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Research paper

Analysis of Research Methods in Construction Pollution Related Research Approaches

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Abstract

The research method is defined as containing numerous research types, explanatory and evaluative data analysis approaches. This paper, presents a review and the analyses of prior research methods implemented to address issues that revolve around construction pollutions by observing several selected peer-reviewed journal articles. As such, 28 journal articles were selected from peer review journals published since 2000 until 2018. The journal articles were retrieved from online scholarly databases. The viability of study results is closely related to the research methods employed. As a result, the outcomes of this review indicate that qualitative research methods, such as doctrinal method, semi-structured interview, personal interview, focus groups discussion, grounded theory, and case study, are the common approaches employed in research studies. Such research techniques are deemed appropriate and reliable for implementation in future researches. In addition, a majority of researchers appear to apply the qualitative method, in comparison to the quantitative approach. Thus, an effective analysis method should be able to identify the pattern of research approaches employed for non-experimental studies to address construction pollution issues. Furthermore, the findings of this study are useful for future researchers who wish to probe into the subject matter of construction pollution issues.

Keywords: *Environment Pollution, Pollution in Construction, Research Methodology, Qualitative Research, Semi-structured Interview*

1. Introduction

The research method is defined as containing numerous research types, for instance, explanatory and evaluative data analysis approaches, as well as qualitative and quantitative approaches, with various data collection methods, such as semi-structured interview, survey interview, intensive literature review, and survey questionnaire. Besides, there are different understandings and clarifications among scholars on what creates a research method. As such, eleven research methodologies have been identified, including theoretical-analytic, design, public survey, and information design system [1]

Based on these methodologies, researchers should consider and select one or more methods for their academic endeavours based on their goals and objectives. There are two types of analysis approaches, which are quantitative and qualitative. The quantitative research approaches consist of a questionnaire survey, as indicated in the literature. The questionnaire is distributed to a target group or randomly selected respondents [2]

The qualitative research method is an approach that is usually associated with the social approach. Besides, qualitative research concerns recording and attempting to analyse information from human behaviour and experience [3]. On the other hand, there are several types of qualitative research methods, for example, doctrinal method, semi-structured interview, personal interview, focus groups discussion, grounded theory, and case study [4]. The doctrinal research is more open and has its methods revealed in detail [5]. This method differs in varied contexts. The doctrinal research is employed to analyse information gathered from semi-structured interviews.

The semi-structured interview method combines several questions that are structured with some unstructured explorations. In fact, several advantages and disadvantages are embedded in this particular method. Semi-structured interviews are useful when a researcher seeks unique components pertaining to a topic. Meanwhile, structured interview checks are useful when one works with complicated problems so as to apply spontaneous quenches and questions to explore, to deepen understanding, and to clarify answers to questions [6].

The advantages of the semi-structured interview are that interviews enable observation of reactions among respondents in order to probe and to clarify ambiguities by analysing the facial expres-

sions of the respondents. The researchers also have flexibility with location and time to gather information.

Apart from that, the interviewer can convince the respondents to cooperate and to provide accurate responses, thus indicating good sampling control [7]. One of the reasons for its popularity is that by focusing on data collection activities, the potential interview protocols standardise data collection and reduce the prevalence of premature data collection [8]. This methodology is designed to match certain questions to specific informers, in the attempt to reduce redundancy and to increase comprehensiveness.

With that, the objective of this study is to analyse if the qualitative techniques, which are semi-structured interview and doctrinal method, are suitable to be implemented for future researches. Therefore, examining the use of the qualitative research methods in past studies would determine if the validity and the degree of variance for the method are accepted for application in addressing issues related to construction pollution in Malaysia.

2. Research Methodology

2.1. Selection of Journal Articles

Journal articles were retrieved from online scholarly databases, such as Science Direct, LexisNexis, Web of Science, and free access journal platforms, which provide access to the latest researches in vast areas. The keywords to search for the specific journals were 'Pollution in Construction' and 'Environmental Pollution' with a period spanning from 2000–2018. The analysis was based on the following headings:

1. Year of publication
2. The title of the research
3. The country where the research was conducted
4. Research approach
5. Non-experimental research method

Amongst the hundreds of journals retrieved, only 28 journal articles were selected for analysis. Most of the journals were selected based on the scope of this study. Thus, the pattern of research methodology had been analysed. Table 1 shows some prior researches in description of headings. The analysis of published articles had been based on articles published from 2000 until 2018. The research approach utilised in this study had been revised and replicated from construction pollution researches. Most of the selected authors had implemented the semi-structured interview and document analysis in their studies, especially regarding to the legislation of environment.

2.2. Analysis of Previous Researches on Constrution Pollution

A study carried out by Banzhaf et al. [9] highlighted the environmental quality impact. Environmental quality has a major impact on the quality of life for human beings. There is lack of studies on the quality of the environment, which leads to environmental impact. Thus, there are correlations between the main elements of the environment, such as water, noise, and air pollutions. In addition, the research conducted by the author required a wide range of data. Hence, a semi-structured interview was employed as the main instrument for data collection. The qualitative methodology of this study describes the environmental perception in detail.

The data were collected via 'open-ended or experts' interviews'. As for the open-ended interview, the researchers held guided interviews with residents, neighbourhoods, and experts in the light of environment. The relevance of these methods is to express how the respondents feel and act towards the environmental problems, and the kinds of daily-life coping tactics applied by the respondents. Literally, this significant method has been adopted by several re-searchers across the globe, including Belayutham, González, and Yiu [10], Feng and Liao [11], Raja Ghazilla et al. [12], Khalid et al. [13], Waris et al. [14], Rosenthal et al. [15], Ariffin and Sulaiman [16], Zhang and Wu [17], Oguntona and Aigbavboa [18] Safinia et al. [19], Akpalu and Normanyo [20], Shen, Wei, and Yang [21], Tanaka [22], Haque [23], Testa et al. [24], Polat et al. [25], Crawford, Mathur, and Gerritsen [26], Panya et al. [27], Li et al. [28], Chang et al. [29], Yusof, Awang, and Iranmanesh [30], Huang et al. [31], Lockrey et al. [21], Casanovas-Rubio and Ramos [32], and Moretti et al. [33]. As described, the methodology adopted in this study is evidently relevant to the nature of the research.

Hence, amongst the 28 selected journal articles, a majority of the researchers implemented the qualitative methods, such as semi-structured interview, document review, and content analysis, in comparison to the quantitative method. Besides, Table 2 shows that the common research methods applied in the journal articles are Questionnaire, Semi-Structured Interview, Doctrinal Research, and Case Study.

3. Result and Discussion

Pollution in constructions has recently become a severe menace globally with air, water, and dust pollutions. The increase of pollution cases from construction projects in Malaysia is alarming and it has contributed to numerous environmental issues. Despite the extensive actions taken to curb these pressing issues, there is no indication of reduction in such cases. In Malaysia, the construction activities are one of the main contributors to pollution. The construction activities can be divided into three categories, which are industrial, building, and infrastructure [34]. Malaysia's poor performance in the global Environmental Performance Index (EPI) has raised attention and concerns from the government and related authorities [35]. Other than that, the environment is undermined by substantial issues, some of which are brought about by the activities of construction projects [36].

Important to note, construction pollution in Malaysia still occurs even after the Federal Government of Malaysia has begun taking serious actions to address environmental issues as there is no indication of reduction in cases [37]. The disconnection between policy and practice of environmental law originates from certain factors, such as ambiguity over roles and responsibilities between governing authorities and limited stakeholder organisation, weak enforcement, and deficiency in implementation [38]. Thus, an effective analysis is required.

A total of 28 journal articles were selected based on the criteria discussed earlier. The practical guide plans and the main methodologic concerns are significant when planning a scientific and ethical research project, including numerous methods, by giving relevant information for the research [39]. As such, a research conducted in 2016 by Belayutham, Gonzalez, and Yiu showed that the semi-structured interview employed allowed retrieval of vast information from the interviewees.

Next, Zuo, Rameezdeen, Hagger, Zhou, and Ding, in 2017, looked into air pollution controls on construction sites in relation to awareness and self-responsibility displayed by managers at construction sites [12]. Thus, the qualitative semi-structured interview was conducted with managers at the construction sites to probe into the aspect of being responsible towards the environment. In order to collect data via interviews, the semi-structured interview method seems more effective for the present study. The interviewees who gave unbiased opinions on the environmental issues indirectly enhanced the quality of data collected.

Third, the study conducted by Ghazilla Sakundarini, Taha, Abdul-Rashid, and Yusoff in 2017 focused on the government bodies that oversee policies associated to environmental issues. Hence, a semi-structured interview was performed with three government

bodies. The criteria of selecting the respondents were: 1) work experience within the related environment for at least five years; 2) has a management position for environmental related scope to ensure that the respondents have communication skills; and 3) the respondents are willing to be interviewed [12].

In another instance, the semi-structured interviews conducted by Khalid, Mokhtar, Jalil, Rahman, and Spray in 2017 investigated the problem of water pollution in the Langat River, Selangor. As such, four local councils were selected as respondents. The results of the interviews were transcribed, coded, and analysed by using data management software [13]. At the end of the research, the findings of the interviews were used to support the development of an environmental framework. Meanwhile, Waris, Mohd Shahir Liew, Mohd Faris Khamidi, and Arazi Idrus, in 2014, conducted a study by employing the semi-structured interview technique. Hence, some industry professionals and Grade 7 contractors were randomly chosen from the Construction Industry Development Board (CIDB) as the respondents.

The potential respondents were contacted for a face-to-face structured interview. All their relevant ideas and opinions are very important and valuable as the findings of the study. This methodology, thus, has been considered as effective and time-saving in order to achieve better results within shorter duration [14]. In addition, the semi-structured review was also applied by Isnin, Ahmad, and Yahya in 2015. The research methodology was used as the primary data-gathering technique. Thus, the respondents were interviewed about awareness of the existing danger in construction sites, which could affect the health of workers.

On top of that, the respondents were selected based on the knowledge level of environmental management at construction sites. Contractors, project consultants, public workers, and developers were involved in the interview sessions [35]. The data were collected and analysed based on opinions and experiences of the respondents.

Meanwhile, a study conducted by Ariffin and Sulaiman in 2015 looked into water pollution in Malaysian rivers. The interviews were conducted face-to-face using semi-structured questions to identify key informants on the causes of pollution in Malaysia [16]. The interview results were transcribed, coded, and analysed via content analysis. Upon analyses, a collection of words and phrases that form the themes had been placed on new pages to create categories. Based on the categories, the findings are discussed in the research.

Additionally, the study conducted by Feng and Liao focused on prevention measure and control of pollution in China. The faulty legislation, the policies, and the plans were linked to air pollution problem [11]. The focus of their research was to look into prevention measure and control of pollution, as understood by the people in China, by providing an overview of legislation pertaining to air pollution. Therefore, selection of document reviews was applied as the qualitative method in their study.

On the contrary, 21 researchers have conducted document review and content analysis methods. The content analysis method was used to re-confirm and to evaluate the proposed frameworks after analysing the findings retrieved from the interviews. Meanwhile, the researchers used the method of content analysis in order to identify themes and categories from the transcribed texts. Content analysis is an indicator to identify the weaknesses in one's perceptions pertaining to environmental quality [9]. The qualitative research via content analysis through literature review includes journals, conference proceedings, and relevant published data, so as to help develop a framework for the researches.

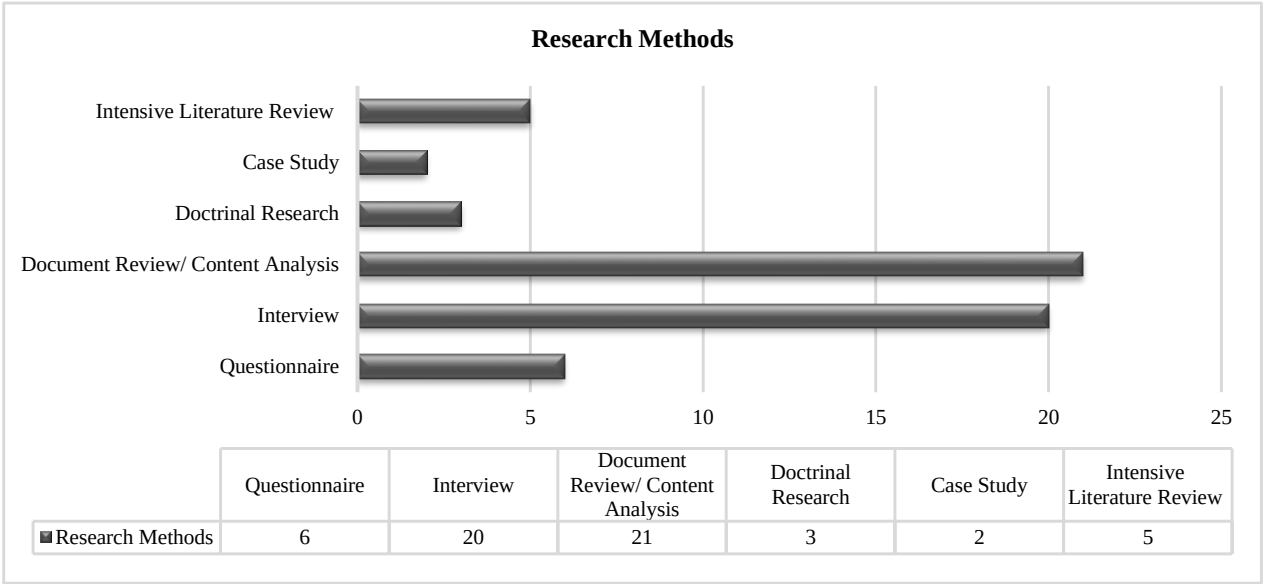
Furthermore, 5 researchers have conducted an intensive literature review. Literature review act as secondary source which help the researchers to present the informative evidence their research [49]. An extensive literature review which is conducted by Polat et al. [25] indicated many causes of construction and demolition waste generation. The factors have categorised into several themes which are design and contract documents-related factors, procurement-related factors, handling-related factors, storage-related factors, workers-related factors, site management and supervision-related factors, waste from cutting uneconomical shapes. By determining the factors, the researcher is able to find the gap of research. Next, to achieve the research aim, it is important reliance upon secondary sources. The data provides value in the comparative study and data analysis. Especially on the environmental impact which is conducted in this research [50]. Research conducted by Moretti, explains how the author used intensive literature review in their methodology to find the environment and human health impact during the construction process. Moretti reviewed several accessible online databases and selected the following keywords regarding the research [33]. Other than that, the research method of intensive literature review and semi-structured interviews were conducted to analyse review and comparative study of policy especially on the national and local policies [48]. All the information get from the intensive literature review and semi-structured interview will reinforce for the further study.

Hence, it is recommended that the qualitative method through semi-structured interview and content analysis be utilised in future studies within the area of concern. The stated research approach is appropriate to further probe into pollution issues in the construction industry.

Table 1: Previous Research with similar Approaches

Year	Author	Source	Locality	Research Title	Research Method
2012	[35]	Procedia - Social and Behavioral Sciences	Malaysia	Awareness and Knowledge of the Hidden Killers in Building Adaptation Projects	1. Semi-Structured Interview
2014	[14]	International Journal of Sustainable Built Environment	Malaysia	Criteria for the selection of sustainable onsite construction equipment	1. Document Review 2. Semi-Structured Interview
2014	[9]	Ecological Indicators	America	A conceptual framework for integrated analysis of environmental quality and quality of life	1. Open-ended Interview 2. Content analysis
2014	[40]	Journal of Cleaner Production	Italy	The effect of Integrated Pollution Prevention and Control regulation on facility performance	1. Document Review 2. Doctrinal Research 3. Interview
2015	[12]	Journal of Cleaner Production	Malaysia	Design for environment and design for disassembly practices in Malaysia: a practitioner's perspectives	1. Open-ended Interview
2015	[41]	Procedia Environmental Sciences	Malaysia	Regulating sewage pollution of Malaysian rivers and its challenges	1. Semi-Structured Interview 2. Content Analysis
2015	[22]	Journal of Health Economics	United States	Environmental regulations on air pollution in China and their impact on infant mortality	1. Document Review 2. Doctrinal Research
2016	[10]	Journal of Cleaner	New	A cleaner production-pollution prevention-based	1. Systematic Review

		Production	Zealand	framework for construction site induced water pollution.	2. Semi-structured Interview
2016	[11]	Journal of Cleaner Production	China	Legislation, plans, and policies for prevention and control of air pollution in China: achievements, challenges, and improvements.	1. Document review
2016	[42]	Journal of Cleaner Production	China	Mitigating construction dust pollution: state of the art and the way forward	1. Content analysis 2. Interview 3. Questionnaire 4. Case Study
2016	[28]	Journal of Cleaner Production	Oman	Health impacts of construction noise on workers: A quantitative assessment model based on exposure measurement	1. Semi-structured Interview
2016	[10]	Journal of Cleaner Production	New Zealand	The dynamics of proximal and distal factors in construction site water pollution	1. Case study 2. Document Review 3. Semi-structured Interview
2017	[43]	Journal of Cleaner Production	Australia	Dust pollution control on construction sites: Awareness and self-responsibility of managers	1. Open-ended Interview
2017	[18]	Procedia - Social and Behavioral Sciences	South Africa	Biomimicry principles as evaluation criteria of sustainability in the construction industry	1. Depth Review Literature 2. Semi-structured Interview 3. Questionnaire
2017	[19]	Procedia Engineering	Oman	Sustainable Construction in Sultanate of Oman: Factors Effecting Materials Utilization	1. Face to face Interview
2017	[20]	Ecological economic	Ghana	Gold Mining Pollution and the Cost of Private Healthcare: The Case of Ghana	1. Open-ended Interview 2. Content Analysis
2017	[21]	Journal of Cleaner Production	China	The impact of environmental regulations on the location of pollution intensive industries in China	1. Document Review
2017	[23]	Water Resources and Industry	United States	Exploratory analysis of fines for water pollution in Bangladesh	1. Document Review 2. Doctrinal Research
2017	[25]	Procedia Engineering	Turkey	Identification of root causes of construction and demolition (C&D) waste: the case of Turkey	1. Intensive Literature Review 2. Questionnaire Survey
2017	[26]	Procedia Engineering	Australia	Barriers to improving the environmental performance of construction waste management in remote communities	1. Case study 2. Document review 3. Semi-Structured Interview
2017	[44]	Journal of social science	Thailand	The performance of the environmental management of local governments in Thailand	1. Questionnaire
2017	[45]	Journal of Cleaner Production	Malaysia	Determinants and outcomes of environmental practices in Malaysian construction projects	1. Questionnaire
2017	[46]	Resources, Conservation and Recycling	Spain	Decision-making tool for the assessment and selection of construction processes based on environmental criteria: Application to precast and castin-situ alternatives	1. Document Review 2. Semi-Structured Interview
2018	[13]	Ecosystem Services	Malaysia	Legal framing for achieving 'good ecological status' for Malaysian rivers: Are there lessons to be learned from the EU Water Framework Directive?	1. Content Analysis 2. Semi-Structured Interview
2018	[43]	Journal of Cleaner Production	Singapore	Sustainability attitude and performance of construction enterprises: A China study	1. Content Analysis 2. Questionnaire Survey
2018	[47]	Water Resources and Industry	Australia	Concrete recycling life cycle flows and performance from construction and demolition waste in Hanoi	1. Intensive Literature 2. Semi-Structured Interview
2018	[33]	Journal of Cleaner Production	Italy	Evaluation of the environmental and human health impact of road construction activities	1. Intensive Literature Review 2. Statistical Data Reported
2018	[48]	Resources, conservations and recycling	China	Construction and demolition waste management in China through the 3R principle	1. Intensive Literature Review 2. Semi-Structured Interview



4. Conclusion

In conclusion, this research systematically analysed prior journal articles regarding construction pollution issues. The analysis aids in decreasing the prevalence of premature data and maximising comprehensiveness. The benefit of the qualitative method through a semi-structured interview, document review or content analysis, and doctrinal research is that it clarifies ambiguities in the existing legislation concerning construction pollution. This method could help to enhance legislation pertaining to construction pollution, apart from reducing the number of pollution cases in Malaysia. The study of research method is an integral element in every research study. The viability of study results is closely related to the research methods employed. As a result, the outcomes of this review indicate that qualitative research methods, such as doctrinal method, semi-structured interview, personal interview, focus groups discussion, grounded theory, and case study, are the common approaches employed in research studies. Such research techniques are deemed appropriate and reliable for implementation in future researches. Therefore, this paper presents some beneficial information for future researchers in terms of research approaches and understanding the pattern of the research method in the light of construction pollution issues.

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