Review of Research Problems in Construction, as Analysed Using Survey Studies

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Abstract. This paper is a review of the literature and focuses on recent studies in construction, specifically construction project engineering, in which surveys and/or interviews were used. This allowed an identification of current research trends in construction project engineering, essential and topical problems of contemporary construction, which were studied using surveys. Second, it was possible to demonstrate that surveys, despite often being used in the social sciences and finding rare use in the technical sciences, are nevertheless a highly effective tool that can be used to solve research problems in construction. They provide useful data that is then analysed, mostly using statistics, and the findings of such analyses and the conclusions that can be drawn from them support decision-makers in construction. The presented research problems that were solved using surveys are highly diverse and concern, among others: building information modelling (BIM), identifying adverse risk factors, design and execution errors, assessing a building’s technical condition, assessing comfort, satisfaction and the social aspect of construction, conflicts and disagreements, cooperation and trust, management, success factors, prefabrication, technologies, waste, green building, sustainable development, safety and cost. In summary, the review of research problems analysed using surveys, as presented, can act as proof that such methods are recognised by scholars all around the world and are used in practically all thematic fields that concern construction project engineering. Survey study methods are a source of valuable data, either independently or in combination with other methods, and supply precious information that can diagnose and aid forecasting phenomena and problems, controlling processes and supporting decision-makers in the difficult process of making decisions, and are often the basis for specific choices.

1. Introduction
The research method should always be well chosen, adequately to the research problem. In the case of survey studies, it is people who are most often the object of study and their opinions are analysed. There are dependencies between participants, which in turn are influenced by external factors [1]. Surveys are sometimes a preliminary stage for further research and analysis in construction [2, 3, 4], and are a source of data used to support decision-making [5, 6].

This paper is a literature review of research carried out in recent years in the construction industry, particularly in the engineering of construction projects, in which an interview or survey questionnaire was used as a research tool. The review was based on selected articles from the Scopus database published from the last ten years.
Two objectives were set. The first objective was to determine current research trends in construction project engineering, the most important and most discussed problems of contemporary construction, which were studied and analysed using a survey study. Secondly, to show that surveys, despite the fact that they are most often used in the social sciences and less often in technical sciences, are a very good tool that can aid in solving research problems in construction industry. The article is also a continuation of the theme presented at the WMCAUS 2020 conference [7].

2. Research problem

2.1. Building Information Modelling (BIM)
Building Information Modelling (BIM) is becoming an increasingly common, even indispensable tool in the construction industry. However, the development of this tool can present difficulties regarding its understanding and proper application. The adoption of BIM technology was investigated in Korea (compared with BIM data in the US) through interviews with experts. The acceptance of BIM by construction companies in Malaysia was described in [8], based on a survey of construction companies.

The benefits of BIM as expected by clients were discussed in [9]. Customers in Malaysia were surveyed through questionnaires, showing the potential of BIM technology in Malaysia. Success factors in the application of BIM in developing countries were investigated in [10] based on data from questionnaires distributed to employees in the public and private construction sector in Turkey.

2.2. Identification of adverse factors, risks
The role of surveys is also to identify adverse factors and their impact on various aspects of a construction project. The impact of adverse, difficult-to-predict and non-contractual site factors on the duration and cost of construction projects in Sri Lanka was presented in [11] by using 10 expert interviews and 93 surveys. Delays are an unfavourable condition on any construction site. The effects of delays in construction projects were discussed in, among others, [12], where a ranking of 17 effects of delays sorted by importance was developed using Malaysia as an example. The results were obtained by a survey of experts (contractors and consultants) and clients (a total of 240 respondents).

The identification of risks in international projects employing companies from Singapore and developing countries is dealt with in [13]—questionnaires were obtained from 38 companies, the types of risks were distinguished and evaluated using a risk criticality index. Different types of construction safety risks in the design and construction phase were described in [14] based on a survey of experts, identifying critical construction safety factors, including human factors such as communication and cooperation.

2.3. Comfort and satisfaction assessment
An unquestioned application of questionnaire surveys is to assess the satisfaction of users of specific buildings and larger built-up areas. In [15], the authors compiled data from an extensive survey conducted in 2015 in as many as 40 cities in China on 6 dimensions of quality: public amenities, environment, culture, safety, environmental health, and transportation.

In [16], the survey method was used to investigate satisfaction with thermal conditions among almost 1000 users of school and residential buildings in Madagascar during rainy and dry seasons. The results showed that there was a greater thermal comfort in residential buildings than in school buildings. Surveys can complement technical studies. Acoustic comfort was investigated in buildings in Poland in [17]. A study of the comfort of use of buildings insulated from the inside with an innovative system was presented in [18, 19].

The authors of [20] presented a study where experts evaluated, by means of a questionnaire, the relationships between the factors affecting the criterion of social benefits and benefits of preserving the
cultural heritage of a building. This research is the basis for multi-criteria analysis based on an original model of selecting a new form of use in the Stara Polana heritage building in Zakopane [21]. Questionnaire surveys of experts’ opinions were also used during the stage of assessing the influence and dependence between measurable and hard-to-measure parameters [22].

2.4. The social aspect of construction
The social aspect is clearly linked with the previous point in terms of satisfaction assessment, and the works presented sometimes overlap thematically.

A survey was applied in the analysis of designers’ approach to construction for displaced people; with the factors considered by designers shown in [23]. Similarly, item [24] examined the social aspect of housing, in the context of designing public space for common use by residents.

The needs, preferences and expectations of suppliers and buyers of construction services can also be considered in the context of the social aspect. The needs of small and medium sized construction entrepreneurs in Ghana were investigated in [25] based on surveys of local authorities, contractors and consultants. On the other hand, the deciding factors considered by buyers of building materials were described by researchers in [26]. The factors that determine the purchase of a dwelling have been studied among 284 respondents in India (Sundrani 2018); the research is intended to be helpful to designers, contractors and developers.

Surveys have also been applied in the development of methods for determining housing rehabilitation needs: determining the rehabilitation needs of buildings [27], and managing renovation in un-renovated buildings [28]. This survey was conducted among people connected with the problem of renovation of residential buildings.

2.5. Conflict versus cooperation
Surveys were used as a source of data in [29], whose authors explored the influence of various factors that can affect the number of claims and litigation on road projects. The results of the study indicate that project delivery methods have a significant relationship with factors such as trust and partnership in the project. The causes of disputes in construction projects in Turkey were analysed in [30]; the results of a survey among 80 contractors showed the main causes of disputes: poor quality of works, payment delays, and management errors.

On the other hand, the opposite approach based on cooperation was presented in [31], where the model of trust in construction projects in the USA was built on the basis of results of surveys conducted among contractors. Survey studies in the field of partner cooperation in construction were presented in a series of publications [32, 33,34, 35], where the level of partner cooperation and its impact on time and cost of the project were analysed. The publication [36] presents the operation of an original algorithm in the support of the general contractor in the selection of subcontractors to cooperate in partnership during the execution of construction projects.

2.6. Management and safety
The measure of good management of a construction enterprise is its success. Preceded by a survey among experts, the identification, evaluation and importance of success factors of construction enterprises [37] was carried out in India; the availability of skilled manpower was found to be the primary success factor.

The process of communication between the developer and the client, the contractor in the design-build system in the US was tracked in the study [38] based on data from surveys and interviews among experts. Similarly, based on the literature and survey data, communication in construction project
management in South Africa was documented and the most important communication skills were highlighted [39]. Survey studies on communication and information flow in construction ventures were also presented in publications [40, 41, 42].

The issue of management was also addressed in [43], which identified practices in the management of a construction project that can improve work efficiency. A qualitative analysis—interviews among experts and then a quantitative analysis—surveys among contractors were conducted first. Trends in construction project management were investigated among companies in Slovakia in [44] with the help of several rounds surveys between 1996 and 2013. Time and cost optimisation in construction project management was addressed in [45,46].

Questionnaires are a natural research tool when studying the problem of occupational health and safety risks on construction sites, because this issue is directly related to people. Among studies on this topic, research works on safety management stand out—such as [47], which identified activities, related to human safety. The purpose of the survey studies is to identify and indicate management practices that will improve the safety of workers who carry out construction projects.

2.7. Waste in Construction
One important aspect of any construction project is to minimise waste generation to avoid site clutter and material waste. Effective waste minimisation at the building design stage was addressed in [48], which identified 19 waste minimisation factors, surveyed 10 design firms and identified critical factors.

Ambiguities regarding the amount of waste in construction projects in Costa Rica were explored in [49] based on surveys and interviews during site visits; these ambiguities mainly resulted due to the lack of environmental knowledge and the lack of waste data recording at the construction site.

2.8. Green building
Green building is a highly topical subject of research, which is often performed using surveys.

The design solutions of green roofs were analysed in Greece (800 survey forms distributed to city dwellers) and showed a high demand for this type of solution [50]. Strategies for promoting green building in developing countries were discussed in [51], where interviews with 43 experts with experience in green building in Ghana, allowed the identification of the best promotion strategies. Barriers to the adoption of green building technologies were of interest to the authors of [52]. A survey among experts in Ghana identified 20 key barriers.

2.9. Sustainability
The article [53] analysed the presence of sustainability factors in the life cycle of a construction project as performed using a survey. Based on a survey of 119 construction engineers in the Gaza Strip, a list of sustainability factors was compiled.

Sustainability was also analysed with the help of a survey study in other works, such as [54] on the adaptation of construction companies to the requirements of sustainable construction. Many studies have been conducted on sustainable construction, both for newly designed buildings and existing buildings undergoing thermal retrofiting [55, 56, 57]. Expert opinion surveys have been used to determine the preference of technical solutions for sustainable construction [58] and the urban layout of a housing estate [59]. However, the new technologies [60, 61] used in the construction industry, such as indoor environmental quality management system and building energy efficiency improvement [62], are not a substitute for user evaluation. Surveys are paramount.
3. Conclusions
The presented research problems, which were solved with the use of survey methods are diverse, they concern, among others, the following issues: building information modelling (BIM), the identification of adverse factors, risk, building condition assessment, comfort assessment, satisfaction, the social aspect of construction, conflicts and disputes, cooperation and trust, management, success factors, waste, technology, green building, sustainability, safety and cost.

In summary of this review of research problems analysed by means of survey studies, it should be stated that these methods are recognised by researchers all over the world and used in practically all subject areas of construction project engineering.

Survey studies provide valuable data, which are then analysed, mainly statistically, and finally the results of this analysis and the resulting conclusions and recommendations support the decision maker in making decisions in the construction industry.

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