Identifying critical dispute causes in the construction industry: A cross-regional comparative study between China and UK

Jinpeng Wang[1], Shang Zhang[2], Ruoyu Jin[3], Peter Fenn[4], Dongwen Yu[5], Lilin Zhao[6]

1: Ph.D. Candidate, School of Mechanical, Aerospace, and Civil Engineering, University of Manchester, U.K. Email: Jinpeng.wang@manchester.ac.uk.

2: Associate Professor and Head, Department of Construction Management, Suzhou University of Science and Technology, Suzhou, China. Email: zhangshfan@163.com. Corresponding author.

3: Associate professor, School of Built Environment and Architecture, London South Bank University, U.K. Email: jinr@lsbu.ac.uk.

4. Reader, School of Mechanical, Aerospace and Civil Engineering, University of Manchester, U.K. Email: Peter.fenn@manchester.ac.uk.

5. Ph.D. Candidate, School of Mechanical, Aerospace, and Civil Engineering, University of Manchester, U.K. Email: dongwen.yu@postgrad.manchester.ac.uk.

6. Ph.D. Candidate, School of Architecture, Civil and Building Engineering, Loughborough University, Loughborough, Leicestershire, LE11 3TU, United Kingdom. Email: L.Zhao3@lboro.ac.uk.

Abstract: Construction disputes have long been identified as epidemics in the construction industry worldwide, which has become a more serious problem due to the impact of the Covid-19 pandemic. Previous studies on the dispute causes have primarily focused on country or region-specific contexts, and hence the results cannot be generalized in solving this chronic problem in a broader construction project worldwide. This study aims to explore and evaluate the critical dispute causes in construction projects through a comparative study between China and U.K. A total of thirty-three common dispute causes were identified through a comprehensive literature review and further consolidated by pilot surveys in the two countries. An online questionnaire survey was administered among the construction professionals in China and U.K., with 170 valid responses returned for data analysis. Principal component factor analysis, mean score ranking approach, quartile analysis, and Mann-Whitney *U* test were employed to identify the most critical dispute causes. Similarities and differences were mapped between the two countries. It was found

that the five most critical categories of dispute causes in the two territories are: *delay-related problems*, *lack of communication*, *contractual problems*, *site conditions*, and *design problems*. The importance of *variation in quantities*, *breach of contract*, *misinterpretation of contractual terms and conditions*, and *poor contract management* was perceived significantly differently by the respondents in China and U.K., whereas *design defects* and *failure to make compensation for additional work* were the most critical common dispute causes in both countries. The research provides important findings for both academics and practitioners to holistically understand the similarities and differences of dispute causes in China and U.K., and aids preventing disputes more effectively in the global construction industry.

Keywords: Dispute causes; Comparative study; Construction project; China; U.K.

Introduction

The growing scale and complexity of construction projects make disputes among parties unavoidable (Seo et al., 2021), leading to costly and time-consuming settlements (Lee et al., 2021). Disputes originate from claims when the assertion of a party's right is neglected or rejected by the other party (Viswanathan et al., 2020), which may arise from increasing uncertainties, incomplete contract systems, opportunistic behaviour, and distrust (Assaf et al., 2019; Cheung and Pang, 2013; Lu et al., 2016). Although claim, conflict, and dispute have co-existed in the construction management literature, it is considered that conflict emerges when there is an irreconcilable disagreement between the parties, while a dispute is associated with distinct justiciable issues and requires third party interventions (Barman and Charoenngam, 2017). Construction disputes have long been identified as epidemics in the construction industry worldwide (Chan and Suen, 2005). The global average value of construction disputes has increased significantly from $30.7 million in 2019 to $54.26 million in 2020 (Arcadis, 2021). The high volume of disputes has a devastating impact on the construction industry, including unceasing delays, bankruptcy, and detrimental relationships among project participants (El-Sayegh et al., 2020). These consequences may further lead to adverse social and economic effects (Zhu and Cheung, 2020).

To manage construction disputes, voluminous literature has focused on dispute prevention strategies and resolution mechanisms (Abdul-Malak and Senan, 2020; Cheung et al., 2020). These

include the evaluation of mediating tactics (Qu and Cheung, 2013); the alignment of dispute review boards in standard forms of contracts (Murphy et al., 2014); the investigation of core reasons for disputes escalation to litigation (Barman and Charoenngam, 2017); the operational mechanisms and factors for effective adjudication (Abdul-Malak and Senan, 2020); and the examination of the practices of reactive devaluation in construction dispute negotiation (Cheung et al., 2020). Due to the Covid-19 pandemic, significantly more projects have been under the unprecedented and severe influence of delivery delay, labour shortage and financing difficulty (Baral et al., 2022; Jeon et al., 2022), which have resulted in a considerable increase of disputes in the construction industry globally (Salami et al., 2021). It is commonly accepted that prevention is better than cure, hence dispute avoidance is preferred as one of the best ways to manage disputes (Zhu and Cheung, 2020). In this regard, it is necessary to identify the critical dispute causes so that more targeted prevention strategies can be implemented for effective construction dispute management.

Despite a significant amount of research has been conducted on finding better ways of managing construction disputes, many tend to focus on dispute resolution from a reactive perspective, rather than proactively preventing disputes with effective strategies (Naji et al., 2020). Moreover, the majority of existing studies addressing dispute management are undertaken in a single-country context, there still lacks a cross-national comparative study on identifying critical dispute causes and exploring their similarities and differences. For instance, El-Sayegh et al. (2020) identified the major dispute causes in the United Arab Emirates (UAE) construction industry. One of the critical problems is that these results were obtained using different measurement tools or instruments, and in turn it is not able to compare the importance of different causes leading to disputes in different regional contexts. In contrast, a cross-regional comparative study is important because the results will reveal the underlying causes for disputes in a broader context, and the results can be generalized to settle this chronic problem in a wider construction project population. Considering the huge volume of international construction market worldwide, this is particularly important for international construction projects where the parties involved have different backgrounds. For instance, the total international contracting revenue for the Top 250 Contractors was $420.4 billion in 2020 (ENR, 2021). As another example, since 2013, the Beijing Construction Engineering Group International Company

(BCEGI) has become a construction partner of the Manchester Airport urban development project with a contract value of £1 billion, who was the first Chinese contractor being involved in major U.K. infrastructure project in the form of equity investment (Beijing Construction Engineering Group, 2021).

To fill this knowledge gap, China and U.K. were used as cases for empirical study to identify and assess significant dispute causes in construction projects through comparative analyses. Cross-national comparative studies have been widely conducted in the field of construction management (e.g., Chan et al., 2012; Osei-Kyei et al., 2019), which can facilitate achieving deeper understanding by suggesting novel perspectives (Gharawi et al., 2009). Identifying the critical dispute causes and understanding their differences and similarities in cross-national construction industries provides an enhanced and broader view on the dispute causes, which facilitates enhancing dispute management for construction projects in cross-regional contexts. Hence, it is valuable to conduct comparative studies to create new knowledge in dispute management domain and provide holistic insights for practitioners in managing disputes in multicultural construction projects.

China and U.K. are selected for the comparative study based on the facts that: (1) China is a developing country which has witnessed a rapid development of the construction industry in recent decades. The unprecedented development of the Chinese construction industry has resulted in the immaturity of the construction market and the insufficiency of qualified project managers (Ye et al., 2015). As a result, many construction projects struggled in handling disputes (Xu and Cheung, 2016). Dissimilar to China, U.K. has a more developed construction market in terms of dispute resolution as evidenced by existing legislation and standards. The comparative study between China and U.K. can therefore provide more robust results to reveal the underlying causes for dispute occurrence. (2) The establishment of bilateral agreements between China and U.K. (e.g., Belt and Road Initiative) has fostered greater economic cooperation and professional mobility between the two countries (Perera et al., 2016), resulting in an increasing number of Chinese construction firms operating in the U.K. (Wang et al., 2016a). Hence, a comparative study is required to help achieve better understandings of how different practices of construction projects affect the occurrence of disputes in both countries. In summary, the research will not only expand the knowledge on construction dispute causes and

construction practices in China and U.K., but also contribute to proactive dispute management in multi-national construction projects with the involvement of the Chinese and U.K. practitioners. The objectives of this paper are: (1) to identify the critical dispute causes in the Chinese and U.K. construction industries. (2) to compare the similarities and differences of the perceptions on the importance of dispute causes among the professionals in China and U.K.

Literature Review

Background Information of China and U.K.

China is a major developing country in the world, which has benefited significantly from the booming construction industry. The added value of the construction industry accounted for 7.01% of the gross domestic product (GDP) in 2021, indicating that it remains a pillar industry of the national economy (China Construction Industry Association, 2022). The rapid growth of the construction industry calls for a more mature and complete legal environment, which otherwise would cause project uncertainties, opportunistic behaviour, and excessive administrative procedures (Ye et al., 2015; Zhang et al., 2019). The U.K. is a typical developed country with a more matured construction industry market and legal system. The U.K. construction industry contributed 6% of GDP in 2018 (Office for National Statistics, 2019). It can be seen that the construction industries in China and U.K. have contributed significantly to their national economies, but they are facing similar challenges of labour and material shortages, poor productivity, and uncertain investment risks (CITB, 2021; Ye et al., 2015). However, they have major differences in terms of construction management practices, legal systems, and cultural backgrounds. For instance, maintaining good relationships with key stakeholders such as the government, clients, and suppliers is an important strategy for contractors working in China (Liu et al., 2017). Despite the Chinese construction industry has been gradually shifting from cooperative relationships to formal contracts, the Chinese practitioners tend to operate in the collectivistic and relational manner within a formal contractual setting (Lord et al., 2010). Dissimilar to the civil law system in China, U.K. adopted a common law system, which emphasizes a Western epistemology grounded in the notions of rationality, scientific thinking, and truth (Jordan, 1997). In addition, the

U.K. is one of the most individualistic countries in the Western world which is influenced by both the religious reformation and the industrial revolution (Liu et al., 2021). As a result, practitioners in the U.K. construction industry emphasize fairness to secure their interest and tend to take contractual approaches to protect their rights (Lord et al., 2010). These similarities and differences may have influences on the causes of dispute and dispute management in construction projects.

Construction dispute management

Existing studies on construction dispute management can be drawn from two perspectives, namely dispute prevention from a proactive perspective and dispute resolution in a reactive manner. From the reactive view, research tends to focus on the settlement or remediation measures after the occurrence of a dispute. For example, the American Arbitration Association (AAA) manual (2013) suggested a wide range of early intervention and resolution methods (e.g., mediation, arbitration) to minimize and avoid lengthy litigation. Li and Cheung (2020) found that successful alleviation of the impact bias can save time for dispute settlement. Zhang et al. (2021) investigated how contract enforcement affects construction dispute resolution satisfaction of claimants, and they recommended reactive contractual governance for dispute settlement. In contrast, the proactive view tends to seek avoidance strategies before the occurrence of disputes, which focuses on the evaluation of pathogenic influences of dispute causation and the prediction of disputes (Love et al., 2010; Zhu and Cheung, 2020). For instance, Viswanathan et al. (2020) developed a dispute causal model through interpretive structural modelling, which demonstrates six-level hierarchical relationships among identified dispute causes. Ayhan et al. (2021) utilized machine learning techniques to predict the occurrence of construction disputes, which forms part of the early-warning mechanism for construction decision-makers. Wang et al. (2021) developed a Bayesian belief network predictive model for the avoidance of delay disputes in the U.K. construction industry and suggested that more emphasis should be placed on the managerial aspect of construction project management.

Construction dispute causes

The causes of disputes have been extensively analyzed in existing literature. These research revealed various common causes or factors leading to disputes in the construction industry (Love et al., 2010). For instance, Chan and Suen (2005) found three main categories of factors resulting in disputes, including contractual matters, cultural matters, and legal matters, in international construction projects in China. The classification was similar to the findings of Cheung and Pang (2013), who proposed other three causes of disputes: task factor, people factor, and contract incompleteness. Similarly, Kumaraswamy (1997) identified eleven root causes and eighteen proximate causes based on the investigation of 61 projects in Hong Kong. El-Sayegh et al. (2020) identified twenty-seven sources of disputes, and they found the top five causes of disputes in the UAE are variations, material change, late approval from the government, delayed decision making, and inadequate time for design. However, these research results were generated in a single region or country. Based on these findings, thirty dispute causes under nine dispute categories were identified as shown in Table 1.

<Place Table 1 here>

Research Methodology

Overall research framework

In order to achieve the research objectives, a questionnaire survey method was employed which was followed by factor analysis, mean score analysis, quartile analysis, and Mann-Whitney *U* test (Figure 1).

<Place Figure 1 here>

Pilot study and questionnaire survey

As shown in Table 1, a total of thirty dispute causes were preliminarily identified from existing literature, which is the basis for the design of the questionnaire. A pilot survey was conducted with seven professionals who have at least ten years of working experience in the construction industry. Among them, five interviewees were from China and the other two were from the U.K. Based on the

pilot study results, the questionnaire was refined by correcting the vagueness of some construction terminologies. In addition, three additional causes were suggested and included in the survey, i.e., the *lack of communication between main contractor and subcontractor; failure to make payment due to the discrepancy of parties' satisfaction to construction deliverables;* and *bid rigging*.

The questionnaire included two sections. In the first section, the respondents were asked to provide their professional backgrounds, including their working experience, type of organizations they worked for, and position. The second section requests the participants to evaluate the significance of the thirty-three variables, using the Likert seven-point scale (1 = strongly disagree, 2 = disagree, 3 = slightly disagree, 4 = neutral, 5 = slightly agree, 6 = agree, 7 = strongly agree). Given that many of the respondents from China were not familiar with the English language, the survey questions were translated to Chinese. One academic who is familiar with both languages and construction disputes was invited to double-check the translation to guarantee the quality of communication.

Data collection

A purposive sampling technique with three pre-defined criteria was employed to ensure the high quality of the data collection processes. The criteria included: (1) they must have at least one year's working experience in the construction industry (adapted from Liang et al., 2021; Osei-Kyei et al., 2019). (2) the participants are construction professionals who have experience in the management of disputes in China or the U.K. (3) they must have professional qualifications and should be working for major construction enterprises.

In China, a total of 200 questionnaires were distributed to the potential respondents via email, post or face-to-face approaches in Jiangsu and Shanghai. The area was selected as the target area for investigation mainly because of the excellent networking between the research team and the industry, which can facilitate obtaining high quality of empirical data. This technique has been frequently employed in the construction management research domain. A total of 67 valid questionnaires were returned, indicating a response rate of 33.5%. In the U.K., 200 questionnaires were sent to targeted respondents by LinkedIn or emails. A total of 103 valid respondents were received, representing a

response rate of 51.5%. It is noted that the response rate from the U.K. is higher than that in China. This may be because LinkedIn serves as a reliable tool to refine target samples and it provides convenience in making contacts (Wang et al., 2021). The sample size and response rate were considered satisfactory and adequate for further analysis when compared with similar comparative studies in the construction management field (El-Sayegh et al., 2020; Osei-Kyei et al., 2019). Participants' demographic information from the two countries is presented in Table 2. Approximately 49% and 64% of respondents from China and U.K. have more than 6 years of experience in the construction industry respectively, indicating that most of the respondents are experienced construction practitioners.

<Place Table 2 here>

Tools for data analysis

Data analysis was conducted by using IBM Statistical Package for Social Science 25 (SPSS). This study employed six common statistical analysis techniques to analyse the data, namely the Cronbach's alpha reliability test, factor analysis, mean score ranking method, Kendall's concordance analysis, quartile analysis, and Mann-Whitney *U* test.

The Cronbach's alpha reliability test was conducted to verify the internal consistency of the questionnaire items. Cronbach's alpha values range from 0 to 1, where a larger value represents a higher level of reliability of the generated results. It is noted that 0.7 has been recommended as the threshold for a reliable scale measurement (Osei-Kyei et al., 2019). In addition, Kendall's concordance analysis was conducted to measure the level of agreement of different respondents in one single group (i.e., from China or the U.K.) on their rankings. If the Kendall's coefficient of concordance (*W*) carries a predefined significance level of 0.05, a reasonable degree of consensus on the rankings of items is indicated (Chan et al., 2012). If the number of items is greater than 7, the chi-square value should be applied as a near approximation instead (Chan et al., 2012). If the actual chi-square value equals or is greater than the critical value of chi-square, it indicates that there is a significant degree of agreement on dispute causes within the Chinese and U.K. groups, respectively.

Factor analysis is a statistical method used to identify a relatively small number of factors that can reveal the relationships among sets of variables (Deng et al., 2014). In this study, factor analysis adopted from Deng et al. (2014) and Yap et al. (2019) was conducted to explore the latent groups of construction dispute causes in China and U.K. To determine the suitability of factor analysis, two issues were considered: (1) sample size should be above the recommended ratio of 5:1 (Hair et al., 1998), and (2) the Kaiser-Meyer-Olkin (KMO) index > 0.5, and the p value of Bartlett's test of sphericity < 0.05 (Deng et al., 2014). The optimal number of factors was determined by their respective eigenvalues, as the general rule applied for factor extraction in factor analysis is eigenvalue greater than one (Ye et al., 2015).

Mean score (MS) ranking technique was used to determine the relative importance of variables within each group of respondents. This method has been widely adopted and proved to be reliable for analysing Likert-type data (Deng et al., 2014). The seven-point Likert scale was used to calculate the MS of each variable. Then the importance ranking of each variable was generated based on the MS values. If two or more variables had the same MS value, the one with lower standard deviation was assigned a higher rank (Ye et al., 2015).

The Mann-Whitney *U* test is a non-parametric test used to determine any statistically significant differences of the same variable ratings among two independent groups. The rule is that if *p* value is less than the pre-defined significance level of 0.05, the null hypothesis which states that there are no significant differences in the ratings of the same item between two groups of respondents will be rejected (Chan et al., 2012). Quartile analysis adopted from Osei-Kyei et al. (2019) was employed to ascertain the most different and similar dispute causes in terms of importance perceived by the respondents. Quartile analysis is a statistical method used to assess the distribution of data. The quartiles divide a set of ranked values into four equal groups, where the upper quartile (Q_3) delimits the 25% of the largest observations and the lower quartile (Q_1) divides the 25% of the lowest observations.

Results and Discussion

Reliability and consistency tests

The Cronbach's alpha values for the investigation results in China and U.K. were 0.939 and 0.910, respectively, which indicate that the questionnaire items for dispute causes have a high level of reliability.

Table 3 shows the results of the Kendall's Coefficient of Concordance test, which reveal that the values of chi-square of the test within China and U.K. are all above the threshold requirements of 46.194, and the levels of significance are all less than 0.05. As a result, there is a significant agreement on the importance of the dispute causes within the respondents in China and U.K., respectively, which is appropriate to conduct further analysis.

<Place Table 3 here>

Factor analysis results

In order to reveal the main category of dispute causes in China and U.K., the dispute causes were extracted by principal component analysis with varimax rotation. According to Norusis (1992), varimax seeks to minimize the number of variables that have high loadings on a factor, thereby enhancing the interpretability and providing a good explanation for the factors. The sample size ratio of this study is higher than the ratio of 5:1 recommended by Hair et al. (1998), indicating that it is appropriate to conduct factor analysis. Table 4 shows the results of KMO and Bartlett's Test of this study. The KMO for the thirty-three variables is 0.860, which is higher than the acceptable threshold of 0.5, and the Bartlett's test of sphericity result is significantly less than 0.05, suggesting good strength of relationship among the variables (Deng et al., 2014).

<Place Table 4 here>

Factor analysis results indicate that eight factors account for 65.34% of the total variance explained, which is higher than 60%, the standard of adequate construct validity (Deng et al., 2014; Yap et al., 2019). The results indicate that dispute causes in the construction industry are diversified, which is similar to many previous studies (e.g., Love et al., 2010). Factor loadings stand for the

correlations of the variables with the factors, and the higher factor loading implies the item is more representative of the factor (Hair et al., 1998). The factor loadings for all dispute causes exceeding 0.45 are needed (Liang et al., 2021). In order to ascertain the key groups of dispute causes, five factors that account for more than 50% of the total variance explained are further discussed. Table 5 shows the factor analysis results for these factors.

<Place Table 5 here>

Delay-related problems

The results indicate that delay-related problems, which accounted for 31.409% of the total variance, are the most important type of causes leading to disputes in the construction industry. Many studies have highlighted that delay is the most common dispute cause globally (e.g., Awwad et al., 2016; El-Sayegh et al., 2020). Delays could result from the client, contractor, government, and external factors (e.g., the Covid-19 pandemic). For example, Acharya et al. (2006) noted that late site handover to the contractor is one of the key dispute causes perceived by the consultant and contractor. Viswanathan et al. (2020) found that clients' delayed project decisions can directly influence project activities, causing idle resources and inefficient mobilization. El-Sayegh et al. (2020) suggested that poorly organized labour, poor supervision and site management can lead to contractor's progress delays, whereas the lengthy process of project assessment is a major cause of delayed approvals and permissions from governmental departments. Due to the impact of the Covid-19 pandemic, the delay issues have become more serious, since the parties in the overall supply chain have all been significantly influenced by unpredictable events (e.g., transportation suspension) or government control measures (e.g., quarantine) (Baral et al., 2022; Jeon et al., 2022).

Lack of communication

Lack of communication among key participants (e.g., client, contractor, designer) accounted for 6.354% of the total variance. Poor communication has long been identified as a common dispute cause that remains persistently in the construction industry (Love et al., 2010). Ineffective communication processes could not only cause misinterpretations among project participants, but also

trigger mistrust and opportunistic behaviours that impede the successful delivery of projects (Viswanathan et al., 2020). Among those four variables, the lack of communication between the designer and contractor exhibited a higher loading (0.806) than others, indicating that the collaboration between these two parties is crucial to avoid construction disputes. For instance, when the client fails to clearly communicate the requirements of a project to the designer, it may cause unclear design specifications and it is less likely that the works could be implemented properly by the contractor and sub-contractor.

Contractual problems

Contractual problems are important causes directly leading to disputes (Cheung and Pang, 2013). Because of the large scale of modern construction projects and many more project participants involved, the contract and its management become much more complicated and hence more problems could occur, leading to serious disputes. Awwad et al. (2016) divided contractual causes of disputes into intra-contractual causes and party-specific causes. The intra-contractual causes are associated with the contract itself (i.e., ambiguities or incompleteness of contract, misinterpretation of contractual terms and conditions); while party-specific causes are concerning the inadequate implementation of the parties (i.e., breach of contract, poor contract management). The causes of contractual problems are interrelated. For example, ambiguous contractual terms can cause misinterpretations and consequently a breach of the contract provisions (Jelodar et al., 2016). Wang et al. (2016b) reported that due to the poor management of EPC (Engineering Procurement and Construction) contracts, China Railway Construction Group suffered cost overruns of $0.676 billion in the Mecca Light Rail project in Saudi Arabia, which is 34.4% of the contract value.

Site conditions

Site conditions comprise three items: differing physical site conditions, inadequate site investigation, and poor site safety conditions. Kisi et al. (2020) found that site condition related issues such as unforeseen physical conditions and site possession are the most common types of construction disputes. In order to enhance the constructability of designs and capture reliable site information,

adequate site investigation including soil tests and subsurface investigations should be conducted to ascertain site conditions before commencing the project (Wu et al., 2017). This is particularly important for the projects where most of the construction activities are undertaken underground, such as the subway construction projects (Zhang et al., 2020). Alnualmi et al. (2010) reported that inadequate geotechnical investigation led to excessive change orders to a road project in Oman, which exceeded 35.6% of the original cost. In addition, poor site safety conditions may also cause accidents and fatal injuries, which could be easily escalated into legal disputes in the construction industry (Randall, 2011). However, the importance of site conditions is contrary to several previous studies conducted in different regions. For instance, both El-Sayegh et al. (2020) and Zaneldin (2020) found that site conditions (e.g., poor site investigation and different subsurface conditions) were ranked as least important dispute causes in the UAE construction industry.

Design problems

Design problems comprise four variables which mainly relate to the quality of the design. They have been identified as critical dispute causes by many researchers (Assaf et al., 2019; Zaneldin, 2020). Design is a highly complicated and iterative process where all parties are required to be involved and kept constantly informed. Hence, consistency of design documents and clarity of design specifications are vital through various developmental phases of a project (Love et al., 2010). However, Kisi et al. (2020) found that despite design errors were perceived important, the problems related to design specification and drawings were ranked as one of the least significant dispute causes in road construction projects in Nepal. In order to improve the design quality, in terms of reducing design defects and consistency of the design documents, BIM (Building Information Modeling) has been advocated (e.g., Ham et al., 2018) to be an effective tool to achieve this target, which might facilitate preventing dispute occurrence.

385 ***Ranking results***

386 Overall ranking results

387 The MS values for the dispute causes were calculated and ranked in descending order of significance
388 as shown in Table 6. The values range from 4.04 to 5.57 and 4.37 to 5.83 for China and U.K.,
389 respectively. The average MS value for China and U.K. is 4.78 and 5.23, which indicates that the
390 ratings of construction causes given by the U.K. respondents were higher than those given by the
391 Chinese respondents. It should be noted that both construction practices and cultural differences
392 between the two countries may lead to the discrepancies in the perceptions of these variables (Chan et
393 al., 2012).

394 **<Place Table 6 here>**

395

396 Ranking results in China

397 The top three causes of construction disputes in the Chinese construction industry were: *design*
398 *defects*, *variation in quantities* and *failure to make compensation for additional work*. The traditional
399 design-bid-build delivery method is widely employed in China (Ye et al., 2015), which constrains the
400 interaction between designers and contractors, resulting in *poor constructability of design*. In addition,
401 due to the fast-paced phenomenon of the Chinese construction industry, the designers are generally
402 under a high level of work overload which also has impacts on the design quality (Wu et al., 2017).
403 *Variation in quantities* was ranked the 2nd, indicating construction projects in China have high
404 uncertainty and risk of changes in quantities. Research revealed that these variations have frequently
405 occurred due to the change order requirements of the client (Zou et al., 2007), design changes (An and
406 Ma, 2019), and different site conditions (Wu et al., 2017) in Chinese construction projects. *Failure to*
407 *make compensation for additional work* was ranked 3rd in China, which is consistent with many
408 studies globally (e.g., Awwad et al., 2016). In China, clients frequently reject claims from contractors
409 for compensation of additional work either using their strong purchasing power or because of the poor
410 proven record for the claim from the contractor (Yu and Ni, 2012).

411

412

Ranking results in the U.K.

The top three causes of construction disputes in the U.K. construction industry were: *unclear design specifications*, *ambiguities in contractual documents*, and *scope of work changes*. According to Chong and Low (2006), incomplete and unclear design specification is the major cause for defective designs and frequent scope of work changes, resulting in frequent disputes related to delays and poor quality of works. Ambiguous contractual clauses may cause misinterpretations and opportunistic behaviour, which may jeopardize the successful delivery of projects (El-Sayegh et al., 2020). Construction professionals lack the proper legal background and knowledge to interpret legalese and technical jargon, which makes the interpretation process time-consuming and fatiguing. Hence, parties often fail to specify their rights and obligations clearly in order to expedite the contract signature process (Koc and Gurgun, 2021).

Results of the quartile analysis and Mann-Whitney U test

Analysis of similarities in dispute causes between China and U.K.

The results of quartile analysis and Mann-Whitney *U* test were used to determine the similarities of dispute causes between China and U.K. As shown in Table 7, the MS values of dispute causes were grouped into upper and lower quartiles (Osei-Kyei et al., 2019). Among the seventeen dispute causes that do not have significant differences between China and U.K. (Table 6), two dispute causes locate in both China and U.K.'s upper quartiles, namely *design defects* and *failure to make compensation for additional work*. The results indicate that these two are common critical dispute causes in both territories.

<Place Table 7 here>

Design defects

Design defects was perceived as the 1st and 5th significant dispute cause in China and U.K., respectively. This result suggests that design defects is a critical dispute cause in both countries, which concurs with the view that design problem is a persistent dispute cause in the construction industry globally (Love et al., 2010). In addition, it was highly ranked in the upper quartile by all the

parties in China, as shown in Table 8. As mentioned earlier, in the Chinese construction industry, the high intensity of organizational competition and monotonous market requirements have resulted in the popularity of fast-track model used in delivering construction projects. In this condition, design firms have to accelerate the design progress and sacrifice the quality of design solutions to meet the completion deadlines, which makes designs prone to changes and defects (Ye et al., 2015). Similarly, in the U.K., both the consultant (MS = 5.75) and client (5.58) agreed that the *design defect* is a critical dispute cause. Woo and O'Connor (2021) noted that information-related factors such as insufficient design information from suppliers and incorrect design specifications are crucial factors resulting in design defects. The results of this study also support this finding, since *unclear design specifications* was ranked 1st by the respondents in the U.K., also suggesting such design problems are significant dispute causes in the U.K. construction industry.

Failure to make compensation for additional work

Failure to make compensation for additional work is another critical dispute cause identified in both countries, which was ranked 3rd (MS = 5.30) and 4th (MS = 5.69) in China and U.K. respectively. It is consistent with Awwad et al. (2016)'s findings, who found that failure to make interim awards and compensation was ranked 2nd in the Middle East region. The competitive nature of the construction industry promotes an adversarial environment, where contractors may behave opportunistically to secure profits, while clients may refuse to fairly compensate contractors for additional works (Cheung and Pang, 2013). In China, this cause was perceived as the second critical cause by contractors, followed by the consultant and the client (Table 8). Due to the lower level of awareness of legal system in China, clients tend to suspend the payment and shift financial risks to contractors or other parties in the lower stream of supply chain, which often leads to disputes (Wu et al., 2011). Similarly, in the U.K., the designer perceived this cause as the most significant dispute cause, followed by the contractor and consultant. Additional work in the U.K. is often caused by changes of work scope where the contractor undertakes the work that is outside the contract due to unpredictable events. Since *unclear design specifications* and *scope of work changes* were highly ranked in the U.K., the

designer and contractor are more likely to issue claims to compensate for their additional work, which may be further escalated into disputes.

Further analysis also indicated that three types of dispute causes were perceived as least important in both China and U.K., namely, *variation in labour and equipment, lack of financial support from the client,* and *bid rigging* (in the lower quartile and not significantly different according to the *U* test results). *Variation in labour and equipment* includes the shortage of labour and equipment and the changes in their costs, which can be caused by adverse weather and inflations, and it is a more serious problem in the Covid-19 pandemic impacted period. *Lack of financial support from the client* refers to the failure to provide proper cost reimbursement to the contractor, which may result from bankruptcy and cash flow problems. El-Sayegh et al. (2020) found that poor financing condition of the client was perceived as a significant dispute cause in the UAE, which is different from the finding of this study. In addition, *bid rigging* is a type of fraud which can cause serious criminal problems in the construction industry, resulting in harmful social and economic impacts on the public (Lee et al., 2021).

<Place Table 8 here>

Analysis of differences in dispute causes between China and U.K.

Similarly, as shown in the last column in Table 6, sixteen out of the thirty-three dispute causes were perceived significantly differently by the respondents in China and U.K., in terms of their importance of the MS values. Among them, four causes are located in the upper quartile in China but in the lower quartile in the U.K. Therefore, these causes are considered the most significantly different dispute causes, which are *variation in quantities*, *misinterpretation of contractual terms and conditions*, *breach of contract*, and *poor contract management*.

Variation in quantities

Variation in quantities was ranked 2nd in China while it was only rated 26th in the U.K, indicating that quantity variation is a significantly more important dispute cause in China. As explained previously, the sources of quantity variations in China include incomplete design, design errors, and change of

work scopes (An and Ma, 2019). The major reason for the difference may be due to the different cost management systems and project management practices in the two countries. First, the predominant pricing approach used in China is resource-based pricing method where the bill of quantities is estimated relying upon quota systems, which is fragile when the market price fluctuates (Zou et al., 2007). In contrast, a risk-based and market-oriented pricing system is commonly employed in the U.K. construction industry, providing up-to-date costings and mitigating uncertain risks (Perera et al., 2016). Second, compared to the fragmented and fast-paced design process in China, the design stage in the U.K. construction industry has been split into various stages which facilitate effective cost and commercial management (Perera et al., 2016). As a result, the quantity surveyors in the U.K. play a more active role in assessing the quantity variations and managing related claims by performing variation valuations and issuing periodic reports of the project status. Third, construction projects are often procured in traditional lump-sum contracts in China, which are exposed to a higher-level risk of quantity variations (An and Ma, 2019; Wu and Xu, 2021). In contrast, more flexible options are provided in construction contracts in the U.K. For instance, the NEC (New Engineering Contract) with target cost contracting approach has been endorsed by the U.K. government for public sector projects, which offers an approach of seeking fair risk allocation and reducing variation claims (Smith and Wood, 2019).

Misinterpretation of contractual terms and conditions

Misinterpretation of contractual terms and conditions was ranked 30th and 8th in China and U.K., respectively. Misinterpretation of contracts mainly results from contract incompleteness, inconsistency of contractual terms, and contract ambiguity (Jelodar et al., 2016). If they are not properly managed, controversies in terms of the parties' entitlement of claims might occur, which could further escalate into a breach of contract and formal disputes (Zhang et al., 2019). The cultural difference on attitudes to the completeness of contractual terms may explain the significantly different perceptions on this variable between the respondents in China and U.K. The Chinese construction practitioners' attitudes to contracts are influenced by the inclusive social environment, which is highly tolerant to ambiguity and patient to changes (Holley and Wu, 2013). Practitioners in China frequently

do not seek excessively specified contract provisions in settling site problems, since it may represent distrust of the other party and prevent the development of their relationships (Lu et al., 2016). When misinterpretation occurs, "*guanxi*" (relationship in Chinese) serves as a bargaining chip, particularly when negotiating ambiguous contract terms in order to maintain a good business relationship with major stakeholders (Liu et al., 2017). In contrast, practitioners in the U.K. tend to pursue procedural justice and rely on the use of contract terms and conditions to claim rights and solve problems. A high level of term clarity and specificity not only define each party's rights and duties, but also provide adequate evidence for third parties to make fairer judgments (Lu et al., 2016). In this case, parties are likely to conduct a formal manner by adopting self-seeking postures because they consider themselves involved in zero-sum games (Lord et al., 2010). The results further imply the fact that contract terms and obligations ostensibly drafted in plain English (e.g., the NEC forms) are not easily understood by the U.K. practitioners.

Breach of contract

Breach of contract was ranked 31st and 7th by respondents in China and U.K., respectively. The significant difference may be because the practitioners of the two countries tend to use different approaches to handle disputes arising from breach of contract. For most of the developed countries (e.g., U.K.), a contract is a crucial tool which provides a formal governance mechanism for regulating each party's behaviour (Sharif et al., 2020). Hence, the breach of contract provisions can directly cause contract termination, especially for the U.K. practitioners who emphasize contractual approaches as their preferred behavioural strategy in dealing with disputes. The contractual approach relies heavily on formal ways featured by temporal and discrete transactions to protect the party's rights and obligations (Zhang et al., 2019). In contrast, the Chinese practitioners tend to adopt traditional relational approaches to prevent the loss of profit and maintain relationships with partners. When dealing with contractual problems (e.g., breach of contract), they often hold the view that the contract can be renegotiated and seek alternative solutions (Ling and Low, 2007; Lord et al., 2010).

Poor contract management

Poor contract management was ranked 26th and 9th in China and U.K., respectively. The different perceptions of contract administration and different traditions of industry in the two countries may explain this variable. For the U.K., the management of contracts has been a heated topic in the construction industry. Practitioners and contract drafters in the U.K. have consistently focused on assessing and updating practical suggestions calling for changes to adopt market requirements (Lord et al., 2010). Despite this, contract administration issues have been reported as a continuous trend of the top dispute cause in the U.K. construction industry, with more than 60% surveyed respondents suggesting that proper contract management could greatly avoid disputes (Arcadis, 2020). This result is similar to current findings. In contrast, the practitioners in China have a relatively weak consciousness of the importance of contract and its management in achieving the project success, and in turn the traditional thinking of relationship generally determines their behaviour in the management of construction projects. In addition, some of Chinese contractors, especially those small-to-medium sized ones, are not familiar with contractual legal systems in China, and in turn they do not perform the contract strictly (Ling and Low, 2007). Some of the Chinese construction organizations still have no independent apartment or position for professional contract administration, and they are less likely to attribute disputes to contract management issues (Ye et al., 2015). This may have influenced the low ranking of this dispute cause in China.

Conclusions and Recommendations

Using China and U.K. as the case regions for empirical investigation, this study aims to explore the critical dispute causes in the broader construction industry and compare the major similarities and differences of dispute causes in the two countries, to provide a holistic view on dispute management for the practitioners in the two countries. The results indicate that *delay-related problems*, *lack of communication*, *contractual problems*, *site conditions*, and *design problems* are the main categories of causes leading to disputes in the wider construction industry. The findings are different from many

previous studies in a single-regional contexts (e.g., Assaf et al., 2019; El-Sayegh et al., 2020; Barman and Charoenngam, 2017).

More importantly, the results reveal both similarities and differences in the dispute causes in the two different contexts. In terms of similarities, the professionals in the two countries share around 50% of similarities on the importance of these dispute causes. Among them, *design defects* and *failure to make compensation for additional work* are the two common critical dispute causes in the two countries. This highlights the importance of improving the design quality and making reasonable compensation to the contractor for additional work, to reduce the occurrence of disputes in the construction industry. As to the design, designers in both contexts should work collaboratively with other project parties (e.g., client, contractor) to provide high-quality design and detailed specifications in the pre-construction stage. In this case, excellent communications between the parties can facilitate preventing controversies in terms of design quality and variations. For instance, if the client communicates the requirements of project objectives clearly to the designers, the disputes arising from this aspect can be reduced (Assaf et al., 2019). Of course, the collaboration within design teams and the best quality control practices are also critical to reduce design errors and defects (Sha'ar et al., 2017). Specifically, for countries like China which places much importance on fast-track models to completing designs, adequate time should be allocated in the design stage to enhance the design quality through more meticulous design reviews and constructability assessments. As to the compensation, the parties are recommended to keep a proven record of all the variations from the tender to completion of a construction project. For instance, at the tendering process, both parties should have a common understanding on the scope of the works and define a detailed change order management process. During the execution of the construction works, it is important that the contractors timely notify the client when they are entitled to additional compensation because of change orders (Zaneldin, 2020). Moreover, inadequate compensation to the designer may result in incomplete design documents and further lead to contractors' frequent requests for change orders during construction, which may give rise to disputes among the parties. Hence, the client is advised to adequately compensate the designer for the design service to ensure the design quality and avoid the subsequent change order problems.

Significant differences also exist for the dispute causes according to the perceptions of the professionals in the two countries. This finding points to the importance of employing different targeted strategies in dispute management in China and U.K. For instance, variation in quantities is considered one of the most important dispute causes in China whereas it is one of the least important ones in the U.K. It is strongly advocated that the best practices used in the U.K. construction industry in reducing variations (e.g., active role played by the quantity surveyor) should be employed in China to reduce the potential problems downstream. It was also surprisingly found that three contract related causes were perceived as significant by the professionals in the U.K. construction industry, where the contract system is more developed and higher-level of importance is attached by the parties in comparison to the situation in China; whereas they were considered least significant by the professionals in the Chinese construction industry, where relationship is highly recognized in handling project management issues or resolving disagreements among the parties. This contradicts many previous studies which claimed that contract incompleteness is the root cause of construction disputes (Awwad et al., 2016; Cheung and Pang, 2013). This result also demonstrates that research efforts can be further directed to validate whether relationship management can be an effective strategy in dispute prevention in the Chinese construction industry.

The research outcomes contribute to the body of knowledge on dispute management in two main aspects. First, using a single survey instrument, the common and critical dispute causes were obtained in a cross-regional context. The results further enrich the understandings on the dispute causes in a single-regional context. Second, in terms of the differences of dispute causes in China and U.K., the broader views generated further validate that some certain factors more easily lead to construction disputes within different country-specific contexts. In this aspect, cultural differences (e.g., relationship), practice (e.g., quantity survey's active role), and law and regulation system (e.g., contract) might have influences on the importance level of different causes leading to the dispute in the construction industry. It is therefore important to take different degrees of prioritized measures in managing disputes in international projects or projects in the two countries.

Limitations and Future Research Directions

This study has some limitations which become the possible future directions on this topic. First, the comparative study was conducted in China and U.K., and in turn the results may not be applicable to other developing or developed countries. However, the outcomes of this study may be helpful in developing proactive dispute management strategies in the contexts which share similar cultural and economic features with China and U.K., respectively. It is therefore imperative to conduct survey investigations in other developing or developed countries to obtain more generalised results for more effective management of disputes in construction projects with multi-regional contexts. Second, the Covid-19 pandemic has brought severe and unprecedented impacts on the construction industry globally. As a result, this study has discussed this issue to highlight its influence on the severity of dispute causes. It is also acknowledged that this paper does not focus on the investigation of the influence of Covid-19 pandemic on the dispute causes. Hence it is not necessary to emphasize further on this issue. However, it is valuable to measure and compare the impact of the Covid-19 pandemic on the empirical results in comparison to the non-pandemic influence scenario. Third, although a set of quantitative methods were employed to obtain the results, qualitative methods (e.g., interviews) can be adopted to further triangulate and verify the findings. Fourth, the investigation in China were mainly conducted in Jiangsu province and Shanghai, which are the most developed areas in China, thus the generalizability of the results may be affected. Therefore, future investigations are suggested to be conducted in other regions in China to further complement the research findings.

Data Availability Statements

Some or all data, models, or code that support the findings of this study are available from the corresponding author upon reasonable request.

References

Abdul-Malak, M.A.U., and Senan, M.H. 2020. "Operational mechanism and effectiveness of adjudication as a key step in construction dispute resolution". *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, 12(1), 04519051.

Acharya, N.K., Lee, Y.D., and Im, H.M. 2006. "Conflicting factors in construction projects: Korean perspective". *Engineering, Construction and Architectural Management*, 13(6), 543-566.

Alnuaimi, A.S., Taha, R.A., Mohsin, M.A., and Al-Harthi, A.S. 2010. "Causes, effects, benefits, and remedies of change orders on public construction projects in Oman". *Journal of Construction Engineering and Management*, 136(5), 615-622.

American Arbitration Association (AAA). 2013. "*A guide to commercial mediation and arbitration for business people*". https://www.adr.org/sites/default/files/document_repository/A%20Guide%20to%20Commercial.pdf. (Accessed on December 15, 2021).

An, S., and Ma, T. 2019. "Causes of variations and their impacts upon construction projects in China". *43rd Australasian Universities Building Education Association Conference*. Australia.

Arcadis. 2020. *"Global construction dispute report: Collaborating to achieve project excellence*". Amsterdam, Netherlands: Arcadis.

Arcadis. 2021. "*Global construction dispute report: the road to early resolution*". Amsterdam, Netherlands: Arcadis.

Assaf, A., Hassanain, M.A., Abdallah, A., Sayed, A.M.Z., and Alshahrani, A. 2019. "Significant causes of claims and disputes in construction projects in Saudi Arabia". *Built Environment Project and Asset Management*, 9(5), 597-615.

Awwad, R., Barakat, B., and Menassa, C. 2016. "Understanding dispute resolution in the Middle East region from perspectives of different stakeholders". *Journal of Management in Engineering*, 32(6), 05016019-1-11.

Ayhan, M., Dikmen, I., and Birgonul, M.T. 2021. "Predicting the occurrence of construction disputes using machine learning techniques". *Journal of Construction Engineering and Management*, 147(4), 04021022.

Baral, A., Liang, Y., Li, M., Gonzalez, M., Shahandashti, M., and Ashuri, B. 2022. "Impact of Covid-19 on the diversity of the construction workforce". *Natural Hazards Review*, 23(3), 04022015-1-16.

Barman, A., and Charoenngam, C. 2017. "Decisional uncertainties in construction projects as a cause of disputes and their formal legal interpretation by the courts: Review of legal cases in the United Kingdom". *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*, 9(3), 04517011.

Beijing Construction Engineering Group. (2021) Airport city Manchester, a place to embrace a changing future. https://bcegi.co.uk/projects/airport-city-manchester/. (Accessed on May 3, 2022).

Chan, E.H.W., and Suen, H.C.H. 2005. "Dispute resolution management for international construction projects in China". *Management Decisions*, 43(4), 589-602.

Chan, D.W.M., Lam, P.T.I., Chan, J.H.L., Ma, T., and Perkin, T. 2012. "A comparative study of the benefits of applying target cost contracts between south Australia and Hong Kong". *Project Management Journal*, 43(2), 4-20.

Cheung, S.O., Li, K., and Chow, O.Y. 2020. "Reactive devaluation as a psychological impediment to construction dispute negotiation". *Journal of Management in Engineering*, 36(4), 04020025-1-12.

Cheung, S.O., and Pang, K.H.Y. 2013. "Anatomy of construction disputes". *Journal of Construction Engineering and Management*, 139(1), 15-23.

China Construction Industry Association. 2022. "*Statistical analysis of the development of construction industry in 2021*". https://mp.weixin.qq.com/s?__biz=MzUyNjM4NzkzOQ==&mid=2247490151&idx=1&sn=ddc2f4415f2dc28907d9341129bb89d3&chksm=fa0ec5ebcd794cfd281603a9e628d1d8438eaa338a267df4e713cd157fee259e93fc0096b750#rd. (In Chinese) (Accessed on May 3, 2022).

711 Chong, H.Y., and Zin, R.M. 2012. "Selection of dispute resolution methods: Factor analysis
712 approach". *Engineering, Construction and Architectural Management,* 19(4), 428-443.
713 Chong, W., and Low, S. 2006. "Latent building defects: Causes and design strategies to prevent them".
714 *Journal of Performance of Constructed Facilities,* 20(3), 213-221.
715 CITB. 2021. "*Construction skills network: the skills construction needs*".
716 https://www.citb.co.uk/media/b4fpu2hg/uk_summary.pdf. (Accessed on May 5, 2022).
717 Deng, X., Low, S.P., Li, Q., and Zhao, X. 2014. "Developing competitive advantages in political risk
718 management for international construction enterprises". *Journal of Construction Engineering*
719 *and Management*, 140(9), 04014040.
720 El-Sayegh, S., Ahmad, I., Aljanabi, M., Herzallah, R., Metry, S., and El-Ashwal, O. 2020.
721 "Construction disputes in the UAE: Causes and resolution methods". *Buildings,* 10(171),
722 doi:10.3390/buildings10100171.
723 ENR (Engineering News-Record). (2021). "*The 2021 Top 250 International Contractors: Paving the*
724 *road to recovery*". https://www.enr.com/articles/52258-the-2021-top-250-international-
725 contractors-paving-the-road-to-recovery. (Accessed on May 18, 2022)
726 Gharawi, M.A., Pardo, T.A., and Guerrero, S. 2009. "Issues and strategies for conducting cross-
727 national e-government comparative research". *3rd International Conference on Theory and*
728 *Practice of Electronic Governance*, November 10-13, 2009.
729 Hair, J. F., Anderson, R. E., Tatham, R. L., and Black, W. C. 1998. "*Multi-variate data analysis*". 5th
730 Ed., London: Prentice Hall.
731 Ham, N., Moon, S., Kim, J.H., and Kim, J.J. 2018. "Economic analysis of design errors in BIM-based
732 high-rise construction projects: Case study of Haeundae L project". *Journal of Construction*
733 *Engineering and Management*, 144(6), 05018006.
734 Holley, E.C., and Wu, K. 2013. "*A new voice in China*". In Cooper, C.L. and Burke, R.J. (eds). *Voice*
735 *and Whistleblowing in Organizations*. United Kingdom: Edward Elgar, 297-307.
736 Jelodar, M.B., Yiu, T.W., and Wilkinson, S. 2016. "Dispute manifestation and relationship quality in
737 practice". *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction.* 8(1),
738 C4515003.

739 Jeon, J., Padhye, S., Bhattacharyya, A., Cai, H., and Hastak, M. 2022. "Impact of Covid-19 on the US
740 construction industry as revealed in the Purdue Index for Construction". *Journal of Management*
741 *in Engineering*, 38(1), 04021082-1-13.
742 Jordan, A.D. 1997. "Lost in the translation: two legal cultures, the common law judiciary and the
743 basic law of the Hong Kong special administrative region". *Cornell International Law Journal*.
744 30(2). http://scholarship.law.cornell.edu/cilj/vol30/iss2/3. (Accessed on May 5, 2022)
745 Kisi, K.P., Lee, N., Kayastha, R., and Kovel, J. 2020. "Alternative dispute resolution practices in
746 international road construction contracts". *Journal of Legal Affairs and Dispute Resolution in*
747 *Engineering and Construction*, 12(2), 04520001.
748 Koc, K., and Gurgun, A.P. 2021. "Ambiguity factors in construction contracts entailing conflicts".
749 *Engineering, Construction and Architectural Management*, DOI 10.1108/ECAM-04-2020-0254.
750 Kumaraswamy, M.M. 1997. "Conflicts, claims and disputes in construction". *Engineering*
751 *Construction and Architectural Management*, 4(2), 95-111.
752 Lee, J.S., Kim, W.R., and Jeong, K. 2021. "Estimating damages from bid-rigging in the construction
753 industry". *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction*,
754 13(3), 05021003.
755 Li, H., Arditi, D., and Wang, Z. 2013. "Determinants of transaction costs in construction projects".
756 *Journal of Civil Engineering and Management*, 21(5), 548-558.
757 Li, K., and Cheung, S.O. 2020. "Alleviating bias to enhance sustainable construction dispute
758 management". *Journal of Cleaner Production*, 249, 119311.
759 Liang, Q., Leung, M., and Zhang, S. 2021. "Examining the critical factors for managing workplace
760 stress in the construction industry: A cross-regional study". *Journal of Management in*
761 *Engineering*, 37(5), 04021045.
762 Ling, F.Y.Y., and Low, S.P. 2007. "Legal risks faced by foreign architectural, engineering, and
763 construction firms in China". *Journal of Professional Issues in Engineering Education and*
764 *Practice*, 133(3), 238-245.

765 Liu, J., Zhao, X., and Li, Y. 2017. "Exploring the factors inducing contractors' unethical behavior:
766 Case of China". *Journal of Professional Issues in Engineering Education and Practice*, 143(3),
767 04016023.
768 Liu, Z. 2014. "The analysis of China's investment in V4". *International Scientific Conference*,
769 Bratislava, Slovakia. 2014
770 Lord, W., Liu, A., Tuuli, M.M., and Zhang, S. 2010. "A modern contract: Developments in the UK
771 and China". *Management, Procurement and Law*, 163, 151-159.
772 Love, P., Davis, P., Ellis, J., and Cheung, S.O. 2010. "Dispute causation: identification of pathogenic
773 influences in construction". *Engineering, Construction and Architectural Management*, 17(4),
774 404-423.
775 Lu, W., Zhang, L., and Zhang, L. 2016. "Effect of contract completeness on contractors' opportunistic
776 behavior and the moderating role of interdependence". *Journal of Construction Engineering and*
777 *Management*, 142(6), 04016004.
778 Murphy, S.E., Spillane, J.P., Hendron, C., and Bruen, J. 2014. "NEC contracting: Evaluation of the
779 inclusion of dispute review boards in lieu of adjudication in the construction industry in the
780 United Kingdom". *Journal of Legal Affairs and Dispute Resolution in Engineering and*
781 *Construction*, 6(4), 04514002.
782 Naji, K.K., Mansour, M.M., and Gunduz, M. 2020. "Methods for modelling and evaluating
783 construction disputes: A critical review". *IEEE Access*, 8, 45641-45652.
784 Norusis, M. J. 1992. SPSS for windows, profession statistics, Release 5, SPSS, Chicago.
785 Office for National Statistics. 2019. "*Construction statistics, Great Britain: 2018*".
786 https://www.ons.gov.uk/businessindustryandtrade/constructionindustry/articles/constructionstatis
787 tics/2018#:~:text=The%20construction%20industry%20accounted%20for,indicators%20includin
788 g%20inflation%20and%20employment. (Accessed on May 3, 2022)
789 Osei-Kyei, R., Chan, A.P.C., Yu, Y., Chen, C., and Dansoh, A. 2019. "Root causes of conflict and
790 conflict resolution mechanisms in public-private partnerships: Comparative study between
791 Ghana and China". *Cities*, 87, 185-195.

792 Perera, S., Zhou, L., Udeaja, C., Victoria, M., and Chen, Q. 2016. "*A comparative study of*
793 *construction cost and commercial management services in the UK and China*". UK: RICS
794 Research Trust.
795 Qu, Y., and Cheung, S.O. 2013. "Experimental evaluation of logrolling as an effective mediating
796 tactic in construction project management". *International Journal of Project Management*, 31,
797 775-790.
798 Randall, T. 2011. "Construction engineering requirements for integrating laser scanning technology
799 and building information modeling". *Journal of Construction Engineering and Management*,
800 137(10), 797-805.
801 Salami, B.A., Ajayi, S.O., and Oyegoke, A.S. 2021. "Tackling the impacts of Covid-19 on
802 construction projects: an exploration of contractual dispute avoidance measures adopted by
803 construction firms". *International Journal of Construction Management*, DOI:
804 10.1080/15623599.2021.1963561.
805 Seo, W., Kwak, Y.H., and Kang, Y. 2021. "Relationship between consistency and performance in the
806 claim management process for construction projects". *Journal of Management in Engineering*,
807 37(6), 04021068-1-11.
808 Sertyesilisik, B. 2010. "Investigation on particular contractual issues in construction". *Journal of*
809 *Legal Affairs and Dispute Resolution in Engineering and Construction*", 2(4), 218-227.
810 Sha'ar, K.Z., Assaf, S.A., Bambang, T., Babsail, M., and Fattah, A.E. 2017. "Design-construction
811 interface problems in large building construction projects". *International Journal of Construction*
812 *Management*, DOI: 10.1080/15623599.2016.1187248.
813 Sharif, S.M.F., Naiding, Y., Rehman, A.U., Sahibzada, U.F., and Kanwal, F. 2020. "From partners'
814 learning intent to knowledge leakage: The role of contract and trust". *Knowledge Management*
815 *Research and Practice*, DOI: 10.1080/14778238.2020.1843985.
816 Sibanyana, G., Muya, M., and Kaliba, C. 2012. "An overview of construction claims: A case study of
817 the Zambian construction industry". *International Journal of Construction Management*, DOI:
818 10.1080/15623599.2012.10773185.

819 Smith, A., and Wood, G. 2019. "Target cost contracts and the development of collaborative
820 behaviours and value for money in the UK construction industry". *Journal of International*
821 *Business Research and Marketing,* 4(4), 7-15.
822 Viswanathan, S.K., Panwar, A., Kar, S., Lavingiya, R., and Jha, K.N. 2020. "Causal modelling of
823 disputes in construction projects". *Journal of Legal Affairs and Dispute Resolution in*
824 *Engineering and Construction,* 12(4), 04520035.
825 Wang, H., Sexton, M., and Lu, S. 2016. "Investment by Chinese construction firms in the UK
826 infrastructure sector: Volumes, patterns and trends". *the 32nd ARCOM Conference, Sep.*
827 *Manchester,* 1127-1136.
828 Wang, P., Fenn, P., Wang, K., and Huang, Y. 2021. "A bayesian belief network predictive model for
829 construction delay avoidance in the UK". *Engineering, Construction and Architectural*
830 *Management*, DOI 10.1108/ECAM-10-2020-0873.
831 Wang, T., Tang, W., Du, L., Duffield, C.F., and Wei, Y. 2016. "Relationships among risk
832 management, partnering, and contractor capability in international EPC project delivery".
833 *Journal of Management in Engineering,* 32(6), 04016017.
834 Woo, J., and O'Connor, J.T. 2021. "Causal factors for engineering design defects and their impacts".
835 *Practice Periodical on Structural Design and Construction*, 26(2), 04020071.
836 Wu, J., Kumaraswamy, M., and Soo, G.K.L. 2011. "Dubious benefits from future exchange: An
837 explanation of payment arrears from 'continuing clients' in mainland China". *Construction*
838 *Management and Economics,* 29(1), 15-23.
839 Wu, X., and Xu, F. 2021. "Detection model for unbalanced bidding in railway construction projects:
840 Considering the risk of quantity variation". *Journal of Construction Engineering and*
841 *Management*, 147(7), 04021055.
842 Wu, Z., Nisar, T., Kapletia, D., and Prabhakar, G. 2017. "Risk factors for project success in the
843 Chinese construction industry". *Journal of Manufacturing Technology Management,* 28(7), 850-
844 866.

Xu, Q., and Cheung, S.O. 2016. "Influence of Confucianism and Taoism on construction dispute handling behaviors in China". *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction,* 8(1), C4515002.

Yap, J.B.H., Chow, I.N., and Shavarebi, K. 2019. "Criticality of construction industry problems in developing countries: Analyzing Malaysian projects". *Journal of Management in Engineering,* 35(5), 04019020-1-15.

Ye, G., Jin, Z., Xia, B., and Skitmore, M. 2015. "Analyzing causes for reworks in construction projects in China". *Journal of Management in Engineering,* 31(6), 04014097.

Yu, J., and Ni, H. 2012. "Analysis of the existing problems and countermeasures of construction claims" (*In Chinese*). *Engineering Construction,* 23, 216-216.

Zaneldin, E.K. 2020. "Investigating the types, causes and severity of claims in construction projects in the UAE". *International Journal of Construction Management,* 20(5), 385-401.

Zhang, L., Fenn, P., and Fu, Y. 2019. "To insist or to concede? Contractors' behavioural strategies when handling disputed claims". *Engineering, Construction and Architectural Management*, 26(3), 424-443.

Zhang, L., Fu, Y., and Lu, W. 2021. "Contract enforcement for claimants' satisfaction with construction dispute resolution: Moderating role of shadow of the future, fairness perception, and trust". *Journal of Construction Engineering and Management*, 147(2), 04020168.

Zhang, S., Sunindijo, R.Y., Loosemore, M., Wang, S., Gu, Y., and Li, H. 2020. "Identifying critical factors influencing the safety of Chinese subway construction projects". *Engineering, Construction and Architectural Management*, https://doi.org/10.1108/ECAM-07-2020-0525.

Zhu, L., and Cheung, S.O. 2020. "Power of incentivization in construction dispute avoidance". *Journal of Legal Affairs and Dispute Resolution in Engineering and Construction,* 12(2), 03720001.

Zou, P.X.W., Zhang, G., and Wang, J. 2007. "Understanding the key risks in construction projects in China". *International Journal of Project Management,* 25, 601-614.

Figure caption list

Figure 1 Flow chart of the research framework

878 **Table 1 Causes of disputes drawn from existing literature**

Dimensions and factors	Literature sources	Description
1. Change order		
Variation in quantities	Kumaraswamy et al. (1997); Assaf et al. (2019); Zaneldin (2020)	Quantity variation is the discrepancy between the estimated and actual quantities of a project. The change of quantity may affect contractor's cash flow and result in claims and disputes.
Scope of work changes	El-Sayegh et al. (2020); Love et al. (2010); Viswanathan et al. (2020); Zaneldin (2020)	Scope of work changes include the changes of design, schedule, material procurement and construction conditions, which can affect project time and cost.
Variation in material prices	Sibanyama et al. (2012); Awwad et al. (2016); Cheung and Pang (2013)	The actual cost of a project may exceed the original budget because the estimated cost for project is based on the market price at the time of bidding.
Variation in labour and equipment	Acharya et al. (2006); Love et al. (2010)	This cause arises when there is inadequate or late supply of labour and equipment on the construction site, which may affect project schedule.
2. Design problem		
Unclear design specifications	Kumaraswamy et al. (1997); Cheung and Pang (2013); El-Sayegh et al. (2020);	Design specifications provide explicit information (e.g., quantities and schedules) about how the design can be executed. Unclear or incomplete specification may cause project delay or failure, which can lead to disputes.
Design defects	Acharya et al. (2006); Assaf et al. (2019); Zaneldin (2020)	Defective designs include design errors and omissions which can result in rework, change orders and delay in construction stage.
Inconsistency of design documents	Cheung and Pang (2013); Assaf et al. (2019); Zaneldin (2020)	Poor coordination among design teams can cause inconsistency of drawings and specifications, leading to design defects and errors.
Poor constructability of design	Acharya et al. (2006); Sibanyama et al. (2012)	This cause can impede the successful delivery of projects, including the sequence of activities, project quality, and health and safety issues.
3. Site condition		
Inadequate site investigation	Kumaraswamy et al. (1997); El-Sayegh et al. (2020); Zaneldin (2020)	Inadequate site investigation (e.g., subsurface conditions) may cause foundation design failure, project delays, and safety issues, which are often controversial and prone to disputes.
Differing physical site conditions	Love et al. (2010); Sibanyama et al. (2012)	This cause is one of the most prominent dispute causes when geo-environmental condition is different from what has been specified in the contract, causing additional expenses and work.
Poor site safety conditions	Acharya et al. (2006); Assaf et al. (2019); Zaneldin (2020)	This cause arises when accidents or injuries occur due to poor site safety management or contractor's negligence of safety issues.

4. Contractual problem		
Ambiguities in contractual documents	Awwad et al. (2016); El-Sayegh et al. (2020); Viswanathan et al. (2020)	This cause pertains to contract documents include vague or unclear terms, either intentional or unintentional, which could lead parties to take advantage of other parties for profits.
Misinterpretation of contractual terms and conditions	Acharya et al. (2006); Assaf et al. (2019)	It is common for contractors to misunderstand or overlook some provisions in the contract because of lengthy terms and conditions or quality of communication, which may affect project budget and progress.
Poor contract management	Love et al. (2010); Awwad et al. (2016); Zaneldin (2020)	Disputes may occur when there is a failure to the successful execution of contract terms or to the timely record keeping of contract changes.
Breach of contract	Sertyesilisik (2010)	Breach of contract can result in termination of contracts and delays, which is a direct cause to construction disputes.
5. Delay problem		
Late approval and permission	El-Sayegh et al. (2020); Zaneldin (2020)	This cause pertains to the late acquiring of permits and approvals from the government authority, which could lead to schedule delays and variations.
Late handover of designs to the contractor	Acharya et al. (2006); Love et al. (2010)	This cause is resulted from delayed or incorrect design information when the designer fails to complete and handover detailed design for construction.
Site-handover delay to the main contractor	Kumaraswamy et al. (1997) ; Acharya et al. (2006)	Before the commencement of construction, disputes may occur when the client fails to hand over the possession of the site to the main contractor within the stipulated dates.
Late decision-making by the client	Awwad et al. (2016); El-Sayegh et al. (2020); Viswanathan et al. (2020)	This is a cause when the lengthy decision-making process delays the construction activities and results in disputes between the client and contractor.
Progress delay by the contractor	Assaf et al. (2019); Viswanathan et al. (2020)	This cause may result from poorly organized labour, poor quality of work, and poor productivity and control.
Material and equipment delay	Acharya et al. (2006); Zaneldin (2020)	This cause is related to delay or shortage in material and equipment supply, which can be caused by the late identification of the types of material and equipment needed.
6. Lack of communication		
Lack of communication between designer and client	Li et al. (2013); Assaf et al. (2019); El-Sayegh et al. (2020)	In the design stage, when the client fails to clearly specify requirements and provide feedback on the design, design expectations cannot be met properly, leading to excessive design changes.
Lack of communication between designer and	El-Sayegh et al. (2020)	In the construction stage, insufficient communication between the two parties may cause

contractor		contractor's misunderstandings of the design intentions, and consequently result in rework and delay.
Lack of communication between contractor and client	Awwad et al. (2016); Viswanathan et al. (2020)	This cause may lead to mistrust, decreased productivity, and failure to comply with contracted obligations.
7. Payment problem		
Late payment issued by the client	Assaf et al. (2019); Viswanathan et al. (2020)	When the client fails to make progress payment on time, mistrust and hostility may occur between the contractor and client, leading to serious problems in the execution of construction activities.
Failure to make compensation for additional work	Awwad et al. (2016); El-Sayegh et al. (2020); Arcadis (2021)	A common dispute source is that the contractor's payment rights cannot be protected when the client fails to comply with contractual obligations to compensate contractor's additional work.
8. Opportunistic behaviour		
Contractors' opportunistic behaviour to secure profit from the lowest bid	Love et al. (2010); Cheung and Pang (2013)	The contractor may behave opportunistically to recover their profits after being awarded the lowest bid.
Lack of financial support from the client	Cheung and Pang (2013); El-Sayegh et al. (2020)	The client may purposely issue extra orders but refuse to provide proper cost reimbursement to the contractor.
9. Bid problem		
Unbalanced bidding	Li et al. (2013); Awwad et al. (2016)	Unit-price contracts allow for the freedom of quotation, which could lead to the manipulation of item prices without affecting the total bid price.
Errors caused by insufficient time for bid preparation	Kumaraswamy et al. (1997); Zaneldin (2020)	This cause pertains to the client's failure to grant adequate time for bid preparation. Consequently, the contractor may not have enough time to review contract documents, leading to errors in bid documents and disputes.

879

880

881

882

883

884 **Table 2 Demographics of survey respondents**

Background	Categories	Total (170)	China (N=67)		UK (N=103)	
			Number	Percentage	Number	Percentage
Years of working experience	1-5	71	34	50.7	37	35.9
	6-10	34	12	17.9	22	21.4
	11-15	25	9	13.4	16	15.5
	16-20	23	9	13.4	14	13.6
	>20	17	3	4.5	14	13.6
Type of organization	Client	40	28	41.8	12	11.7
	Contractor	52	10	14.9	42	40.8
	Designer	32	16	23.9	16	15.5
	Consultant	35	11	16.4	24	23.3
	Others	11	2	3.0	9	8.7
Position	Project management staff	93	43	64.2	50	48.5
	Design professional	30	14	20.9	16	15.5
	Construction professional	24	2	3.0	22	21.4
	Others	23	8	11.9	15	14.6

885

886

887

888

889

890 **Table 3 Results of Kendall's concordance analysis**

Characteristics	China	UK	China and UK
Number of survey respondents (N)	67	103	170
Kendall's Coefficient of Concordance (W)	0.065	0.092	0.060
Chi-square	138.726	303.667	327.440
Degree of freedom (df)	32	32	32
Critical value of chi-square	46.194	46.194	46.194
Asymp. Sig.	0.000	0.000	0.000

891

892

Table 4 Results of KMO and Bartlett's Tests

Parameter	Value
Kaiser-Meyer-Olkin measure of sampling adequacy	0.860
Bartlett's test of sphericity	
Approximate chi square	2768.054
Df (degree of freedom)	528
Sig.	0.000

899 **Table 5 Factor analysis results**

Details of the factors and dispute causes	Factor loading	Variance explained (%)	Cumulative variance (%)
Factor 1: delay-related problems	-	31.409	31.409
Site handover delay to the main contractor	0.745		
Late handover of designs to the contractor	0.716		
Late decision-making by the client	0.706		
Progress delay by the contractor	0.621		
Late approval and permission	0.618		
Factor 2: lack of communication	-	6.354	37.763
Lack of communication between designer and client	0.806		
Lack of communication between main contractor and sub-contractor	0.764		
Lack of communication between contractor and client	0.726		
Lack of communication between designer and contractor	0.709		
Factor 3: contractual problems	-	5.560	43.323
Misinterpretation of contractual terms and conditions	0.768		
Ambiguities in contractual documents	0.740		
Breach of contract	0.716		
Poor contract management	0.691		
Factor 4: Site conditions	-	5.005	48.328
Differing physical site conditions	0.721		
Inadequate site investigation	0.691		
Poor site safety conditions	0.593		
Factor 5: Design problems	-	4.845	53.173
Design defects	0.707		
Inconsistencies of design documentations	0.706		
Unclear design specifications	0.583		
Poor constructability of design	0.497		

900 Note: (1) Only loadings that exceed 0.45 are presented in the table. (2) The five extracted key factors explained
901 53.173% of total variance.

902

903

904 **Table 6 Mean score analysis and test results for causes of construction disputes in China and U.K.**

Codes	Causes of disputes	China and UK		China		UK		Mann-Whitney U test		
		Mean	Rank	Mean	Rank	Mean	Rank	U statistics	Z	Sig.
D1	Variation in quantities	5.19	9	5.46	2	5.01	26	2778.5	-2.198	0.03*
D2	Scope of work changes	5.60	2	5.28	4	5.81	3	2647.5	-2.652	0.01*
D3	Variation in material prices	4.64	30	4.73	18	4.58	31	3265	-0.605	0.55
D4	Variation in labour and equipment	4.46	31	4.42	29	4.49	32	3326.5	-0.403	0.69
D5	Unclear design specifications	5.49	4	4.96	7	5.83	1	2164	-4.239	0.00*
D6	Design defects	5.61	1	5.57	1	5.63	5	3301.5	-0.492	0.62
D7	Inconsistency of design documents	5.05	20	4.79	15	5.21	21	2922	-1.718	0.09
D8	Poor constructability of design	5.19	8	4.91	10	5.37	14	2797	-2.132	0.03*
D9	Inadequate site investigation	4.93	24	4.48	28	5.22	18	2507	-3.081	0.00*
D10	Differing physical site conditions	4.75	28	4.70	20	4.78	29	3405	-0.149	0.88
D11	Poor site safety conditions	4.41	32	4.04	33	4.64	30	2746.5	-2.283	0.02*
D12	Ambiguities in contractual documents	5.36	5	4.67	22	5.81	2	2082	-4.483	0.00*
D13	Misinterpretation of contractual terms and conditions	5.14	14	4.42	30	5.60	8	1956	-4.874	0.00*
D14	Breach of contract	5.14	15	4.40	31	5.62	7	1962	-4.849	0.00*
D15	Poor contract management	5.15	12	4.49	26	5.58	9	2090	-4.442	0.00*
D16	Late approval and permission	5.18	10	4.90	12	5.37	13	2926.5	-1.717	0.09
D17	Late handover of designs to the contractor	5.16	11	4.76	16	5.43	10	2436	-3.317	0.00*
D18	Site-handover delay to the main contractor	4.90	25	4.70	19	5.03	25	2927.5	-1.704	0.09

D19	Late decision-making by the client	5.11	17	4.93	9	5.22	20	3026	-1.387	0.17
D20	Progress delay by the contractor	5.26	7	5.15	5	5.34	15	3278	-0.565	0.57
D21	Material and equipment delay	4.79	27	4.63	23	4.89	27	3052.5	-1.301	0.19
D22	Lack of communication between designer and client	5.01	22	4.67	21	5.22	19	2715	-2.402	0.02*
D23	Lack of communication between designer and contractor	5.14	13	4.75	17	5.39	12	2538.5	-2.984	0.00*
D24	Lack of communication between contractor and client	5.12	16	4.94	8	5.23	17	3124.5	-1.066	0.29
D25	Lack of communication between main contractor and sub-contractor	5.10	18	4.85	14	5.26	16	2988	-1.509	0.13
D26	Late payment issued by the client	5.04	21	4.49	27	5.40	11	2424.5	-3.350	0.00*
D27	Failure to make compensation for additional work	5.54	3	5.30	3	5.69	4	2867	-1.921	0.06
D28	Failure to make payment due to the discrepancy of parties' satisfaction to construction deliverables	5.34	6	4.91	11	5.62	6	2606.5	-2.768	0.01*
D29	Contractors' opportunistic behaviour to secure profit from the lowest bid	5.08	19	5.12	6	5.06	23	3355	-0.312	0.76
D30	Lack of financial support from the client	4.69	29	4.52	25	4.80	28	3153	-0.967	0.33
D31	Unbalanced bidding	5.00	23	4.87	13	5.09	22	3217	-0.762	0.45
D32	Errors caused by insufficient time for bid preparation	4.85	26	4.54	24	5.05	24	2675.5	-2.529	0.01*
D33	Bid rigging	4.32	33	4.25	32	4.37	33	3252.5	-0.642	0.52

905 Note: When the Mann-Whitney *U* test result (right most column) is less than 0.05 (highlighted with *), it means significant different perceptions existing among the two types of respondent
906 groups.

907

908

909

910

911 **Table 7 Quartile analysis of dispute causes in China and U.K.**

Quartiles	China	Mean	UK	Mean
Upper quartile $(Q_3)_{China}$ = 4.93 $(Q_3)_{UK}$ = 5.58	**Design defects**	5.57	Unclear design specifications	5.83
	Variation in quantities	5.46	Ambiguities in contractual documents	5.81
	Failure to make compensation for additional work	5.30	Scope of work changes	5.81
	Scope of work changes	5.28	**Failure to make compensation for additional work**	5.69
	Progress delay by contractor	5.15	**Design defects**	5.63
	Contractor's opportunistic behaviour	5.12	Failure to make payment due to discrepancy	5.62
	Unclear design specifications	4.96	**Breach of contract**	5.62
	LoC between contractor and client	4.94	**Misinterpretation of contractual terms and conditions**	5.60
	Late decision making by the client	4.93	**Poor contract management**	5.58
Lower quartile $(Q_1)_{China}$ = 4.52 $(Q_1)_{UK}$ = 5.03	Lack of financial support from the client	4.52	Site handover delay to the contractor	5.03
	Poor contract management	4.49	**Variation in quantities**	5.01
	Late payment issued by the client	4.49	Material and equipment delay	4.89
	Inadequate site investigation	4.48	Lack of financial support from the client	4.80
	Variation in labour and equipment	4.42	Differing physical site conditions	4.78
	Misinterpretation of contractual terms and conditions	4.42	Poor site safety conditions	4.64
	Breach of contract	4.40	Variation in material prices	4.58
	Bid rigging	4.25	Variation in labour and equipment	4.49
	Poor site safety conditions	4.04	Bid rigging	4.37

912

913

914

915

916

917 **Table 8 Critical dispute causes perceived by different project participants**

Dispute causes	Client	Mean	Contractor	Mean	Designer	Mean	Consultant	Mean
Critical dispute causes in China								
Design defects	√	5.61	√	5.50	√	5.56	√	5.64
Failure to make compensations for additional work	√	5.14	√	5.80			√	5.55
Critical dispute causes in the U.K.								
Design defects	√	5.58					√	5.75
Failure to make compensations for additional work			√	5.74	√	6.38	√	5.50

918 Note: √ represents that the dispute cause was perceived as critical (in the upper quartile) by the particular group
919 of respondents.

920