

Implementation of Legislation Related to Construction Waste among Contractors

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Abstract: The fast improvement in Malaysia has expanded the interest of construction material usage for development purposes and then again, the substantial waste was likewise expanding consistently, and it has been brought up as the most produced waste from development industry. When dealing with construction waste which involves in any party for assuring construction site were most probably lack of regulations and irresponsibility of local authorities to manage the issue well. Level of awareness on the legislation towards environmental in the field of contractors were lower among project developers with regards of laws and regulations stated within the implementation in Malaysia. This study aims to identify the perception of contractors and to investigate the implementation of legislation related to construction waste among contractors. Besides, this research identified different types of construction waste in construction site and investigated the construction waste generated on how implementation of laws and regulations helped increase the awareness. The questionnaires have been distributed to G7 construction practitioners such as consultants, contractors, site supervisor, engineers, and project managers in Johor Bahru. Thus, the survey was obtained from 60 respondents and were analyzed using Statistical Package for Social Science (SPSS) system in determining the mean score values. In conclusion, this research had improved the economical and overall construction industry quality where the acknowledgment of legislation in the study area provided a clearer view in enhancing a better atmosphere.

Keywords: Construction waste, Legislation, Implementation, Awareness

1. Introduction

Waste from construction activities, including pre-construction, construction, and post-construction, is known as construction waste. Human activities generated all construction waste, which will add to environmental difficulties (Rahim *et al.*, 2017). The construction industry is vital to the nation's infrastructure development. However, the industry's primary problem is construction waste. The construction industry generates more waste than other businesses. According to Nabil Kartam (2004), development waste removal essentially affects the limit of the removal site, the expense of development waste the board, and the environment. This paper examines the concepts of construction waste and definition of inputting legislation and regulations of construction industry in a more specific way. The discussion of achieving aim and targeting the questions mentioned in the research is mandatory.

Globally, waste volumes are expanding at a rate that is even faster than urbanization. Approximately 1,300 million tons of solid trash are produced annually by the world's cities. By 2025, this quantity is projected to climb to 2.2 billion tons (Hoornweg & Bhada-Tata, 2012). According to Taha (2015), Malaysia's solid waste alongside Public Cleansing Management Corporation uncovers that improvement projects made around 8 million tons of waste. Since the advancement of development has been growing rapidly, 28% of the hard and fast waste made was contributed by development and modern waste stream (Begum *et al.*, 2006). Investigation on the construction waste has brought into effect to the environment (Lachimpadi, Pereira, Taha, & Mokhtar, 2012; Shen & Tam, 2002). As far from we discuss, construction waste management in Malaysia has been facing a major barrier of lacking a proper management that subsequently caused all the effect (Al-Hajj & Hamani, 2011).

The construction waste issue has particularly been an unsolved problem and ever rising due to the development of a nation. It leads to environmental problems such as the consumption of waste sites and nonrecoverable natural resources. The statistics of construction waste shown in recent years are still increasing rapidly and the problem is not properly resolve. In Malaysia, applying rules and regulations as a formal waste management approach is a widely acknowledged practice, although it still requires considerable attention from the contractors.

Absence of guidelines and untrustworthiness of neighbourhood specialists and regulation under their purview in dealing with strong waste to any party for guaranteeing construction sites in dealing with the issue appropriately that by implication causes high measure of waste created (Ferguson *et al.*, 1995; Coventry and Guthrie, 1998). According to Shen & Tam (2002), level of awareness on the legislation towards environmental in the field of contractors are lower among project developers with regards of laws and regulations stated within the implementation in Malaysia. Therefore, the aim of the study is to investigate the implementation of legislation related to construction waste among contractors. To achieve the aim, the study seeks to the following objectives (i) To study on the perception of contractor on the legislation related to the construction waste and (ii) To analyze the factors that increase the awareness among contractors.

This research was conducting in Pasir Gudang, Johor Bahru with focusing on the construction practitioners in Malaysia's construction industry where we will be identifying different types of construction waste in construction site. The respondent will include with clients, consultants and the contractors who are registered with Construction Industry Development Board (CIDB). This study will also investigate the construction waste generated and to identify how implementation of laws and regulation will help in managing the construction waste at site. The research will be conducted through presenting a survey finding with approximately 90 respondents pertaining from the key players' chosen and data will be computed in the percentage based on the Likert scale.

The findings of this study reflect in the benefits for construction industry and seeks to facilitate understanding and implementation of legislation by related parties. Malaysia's construction industry has been rising significantly with social growth. While the expansion of construction contributes to the progress of nations, it has detrimental environmental effects. Creating awareness about the application of legislation that aids in resolving the problem, this research was conducted to educate parties involved

in the construction sector about how inappropriate waste management practices lead to construction waste production. In addition, this research will aid parties involved in construction development who are contractors in handling construction trash with better care. This research's recommendations can therefore serve as a roadmap for the building industry's transition to a green or sustainable environment.

2. Literature Review

2.1 Concept of construction waste

Franklin *et al.* (1995) determined that industrial waste might be characterized as waste from any factory or from facilities used for the provision of public transport services, the provision of public utilities, or the provision of postal and telecommunication services. Construction waste is characterized as any substance, matter or thing which is created because of construction work also, deserted whether it has been handled or stored prior to being deserted. According to EDP (2015), it is a combination of surplus materials emerging from site leeway, removal, development, renovation, redesign, destruction, and street works.

By and large, the development exercises imply various exercises like design works, tunnelling, road works, expansions, and runway (Nagapan *et al.*, 2012). Because of development exercises (Jaillon *et al.*, 2009) and emotional ascent in light of quick turn of events and urbanization, the amount of development garbage has consistently expanded throughout the course of recent many years (Papargyropoulou, 2011). As according to Begum. R. A (2006), construction waste created from a development project site of another structure is assessed around 27,068.4 tons yearly around the world. The construction waste is partitioned into 8 kinds and the substantial and total waste is the most elevated produced waste among these losses with 17,820 tons or 65.8% of the all-out produced construction waste (Wong, 2012).

2.1 Definition of legislation and regulation

Increasingly, legislation and regulation affect our lives. Statutes, ordinances, decrees, orders, bylaws, case laws, treaties, and codes of various forms and origins continue to proliferate inside and between states (Nir Kosti, 2020). According to Kivumbi (2010), to keep within the legal bounds of a country, community, or industry, legislation is a command given by a government or other governing body to that industry, community, or group of individuals. All market participants must abide by legislation as an external force to be compliant. A country's parliament or another legislative branch of government enacts legislation as laws.

On the other hand, definition of regulation is a specified requirement that can take many forms, including industry specific regulations as well as regulations with a much broader scope. They are essentially how regulators enforce legislation and support the requirements of the legislation (Kivumbi, 2010).

2.2 Authorities involved by laws

Table 1: Authorities involving in construction waste management

Authorities	Laws/ Acts/ Standard	Scope	Remarks
Ministry of Housing and Local Government	Solid Waste and Public Cleansing Management Act 2007 (Act 672)	The goal of this act is to establish and regulate the management of regulated solid waste and public cleansing to preserve adequate sanitation.	The definition of solid waste includes construction solid waste.
Construction	Pembinaan Malaysia	This legislation is	Part IV, section 24 (2b)

Industry Development Board	Act 1994 (Act 520) – Part IX Section 35 (2)	intended to prevent, reduce, control, and improve the environment in Malaysia.	(prohibition and regulation of pollution) stipulates that a person is considered to have polluted soil or land if the dumping of solid waste is poisonous and offensive to humans; affects underground water; and is injurious to soil and land surface.
Ministry of Natural Resources and Environment	Environmental Quality Act 1974 (Act 127) – Part IV Section 24 (2b)	This act is intended to offer construction-related functions.	In accordance with Section 35(2) of Part IX (Enforcement and Investigation), an investigation officer may enter a construction site at any time to inspect the construction works.

(a) *Solid Waste and Public Cleaning Management Act 2007 (PPSPPA)*

PPSPPA was the latest legislation formed in the industry of construction waste management when it officially commenced on 30 August 2007 (PPSPPA, Act 2007). PPSPPA comprises of 12 Parts containing 112 areas and no timetable including not amended. The act is limited in its coverage of housing schemes and areas governed by local authority. The law focuses mostly on preventing waste from contributing to poor sanitation.

Table 2: Arrangement of sections of PPSPPA

Part I	Preliminary
Part II	Administration
Part III	Approval for the Construction, Alteration or Closure of Prescribed Solid Waste Management Facilities
Part IV	Licensing Provisions
Part V	Charges
Part VI	Tribunal for Solid Waste Management Services
Part VII	Assumption of Control
Part VIII	Control of Solid Waste Generators and Persons in Possession of Controlled Solid Waste
Part IX	Enforcement Provisions
Part X	Reduction and Recovery of Controlled Solid Waste
Part XI	General
Part XII	Savings and Transitional

(b) Pembinaan Malaysia Act 1991 (PMA) Act 520

Act 520 was passed in 1994 to lay out the Lembaga Pembangunan Industri Pembinaan Malaysia, otherwise called the Malaysian Construction Industry Development Board (CIDB), and to accommodate its capacities connecting with the development business and for issues associated (CIDB, 2013).

Table 3: Arrangement of sections of PMA Act 520

Part I	Preliminary
Part II	The Lembaga
Part III	Chairman, Officer, Servants
Part IV	Finance
Part V	Other Powers of The Lembaga
Part VI	Registration of Contractors
Part VII	Accreditation and Certification of Skilled Construction Workers and Construction Site Supervisors
Part VIII	Levy
Part IX	Enforcement and Investigation
Part X	General

(c) Environment Quality Act 1974 (EQA)

The demonstration degrees are to forestall, lessen, control contamination, and upgrade the climate. The squanders show up in this act are more connected with general ecological issues. The squanders are deciphered as fluid, strong, gasses and radioactive. The squanders are either typical waste or timetable waste (Sasitharan *et al.*, 2012).

The wastes recorded in this act are essentially connected with more extensive ecological issues. The squanders are named fluid, strong, vaporous, or radioactive. Normal waste or schedule waste constitute the wastes (Mustafa, 2011; Environmental Quality Report, 2006). The disadvantage of the law is that it considers waste when it is deposited and causes environmental degradation.

Table 4: Arrangement of sections EQA Act 1974

Part I	Preliminary
Part II	Administration
Part III	Licenses
Part IV	Prohibition and Control of Pollution
Part V	Appeal and Appeal Board
Part VI	Miscellaneous

2.3 Concept of construction waste management in hierarchy

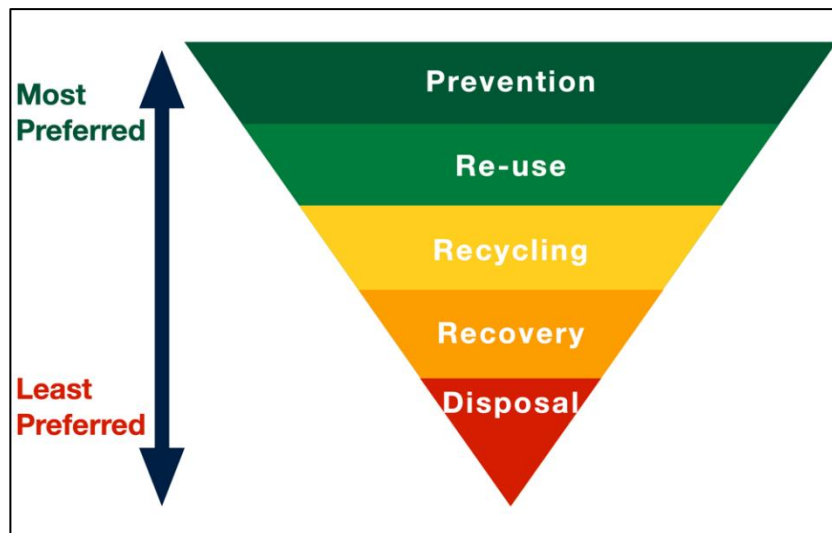


Figure 1: Construction waste management hierarchy

Management of construction waste should be performed after passing through various stages. Figure 1 demonstrates that waste management should be based on the hierarchical model proposed by Peng *et al.* in 1997. According to his advice, the waste management process should involve reducing, recycling, and reusing rubbish. Moreover, Wolsink (2010) has proposed a waste management hierarchy model.

According to Davis R. (2002), the waste administration order is a calculated structure intended to guide and rank waste administration activities at both the individual and hierarchical level. It gives top accentuation to waste avoidance, trailed by re-use, reusing, recuperation and ultimately removal. According to Katherine Adam (2022), the hierarchy system assists us reexamine our relationship with waste in view of five needs positioned as far as what is best for the climate. This is commonly depicted as a five-tier inverted pyramid. Sustainability in construction waste can be viewed as a step-by-step plan to attain the most desirable and optimal procedure based on the waste generating conditions and kind (Price and Joseph, 2000). Although the waste management hierarchy consists of five steps, it is advised that waste management be applied from the most desirable step, prevention, to the least important step. (Aadal. H., 2013)

(a) *Prevention*

(b) *Re-use*

(c) *Recycling*

(d) *Recovery*

(e) *Disposal*

2.4 Practices of construction waste

(a) *India*

It is extremely difficult to measure the amount of construction and demolition (C&D) waste generated in India (Kolaventi *et al.*, 2017). Currently in India, C&D waste generated on-site is removed with the assistance of local vendors. The local vendors will charge a minimal fee to clear the location, and the local vendors intern will trade the material to a person in need. Thus, the current circumstance makes recycling goals, processing and quantification estimates for construction waste more difficult.

(b) Bangladesh

Being a part of that, proper construction waste management is a significant concern these days. Bangladesh, as a developing country, faces huge construction development work given its existing socioeconomic situation. However, most building waste management practices are deplorable. It is past time to consider some immediate initiatives to execute various techniques for overall management. Reliable and thoroughly studied case studies are required for successful waste management techniques (F. H. Chowdhury, 2016)

(c) Malaysia

In Malaysia, the government has established the Construction Industry Development Board (CIDB) to provide environmental guidance to the construction industry (Tey *et al.*, 2012). Giusti (2009) stated that the most environmentally sound criteria for a waste management hierarchy are waste reduction, waste reuse, recycling, and then disposing of garbage in a sustainable manner at a landfill. As a result, the building industry began to recognize the significance of waste management hierarchy as a method for reducing waste (Hassan *et al.*, 2012).

(d) Singapore

According to Sasitharan. N. (2012), the characteristics of construction projects are divided into the following major categories for this study in Singapore's perception. Moreover, among the six categories, the following sections will elaborate on the essential aspects of building projects that influence perceptions of waste management advantages. As stated previously, disposal management offers numerous benefits. By examining how different project criteria influence these benefits, the construction industry may gain a better understanding of their relationship. (Ade. Asmi., 2012).

2.5 Perception of construction waste

Increased disposal costs and a decline in the number of landfills have prompted the building industry to embrace efficient waste management. As each construction project is developed in a unique manner, the benefits of waste management may also vary from project to project. Therefore, project features must be considered when executing the plan (Prakash *et al.*, 2020).

The construction industry is one of the leading contributors to national development, since it supplies the infrastructure and physical structures necessary for commercial, service, and utility activities. The industry creates employment opportunities and injects capital into the economy by attracting international and domestic investment (M. Agung, 2009). Despite these contributions, the construction industry has been connected to global warming, pollution, and environmental degradation that related to construction waste among contractor's behavior (Jones & Greenwood, 2009).

2.6 Types of construction waste

According to Construction & Demolition Recycling (2020), construction waste can be categorized in eight types of waste which are stated at below table.

Table 5: Types of construction waste

Types	Description
Bricks	Brick wastes may be contaminated with mortar and plaster because of demolition work.
Concrete	Due to the destruction of existing structures and the testing of concrete samples, etc., concrete wastes can be produced.
Ferrous metal	Another sort of waste that is not only very valuable but also nearly entirely recyclable is ferrous metal. Additionally, ferrous metals can be recycled

	repeatedly.
Non-ferrous metal	On construction sites, aluminium, copper, lead, and zinc are examples of nonferrous materials waste. The bulk of these substances are recyclable.
Masonry	Masonry waste is generated during the demolition of masonry structures. By crushing the debris, it can be recycled and utilized as recycled construction aggregate.
Paper and cardboard	A third of the volume of building and demolition trash is projected to consist of paper and paperboard. This garbage is recycled and converted into new paper goods.
Plastic	Plastic can be recycled and utilized in items intended expressly for the use of recycled plastic, such as street furniture, roof and floor, PVC window noise barrier, cable ducting, and panelling.
Timber	Construction and demolition activities generate a substantial amount of wood debris. After cleaning, detailing, and sizing, whole timber from construction and demolition projects can be easily and immediately reused in other construction projects.

2.7 Issue of handling construction waste

Construction waste has become a significant issue in many developing countries, with negative consequences for the environment, economy, and society. The environmental impact of building waste is always a major concern, and adequate management is necessary to avoid environmental liabilities. The negative effect of building wastes is initiated by dumping operations, such as dumping in woods, streams, ravines, and vacant land, which causes erosion, contaminates wells, and has an influence on water tables and surface water (Arslan *et al.*, 2012).

(a) *Ineffective enforcement*

Enforcement is a common concern in solid waste management. Some challenges with enforcement include a lack of empowerment, limited manpower, a dearth of skilled enforcement officials, and inadequate funding from local authorities.

(b) *Illegal dumping*

According to M. B. Mokhtar (2003), the legal dumpsite isn't as expected monitored and doesn't give a legitimate program to the reusing of development waste or any separation of the development waste arranged. These waste are routinely discarded at a similar removal site as other strong waste bringing about a combination of idle and natural materials at the landfill.

(c) *Lack of awareness and attitude*

The cognizance and mindset of organizations drew in with the improvement industry, like the advancement field, neighborhood government, and tenants, ought to in like manner be seen as to redesign the organization of improvement waste evacuation (S. A. Mahayuddin, 2008). Negative attitudes toward subordinates, variances in attitudes across different working groups, and a lack of training to emphasize the necessity of waste minimization methods have impeded the industry's implementation of effective waste management procedures.

2.8 Factors to increase awareness among contractors

(a) *Financial support*

The Environmental Performance Reviews have demonstrated that government support in the form of grants, loans, tax breaks, and other mechanisms is a crucial component of the overall waste

management policy mix. In addition, governments are exploring appropriate financial structures to facilitate the transition to a circular economy. Private and state waste contractors as well as private businesses contribute significantly to the financing of waste management. In the circular economy, company investments will be crucial (OECD, 2013)

(b) Induction and training

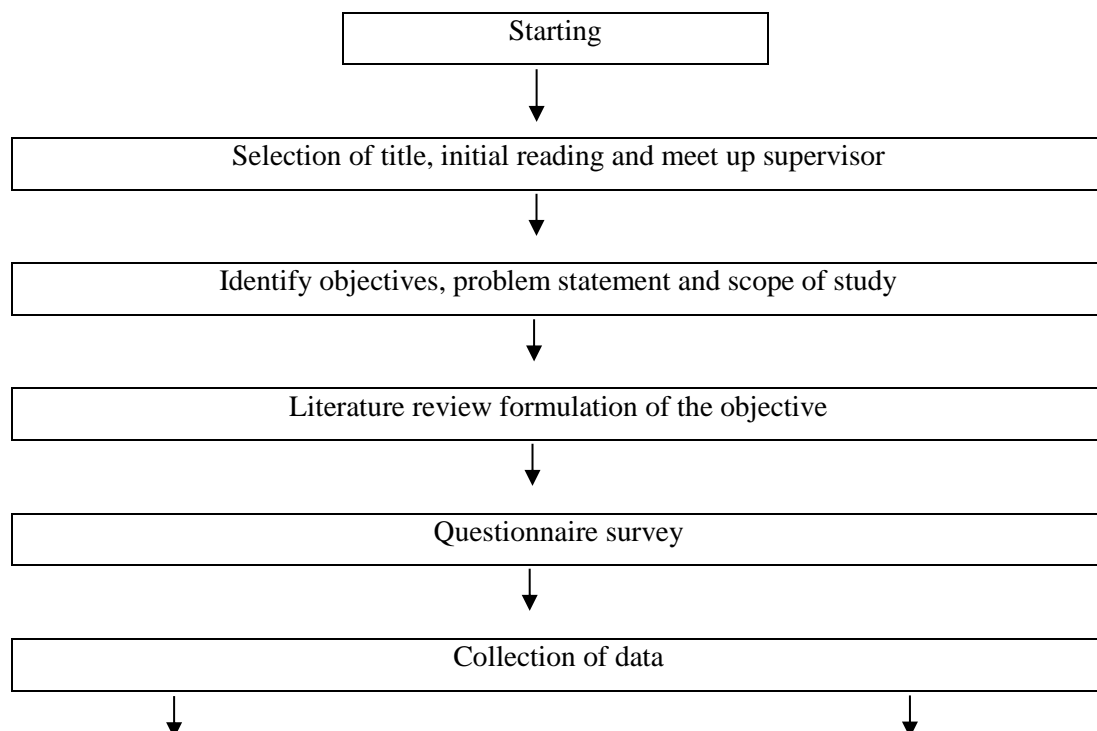
According to the research report by Resource Efficient Scotland (2022), one of the solutions in increasing awareness among contractors is to give training where it will ensure that personnel and subcontractors are made aware of effective waste management and the specific methods employed at the site during site orientation. Include waste management theory education in every meeting on the job site, including the progress meeting, coordination meeting, and safety committee meeting. As for the role of subordinates, keep track progress and highlighting it at site meetings can help drive employees to attain their objectives. Create site and public bulletin boards to promote the waste program and display KPIs and their development. This could also help with Respectful Builder objectives.

(c) Green rating system

Implementing green rating systems can help in improving the means to work on the general quality of buildings and infrastructure where green rating system means a collection of rating systems and instruments used to evaluate the sustainability and environmental performance of a building or development project. The materials portions of these standards and evaluations include design techniques, material selection and utilization, and C&D waste reduction. For instance, these sustainability assessment tools, such as Building Environmental Assessment Method Plus (BEAM Plus) and Leadership in Energy and Environmental Design (LEED), (Ann T. W. Yu., 2021).

3. Research Methodology

Research methodology is a rational and systematic approach to solving a research issue. Research methodology can be defined as study or investigation that must be conducted in a careful, scientific, and critical manner (Scones and Stevensons, 2004). study. The objectives are to determine whether the perception of contractor on the legislation related to the construction waste and to analyze the factors that increase the awareness among contractors.



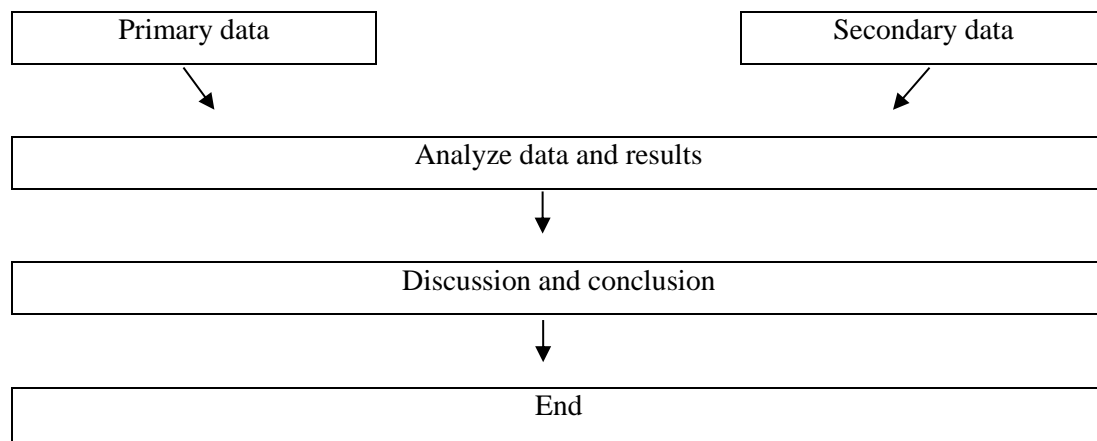


Figure 2: Research methodology flow chart

3.1 Research Design

A research design is the collection of methods and procedures used to gather and analyze measurements of the variables outlined in the study topic. Besides, this allows the researcher to provide insights about the research's purpose and methodology (Question Pro, 2020). The objectives that need to be achieved in this research are to identify the perception of contractor on the implementation of legislation related to the construction waste, to analyze the factors that increase the awareness among contractors and issue of handling construction waste in Malaysia.

3.2 Data Collection

The data collection was done through by quantitative research of doing survey where this section focusses on the demographics of the clients, consultants, contractors, engineer, site supervisor and project manager who answered the questionnaires at random. The questionnaire includes every question that was useful for achieving the study's goal. By collecting their response, the questionnaire was given to each of the selected G7 contractors and construction management personnel. The population of the survey distributed was 100 respondents and the final obtained response from the respondent were 60 replies. The questionnaire was distributed personally, via email, and via social media platforms like WhatsApp, which was convenient for the respondent.

3.3 Data Analysis

Data analysis is the process of selecting a portion of the population to represent the entire population (Polit & Hunger,1999). Sampling method is not random, as the researcher chooses the individuals or objects to include in the sample. Primary data are authentic and factual. While collecting primary data to identify a solution to the problem at hand. To obtaining a suitable and relevant result that satisfies the study's objectives, all the information gathered from the questionnaires was analyzed and then summarized (Sajjad Kabir, 2016).

4. Results and Discussion

4.1 Respondents Demographic

Table 6: Respondents demographic

Demographic Respondents Background	Frequency	Percentage
Age		
Below 21	16	26.7
21 – 25	22	36.7
26 – 30	12	20.0

31 and above	10	16.7
Gender		
Male	26	43.3
Female	34	56.7
Ethnicity		
Malay	12	20.0
Chinese	40	66.7
Indian	6	10.0
Other	2	3.3
Educational Level		
Certificate	14	23.3
Diploma/ A Level	14	23.3
Degree	30	50.0
Master	2	3.3
Ph. D.	0	0
Job Position		
Client	14	23.3
Contractor	8	13.3
Consultant	14	23.3
Engineer/ Asst Engineer	10	16.7
Site Supervisor	2	3.3
Project Manager	12	20.0
Experience in Current Industry		
Less than 2 years	28	46.7
2 to 5 years	8	13.3
6 to 10 years	6	10.0
More than 10 years	12	20.0
Not related	6	10.0

4.2 Perception of Contractor on the Implementation of the Legislation Related to the Construction Waste

Table 7: Section B data analysis summary

Perception of Contractor on the Implementation of the Legislation Related to the Construction Waste	Mean	Ranking	Category
Local authorities have been given full liabilities to ensure legitimate waste administration strategy which can be presented	2.30	1	No
The arrangement of sections of PMA Act 520 comprises 10 parts and only part I and IX are applicable to building waste issue	2.10	2	No
Do you think the concept of legislation in Malaysia has widely been approach to many local authorities?	2.07	3	No
Do you think that Malaysia's implementation of legislation in construction industry is high?	2.06	4	No
The perception on construction waste have been categorized in discussion of four countries which are under India, Bangladesh, Malaysia, and Singapore	1.97	5	Yes
PPSPPA comprises of 12 parts containing 112 areas of arrangement	1.87	6	Yes
Do you know or have any information about implementation of legislation in construction industry in Malaysia?	1.83	7	Yes
Is the authority of Ministry of Natural Resources indicating the act of Environmental Quality Act 1974 EQA (Act 127)	1.77	8	Yes
PPSPPA was the latest legislation formed in the industry of construction	1.70	9	Yes
In Ministry of Housing and Local Government authorities entitled the law of Solid Waste and Public Cleansing Management Act 2007 (Act 672) PPSPPA	1.67	10	Yes
The wasted listed in arrangement of section of Environmental Quality Act 1974 are primarily associated with broader environmental issues	1.57	11	Yes
Construction waste management is categorized into five parts of disposal, recovery, recycling, re-use and prevention	1.53	12	Yes
In Construction Industry Development Board entitled the standards of Pembinaan Malaysia Act 1994 (Act 520)	1.53	12	Yes
The legislation of Act 520 is intended to prevent, reduce, control, and improve the environment in Malaysia	1.43	13	Yes
Construction waste has become a significant issue in many developing countries	1.27	14	Yes
Construction wastes are waste that is characterized as any substance, matter or thing which is created because of construction work?	1.20	15	Yes

From the discussion of the perception of contractor on the implementation of the legislation related to the construction waste among G7 Contractors in Malaysia, Table 8 has calculated that the highest

ranking of “local authorities has been given full liabilities to ensure legitimate waste administration strategy” which can be presented were chosen as the first with the mean of 2.30 from the other following. In this case, it shows that most of the respondent acknowledge that local authorities did not given liabilities in ensuring the waste administration that were presented.

4.3 The Factors that Increase the Awareness Among Contractors

Table 8: Section C data analysis summary

The Factors that Increase the Awareness Among Contractors (Financial support)	Mean	Ranking	Category
Private waste contractors contribute significantly	3.87	1	Neutral
Government exploring appropriate financial structures to facilitate the transition	3.77	2	Neutral
Government support in form of loans and tax breaks	3.73	3	Neutral
Government support in form of grants	3.67	4	Neutral
The Factors that Increase the Awareness Among Contractors (Induction and Training)	Mean	Ranking	Category
Waste management theory education in every meeting	4.13	1	Agree
Keep track of progress and highlighting at site meetings	4.00	2	Agree
Hosting progress meeting	3.93	3	Neutral
Hosting coordination meeting	3.93	3	Neutral
Create site and public bulletin boards	3.83	4	Neutral
Ensure that personnel and subcontractors are made aware	3.80	5	Neutral
Hosting safety committee meeting	3.73	6	Neutral
The Factors that Increase the Awareness Among Contractors (Green Rating System)	Mean	Ranking	Category
Evaluation on construction and development waste reduction	4.20	1	Agree
Evaluate the environmental performance of a project	4.13	2	Agree
Evaluate the sustainability of a project	4.07	3	Agree
Evaluation on material selection and utilization	3.93	4	Neutral
Using tools such as BEAM Plus	3.73	5	Neutral
Using tools such as LEED	3.70	6	Neutral
A collection of rating systems and instrument used	3.67	7	Neutral
Evaluation on design techniques	3.63	8	Neutral

According to Table8, the factors that increase the awareness among contractor were categorized into three facts where “private waste contractors contribute significantly” was listed as the prior factor at the mean of 3.87. However, in the fact of induction and training, most of the respondents agreeing the fact of “waste management theory education in every meeting” was important with receiving of 4.13 while the highest ranking for Green Rating System from the factor goes to “evaluation on construction and development waste reduction” with a mean score of 4.20.

4.4 Issue of Handling Construction Waste

According to Table 9, there were a few issues of handling construction waste significantly in three facts of ineffective enforcement where “limited manpower” gained first ranking of hitting a mean score of 3.97. One of the issues from illegal dumping gained respond of agreement from respondents with mean score of 4.13 which was “health and safety risk” while “lack of sustainable

industrial training and experience” were the highest-ranking issue from the fact of lacking awareness and attitude.

Table 9: Section D data analysis summary

Issue of Handling Construction Waste (Ineffective Enforcement)	Mean	Ranking	Category
Limited manpower	3.97	1	Neutral
Inadequate funding from local authorities	3.90	2	Neutral
Lack of financial resources to pay upfront costs	3.90	2	Neutral
Lack of empowerment	3.70	3	Neutral
A dearth of skilled enforcement officials	3.50	4	Neutral
Issue of Handling Construction Waste (Illegal Dumping)	Mean	Ranking	Category
Health and safety risk	4.13	1	Agree
Insufficient management	4.00	2	Agree
Avoidance of disposable fee at waste management sites	3.93	3	Neutral
Soil and water become contaminated	3.50	4	Neutral
Diminished property value	3.40	5	Neutral
Issue of Handling Construction Waste (Lack of Awareness and Attitude)	Mean	Ranking	Category
Lack of sustainable industrial training and experience	4.13	1	Agree
Lack of training to emphasize the necessity of waste minimization	3.97	2	Neutral
Variance in attitude across different working groups	3.63	3	Neutral
Lack of market demand	3.57	4	Neutral
Negative attitudes toward subordinates	3.50	5	Neutral

5. Conclusion

This research describes briefly on the reviews of how legislation been implemented into the investigation on construction waste among contractors. The overview of waste and initiatives in the construction industry highlights the current state of waste management in Malaysia. Not every initiative is executed by construction industry players. Thus, a more holistic strategy is required to protect the economic, social, and environmental components. This chapter concludes the study approach and analysis to deliver necessary researchers with guidance by discussing how to construct the questionnaire to fulfill the stated objectives.

In conclusion, the Malaysian government must provide significant support for a more effective policy to manage construction waste. Otherwise, sustainability and environmental issues will not be successfully addressed. The construction industry is regarded as the industry with the greatest negative environmental impact. Therefore, stakeholders in the construction industry should have major and accountable roles in efforts to limit the waste of building materials. Increased contractor awareness will increase the acceptability of advice for all parties concerned.

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References

- Aadal, H., Rad, K. G., Fard, A. B., Sabet, P. G. P., & Harirchian, E. (2013). Implementing 3R concept in construction waste management at construction site. *J. Appl. Environ. Biol. Sci*, 3(10), 160-166.
- Act 520 | Construction Industry Development Board. (n.d.). CIDB. <https://www.cidb.gov.my/en/about-us/legislation/act-520> Ana Pires, Graça Martinho. Waste hierarchy index for circular economy in waste management, *Waste Management*, Volume 95, 2019, Pages 298-305, <https://doi.org/10.1016/j.wasman.2019.06.014>.
- Amasuomo, E., & Baird, J. (2016). The concept of waste and waste management. *J. Mgmt. & Sustainability*, 6, 88.
- B. (2022, May 28). Research Methodology – Introduction. BBA|mantra. Retrieved June 12, 2022, from <https://bbamantra.com/research-methodology/> Chowdhury, F. H., Raihan, M. T., Islam, G. M. S., & Ramiz, F. (2016, December).
- Construction waste management practice: Bangladesh perception. In *Proceedings of 3rd International Conference on Advances in Civil Engineering* (pp. 21-23).
- Davies, R. (2022, May 4). What Is a Waste Management Hierarchy? | Axil-IS. Axil Integrated Services. <https://axil-is.com/waste-management-hierarchy/> Ebikapade Amasuomo and Jim Baird. The Concept of Waste and Waste Management.
- Facility, P. R. (n.d.). SMV <https://www.smvresources.com.my/others.html> Resources. SMV.
- Hamakareem, M. I. (2021, May 13). Construction Wastes: Types, Causes, and Recycling Strategies. *The Constructor*. <https://theconstructor.org/concrete/construction-waste-recycling/1088/> Hamid, A. Kiyanoosh, G. R., Ali, B. F., Pejman & Ehsan, H. (2013, September 20).
- Implementing 3R Concept in Construction Waste Management at Construction Site. *Journal of Applied Environmental and Biological Sciences*, 3(10)160-166 Hasan, M. R., Sagar, M. S. I., & Ray, B. C. (2022). Barriers to improving construction and demolition waste management in Bangladesh. *International Journal of Construction Management*, 1–15. <https://doi.org/10.1080/15623599.2022.2056804> Hwang, B. G., & Yeo, Z. B. (2011). Perception on benefits of construction waste management in the Singapore construction industry. *Engineering, Construction and Architectural Management*.
- Issues on Construction Waste: The Need for Sustainable Waste Management Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Sustainable-waste-managementhierarchy_fig1_258224190 [accessed 13 Jun, 2022] Madurwar, M. V., Ralegaonkar, R. V., & Mandavgane, S. A. (2013). Application of agro-waste for sustainable construction materials: A review. *construction and Building materials*, 38, 872-878.
- Journal of Management and Sustainability*, 2016, Vol.6, No.4 Effie.P, Christopher, Rory & Anis, A. A. (2011). Sustainable Construction Waste Management in Malaysia: A Contractor's Perspective. *Management and Innovation for a Sustainable Built Environment*, Retrieved from, <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.842.6622&rep=rep1&type=pdf> Environmental Quality Act, 1974 (Act 127).
- Katherine Adams (2022). What is the Waste Hierarchy?. *Construction Products Association*. Retrieved from <https://www.constructionproducts.org.uk/media/557063/waste-hierarchy.pdf> K., S. S., T.P., T., & M.V.N., S. K. (2022). Implementing construction waste management in India: An extended theory of planned behaviour approach. *Environmental Technology & Innovation*, 27, 102401. <https://doi.org/10.1016/j.eti.2022.102401>
- Laws of Malaysia. Online Version of Updated Text of Reprint. Act 520. Lembaga Pembangunan Industri Pembinaan Malaysia Act 1994 Laws of Malaysia. Act 672. Solid Waste and Public Cleansing Management Act 2007
- LibGuides: Research Support: Research Methodology. (n.d.). LibGuides. <https://libguides.wits.ac.za/c.php?g=693518&p=4914913#:~:text=Research%20methodology%20is%20the%20specific,study's%20overall%20validity%20and%20reliability.>
- L. Y. Shen and Vivian W. Y. Tam. Implementation of Environmental Management in the Hong Kong Construction Industry. *International Journal of Project Management* 20, 2002. 535-543 Md. Bakri Ishak (2002). The Law of Industrial Waste Management in Malaysia. *Waste Management and the Environment*, Department of Law, School of Management, Northern University of Malaysia. Retrieved from <https://www.witpress.com/Secure/elibrary/papers/WM02/WM02066FU.pdf>
- Mahayuddin, S. A., Pereira, J. J., Badaruzzaman, W. H. W., & Mokhtar, M. B. (2008). Construction waste management in a developing country: case study of Ipoh, Malaysia. *WIT Transactions on Ecology and the Environment*. <https://doi.org/10.2495/wm080491>
- Md. Bakri Ishak. (2002). The Law of Industrial Waste Management in Malaysia. *Waste Management and the Environment*.
- Nagapan, Sasitharan & Abdul Rahman, Ismail & Asmi, Ade. (2012). *Construction Waste Management: Malaysian Perspective*.

- Noraziah, W., Corina, J., Rudy, T., & Roseline, I. (August, 2015). Critical Review on Construction Waste Control Practices: Legislative and Waste Management Perspective. 6 th International Research Symposium in Service Management, IRSSM-6 2015, 11-15.
- Nurzalikhah, S., Zulhabri, I., & Zarina A. (December, 2016). A Review of Construction Waste Management and Initiatives in Malaysia. *Journal of Sustainability Science and Management*. Volume 11 Number 2.
- Osmani, M. (2011, January). Construction waste. In *Waste* (pp. 207-218). Academic Press.
- Pires, A., & Martinho, G. (2019). Waste hierarchy index for circular economy in waste management. *Waste Management*, 95, 298-305.
- Price, J. L., & Joseph, J. B. (2000). Demand management—a basis for waste policy: a critical review of the applicability of the waste hierarchy in terms of achieving sustainable waste management. *Sustainable Development*, 8(2), 96-105.
- Rafizul, I. M., Howlader, M. K., & Alamgir, M. (2012). Construction and evaluation of simulated pilot scale landfill lysimeter in Bangladesh. *Waste Management*, 32(11), 2068–2079. <https://doi.org/10.1016/j.wasman.2012.02.008>
- Roseline Ikau and Corina Joseph. Environmental Legislation Awareness Among Construction Contractors in Malaysia. *International Journal of Service Management and Sustainability (IJSMS)*, 2017. Vol.2 No.2 Sadi, K., Abdullah, A., Navazandeh Sajoudi, M., Kamal, M. M., Torshizi, F., & Taherkhani, R. (2012). Reduce, reuse, recycle and recovery in sustainable construction waste management. In *Advanced Materials Research* (Vol. 446, pp. 937-944). Trans Tech Publications Ltd.
- Sa'adi, N. B. (2020, January 14). *Implementation Of Malaysian Government Initiatives In Managing Construction Waste*. Nurzalikhah. https://www.academia.edu/41631036/Implementation_Of_Malaysian_Government_Initiatives_In_Managing_Construction_Waste
- Safiuddin, M., Jumaat, M. Z., Salam, M. A., Islam, M. S., & Hashim, R. (2010). Utilization of solid wastes in construction materials. *International journal of physical sciences*, 5(13), 1952-1963.
- Siregar, A. M. R., & Kustiani, I. (2019, March). Contractors' perception on construction waste management case study in the City of Bandar Lampung. In *IOP Conference Series: Earth and Environmental Science* (Vol. 245, No. 1, p. 012035). IOP Publishing.
- Soewin, E., & Chinda, T. (2018). Factors affecting construction performance: exploratory factor analysis. *IOP Conference Series: Earth and Environmental Science*, 140, 012102. <https://doi.org/10.1088/1755-1315/140/1/012102>
- S. Nagapan, I. A. Rahman, A. Asmi, A. H. Memon and I. Latif, "Issues on construction waste: The need for sustainable waste management," 2012 IEEE Colloquium on Humanities, Science and Engineering (CHUSER), 2012, pp. 325-330, doi:10.1109/CHUSER.2012.6504333.
- Taofeeq, D. M., & Adeleke, A. Q. (2019). Factor's Influencing Contractors Risk Attitude in the Malaysian Construction Industry. *Journal of Construction Business and Management*, 3(2), 59–67. <https://doi.org/10.15641/jcbm.3.2.668>
- The on-site waste minimization practices for construction waste - Scientific Figure on ResearchGate. Available from: https://www.researchgate.net/figure/Wastemanagement-hierarchy-14_fig1_338374425 Waste Hierarchy. (2021, June 24). *ISM Waste & Recycling*.
- Wahi, N., Joseph, C., Tawie, R., & Ikau, R. (2016). Critical Review on Construction Waste Control Practices: Legislative and Waste Management Perspective. *Procedia - Social and Behavioral Sciences*, 224, 276–283. <https://doi.org/10.1016/j.sbspro.2016.05.460>
- Zhang, C., Hu, M., Di Maio, F., Sprecher, B., Yang, X., & Tukker, A. (2022). An overview of the waste hierarchy framework for analysing the circularity in construction and demolition waste management in Europe. *Science of the Total Environment*, 803, 149892.