AN OVERVIEW OF MULTI-CRITERIA DECISION MAKING TECHNIQUES IN CONSTRUCTION PROJECTS CLAIMS MANAGEMENT

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Claims in the construction sector result from, but not limited to, poor contract performance, delays, conflicts and force majeure. The use of Multi-Criteria Decision Making (MCDM) techniques are proposed in construction-related decision-making and prove advantageous in ensuring that claims management processes are effective. This paper provides an overview of existing MCDM techniques proposed for construction claims management. A narrative literature review is performed where Google Scholar and EBSCO host are used to identify relevant articles for the study and 49 articles were selected. From literature, some of the proposed techniques in construction claims management are AHP, ANN, NN, MAUT, SWOT, TOPSIS and VIKOR. Findings from the study indicate that the outdated nature of traditional standalone MCDM techniques has seen the use of hybridised models in construction-related decision-making more useful. Supplementing MCDM techniques with techniques such as BIM is rather relevant since BIM alone has the potential to reduce claims emerging from large construction projects.

Keywords: Effectiveness, Hybridized, Conflict, Resolution

1 INTRODUCTION

Claims are commonplace in the construction sector (Mashwama et al. 2021). They result from poor contract performance (Batarliené and Meleniakas 2021) and occur between various contracting parties such as project owner, contractor and designer (El-Sayegh et al. 2020). Causes of claims include incorrect design/specifications, unusually severe weather conditions, change orders, and extra work (ibid). According to Araya (2019), some claims result from conflicts. Conflicts disrupt workflow resulting in additional costs, delays, and other impacts that lead to construction-related claims (Ali et al. 2020, Tshidavhu and Khatleli 2020). Claims administration need to be effective and efficient throughout a project’s life cycle to prevent disputes, arbitration and litigation (Faraji et al. 2021, Grant 2021). It is imperative that the usefulness and the weaknesses of the current MCDM techniques used in claims management processes be identified and understood.

2 LITERATURE REVIEW

Claims management exists as a mechanism for resolving, mitigating, minimising, specifying and regulating processes meant to track, expedite and resolve claims resulting from construction contracts (Barakat et al. 2018). It exists to ensure that claims are avoided by a thorough oversite of all contract documents, design plans, and an ongoing awareness of the project’s adjusted contract price and schedule (Grant 2021). Araya (2019) opined the importance of claims management by stakeholders and how imperative it is to clearly understand the information used
for construction claims resolution. The claims continuum model developed by Moore for example, indicates how some claims emerge from conflicts that are not managed (Fenn et al. 1997). Many MCDM techniques are proposed and discussed in literature regarding dispute resolution with little focus on claims. In line with the aim of this paper, which seeks to identify and understand the feasibility of MCDM techniques in claims administration, the next section discusses BIM as an integral part of claims management and the various MCDM techniques proposed in resolving claims.

2.1 Building Information Modelling (BIM)

BIM is an innovative technology that has contributed to the immense transformation of traditional information management processes (Tan et al. 2021). BIM provides digital representations of buildings and facilities’ physical and functional aspects, provides shared knowledge for all stakeholders involved in a project, and facilitates collaboration during the different lifecycle stages of a construction project (Araya 2019). Studies suggest importance of BIM (Tan et al. 2021, Chen et al. 2021). Accordingly, it is stated that the development of a BIM-based claims management system is an area that remains significantly under-researched (Charehzehi et al. 2017, Shahhosseini and Hajarolasvadi 2021). This leads to the next section which gives an overview of the MCDM techniques regarding claims administration.

2.2 MCDM Techniques

MCDM techniques are applied in various aspects of construction. One key area is in the resolution of sustainability problems (Siksnelyte et al. 2018). Most researchers tend to focus and emphasise robust hybridised MCDM techniques that combine two or more MCDM techniques to address decision-making problems (Goswami et al. 2020), and this is due to the outdated nature of applying standalone traditional MCDM techniques (ibid).

2.2.1 Analytical hierarchy process (AHP)

The AHP established by Saaty (1980) is a robust MCDM approach that has played an immense role in MCDM development. AHP leverages pairwise comparison to determine the priority scales of complex criteria and constraints based on linear algebra (Tan et al. 2021). Cakmak and Cakmak (2013) state that AHP helps decision makers prioritise and select the best alternative approaches when both quantitative and qualitative aspects are considered. AHP has been applied in claims management within construction engineering management (Elsayegh and El-adaway 2021, Parikh et al. 2019; Patel and Jha 2017). Compared to other MCDMs, AHP is versatile, can check inconsistencies and has intuitive appeal among decision-makers (Kumar and Tiwari 2021). However, AHP possess significant benefits for small claims litigants (Charkoudian et al. 2019).

2.2.2 Artificial neural network (ANN)

ANN has recently gained considerable application in construction engineering and management (Waziri et al. 2017). Chaphalkar and Sandbhor (2015) confirm its cost-effectiveness, usefulness in forecasting the outcomes of construction disputes and claims as per the differing characteristics of different cases and the corresponding court decisions. Waziri et al. (2017) argued that the applications of ANN proved successful in the following areas; cost prediction, optimisation and scheduling, risk assessment, claims and dispute resolution outcomes, and decision making.
2.2.3 **Neural network (NN)**

NN technique uses a learning algorithm that generates “functional relationships” between inputs and outputs based on historical data. The model is first trained using past cases so it can make future predictions (Chaphalkar and Sandbhore 2015). During the training processes, historical input data such as conditions of a contract, critical project execution dates, causes of claims, claimed amount, entitlement costs, claimant’s dispute, respondent’s defence, and the grounds according to the judgement is required by the arbitrator (ibid). The model’s output is the final decision, which can either partially award, fully award, or rejects the claim. NN’s predicted output values have a slight error of 1 percent (Arditi and Pulket 2008).

2.2.4 **Multi-attribute utility theory (MAUT)**

MAUT is a decision support system for selecting appropriate procurement methods for construction projects in the Gaza Strip (El Sawalhi and El Agha 2017). AHP and MAUT hybridisation was adopted by Charehzehi *et al.* (2017) to identify causes of conflict in the Malaysian construction industry. Studies that discuss MAUT in the construction sector deal more specifically with disputes (Awwad *et al.* 2016, Jagannathan and Delhi 2019) and, as a result, its tangible application in claims is yet to be explored.

2.2.5 **SWOT analyses**

SWOT is a technique that provides a means of identifying strengths and opportunities to ensure they are maximised, whilst identifying weaknesses and threats with efforts to minimise these (Shahabi *et al.* 2018). SWOT analysis gives organisations the ability to avoid threats whilst taking advantage of opportunities (Khan 2018). Görener *et al.* (2012) suggested using a hybridized SWOT-AHP technique that patronises the functionality of SWOT and AHP both to quantify and measure the importance of SWOT analysis factors, however, it is important to note that SWOT-AHP has not been used in claims management.

2.2.6 **TOPsis**

The integration of fuzzy comprehensive evaluation (FCE) and TOPSIS was proposed by Gebrehiwet and Luo (2019) to evaluate schedule delays that contribute to the escalation of claims in various projects. TOPSIS proved helpful in prioritising the most critical factors affecting claims, while the FCE aided in weighting the different criteria. Integrated fuzzy AHP and fuzzy TOPSIS soft computing method applied by Taylan *et al.* (2014) proved feasible in determining the critical risk factors of construction projects at King Abdulaziz University (KAU).

2.2.7 **VIKOR**

Fuzzy VIKOR has been argued to address the issue of the selection of competent contractors to avoid increasing claims (Vardin *et al.* 2021). VIKOR can obtain a feasible solution that has a tight correlation with the ideal solution (Fei *et al.* 2019). The technique is used to identify contract readability risk factors (Koc and Gurgun 2021).

3 **RESEARCH METHODOLOGY**

The methodology for the paper is a narrative review. Evidence for the synthesis is provided as per the process suggested by Lee *et al.* (2016). The first step taken is in framing the research question, ‘which methods exist for the effective management of claims?’ The question forms the
basis for the systematic literature review. Search phrases such as ‘construction claims resolution’ ‘claims resolution methods’ ‘claims in construction’ were operationalised in Google Scholar and EbscoHost. As suggested by Joshi and Pimplikar (2021), an extensive literature search was performed. Relevant articles were identified and selected. Additional search results that were specific to construction claims were yielded when ‘disputes’ was added to the search phrases. The reason is that claims and disputes are treated as “hand-in-glove” themes. The articles are restricted to those discussing claims in the construction sector and has proposed MCDM techniques for addressing the different claims. The articles are examined for relevance to the research question. Evidence from the selected articles is extracted and summarised.

4 RESULTS AND DISCUSSION
Claims is endemic to the construction sector (El-Sayegh et al. 2020, Mashwama et al. 2021), there is the need to address the problem before it evolves into dispute. Predictability models in the form of MCDM techniques supplemented with BIM could prove useful in effective claims management. BIM alone harnesses the capabilities of ensuring robustly managed claims by early identification and visualisation of claims (Jalal et al. 2020), and early execution of resolution strategies (Jobim et al. 2018) to prevent their escalation into disputes. Since some claims emerge from conflicts (Araya 2019), it is fitting for early identification of their causes using MCDM techniques. MAUT is useful in the identification of causes of conflict (Charchzehi et al. 2017). Proposed MCDM techniques in claims resolution practices include TOPSIS, it evaluates scheduled delays (Gebrehiwet and Luo 2019), and identification of claim causes emerging from force majeure (Nodehi 2018). The selection of competent contractors through the application of VIKOR method has also proven useful in averting potential claims (Vardin et al. 2021) and also contractual defects (Jagannathan and Delhi 2020). Siksnelyte et al. (2018) opine that integrating two or more techniques help address the shortcomings of using standalone MCDM techniques therefore minimising possible flaws. Hybridized SWOT-AHP is strongly suggested as promising model to be used in management processes (Görener et al. 2012) however, its usefulness in the management of claims still needs to be interrogated. NN was found to have predictive strength abilities with inherent weaknesses of heavy reliance on historical data. Regarding predicting claims, ANN possesses promising practical utility in preventing claim escalations (Fatima et al. 2017). The hybridised PSO-ANN had a high success rate in predicting claim causes, therefore avoiding labour productivity claims (El-Gohary et al. 2017).

5 CONCLUSION
Many scholars argue the prevalence of claims in construction. The inadequate management or resolution can cause its escalation into undesirable disputes. Since claims are unpleasant and resource-consuming, they can be expensive. Prevention is widely suggested for adequately resolving conflict-causing claims. Scholars have proposed applying various MCDM techniques to be used in construction claims management and prevention from further escalation. This paper mentioned ANN, AHP, NN, MAUT, SWOT, TOPSIS and VIKOR MCDM techniques. The use of hybridised MCDM techniques seems more useful than the use of standalone MCDM techniques. More so, their supplementation with BIM could enhance the MCDM functionality for early identification and visualisation of claims.
References
Awwad, R., Barakat, B., and Menassa, C., Understanding Dispute Resolution in the Middle East Region from Perspectives of Different Stakeholders, Journal of Management in Engineering, 32(6), 05016019, 2016.


