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INCORPORATING DIGITAL TECHNOLOGIES FOR ALTERNATIVE DISPUTE RESOLUTION IN THE SRI LANKAN CONSTRUCTION INDUSTRY

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ABSTRACT

The Construction Industry (CI) faces disputes that cause several negative impacts such as project delays and cost overruns. Alternative Dispute Resolution (ADR) methods are often recommended in resolving disputes due to their time and cost efficiency. However, with the technological advancements of the CI, it is necessary to incorporate Digital Technologies (DT) for effective dispute resolution. Thus, the study aims to explore the applications of DT in ADR in the CI to address the challenges in the Sri Lankan context. The research aim was accomplished through a quantitative approach by conducting a questionnaire survey with the participation of 37 respondents. Collected data was analysed through descriptive analysis. The findings identified three major causes of construction disputes in the Sri Lankan context contract-related factors, financial and economic factors, and task factors. Further, negotiation was found the most commonly used ADR method in Sri Lanka followed by arbitration and adjudication. Findings indicated that DT such as MS Office Packages, Virtual Online Dispute Resolution (ODR), Building Information Modelling (BIM), and Artificial Intelligence (AI) have high levels of effectiveness in enhancing ADR processes. BIM and Virtual ODR were highly valued for their ability to facilitate visualisation and remote dispute resolution respectively. The study suggests that DT applications can significantly improve ADR processes, enhancing efficiency and decision-making in dispute resolution, and calls for further research on global applicability and ethical implications.

Keywords: *Alternative Dispute Resolution; Construction Industry; Digital Technologies; Disputes; Sri Lanka.*

1. INTRODUCTION

Disputes are inevitable among construction stakeholders due to behavioural, contractual, and technical disagreements (Cakmak & Cakmak, 2013; Patil et al., 2019). These disputes are not only resource-intensive but also hostile and costly (Senarath & Francis, 2021). The surge in disputes leads to project delays, cost overruns, rework, potential legal cases,

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strained relationships, and reputation damages (El-Sayegh et al., 2020). For example, Love et al. (2010) reported that dispute costs range from 0.5% to 5% of the contract value, depending on the resolution method. Moreover, failure to manage disputes effectively will result in industrial collapses and ultimately affect the national economy (Broto & Nugraheni, 2023). Thus, it is crucial to promptly address the conflicts to prevent them from escalating into disputes, as disputes significantly hinder the successful completion of construction projects within the expected time, budget, and quality (Soni et al., 2017).

Considering the current competitive landscape in the CI, it is essential to minimise the potential for disputes and establish effective mechanisms for dispute mitigation (Senarath & Francis, 2021). ADR methods are widely acknowledged as fast and cost-effective methods for resolving disputes in out-of-court settlements (Mashwama et al., 2016; Ustuner & Tas, 2019). These ADR methods include facilitation, negotiation, conciliation, mediation, adjudication, arbitration, and hybrid models like mediation-arbitration. In the Sri Lankan CI, negotiation, mediation, dispute adjudication board and arbitration are extensively employed as ADR methods (Abeynayake & Weddikkara, 2013; Lingasabesan & Abenayake, 2022; Nitharsan & Francis, 2022). The effective implementation of ADR is crucial for alleviating the workload of the judicial system, improving the efficiency and affordability of resolving disputes, and fostering continued positive relationships between the parties involved (Illankoon et al., 2022). Saygili et al. (2022) and Vo et al. (2020) suggested that the CI has experienced significant advancements in technology, which require further research in incorporating DT in ADR. Further, Utama (2017) highlighted the global movement towards DT in resolving disputes. It offers a lower-cost, efficient, and innovative solution for cross-border disputes, transforming traditional dispute resolution methods into more innovative and technological approaches (Abbasli, 2022).

However, compared to the global initiatives Sri Lankan CI is far behind in implementing DT in ADR (Lingasabesan & Abenayake, 2022). Accordingly, this study aims to explore the applications of DT in ADR in the CI to address the challenges in the Sri Lankan context. Thus, the study objectivates to explore the causes of disputes in CI' and issues of ADR methods in SL and DT that are applicable for dispute resolution.

2. LITERATURE REVIEW

2.1 CAUSES OF CONSTRUCTION DISPUTES

Various researchers have categorised the causes of disputes in several ways. Cakmak and Cakmak (2013) categorised disputes based on responsible parties, such as contract-related, project-related, contractor-related, client-related, human behaviour-related, design-related, financial, and economic-related, material labour and equipment-related and external. Contrarily, Cheung and Pang (2013) identified three main factors contributing to construction disputes: contract incompleteness, people, and tasks. Further, they mainly categorised the disputes into process (pre-construction and construction) and project (external and internal). Table 1 illustrates the causes of disputes in the CI.

Table 1: Causes of disputes in Sri Lanka

Cause	Description	Reference
Task factors	Collaborative conflict, Risk and uncertainty	[1], [2]
Contract related	Ambiguity, Deficiency, Inconsistency, Defectiveness	[3]
Client related	Variations, Accelerations, Scope creep,	[4], [5],
Contractor related	Ambiguities, Mistakes, Vague specifications,	[6], [7]
Design related	Design errors, Poor designs, Incomplete specifications	[8], [91]
Human behaviour related	Misunderstandings, Lack of team spirit and Communication, Slow decision-making,	[1], [4], [5]
Financial and economic related	Changes to the payment date, Underestimation, Mismanagement of funds	[10]], [11]
Material, labour and equipment	Poor quality, Shortage and price fluctuations of materials plant and labour,	[12], [13], [14]
External factors	Uncertain incidents, Rework, Unrealistic expectations	[15], [16],

[1] (Cheung & Pang, 2013); [2] (Tanriverdi et al., 2021); [3] (Edirisinghe et al., 2020); [4] (Vo et al., 2020); [5] (Shash & Habash, 2021); [6] (Woodley, 2019); [7] (Mishmish & El-Sayegh, 2018); [8] (Stamatiou et al., 2019); [9] (Soni et al., 2017); [10] (Rauzana, 2016); [11] (Çakmak, 2016); [12] (Apte & Pathak, 2016); [13] (Edirisinghe et al., 2020); [14] (Equbal et al., 2017); [15] (Francis et al., 2017); [16] (Zhao, 2019)

Disputes related to task factors often arise from collaborative conflicts, where disagreements among team members on project execution methods occur (Cheung & Pang, 2013). Additionally, the risks and uncertainties inherent to the construction projects lead to conflicts. Ambiguities, deficiencies, inconsistencies, and defects in the contract documents lead to misunderstandings and eventually become disputes (Edirisinghe et al., 2020). Further, construction disputes are often caused by external factors such as adverse weather conditions, social unrest, and pandemics such as COVID-19 etc.

2.2 ALTERNATIVE DISPUTE RESOLUTION METHODS IN THE SRI LANKAN CONSTRUCTION INDUSTRY

ADR methods are affordable, time-efficient, and less adversarial, making them more accessible than traditional litigation (Ness, 2020). ADR methods help avoid project delays, preserve business relationships, and offer flexibility by allowing customised solutions that cater to specific needs (Shyamal, 2016). Negotiation is a universal dispute resolution method that allows parties to settle differences voluntarily without neutral influence (Viththakan, 2016). Arbitration is a fast, cost-efficient, and final decision-making approach for resolving construction disputes, with the Arbitration Act of Sri Lanka No. 11 of 1995 providing a legislative framework (Nihaaj, 2016). Mediation is a formalised yet flexible negotiation style, facilitated by an unbiased third-party advisor (Goski, 2021). Over 70% of parties actively pursue resolution, offering reduced time and costs, a more satisfactory outcome, and reduced further disputes. Online mediation and case law analysis may be a better alternative than traditional adjudicative procedures for complex disputes (Hardjomuljadi, 2020). The med-arb method combines elements of mediation and arbitration, aiming to resolve conflicts promptly and legally enforceable by establishing a neutral entity at the beginning of the project (Shyamal, 2016). Conciliation involves parties working with an impartial third party to address problems and reach a mutually acceptable conclusion (Palihawadana, 2020). Adjudication refers to

disputes to a neutral third party for a binding decision until the dispute is resolved by arbitration or litigation (Palihawadana, 2020). Mini trial is a voluntary, non-binding procedure that treats disputes as business problems (Ustuner & Tas, 2019). The Dispute Review Board (DRB) is a proactive project management technique that anticipates and resolves disputes throughout the project, offering more reliable and appropriate solutions than litigation and other alternatives (Gulati, 2022). However, implementation of ADR methods in Sri Lankan CI is challenging. Researchers highlighted a lack of skilled practitioners, less awareness, and a non-legally binding nature as the major challenges to the successful practice of ADR (Shyamal, 2016). Table 2 extensively discusses the challenges faced by each ADR method.

Table 2: Challenges and limitations of ADR methods in Sri Lanka

ADR Method	Challenges and Limitations	References
Negotiation	Parties not compelled to use, Not legally binding, Need for skilled negotiators, Lack of neutral involvement	(Shyamal, 2016; Viththakan, 2016)
Adjudication	Necessitates thorough analysis of historical aspects Absence of legal ascent to enforce an adjudicator's decision, Comprehensive protocol	(Jayasinghe & Ramachandra, 2016)
Arbitration	Difficulty in scheduling hearings and finding arbitrators on a full-time and daily basis, lack of other venues outside Colombo, The Arbitration Act No. 11, 1995 does not specify a time limit, lack of enforcement,	(Mashwama et al., 2016; Nihaaj, 2016)
Mediation	Non-binding Nature, Dependence on the skill of the Mediator, The rigid contractual frameworks	(Iyiola & Rjoub, 2020)

Firstly, the absence of legal enforcement and the binding nature of the agreement affect negotiation and mediation, which in turn limits the effectiveness of these processes (Faghih & Akhavian, 2019; Lu et al., 2019). Secondly, adjudication and arbitration are hampered by complexity and a lack of awareness (Ranasinghe & Korale, 2011). Adjudication is not well understood by the parties involved whereas arbitration confronts difficulties with procedural nuances and a lack of specified time limits under the relevant legal frameworks. Further, arbitration is plagued by logistical challenges such as difficulties in locating arbitrators and the concentration of proceedings in Colombo, which restrict its accessibility to areas outside the country (Senarathna, 2019). Moreover, arbitration faces the challenges most compared to other ADR methods. These challenges range from procedural complexities to geographic and legal limitations which indicate the urgent need for reforms to improve the efficiency and accessibility of ADR in Sri Lanka. According to Amoah and Nkosazana (2022), implementing a regulatory framework could improve industry participants' understanding of ADR, enhance confidence, and foster a culture of sincere intentions and respect towards mediators. The literature underscores the significance of enhancing construction professionals' understanding of ADR practices to prevent significant litigation cases, emphasising the need for a neutral third party (Saeb et al., 2018).

2.3 APPLICATION OF DIGITAL TECHNOLOGIES IN CONSTRUCTION DISPUTE RESOLUTION

The increase in construction disputes has led to significant advancements in developing more effective methods of resolving disputes within the CI, particularly in ADR (Ahmad & El-Sayegh, 2021). Among them, big data analytics and AI are considered to be the most crucial tools in the CI for resolving disputes and enhancing legal information accessibility (Putera et al., 2021; Wattuhewa et al., 2023). AI has been applied in various fields, including construction and dispute resolution (Ridmika & Thayaparan, 2021). For instance, Game theory, an AI concept, has been used in Intelligent Negotiation Support (INS), which can save time and reduce costs through simplified result presentation and minimum time requirements (Abidoye et al., 2022; Zeleznikow, 2021). Further data mining techniques are used to analyse historical legal cases to identify contract terms and judicial decision patterns related to disputes (Ahmed et al., 2022; Fatima et al., 2014). Text mining is also being used to refine unstructured large-capacity text data, extracting keywords and identifying connected meanings (Fatima et al., 2014). In addition, 'Machine Learning' and 'Artificial Neural Networks' have been used to predict resolutions for disputes, revealing the factors that will affect resolutions and potential prediction models (Ayhan et al., 2022). Nonetheless, smart contracts and Virtual ODR procedures are crucial in digitally reviving contractual legal relationships, monitoring term fulfilment, and automatically triggering execution (Abbasli, 2022; Chaisse & Kirkwood, 2022; Utama, 2017). Blockchain technology and societal digitalisation can also help overcome limitations in SCs. BIM is increasingly recognised for its potential to facilitate construction by standardising legal aspects and providing a digital representation of building elements (Jamil & Fathi, 2020). A dedicated protocol for BIM in dispute resolution could enhance contract systems and stakeholder engagement across project phases. BIM models can visually represent construction processes, facilitating quick recovery of necessary data for effective dispute resolution (Muhammad & Nasir, 2022).

3. RESEARCH METHODOLOGY

This study followed the quantitative research approach to accomplish its objectivity, generalisability, and statistical rigour, enabling measurable insights into the adoption and impact of digital ADR tools across the construction industry. It is highly systematic offering robust and replicable results that can be generalised to broader contexts. Accordingly, as the first step, a thorough literature review was undertaken to understand the origin of disputes, challenges to the implementation of ADR and the use of DT to enhance the efficacy of ADR. Secondly, following the survey research strategy, an online questionnaire survey was conducted. Given the population size of 37 responses were received recording a response rate of 56% and the selected sample encompasses the entire population, ensuring complete representation of dispute resolution of each ADR method. Herein, two distinct sampling techniques were used to draw the sample. Firstly, using the stratified sampling method, three strata were formed from the population of dispute resolution practitioners based on the primary party they serve in a dispute. The three strata were client, contractor, and consultant. Subsequently, the simple random sampling method was applied to select 22 members from each stratum for the sample. Thus, the questionnaire was distributed to the sample of 66 industry practitioners in the form of a Google® Form through emails. Consequently, the findings were analysed using

descriptive analysis and the results were presented through statistical calculations, graphs, and tables. Further, Equation 1 was used to calculate the Relative Important Index (RII).

$$RII = \frac{\Sigma W}{AXN} \qquad (Eq.\ 01)$$

Where;

W= Weight given to each factor by the respondents in a range from 1 to 5

A=Highest weight (5)

N=Total no of respondents

4. RESEARCH FINDINGS AND DISCUSSION

4.1 CAUSES OF CONSTRUCTION DISPUTES IN SRI LANKA

The study identifies and evaluates potential construction disputes through a questionnaire, graded based on their significance in the Sri Lankan CI, and presents the identified causes and their relative importance. Subsequently, RII was calculated using Equation 1 and the causes were ranked based on the RII scores as shown in Figure 1.

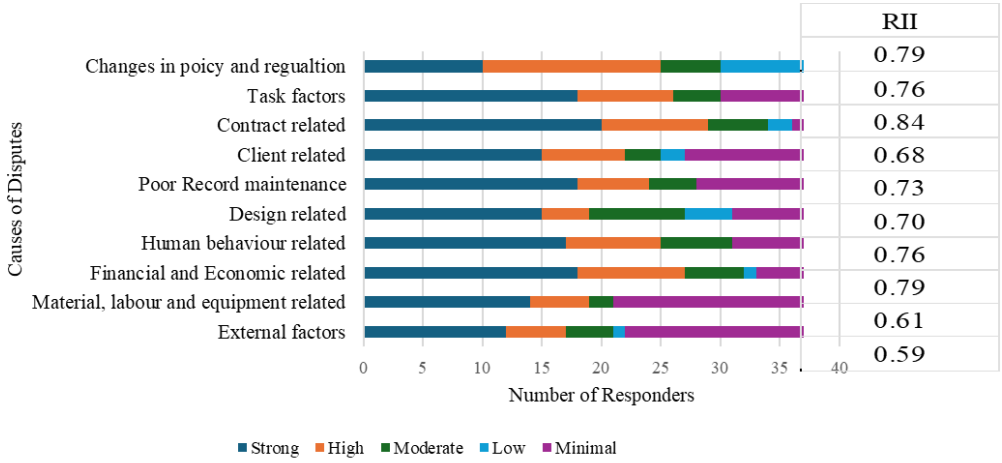

Figure 1: Significance of the causes of disputes in the Sri Lankan CI

The RII scores indicate the degree of significance attributed to each cause of dispute. According to the benchmark study by Holt (2014) having an RII score above 0.6 is an indication of relevance of the studied factors. Accordingly, eight out of the nine studied causes of disputes reported a RII above 0.600, indicating their relevance to the Sri Lankan context. However, the 'external factors' reported an RII value of 0.589 and ranked in ninth place indicating that external factors are not significant in causing construction disputes in Sri Lanka. Further, the results acknowledge 'contract-related' causes as the most significant causes of disputes in the Sri Lankan CI, with the highest RII of 0.843. The 'financial/economic related' causes are ranked in the second place with a RII of 0.795. This highlights the substantial influence of financial management and economic conditions on construction projects. The RII value of 0.762 is shared by both 'task factor' and 'human behaviour-related' causes, placing them in a tie for third place. Disputes concerning the clients have been ranked fifth with a RII of 0.730 whereas the 'design-related' causes hold the sixth position with a RII of 0.697 indicating that design-related causes are vulnerable to disputes but not among the primary concerns. Further, factors to

'human behaviour' and 'material, labour, and equipment' are less significant in terms of causing construction disputes as they are ranked in seventh and eighth places respectively with RII scores of 0.681 and 0.605. However, as Woodley (2019) discussed the design-related issues are subjective considering the procurement roots. Thus, they can still significantly impact a project when they do occur.

4.2 ALTERNATIVE DISPUTE RESOLUTION METHODS IN THE SRI LANKAN CONSTRUCTION INDUSTRY

The next section of the questionnaire focused on the ADR methods practised in the construction industry. Accordingly, respondents were provided with a list of six ADR methods which were identified through the literature review and checked their experience of the practice. Figure 2 shows the results.

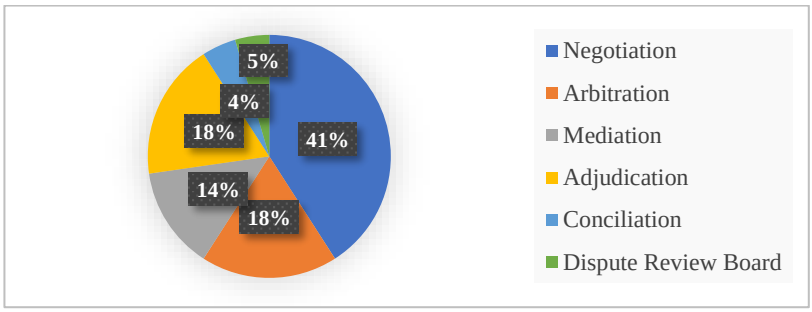

Figure 2: Ranking of ADR methods in the Sri Lankan CI

Accordingly, negotiation is the most used ADR method aligning with global trends that favour negotiation for its flexibility, speed, and less formal nature (Li & Cheung, 2022). This preference is consistent with the cultural inclination in Sri Lanka towards non-confrontational methods of dispute resolution (Viththakan, 2016). On the other end of the spectrum, conciliation and DRB are the least used methods reflecting their suitability in more structured environments such as large-scale construction projects (Liyanawatta et al., 2023). Arbitration and adjudication which are considered formal and costly are equally practised (Jayasinghe & Ramachandra, 2016; Palihawadana, 2020). Mediation reports moderate use due to its ability to preserve business relationships a valued aspect in many cultures (Iyiola & Rjoub, 2020). Sri Lanka's CI lacks innovative ADR methods including Facilitation, Standing Neutral, and Med-Arb due to a lack of awareness and familiarity with these techniques.

4.3 APPLICATION OF DIGITAL TECHNOLOGIES IN CONSTRUCTION DISPUTE RESOLUTION IN SRI LANKA

The last section of the questionnaire focused on using DT in ADR. Accordingly, as the first step, respondents' opinion on the impact of DT in ADR was questioned. Figure 3 illustrates the responses according to a five-point Likert scale.

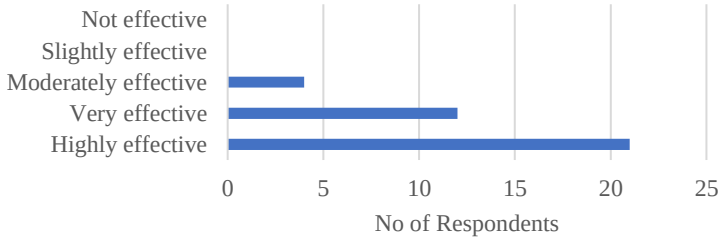

Figure 3: Impact of DT in ADR

The study shows that over 89% of respondents in the Sri Lankan CI highly or very highly endorse the use of DT in ADR, highlighting its effectiveness in improving the efficiency and effectiveness of ADR methods.

Figure 4: Experience in DT in dispute resolution

Results revealed a positive shift towards embracing DT in ADR. However, 43% of the respondents who still have not experienced DT in ADR indicate the potential areas for growth in training and technology adoption. Consequently, the respondents were provided with a list of frequently practising DT in ADR and asked to rate them based on their effectiveness. Subsequently, RII was calculated using Equation 1 and the causes were ranked based on the RII scores as shown in Table 3.

Table 3: Effectiveness of DT in ADR

Digital Technology	Scale					RII	Rank
	1	2	3	4	5		
BIM	5	4	7	7	14	0.714	3
Artificial Intelligence	9	3	5	11	9	0.643	4
Blockchain	6	8	6	9	8	0.627	5
Smart Contract	10	5	7	4	11	0.605	6
Big Data Analytics	15	1	9	5	7	0.535	7
Virtual ODR	0	7	4	7	19	0.805	2
Artificial Neural Networks	16	6	4	4	7	0.492	8
MS Office Packages	1	6	3	5	22	0.822	1

Accordingly, MS Office Packages have the highest RII score among all technologies, with an RII of 0.822, placing in the top rank. Virtual ODR follows in line, with an RII of 0.805, placing it in second place. This demonstrates a solid appreciation for its ability to remotely facilitate the dispute resolution processes. BIM ranks third, with a RII of 0.714.

The CI dramatically benefits from BIM, as it plays a crucial role in visualising and enables effective decision-making. Further, BIM is highly valued in promoting teamwork and its openness in construction conflicts. Artificial Intelligence, with an RII of 0.643, is ranked fourth, signifying its increasing yet unrealised capacity to automate and improve decision-making in construction projects. Blockchain technology ranks fifth, with a RII of 0.627. While the use of blockchain technology in ADR in the CI shows promise in enhancing transparency and trust in transactions, its application is still in the early stages of development. Smart contracts rank sixth with a RII of 0.605. This indicates the relevance of automating contractual obligations and the potential to reduce causes of disputes. However, the application of smart contracts in ADR is still in the early stages in the Sri Lankan context. big data analytics ranks seventh with an RII of 0.535, while artificial neural network implementation in dispute resolution is moderate due to its complexity and large dataset management proficiency.

5. CONCLUSIONS AND RECOMMENDATIONS

The CI faces disputes that cause several negative impacts such as project delays and cost overruns. However, traditional ADR methods struggle with complexity, unavailability of expert mediators, and logistical constraints. Consequently, the evolving nature of the CI necessitates advancements in dispute resolution methods. However, in the Sri Lankan context, in-depth investigations are lacking in incorporating DT into ADR processes to improve accessibility, transparency, and efficiency. Following a quantitative approach, this study conducted a survey involving 37 respondents to fill the research gap. The key findings of the study indicate that DT such as MS Office Packages, Virtual ODR, BIM, and AI have high levels of effectiveness in enhancing ADR processes. BIM and virtual ODR were highly valued for their ability to facilitate visualisation and remote dispute resolution respectively. Moreover, the integration of SC and BC is also highlighted mainly to notify parties about notices and letters. Despite their potential, Big data analytics and artificial neural networks showed lower effectiveness and implementation levels in the Sri Lankan context. Based on these findings the study concludes that there is a significant potential for enhancing ADR processes through targeted DT applications, particularly in improving efficiency and decision-making in dispute resolution. The study has limitations including a small sample size and geographical focus. It is recommended for future researchers to develop strategies to apply DT in ADR to address the unique challenges of the Sri Lankan CI. Furthermore, it is necessary to identify the possible DT for effective implementation of ADR methods considering the disadvantages of each method. This will guarantee the seamless incorporation and optimise the advantageous outcomes. Further research could investigate global applicability, longitudinal studies, and legal and ethical implications of DT in ADR.

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