40, 102730.
- [87]. Panday, P., & Kaur, G. (2021). Talent Management and employee retention practices: A systematic literature review and future agenda. *Journal of Contemporary Issues in Business and Government* | Vol, 27(3). <https://doi.org/10.47750/cibg.2021.27.03.348>
- [88]. Pandey, R. (2021, August 18). How strategic planning can swing the pendulum to success for MSMEs. *EXPERT OPINION*, pp. <https://yourstory.com/smbstory/strategic-planning-msmes-employees-motivation-right-environment/amp>.
- [89]. Parasuraman, A., Zeithaml, V. A., & Berry, L. (1988). Servqual: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, 64(1), 12-40.
- [90]. Permana, A., Purba, H. H., & Rizkiyah, N. D. (2021). A systematic literature review of Total Quality Management (TQM) implementation in the organization. *International Journal of Production Management and Engineering*, 9(1), 25-36. <https://doi.org/10.4995/ijpme.2021.13765>
- [91]. Qiu, H. Z., Chen, X. Q., Wu, Q. H., Wang, R. C., Zhao, W. Y., & Qian, K. J. (2020). Deformation mechanism and collapse treatment of the rock surrounding a shallow tunnel based on on-site monitoring. *Journal of Mountain Science*, 17(12), 2897-2914.
- [92]. Rabia Bashir, A. S. (2021). Project Managers' Competencies in International Development Projects A Delphi Study. *SAGE Open*, <https://doi.org/10.1177/21582440211058188>.
- [93]. Ramli, M. Z., Malek, M. A., Hanipah, M. H., Lin, C. L., Sukri, M. M., Zawawi, M. H., & Fuad, N. M. (2018). Study of factors influencing construction delays at rural area in Malaysia. *Journal of Physics: Conference Series* (Vol. 1049, No. 1, p. 012017). IOP Publishing.
- [94]. Rani, U., Kumar Dhir, R., Furrer, M., Göbel, N., Moraiti, A., & Cooney, S. (2021). World employment and social outlook: the role of digital labour platforms in transforming the world of work. Geneva: International Labour Organisation.
- [95]. Rao, A. S., Radanovic, M., Liu, Y., Hu, S., Fang, Y., Khoshelham, K., & Ngo, T. (2022). Real-time monitoring of construction sites sensors, methods, and applications. *Automation in Construction*, April 2022. DOI: 10.1016/j.autcon.2021.104099.
- [96]. Rehman, A.U., & Anwar, M. (2019). Mediating role of enterprise risk management practices between business strategy and SME performance. *Small Enterprise Research*, 26(2), 207-227.
- [97]. Rehman, M. A., & Ishak, M. S. B. (2022). Moderation role of government policies, laws and acts between cultural factors and risk management among Saudi Arabian contractors. *FWU Journal of Social Sciences*, 16(1).
- [98]. Rosita, S., Sumarni, S. & Fazri, A. (2020). Application of Talent Management through Employee Competence in State-Owned Enterprises. *Proceedings of the 5th NA International Conference on Industrial Engineering and Operations Management*. 3717-3725. <http://ieomsociety.org/detroit2020/proceedings/>
- [99]. Roslan, Ahmad Farhan & Aminudin, Eeydzah & Lau, Santi Edra Nisa & Abidin, Nur & Khairolden, Mohd & Abd. Hamid, Zuhairi. (2022). Construction 4.0 to transform the Malaysian construction industry. *The Ingeniuer*. <https://www.researchgate.net/publication/358199722>.
- [100]. Rukmunnisa, C. & Kumar, P.N. (2020). Safety management in construction project management. *International Research Journal of Engineering and Technology (IRJET)*, 7(12).
- [101]. Saeed, Y., Aziz, E., & Zelentsov, L. (2021). Technology role in safety management of Iraqi construction projects. In *E3S Web of Conferences* (Vol. 263, p. 04043). EDP Sciences.
- [102]. Samad, S., & Ahmed, W. (2021). Do strategic planning dimensions and transformational leadership contribute to performance? Evidence from the banking sector. *Management Science Letters*, 11(3), 719-728.
- [103]. Sharafat, A., Khan, M. S., Latif, K., & Seo, J. (2020). BIM-based tunnel information modeling framework for visualization, management, and simulation of drill-and-blast tunneling projects. *Journal of Computing in Civil Engineering*, 35(2).
- [104]. Shi, S. S., Li, S. C., Li, L. P., Zhou, Z. Q., & Wang, J. (2014). Advance optimized classification and application of surrounding rock based on fuzzy analytic hierarchy process and Tunnel Seismic Prediction. *Automation in construction*, 37, 217-222. <https://doi.org/10.1016/j.autcon.2013.08.019>
- [105]. Shirinda, V. (2019). Impact of Risk Management in construction projects. [Doctoral dissertation, University of Johannesburg]. <https://www.proquest.com/docview/2521471731?pq-origsite=gscholar&fromopenview=true>
- [106]. Shoshan, A. A. A., & Çelik, G. (2018). Application of TQM in the construction industry of developing countries-case of Turkey. *Anadolu University Journal of Science and Technology A-Applied Sciences and Engineering*, 19(1), 177-191.

- [107]. Singh, S. (2021). Stakeholder management within bim implemented projects in the UK construction industry. [Doctoral thesis, University of Wolverhampton]. <https://wlv.openrepository.com/handle/2436/624052?show=full>
- [108]. Smith, K. D. (2022). Strategies for retaining talented employees during downsizing (Doctoral dissertation, Walden University). https://www.researchgate.net/profile/Kanagi-Kanapathy/publication/315061906_The_impact_of_soft_TQM_and_hard_TQM_on_innovation_performance_The_moderating_effect_of_organisational_culture/links/59967f3b458515017ea82dc8/The-impact-of-soft-TQM-and-hard-TQM-on-innovation-performance-The-moderating-effect-of-organisational-culture.pdf
- [109]. Song, Z., Shi, G., Zhao, B., Zhao, K., & Wang, J. (2020). Study of the stability of tunnel construction based on double-heading advance construction method. *Advances in Mechanical Engineering*, 12(1). <https://doi.org/10.1177/16878140198969>
- [110]. Songling Yang, M. I. (2018). Enterprise Risk Management Practices and Firm Performance, the Mediating Role of Competitive Advantage and the Moderating Role of Financial Literacy. *Journal of Risk and financial Management*, J. Risk Financial Manag. 2018, 11, 35; doi:10.3390/jrfm11030035.
- [111]. Sospeter, N. G., & Chileshe, N. (2021). Risk handling responsibilities in Tanzanian project-based organisations. *Sustainability*, 13(14). <https://doi.org/10.3390/su13148078>
- [112]. Stewart, R. (2021). Transforming how people engage with major projects: The future of infrastructure. AECOM. <https://infrastructure.aecom.com/2020/transforming-how-people-engage-with-major-projects>
- [113]. Sulaiman, N., Ismail, R., Saukani, N., & Lelchumanan, B. (2021). Demand for Skilled Labour in Construction Sector. *Journal of Sustainability Science and Management*, 16(4)
- [114]. Sulhi Khalid. (2021, October 5). ECRL project slightly behind schedule due to MCO — transport minister. The Edge Markets. <https://www.theedgemarkets.com/article/ecrl-project-slightly-behind-schedule-due-mco-%E2%80%94-transport-minister>
- [115]. Susilowati, F., Prawent, H., & Puspitasari, E. (2021). Human resource management patterns in Indonesia's construction companies. *Journal of Applied Engineering Science*, 19(3), 659-666.
- [116]. Tahir, O., Tahir, I., & Shujaat, S. (2019). Effects of risk management practices on project success in the construction industry of Pakistan. *International Journal of Business and Management Study*, 6(2).
- [117]. Tamimi N. & Gershon M. (1995). Tools for assessing industry TQM practices verses the Deming philosophy. *Production and Inventory Management Journal*, <https://www.researchgate.net/publication/267216545>.
- [118]. Taofeeq, D. M., Adeleke, A. Q., & Lee, C. K. (2022). Individual factors influencing contractors' risk attitudes among Malaysian construction industries: the moderating role of government policy. *International Journal of Construction Management*, 22(4), 612-631.
- [119]. The Edge Markets. (2021, May 31). Sustainability and technology go hand in hand. The Edge Markets. <https://www.theedgemarkets.com/content/advertise/sustainability-and-technology-go-hand-in-hand>
- [120]. The Edge Markets. (2021, October 11). Working with covid-19: Ensuring Employee Safety in a Post-Pandemic Era. The Edge Markets. <https://www.theedgemarkets.com/content/advertise/working-covid19-ensuring-employee-safety-postpandemic-era>
- [121]. Tzourmakliotou, D. (2021). Modular disruption in construction industry: The environmental benefits. *Journal of Civil Engineering and Architecture*. <https://doi.org/10.17265/1934-7359/2021.06.004>.
- [122]. Umer Zaman, L. F.-P. (2022). A Stitch in Time Saves Nine Nexus between Critical Delay Factors, Leadership Self-Efficacy, and Transnational Mega Construction Project Success. *Sustainability*, <https://doi.org/10.3390/su14042091>.
- [123]. Upeksha Hansini Madanayake, M. S. (2019). The potential of digital technology to improve construction productivity. *Proceedings of the 35th Annual ARCOM conference*, 416-425.
- [124]. Urbański, M., Haque, A. U., & Oino, I. (2019). The moderating role of risk management in project planning and project success: Evidence from construction businesses of Pakistan and the UK. *Engineering Management in Production and Services*, 11(1), 23-35. <https://doi.org/10.2478/emj-2019-0002>
- [125]. Waite, M. (2020). Sustainability in construction: using lean management. [Unpublished master's thesis]. The University of Wisconsin.
- [126]. Waxman, B. (2021). The Future of Resilient Leadership: MINDSET, ENERGY AND WORK-LIFE INTEGRATION. Odyssey Group Coaching LLC, www.BarbaraWaxman.com.
- [127]. Xiong Zheng, S. M. (2022). As above, so below? The influence of leader humor on bootleg innovation: The mechanism of psychological empowerment and affective trust in leaders. *Frontiers in Psychology*, <https://www.frontiersin.org/articles/10.3389/fpsyg.2022.956782/full>.
- [128]. Yang Yingfei, Z. M.-H. (2022). Green logistics performance and infrastructure on service trade and environment-Measuring firm's performance and service quality. *Journal of King Saud University*, <https://doi.org/10.1016/j.jksus.2021.101683>.
- [129]. Yap, J. B. H., & Tan, S. M. (2021). Investigating rework: insights from the Malaysian construction industry. *ASM Science Journal*, 14.
- [130]. Yu, M., Zhu, F., Yang, X., Wang, L., & Sun, X. (2018). Integrating sustainability into construction engineering projects: Perspective of sustainable project planning. *Sustainability*, 10(3), 784. <https://doi.org/10.3390/su10030784>

- [131]. Zainon, S., Fadhilah Ismai, R., Adzrin Raja Ahmad, R., Mohamad Shafi, R., Najuna Misman, F., Md Nawi, S., & Mohamed Abdul Kadir, J. (2020). Factors of Human Resource Management Practices Affecting Organizational Performance. *International Journal of Organizational Leadership*, 9(4), 184-197.
- [132]. Zhen, F., Cao, J., & Tang, J. (2018). Exploring correlates of passenger satisfaction and service improvement priorities of the Shanghai-Nanjing High Speed Rail. *Journal of Transport and Land Use*, 11(1), 559-573.
- [133]. Zhong, Y., Li, Y., Ding, J., & Liao, Y. (2021). Risk management: Exploring emerging Human Resource issues during the COVID-19 pandemic. *Journal of Risk and Financial Management*, 14(5), 228. <https://doi.org/10.3390/jrfm14050228>
- [134]. Zygiaris, S., Hameed, Z., Alsubaie, M. A., & Rehman, S. U. (2022). Service quality and customer satisfaction in the post pandemic world: A study of Saudi Auto Care Industry. *Frontiers in Psychology*, 13. 10.3389/fpsyg.2022.842141