


## Article

# Practitioners Recycling Attitude and Behaviour in the Australian Construction Industry

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**Abstract:** Construction waste management and recycling is widely discussed. However, at present there is still a significant amount of waste generated during the construction process. Considering this fact, this research aims to analyse the recycling attitudes and behaviours in the Australian construction industry. This paper investigates attitudes and behaviour towards recycling habits in construction; understands how recycling is viewed and carried out by practitioners in the industry; explains the causes of these states of mind; and formulates techniques that could be utilized to improve waste management and recycling acceptance within the industry and improve its effectiveness. Initially, the required data was collected through a questionnaire survey. Afterwards, a statistical analysis was carried out using SPSS software. It was found that the practitioners' attitude towards recycling habits are positive; however, their behaviour is not as strong as it should be. This means that the industry is aware and concerned about recycling in construction and willing to improve the environment by developing recycling habits. Recommendations to improve attitudes and behaviour towards recycling habits are also suggested, such as legislation and market driven developments, improvements of waste management methods, provisions in work method statements, sharing research and applications in sub-industries and developing communication.

**Keywords:** attitude; behaviour; construction waste management

## 1. Introduction

Construction industry practices always have a significant negative influence on the environment. According to Poon, Yu [1], the contribution of construction and demolition waste by building projects is significant. As a result, construction waste management has been in the spotlight over the years. There are many practices undertaken to control construction waste. However, Teo and Loosemore [2] illustrated that there are two principles in waste management: reduction of the quantities of waste generated and adoption of an effective system for managing the unavoidable waste produced. In managing the unavoidable waste, there are three options in order of preference—namely, 'reuse,' 'recycling' or 'disposal' [2]. The construction industry always uses these practices in construction waste management.

Construction debris resulting from construction and demolition work constitutes a large proportion of solid waste. In the United Kingdom, more than 50% of waste deposited in a typical landfill comes from construction [3–5], while about 70 million tons of waste arise from construction and demolition activities [6]. In Australia, about 17 million tons of waste are put into landfills each year and about 42% of waste is attributed to the construction industry [7,8] (Productivity Commission 2006, Udawatta et al. 2015). In the United States of America, around 29% of solid waste is from construction [9,10]. In Hong Kong, about 38% of solid waste comes from construction [11,12].

When considering the contribution of various materials to construction and demolition waste, waste generated from concrete is significant (see Table 1). According to Table 1, concrete generates 81.8% of construction and demolition waste, which is more than ten times higher than the second highest waste generating material. Further, when considering the sources of waste generation, construction demolition waste generated through concrete is once again significantly higher than any other waste generating source (see Table 1). Therefore, when attempting to reduce waste generation, the main focus should be on concrete.

**Table 1.** The composition of construction and demolition waste generated in Australia, by sources and types of material [4,11].

Waste Type	Sources (in %)		
	Municipal	Commercial and Industrial	Construction and Demolition
Concrete	3	3	81.8
Food and garden	47	13	0.9
Glass	7	2	0.1
Metal	5	22	6.8
Paper	23	22	0.1
Plastic	4	6	0.2
Timber	1	9	4.1
Others	12	24	6.1

The treatment of municipal waste in Australia, compared with selected Organisation for Economic Cooperation and Development (OECD) countries, is shown in Table 2. According to the Productivity Commission [11], there are many ways, adopted by various countries, to classify waste treatment. As an example, thermal treatment methods are used in Japan and in European countries to deal with high proportions of waste. However, this method has energy recovery and is therefore classified as recycling and not disposal. Due to these inconsistencies in classification and data collection for waste sources among countries, there are difficulties in comparing data. Therefore, only selected OECD countries are taken for comparison in Table 2.

**Table 2.** The treatment of municipal waste in Australia and selected Organisation for Economic Cooperation and Development (OECD) countries [4,11].

Country	Waste Treatment (%)			
	Landfill	Incineration	Recycling	Unknown
Australia	93	0	7	0
Ireland	87	0	13	0
Iceland	85	5	10	0
United Kingdom	80	8	12	0
United States of America	56	11	33	0
France	43	29	28	0
Germany	25	21	54	0
Denmark	10	52	38	0
Netherlands	8	32	45	5
Japan	6	74	20	0

Citizen demands to increase the practice of sustainable development have led to the consideration and implementation of options to improve environmental practices in all industries including building and construction [13,14]. An effective contribution to embedding sustainability into companies' systems with voluntary corporate initiatives has been suggested [15]. Corporate social responsibility has been a pressing issue in the last few years and a corporate social responsibility indicator system for construction enterprises has been developed [16]. Extended producer responsibility for vehicle

remanufacturing has also been adopted [17] (Wang and Chen 2011). There is no doubt that the effectiveness of variable charges is higher than that of fixed fees but the crucial question for local representatives is not effectiveness but the economy of charges in waste management [18]. An overview of different methods of collection, transportation and treatment of municipal solid waste—as well as making a comparative analysis of municipal solid waste source-separated collection in China—had been analysed [19]. According to Peng, Scorpio [20] there are six hierarchical disposal options, from low to high—to reduce, reuse, recycle, compost, incinerate and landfill. However, all these disposal options need to be properly coordinated to reduce construction waste generation. According to Tam and Tam [21], the most effective way is to implement all three—reuse, recycling and reduction—ways of dealing with construction materials in construction activities. Reuse refers to moving materials from one application to another Peng, Scorpio [20]. Recycling refers to producing new materials out of waste, which not only fulfils the purpose of recycling but also generates economic benefits [20]. The end of the demolition stage marks the end of the entire life cycle of green building.

Recycling, being one of the key strategies for the minimisation of waste, offers the following three benefits (Edwards 1999): (i) reduction in the demand for materials made from virgin resources; (ii) reduction in the use of energy to transport waste and produce virgin materials; and (iii) diversion of waste that would otherwise occupy landfill space. According to the Environmental Protection Agency [22], building and demolition waste is twofold; unsegregated material that results from the demolition, erection, construction, refurbishment or alteration of buildings and the construction, replacement, repair or alteration of infrastructure development such as roads, tunnels, sewage, water, electricity, telecommunications and airports.

Sustainability methodologies adopted by the industry have been studied, including their eco-design and risk [23]. Source reduction, reuse and recycling measures, waste collection frequency, staff participation in training programs and waste disposal methods were all found to affect attitudes toward waste management. Construction-related education among employees, contractor experience in construction works, source reduction measures, reuse of materials, waste disposal behaviour and attitudes toward waste management are found to be the most significant factors affecting contractor behaviour regarding waste management [24] (AS 1141 1996). Waste prevention behaviour should be investigated separately from recycling behaviour and analysed in the context of local policies and measures [25]. Although there are studies on waste management and recycling in construction, there are limited studies on attitudes and behaviour in these areas. Intentions to increase the level of recycling behaviour are greatly influenced by non-monetary motives such as attitudes and behavioural patterns [26]. Similarly, according to Tam and Hao [27], attitudes have a significant influence on construction waste recycling on site. According to Teo and Loosemore [2], attitudes towards construction waste management are not negative, although they are pragmatic and impeded by perceptions of a lack of managerial commitment and therefore perceived as a low project priority and there is a lack of appropriate resources and incentives to support it.

Despite the significance of attitudes and behaviours towards construction waste recycling, there has been a considerable lack of research carried out on this subject. There have been significant research contributions on attitudes towards waste recycling in other disciplines such as electronic waste recycling [28] and pro-environmental behaviour from university graduates [29]. Pro-environmental behaviour refers to behaviour that minimizes negative impacts on the natural and built environment [30]. Research on willingness to pay for household electrical and electronic equipment has also been conducted in Kuala Lumpur, Malaysia [31]. The construction industry is considered a highly labour-intensive industry. Despite this, the waste management part of the equation has been ignored [2]. After an extensive literature review, Yuan and Shen [32] illustrated that construction and demolition waste recycling is one of the main research directions and further illustrated the research gap with regard to the human factors affecting construction waste management. Therefore, this paper investigates the attitudes and behaviour towards recycling habits in construction in order to understand how recycling is viewed and carried out by individuals working in the industry,

to explain the causes of these states of mind and to formulate techniques that could be utilized to improve waste management and recycling acceptance within the industry as well as to improve its effectiveness.

## 2. Waste Recycling Attitudes and Behaviour

As illustrated in the previous section, there have been studies carried out on attitudes towards and behaviour around waste recycling in other disciplines. It is a known fact that attitudes and behaviours of people are highly subjective and capturing these to identify their influence on waste recycling is a challenging task. In a study to identify the behavioural determinants of construction waste management, Bakshan, Srouf [33] identified that behaviour is influenced by both personal and corporate factors. In the personal category, sub factors such as work experience, attitudes, awareness of consequences, past experience and social pressure were identified [33]. Similarly, training, supervision and incentives were identified in the corporate category [33]. Further, the behaviour category is constantly influenced by the personal and corporate categories and, in construction waste management, the behaviour category is more sensitive to changes in personal factors—such as attitude—compared to corporate factors—such as training [33]. According to Ari and Yılmaz [34], positive ideas, in terms of a person's perceived behavioural control and the individuals in their immediate social surroundings—whose opinions they value—have a positive impact on guiding their recycling behaviour. Therefore, it can be illustrated that positive ideas about construction waste recycling generate good impacts on recycling in construction.

Illustrating the theory of planned behaviour, Ajzen [35] emphasized behavioural intentions as a function of three components: attitude, subjective norm and perceived behavioural control. According to Reference [36], in simplified terms, attitudes refer to 'the individual evaluation of the action under study from negative to positive' and the 'subjective norm corresponds to the degree of individual perception of the social desirability that the person should perform that action.' Further, Reference [36] (p. 184) defined 'perceived behavioural control' as 'both measures of self-efficacy and perceived control and indicates how well an individual feels that he or she can overcome the obstacles, or taking advantage of the facilitators.' Therefore, in terms of construction waste recycling perspectives, attitudes can be identified as people's perceptions about whether recycling actions are positive or negative. Social desirability illustrates the extent to which a person will be involved in the process. As an example a construction worker may have a positive perception about categorizing waste as required, however that person might not actively be involved in that process any further. There is a positive relationship between the environmental concerns due to recycling and the attitude towards it [37]. The theory of planned behaviour is considered by many researchers when conducting research in construction waste management and also in the waste management discipline as a whole [2,34,36–38].

According to Barr, Ford [39], recycling behaviour is based on three groups of factors—environmental values, situational variables and psychological variables. The first group relates to beliefs about the environment and the extent to which the recycling activity facilitates those beliefs. Situational variables are the factors that enable the recycling activity, such as prior knowledge and experience. Psychological variables refer to factors such as motivation, including social norms, response efficacy, self-efficacy, any perceived threat posed by not acting, personal satisfaction, altruism and citizenship. Reference [40] further discussed this framework and concluded that the basic intention to act on recycling stems from an individual's environmental beliefs but whether or not that behavioural intention proceeds to actual behaviour will depend upon the modifying effects of the situational and psychological factors.

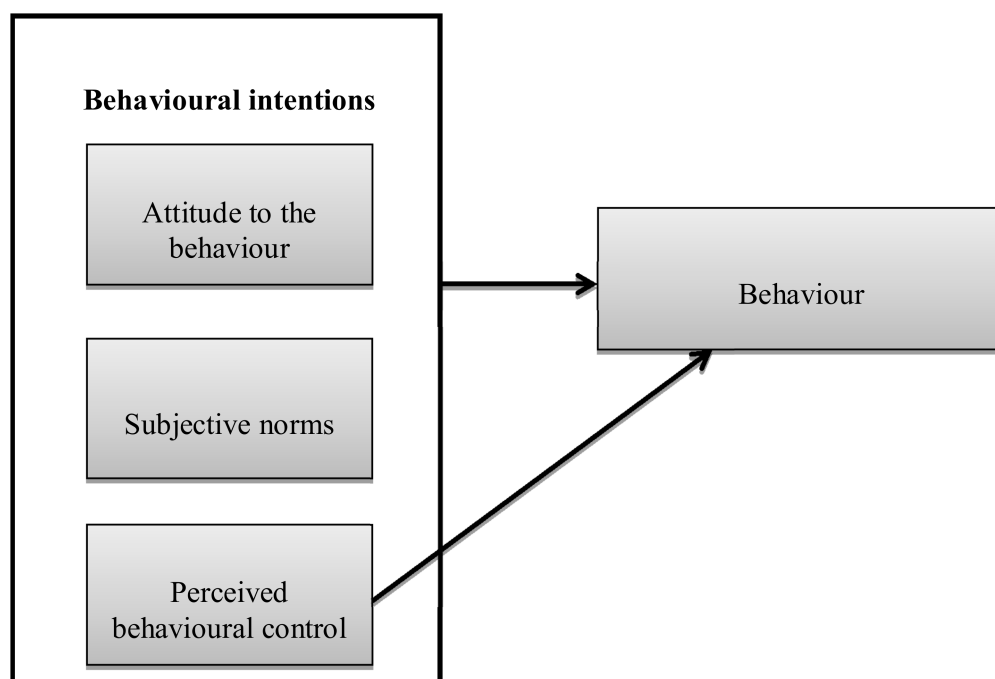
Attitudinal factors have a significant influence on recycling behaviour. Sidique, Lupi [41] identified four interpretable variables by which to analyse attitudinal behaviours—attitude, convenience, social pressures and familiarity. In their survey, Sidique, Lupi [41] included statements such as 'Recycling is a major way to reduce pollution' to identify the attitudes of the respondents. Further, questionnaire statements relating to time for recycling and space represented the convenience

variable and knowledge of, and familiarity with, recyclable materials and recycling facilities represented the familiarity variable [41] (see Appendix A).

When considering all these theories and frameworks, it is necessary to illustrate that individual attitudes towards waste recycling are significant. Further, the perceptions of society, such as the attitude of the working environment towards waste recycling, self-efficacy and convenience of recycling are identified by most of the frameworks both directly and indirectly.

### 3. Overview of Research and Hypothesis Development

Many studies have been carried out that focus on behavioural patterns, using the theory of planned behaviour [2,34,36–38]. According to the theory of planned behaviour, human action is guided by behavioural beliefs, normative beliefs and control beliefs [35]. Further, behavioural beliefs have either a favourable or unfavourable influence on attitudes towards behaviour, normative beliefs result in perceived social pressure or subjective norms and control beliefs give rise to perceived behavioural control [35]. Therefore, attitudes toward the behaviour, subjective norms and perception of behavioural control lead to the formation of a behavioural intention. In summary, Ajzen [35] illustrated that with more favourable attitudes, subjective norms and greater perceived control, a person's intention to perform the behaviour in question becomes much stronger. This perception is further illustrated in Figure 1 as follows.



**Figure 1.** Theory of planned behaviour.

As illustrated in Figure 1, perceived behavioural control contributes to the behavioural intention. and behavioural control has a strong influence on the ultimate behaviour in question. Therefore, when developing Figure 1, the horizontal arrow represents the collective influence behavioural intentions have on the behaviour and the vertical arrow represents the individual contribution of behavioural controls towards a particular behaviour. This Figure is developed considering the literature, especially the theory of planned behaviour presented by Ajzen [35]. Similarly, Sidique, Lupi [41] illustrated that attitudes and social pressure are the main variables for certain behaviours. As illustrated in the previous section, researchers such as Jekria and Daud [37] identified attitudes and social beliefs as factors influencing behaviour and in construction waste recycling the same behavioural patterns can be identified. According to the theory of behaviour, perceived behavioural control always has a strong

influence on behavioural intention and behaviour. In terms of construction waste recycling, there is a question of the management's commitment to recycling. As an example, Teo and Loosemore [2] illustrate that a lack of managerial commitment impedes construction waste practices. Based on this, it is possible to state that the supportiveness of recycling from the top level managers or employers in the construction industry is questionable. Therefore, positive attitudes, social beliefs and behavioural controls such as self-efficacy and the ability of individuals to overcome obstacles are of no use due to the lack of support from construction employers towards construction waste recycling. This lack of supportiveness of employers leads the industry towards lesser levels of recycling. Accordingly, the following hypotheses are proposed;

**H1:** *Construction employees working for construction employers supporting construction waste recycling have a positive impact on attitudes towards construction waste recycling.*

**H2:** *Construction employees working for construction employers supporting construction waste recycling have a positive impact on subjective norms towards construction waste recycling.*

**H3:** *Construction employees working for construction employers supporting construction waste recycling have a positive impact on behavioural controls towards construction waste recycling.*

#### 4. Research Methodologies

The research methodology for this research includes two separate sections. The entire research method used in this research is illustrated in Figure 2. As shown in Figure 2, once the data is collected through a questionnaire survey, it is tested for reliability. Afterwards, the data analysis is carried out in two sections. The Relative Importance Index (RII) is used to identify existing recycling behaviours, work habits, routines and standard operations. Afterwards, a one-way ANOVA test is carried out to identify whether there are any significant differences in attitudes and behaviours among six construction organisations. A principle component analysis and a correlation matrix are used for hypothesis testing. Finally, based on the analysed data, conclusions are drawn (see Figure 2).

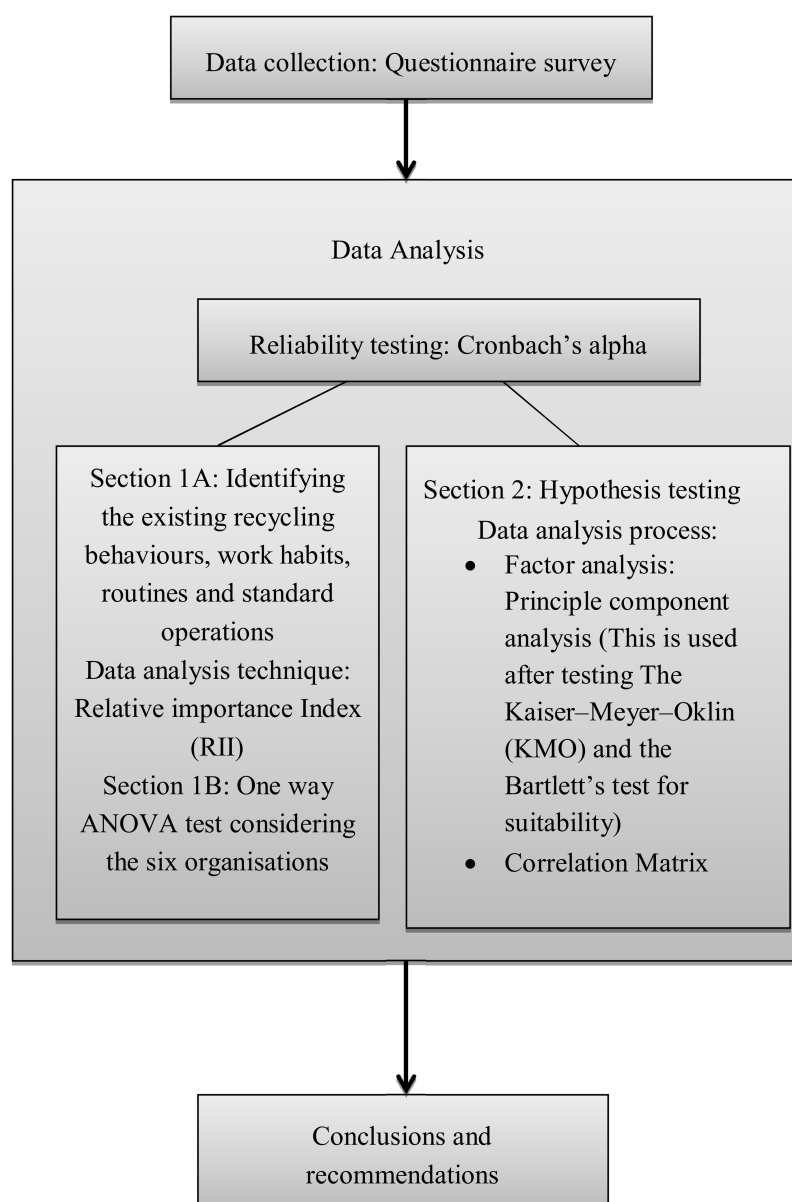
##### 4.1. Data Collection Method

As illustrated in Figure 2, a questionnaire survey was employed to collect data.

In order to collect data from a large number of participants working in the construction industry, six major construction organizations were selected. These organizations occupied many construction sites with various construction professionals including developers, consultants, suppliers, workers and many more. Details of the construction companies are illustrated in Table 3.

The main reason for selecting these companies is to reach a higher number of participants and to get responses from different types of construction organizations. The six selected companies included major contractors, mid-tier construction companies and also small-scale contractors covering a large spectrum of the construction industry (refer to Table 3).

Questionnaires were sent to 1000 parties including developers, consultants, contractors, subcontractors and suppliers from these six construction organizations. 365 were completed and returned with a response rate of 36.5%. However, four of the questionnaires were not properly completed and only 361 questionnaires were valid. The 'workplace' refers to the relevant construction site where the individuals assigned to work. The respondents were advised of this during the survey when the questionnaire was handed over to the particular individual.



**Figure 2.** Research methodologies.

**Table 3.** Details of construction companies used for the questionnaire survey.

Construction Company	Description
Construction organization 1	<ul style="list-style-type: none"> <li>• One of the top Australian contractors and considered as one of the industry leaders</li> <li>• Has widespread building experience across a wide variety of development styles including some of the most iconic structures in the country and have received numerous awards and recognitions</li> <li>• Has an extensive line-up of services to offer and has the capacity to handle multiple projects of different magnitudes</li> <li>• Consider environmental conservation as part of their responsibility of care to the community</li> </ul>



Table 3. Cont.

Construction Company	Description
Construction organization 2	<ul style="list-style-type: none"> <li>• Major player located in Queensland's building industry and has projects throughout the state and neighbouring state New South Wales</li> <li>• Has capabilities and expertise in building, mining and engineering division and provide services to government, education, commercial, health, residential and industrial sectors</li> <li>• Completed project are mostly vertical structures of medium to large scale</li> <li>• Environmental commitment of this organization is focused on green building design</li> </ul>
Construction organization 3	<ul style="list-style-type: none"> <li>• An industry leader and one of the biggest construction contractors in Australia</li> <li>• The company experience envelops a diversity of projects across the majority of market sectors, from initial client contact through every single phase of design, building, commissioning and handover</li> <li>• Has an impressive portfolio with 21 landmark projects to unique construction endeavours to boast</li> <li>• Has an annual turnover in billions and employs a huge workforce</li> </ul>
Construction organization 4	<ul style="list-style-type: none"> <li>• Mid-tier infrastructure development contractor operates for public and private clients within the Queensland and New South Wales region</li> <li>• Previous work includes transport, water, mining and energy, environment, urban development and community infrastructure projects</li> </ul>
Construction organization 5	<ul style="list-style-type: none"> <li>• Multi-discipline engineering and development consultancy and ranks as one of the world's top international design and construction firms</li> <li>• Operations spread beyond Australia to locations in Africa, Asia Pacific and the Middle East</li> <li>• Work includes development of motorways, dam design and major tunnelling; and</li> </ul>
Construction organization 6	<ul style="list-style-type: none"> <li>• A small-scale main contractor</li> <li>• Focusing on residential and small-scale infrastructure projects. Sustainable construction is considered as one of the important criteria for their projects together with time and cost</li> <li>• Have in-house environmental management teams in improving the sustainability for their projects</li> </ul>

#### 4.2. Questionnaire Design

The questionnaire was developed based on the literature findings. According to Bakshan, Srour [33], attitudes towards construction waste can be measured by asking individuals to specify their feelings about performing the behaviour, such as whether the task in question is good, useful or rewarding. Any standard attitude scaling procedure such as Likert or Thurstone scaling can be used to obtain a respondent's evaluation of the behaviour [42]. Therefore, this questionnaire was comprised of quantitative elements and survey statements which were ranked on a Likert scale. The basis of the questionnaire was developed from the literature review. It included statements on employees' behaviour with regard to construction recycling, habits, perception of their workplace towards recycling, familiarity with recycling, especially on their attitudes towards the recycling process and employers' supportiveness.

According to Ajzen [42], attitude toward a behaviour is defined as a person's overall evaluation of performing the behaviour in question. Further, it is recommended that a set of scales include adjective pairs such as the 'good-bad' scale which tends to capture overall evaluation of attitudes very



well [42,43]. Therefore, to measure an individual's attitude towards recycling the respondents were asked whether the attitude towards recycling is bad-good, undesirable-desirable, harmful-beneficial, useless-useful and unfavourable-favourable on a seven point Likert scale.

According to Ajzen [35], subjective norm refers to the degree of individual perception of social desirability. Therefore, the subjective norms focus on the expectations of others towards the behaviour. In construction waste recycling, subjective norm refers to the perception of fellow workers in the construction industry towards construction waste recycling. The measurement scale for subjective norms contained three statements and the respondents were asked to indicate their level of agreement with each of these statements.

Ajzen [42] illustrated that perceived behavioural control can be measured by asking direct questions about capability to perform a behaviour or indirectly on the basis of beliefs about ability to deal with specific inhibiting or facilitating factors. A direct measure of perceived behavioural control should capture a person's confidence that they are capable of performing the behaviour under investigation [42]. Therefore, statements have to do with the difficulty of performing the behaviour, or with the likelihood that the participant could do it are often used to capture the respondent's sense of self-efficacy with respect to performing the behaviour [42]. In this questionnaire, four statements were developed and the participants were asked to rate them on 7-point Likert scale.

#### 4.3. Data Analysis

As illustrated in Figure 2, the dataset was initially tested for reliability. Reliability analysis allows study of the properties of measurement scales and the individual items of which it is composed.

The data will be useless if their reliability is low, indicating issues in data collection. One of the most popular reliability statistics in use today is Cronbach's alpha [44]. Cronbach's alpha determines the internal consistency or average correlation of items in a survey instrument for gauging its reliability [45]. Alpha ranges from 0 to 1, in which 0 means complete unreliable and 1 means perfect reliable [46]. The larger score will reflect a higher reliability. Score more than 0.5 is an acceptable reliable value. The following outcomes are commonly accepted for the value of Cronbach's alpha; " $\alpha > 0.9$  – Excellent,  $\alpha > 0.8$  – Good,  $\alpha > 0.7$  – Acceptable,  $\alpha > 0.6$  – Questionable,  $\alpha > 0.5$  – Poor and  $\alpha < 0.5$  – Unacceptable" [47,48]. B. Cronbach's alpha can be computed using the following formula [49]:  $\alpha = k\overline{cov}/\overline{var}/[1 + (k - 1)\overline{cov}/\overline{var}]$  or  $k\bar{r}/[1 + (k - 1)\bar{r}]$  (if the items are standardized to have the same variance), where  $k$  is the number of items in the scale,  $\overline{cov}$  is the average covariance between items;  $\overline{var}$  is the average variance of the items and  $\bar{r}$  is the average correlation between items.

Initially, this research identified the prevailing conditions in the construction industry regarding the recycling of construction waste. To determine the relative ranking of factors, the scores were transformed to important indices based on the following formula [50] (Tam et al. 2000): Relative important index =  $\sum w/AN$ . This method is commonly used in order to determine the rank of each factor surveyed relative to all factors explored [51,52]. In this formula,  $w$  is the weighting given to each factor by the respondent, ranging from 1 to 7 where '1' is the least important and '7' is the most important;  $A$  is the highest weight, in this study will be 7;  $N$  is the total number of respondents. The relative important index will range from 0 to 1.

One-way ANOVA is used for comparing the means of the groups to make inferences about the population means based on one independent variable only [53]. The ANOVA test was applied to check whether the respondents working in the six different organisations have significant differences in their recycling attitudes and behaviours. The mean values of the categories were derived first. Then the values were tested for concordance among groups and F-test was performed with a demarcation level of significance at 0.05. The test was used to assess any similarity of opinion among groups on recycling attitude and behaviour.

The second section of this study focused on illustrating the impact of employers' supportiveness towards the attitudes, subjective norms and behavioural control. The Kaiser–Meyer–Oklin (KMO) and the Bartlett's test were conducted to ascertain the suitability of the factors for the analysis. Kaiser and

Rice [54]) stated that, KMO value should be 0.600 or higher for a data set to be appropriate for factor analysis. Afterwards, principal component analysis is carried out for the different factors. According to Spector [55], items with heavy loadings provides the best results. Finally, a bivariate correlation was performed to examine the impact of employer supportiveness towards the attitudes, subjective norms and behavioural controls. Data collected from questionnaires were analysed using the Statistical Package for Social Sciences (SPSS) Version 18.0 for Windows.

After receiving the questionnaire responses, individual structured interviews were arranged with sixteen respondents from five companies and different positions. The interviewees were well experienced in the construction industry with direct exposure to construction waste recycling, representing all the positions in the construction industry. The interviews were intended for gathering further comments and elaboration and interpretation of the results obtained from the questionnaire. The interviews were conducted based on the survey results in order to analyse the questionnaire survey outcomes. The reasons for certain significant values and solutions are discussed in depth throughout the interviews.

## 5. Results and Analysis

From the questionnaire survey, about 10.8% of the respondents were developers, about 48.6% were consultants, about 12.2% were contractors, about 24.3% were subcontractors and about 4.1% were suppliers. These respondents can be considered a cross-section of the construction industry representing all the stakeholders.

The reliability of the data, which aims to investigate the attitudes and behaviour towards recycling habits in construction, is very high. All the reliability factors were acceptable, in which the alpha value exceeds 0.8 (refer Table 4). This forms strong evidence to show that there is high reliability of the data, which can show validity to support the below discussions.

**Table 4.** Coefficient Alphas from the survey.

	Cronbach's Alpha
Frequency	0.842
Employees' behaviour	0.958
Work habits, routines and standard operating procedures	0.951
Feeling on recycling at their workplace	0.920
Recycling construction and demolition waste	0.896
Peer effects on recycling	0.829
Recycling attitude	0.905
Work environment	0.870
Overall	0.924

As illustrated in Figure 2, the analysis was carried out in two main sections. Initially, the prevailing recycling behaviours and habits are discussed. In the latter section, the impact of employers' supportiveness towards the behavioural intentions are explored using detailed statistical analysis.

### 5.1. Recycling Habits in the Construction Industry

From Table 5, the survey results on the frequency that they do all that is needed to recycle at their workplace and the frequency that they recycle at their workplace are similar. Most of the respondents do a few times a week what is needed to recycle at their workplace (about 33.8% of the respondents) and also actually recycling at their workplace (about 37.8% of the respondents). Although the frequency is not very often for recycling at their workplace, the majority of the respondents (about 81.1% and 82.4%) are still preparing and actually recycling at their workplace respectively. This shows recycling is a well-supported action in construction.

**Table 5.** Survey results on recycling habits in construction.

How often do you do all that is needed to recycle at your workplace?	Responses (in %)
A few times a day	20.3
A few times a week	33.8
Just about every day	27.0
Once or none this week	18.9
While doing your job, how often do you recycle at your workplace?	
A few times a day	17.6
A few times a week	37.8
Just about every day	27.0
Once or none this week	17.6
Did you usually recycle in the same location each time at work in the past week?	
Usually in the same location	44.6
Sometimes in the same location (and sometimes in different places)	27.0
Rarely or never in the same location (typically in different places)	13.5
I never recycle at work	14.9
Do you usually recycle at the same time of the day at your workplace?	
It was usually at the same time of the day	12.2
It was sometimes at the same time of the day	29.7
It was rarely at the same time of the day	40.5
I never recycle at work	17.6
Do you usually recycle in the same mood at work?	
I was usually in the same mood	35.1
I was sometimes in the same mood	28.4
I was rarely in the same mood	21.6
I never recycle at my workplace	14.9
Is your employer supportive of recycling at work?	

According to the literature survey, it was established that familiarity with recycling facilities was one of the drivers for recycling. According to Table 5, 44.6% of the respondents identified a particular location as a recycling place at the worksite. Therefore, the literature findings on using a familiar recycling facility as a driver for recycling, is strengthened by this higher response rate in Table 5. However, it is illustrated that 40.5% of the respondents do not carry out recycle recycling activities during a specific time period of a day. The recycling activities are carried out mainly a few times a week (37.8%) and not within a given schedule. It is difficult for the construction workers to recycle at the same time of the day, which depends on the procedures of the construction activities. The interviewees highlighted the importance of setting up organized waste management plans. The combination of convenience and routines becomes imperative in achieving recycling success. This may be difficult to achieve with non-repetitive tasks and the uniqueness of a work environment but adjustments and compromises may provide an ideal setup that maximizes the potential to recycle. An interviewee pointed out that recycling is a common activity and may have developed as a routine for most of the organizations. The activity has gained widespread adoption within the industry to the point that it has been the standard. In general, it shows positive recycling activities happening at their workplace.

One of the interviewed contractors highlighted that different organizations will have different waste management culture, programs and procedures in controlling their waste management and recycling practices. Some would have stricter policies compared to others. Large-scale main contractors may consider recycling more than small-scale main contractors, as limited resources are available for small-scale contractors.

## 5.2. Employees' Perception in Construction Waste Recycling

There are twelve questions in the questionnaire seeking employees' perceptions of construction waste recycling (refer Table 6). The survey results show positive perceptions of recycling from the respondents. The RII measure from 0.540 to 0.674 for the above twelve questions. The question, "It would require effort on my part not to do all that is needed to recycle at work" receives significant results from the F-statistics analysis among construction organizations. Construction organization 4 receives significantly high RII with about 0.761 in this question compared to the overall RII of about 0.540 from the survey results. The interviewees from this construction organization highlighted that the construction organization is a very divest organization for public and private clients and also for different types of infrastructure projects. They have been educated in the implementation of recycling as part of their routines in their work. The site environment did not provide huge normal waste bins. The organization believes that most of the waste generated by the site is recyclable, different types of recyclable materials are encouraged to put in different recycling bins and leave only small amounts of unrecyclable materials in the normal waste bins. The results of the other eleven questions can also be reflected by this culture developed in construction organization 4 with relatively higher RII than other construction organizations.

**Table 6.** Survey results on employees' perception in recycling.

	Responses (in %)							RII
	Strongly Disagree				Strongly Agree			
	1	2	3	4	5	6	7	
I typically do all that is needed to recycle at work.	4.1	1.4	16.2	21.6	25.7	16.2	14.9	0.674
Doing all that is needed to recycle at work is something I do automatically.	5.4	2.7	20.3	21.6	21.6	14.9	13.5	0.643
Doing all that is needed to recycle at work is something I do without having to consciously remember to do so.	5.4	4.1	18.9	24.3	17.6	17.6	12.2	0.637
It makes me feel weird if I do not do all that is needed to recycle at work.	13.5	9.5	16.2	28.4	14.9	5.4	12.2	0.551
Doing all that is needed to recycle at work is something I do without thinking.	2.7	6.8	18.9	27.0	17.6	13.5	13.5	0.636
It would require effort on my part not to do all that is needed to recycle at work.	13.5	10.8	14.9	23.0	25.7	6.8	5.4	0.540
Doing all that is needed to recycle at work without realizing I'm doing it.	4.1	6.8	16.2	32.4	17.6	13.5	9.5	0.616
I would find it hard not to do all that is needed to recycle at work.	4.1	8.1	21.6	27.0	12.2	18.9	8.1	0.606
I do all that is needed to recycle at work without needing to think about it.	4.1	12.2	10.8	25.7	20.3	14.9	12.2	0.627
I frequently do all that is needed to recycle at work.	4.1	6.8	13.5	27.0	20.3	14.9	13.5	0.644
Doing all that is needed to recycle at work is something that's typically "me."	4.1	8.1	12.2	23.0	25.7	16.2	10.8	0.643
Doing all that is needed to recycle at work is something I have been doing for a long time.	5.4	8.1	18.9	17.6	24.3	12.2	13.5	0.626

If the construction organizations educate the employees with better work habit, routines and operating procedures similar as the examples shown above from the construction organization 4, the recycling outcomes can significantly be improved in the industry. One of the interviewees argued that site construction is not usually repetitive and locations often change. There are difficulties in

establishing a habit, routine or procedure for recycling. Another interviewee explained that it should be taken into account that workers are pushed to try to do as much work as possible in the site environment, this makes it difficult to provide any time-consuming activities such as waste sorting on site. This may have made workers lost the awkward feeling through the convenience received by taking the easier option but it is impressive to know that an equilibrium still exists and when recycling difficulties are overcome, changes in perceptions will be possible.

### 5.3. Routines and Operating Procedures Related to Recycling in Construction

Seven major types of construction and demolition waste are studied in the survey in terms of frequency of recycling: (1) Concrete; (2) Brick; (3) Timber; (4) Plastic; (5) Metal; (6) Glass; and (7) Paper. It is not surprising to find that metal is the most common type of construction and demolition waste for recycling with an RII of about 0.656 from the survey results (refer Table 7). The interviewees explained that recycling metal can provide profit for the construction organization, all organizations are trying to recycle every single piece of metal from construction and demolished waste. Recycling metal is receiving significant results from the F-statistic among positions. The contractors and suppliers are receiving relatively low RII of about 0.286 and 0.333 respectively comparing to the overall RII of about 0.656 from the survey results. An interviewee pointed out that it is not understandable why contractors and suppliers are not putting recycling metal as their major priority. An interviewed contractor explained that recycling metal can gain profit for their projects; however, collecting metal waste requires crushing demolished concrete and manual sorting. In the tight timeframe of construction and demolition projects, some construction organizations are not putting a lot of efforts in recycling metals. Finishing their projects within the required timeframe is still the first priority, otherwise, the construction organizations still need to pay for the late completion penalty, in which it cannot be offset by the profit gained from recycling metal.

**Table 7.** Survey results on routines and operating procedures related to recycling in construction.

Recycling in Construction		Responses (in %)							RII
		Never				Always			
		1	2	3	4	5	6	7	
Unfavourable–Favourable		0.0	1.4	8.1	32.4	14.9	16.2	27.0	0.740
How often you receive different types of construction and demolition waste?		Never				Always			RII
	Concrete	24.3	13.5	8.1	21.6	4.1	12.2	16.2	0.527
	Brick	29.7	8.1	8.1	31.1	4.1	9.5	9.5	0.483
	Timber	20.3	13.5	4.1	24.3	10.8	13.5	13.5	0.551
	Plastic	16.2	13.5	8.1	21.6	16.2	12.2	12.2	0.561
	Metal	13.5	8.1	4.1	18.9	14.9	16.2	24.3	0.656
	Glass	23.0	13.5	6.8	31.1	8.1	10.8	6.8	0.496
	Paper	14.9	5.4	12.2	24.3	12.2	14.9	16.2	0.604
		Strongly disagree				Strongly agree			
For me to recycle at work is difficult.		14.9	10.8	10.8	35.1	10.8	9.5	8.1	0.539
I want to recycle at my workplace.		9.5	2.7	5.4	24.3	20.3	16.2	21.6	0.683
I intend to recycle at my workplace.		8.1	4.1	5.4	21.6	24.3	20.3	16.2	0.680
I plan to recycle at work.		8.1	4.1	10.8	27.0	17.6	17.6	14.9	0.649
I will recycle at my workplace.		8.1	4.1	5.4	28.4	17.6	20.3	16.2	0.670

For the survey result on “For me to recycle at work is difficult” receives a lower RII of about 0.539 than the survey results on “I want to recycle at my workplace”, “I intend to recycle at my workplace,” “I plan to recycle at work” and “I will recycle at my workplace” with the RII of about 0.683, 0.680, 0.649 and 0.670 respectively (refer Table 7). This shows that the respondents are eager

to recycle but seem have some burdens at their workplace for effective recycling. The interviewees pointed out that meeting tight construction timeframe and construction budget are always the first two priorities in every construction project. The companies have to put environmental protection as a minor priority, which affect their effectiveness in recycling. Large-scale organizations may be better in the implementation of waste management plan due to the economies of scale and the ability to delegate specific staff for the tasks. This leads to better refined recycling methods and the benefits of the companies. Although small-scale organizations will need to concern on their budget at their first priority. The interviewees pointed out that they are willing to recycle as the recent promotion of global warming and climate change issues, in which they are aware of it. The comparatively higher RII on the survey results on want and intend to recycle than the survey results on plan and will recycle at their workplace shows that the respondents are highly inclined to recycle but holds a wait-and-see attitude. The lack of self-initiative to recycle might be the cause of this. In general, the industry remains positive on the willingness in recycling.

#### 5.4. One Way ANOVA between Different Construction Organisations

In the construction industry, there are different construction organisations involved in different capacities. Therefore, it is necessary to understand the perception towards recycling among those different organisations. As illustrated earlier in this research the data were collected from six different organisations with varying capacities. These six organisations were then tested with a one-way ANOVA to analyse whether there are any significant differences in recycling attitudes and behaviours. The data are reported in Table 8.

**Table 8.** One way ANOVA table for different organisations.

	Sig.
<b>Employees' recycling behaviour</b>	0.828
I typically do all that is needed to recycle at work	0.576
Doing all that is needed to recycle at work is something I do automatically	0.075
Doing all that is needed to recycle at work is something I do without having to consciously remember to do so	0.507
It makes me feel weird if I do not do all that is needed to recycle at work	0.681
Doing all that is needed to recycle at work is something I do without thinking	0.014
It would require effort on my part not to do all that is needed to recycle at work	0.809
Doing all that is needed to recycle at work without realizing I'm doing it	0.546
I would find it hard not to do all that is needed to recycle at work	0.688
I do all that is needed to recycle at work without needing to think about it	0.637
I frequently do all that is needed to recycle at work	0.780
Doing all that is needed to recycle at work is something that's typically "me."	0.618
Doing all that is needed to recycle at work is something I have been doing for a long time	0.828
<b>Work habits, routines and operating procedures in construction</b>	
How often your work habits helped recycle at work?	0.394
How often the routines you follow helped recycle at work?	0.176
How often the standard operating procedures helped recycle at work?	0.105
How often doing the tasks the same way helped recycle at work?	0.163
<b>Recycling at workplace</b>	
Bad	0.272
Undesirable	0.262
Harmful	0.115
Useless	0.086
Unfavourable	0.112



Table 8. Cont.

	Sig.
<i>Types of construction demolition waste</i>	
Concrete	0.449
Brick	0.089
Timber	0.215
Plastic	0.124
Metal	0.359
Glass	0.269
Paper	0.348
Others	0.064
<i>Other</i>	0.449
People who are important to me think I should recycle at work.	0.238
Other people whose opinion I value the most think it is a good idea if I recycle at work.	0.490
How much control do you have over recycling at your workplace?	0.030
For me to recycle at work is difficult	0.330
I want to recycle at my workplace	0.303
I intend to recycle at my workplace	0.071
I plan to recycle at work	0.104
I will recycle at my workplace	0.270

In general, when  $\text{Sig} \leq 0.05$ , it is considered that there is a significant difference of the perceptions between different organisations, otherwise all the organisations are reasonably consistent in their perceptions on the importance of a specific variable. According to Table 8, all the values are greater than 0.05. Therefore, it is necessary to conclude that the behaviours and attitudes towards recycling does not change among different positions within the construction industry.

#### 5.5. Analysis on Employers' Supportiveness towards the Attitudes, Subjective Norm and Behavioural Control of Construction Waste Recycling

Principal component analysis is used to explore the dimensions of three measurement scales for attitudes, subjective norms and behavioural control. The study recorded KMO values of 0.822, 0.651 and 0.865 for measurement scales of attitudes, subjective norms and behavioural control respectively which makes the factors highly suitable for the study (refer Table 8).

Table 9 illustrates the details of principal component analysis and the figures show that all the three scales have a clear structure with only one extracted factor. The total variation for attitudes, subjective norms and behavioural control is 78.876%, 69.951% and 75.922% respectively.

Table 9. KMO and Bartlett's test.

Tests	Attitude	Subjective Norm	Behavioural Control
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.822	0.651	0.865
Bartlett's Test of Sphericity	79.638	327.492	79.638
Approx. Chi-Square	3	10	3
df	0.000	0.000	0.000
Sig.			

After the factor extraction, a bivariate correlation is conducted between attitudes, subjective norms, behavioural controls and employers' supportiveness. Further, the type of organization is also included in the correlation matrix to analyse whether there are any changes to recycling behaviour in different organisations. Results of bivariate correlations are tabulated in Table 9.

The correlation results show that at 0.001 level of significance controlled behaviour and subjective norms are positively correlated (refer Table 10). Further there is a negative correlation between employer supportiveness and subjective norms and controlled behaviour. However, the type of



organisation does not have any significant correlation with any of the variable. Therefore, it is possible to conclude that the behavioural intentions towards construction waste recycling do not change irrespective of the type of organisation such as a consultant, contractor or a developer.

**Table 10.** Bivariate correlation analysis.

	Attitude	Subjective Norms	Controlled Behaviour	Employer Supportiveness	Type of Organisation
Attitude	1.000				
Subjective norms	0.157	1.000			
Controlled behaviour	0.045	0.553 **	1.000		
Employer supportiveness	−0.190	−0.485 **	−0.472 **	1.000	
Type of organisation	−0.202	−0.157	0.060	0.202	1.000

\*\* Correlation is significant at the 0.01 level (2-tailed).

The impact employer supportiveness towards the attitude is insignificant according to the bivariate correlations (refer Table 11). Therefore, H1 is not supported. One possible explanation for this is that the attitude towards construction waste recycling is a personal norm. Therefore, it is not challenged by the employers' supportiveness towards recycling. Similarly, according to Bakshan, Srour [34], attitudes are personal in nature and falls under personal factors influencing the recycling behaviour. However, if attitude towards construction waste recycling needs to be enhanced then positive personal beliefs towards recycling must be cultivated through personal training and workshops.

**Table 11.** Principal component analysis.

Measurement Scales	Factor Loading	Variance
<b>Attitude</b>		76.876
Bad–Good	0.803	
Undesirable–Desirable	0.910	
Harmful–Beneficial	0.897	
Useless–Useful	0.877	
Unfavourable–Favourable	0.893	
<b>Subjective norm</b>		69.951
People who are important to me think I should recycle at work	0.865	
Other people whose opinion I value the most think it is a good idea if I recycle at work	0.918	
People work with you recycle at work	−0.713	
<b>Perceived behavioural control</b>		75.922
How often your work habits helped recycle at work?	0.886	
How often the routines you follow helped recycle at work?	0.929	
How often the standard operating procedures helped recycle at work?	0.938	
How often doing the tasks the same way helped recycle at work?	0.942	
How much control do you have over recycling at work?	0.616	

Contrary to the prediction, the impact employer supportiveness towards subjective norms and controlled behaviour shows a significant negative correlation. Therefore, both H2 and H3 are also not supported. One possible reason for this is that if the employers lay down strict procedures on waste recycling the construction professionals might take it as an additional work. As a result, construction waste recycling is carried out as a part and parcel of the job description. Since the professionals are working according to the laid rules and regulations there is no requirement for them to overcome obstacles and further develop the recycling process. In such a situation, construction professionals are neutral towards the social perception towards construction waste recycling as well.

It is interesting to note that there is an inconsistency high frequency of recycling at work (refer Table 5) and negative subjective norm of people around the respondent who don't recycle (refer Table 11). The main reason for this is, each and every respondent contributes to recycling but it is not communicated among each other. The organisations selected for the study always supported recycling and the organisations have rules and regulations governing recycling. However, there is no recycling culture within these organisations so that the employees can collectively engage in recycling practices.

The interviewees also explained that following the important people or valuable people on site for young workers is a suitable education approach as the young people may not have enough experience and knowledge for proper recycling on site and not affecting the construction progress. This can also provide the importance of peer effect and shows a positive outlook on recycling and may be a source of encouragement. An interviewee from the construction organization 6 highlighted that although the organization is a small-scale main contractor, the employees have complete control and can be in charge of any new innovative approaches for recycling. They also have regular weekly meetings for discussing any possible approaches or suggestions for improving recycling rates on site.

## 6. Discussion

Based on the above analysis and discussions with the interviewees, the following recommendations are suggested to improve the attitude and behaviour towards recycling habits.

### 6.1. Legislation and Market Driven

The development of driving forces would eventually lead to eventual improvement of behaviour. The development of these driving forces could be done by: (1) Legislation driven: Initiative provided by legislation to make recycling compulsory both as a waste management process and as a market source of materials. For example, if recycling is made compulsory in the casting of precast concrete barriers, then market would respond to these requirements. This is an artificial way of creating demand, which is needed for an industry to thrive. On the other side, if recycling is made mandatory with government inspections to site compliance, then all sites would have proper waste management implementations, only then recycling will not be seen as an option but as a requirement; and (2) Market driven: If market has created a demand through a competitive product by quality or by price, interest on such products will increase. This will accelerate the growth of industries to provide for demand and this would also create a demand for salvageable materials thus the industry will improve collection and recycling efficiency. The focus is best aimed in developing ways that will provide seamless transition of the newer methods to currently performed processes. This will keep resistance to change minimal, lower requirements for training and faster transition.

### 6.2. Improvements of Waste Management Methods

Proper waste management should begin early in the design process. In this manner, many variables could be set up, simulated and adjusted before cost implications. This is not only cheaper but also saves time. The more beneficial feature early consideration would be in the first two upper processes in the construction and demolition waste hierarchy namely "avoid" and "reduce." Because the design specifies the type of materials to be used, potential waste could be avoided and more efficient processes could be employed. The use of standard, modular or prefabricated components may improve waste reduction while also reducing cost. Other method is to specify use of materials that could have better properties for recycling and preserve the material homogeneity for the building life span and make recycling easier after the structure's life span. The themes in this area would be to avoid and reduce the amount of waste then provide ground work for easier and more efficient recycling during the construction phase with a clear routine and operating procedures developed in the organizations.

### 6.3. Provisions in Work Method Statement

Recycling is considered as a part of site decorum and not usually treated as a formal task. The implementation of recycling in a contractor's work method statement allows more official treatment of the process. This should also be in the case for subcontractors and suppliers, where strict adherence to regulations will be implemented and the work method statement is part of the agreement. Formalizing recycling will create a more serious view of the task resulting in more conformity and legal bound sanctions.

### 6.4. Share Research and Applications in Sub-Industries

The implementation of a generic process will not be able to address the unique characteristics of the construction industry. With economic downturns affecting all, the option of investing on research and development become an unattractive proposition. This results in difficulty in improving current status and likelihood in investments in the concept. The more appealing path would be to merge resources from different organizations in the effort of research and development. This could be done as a sub-industry consortium among organizations with nearly the same expertise. For example, landscaping specialist contractors could merge in studying methods of improving recycling. In this manner, the recycling methods developed become sectarian and more suited to their sub-industries.

### 6.5. Developing Communication among Employees

According to the analysis, even though the individuals are involved in recycling practices, these are not communicated to other colleagues. Therefore, it is necessary to develop communication among employees to discuss about recycling practices among each other. Further, the organisations can organize workshops to exhibit the recycling practices carried out by various individuals.

## 7. Conclusions

This paper investigated the attitude and behaviour towards recycling habits in construction. A questionnaire survey and structured interviews were conducted. The most common types of construction and demolished waste for recycling is metal. The industry welcomes and accepts recycling as useful and favourable. The industry wants and intends to recycle but is not yet well planned and recycled at their workplace. It was found that the industry's attitude towards recycling habit is positive; however, their behaviour is not as strong as it should be. Further, employers' supportiveness towards construction waste recycling does not enhance the positive attitude of the construction workers. The employers' contribution to enhance the behavioural intentions of employees through supporting construction waste recycling is minimal. The industry is aware and concern about recycling in construction and willing to improve the environment by develop recycling habit. However, work environment, including work routines and operating procedures are not very well prepared than it should be to match with the recycling behaviour and thus affects the recycling outcomes. The employers are in general supportive of recycling and practice recycling at work. Recommendations to improve the attitude and behaviour towards recycling habits were suggested, including: (1) Legislation and market driven; (2) Improvements on waste management methods; (3) Provisions in work method statement; and (4) Share research and applications in sub-industries.

## 8. Limitations and Future Research Directions

This research is carried out within the construction sites. However, the recycling of construction waste can be implemented at the design level of the project which is not captured in this research. Therefore, it is necessary to carry out research to carry out research in the initial design stage which prevails in consultancy working environment. Further, according to the research findings although recycling construction waste is supported by almost all the positions in the industry there is no proper

plans developed within the construction sites as how to incorporate recycling. Therefore, it is suggested to carryout future research on incorporating recycling in construction as a planned activity.

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## Appendix

### QUESTIONNAIRE FOR RECYCLING HABIT IN THE CONSTRUCTION INDUSTRY

**Aims:** These questionnaires are designed to generate some personal views towards recycling in your organization. The information provided will be used only for my research study and will not be used for any other purpose.

I would like to give my appreciation again for your helpful opinion.

Please tick  against the correct choice.

How often do you do all that is needed to recycle at your workplace?

- ☐ A few times a day ☐ Just about every day  
☐ A few times a week ☐ Once or none this week

While doing your job, how often do you recycle at your workplace?

- ☐ A few times a day ☐ Just about every day  
☐ A few times a week ☐ Once or none this week

For each of the statements below, please indicate the extent to which you agree or disagree and the statement applies to or describes you personally by circling a number to represent your response.

	Strongly disagree			Strongly agree			
1. I typically do all that is needed to recycle at work.	1	2	3	4	5	6	7
2. Doing all that is needed to recycle at work is something I do automatically.	1	2	3	4	5	6	7
3. Doing all that is needed to recycle at work is something I do without having to consciously remember to do so.	1	2	3	4	5	6	7
4. It makes me feel weird if I do not do all that is needed to recycle at work.	1	2	3	4	5	6	7
5. Doing all that is needed to recycle at work is something I do without thinking.	1	2	3	4	5	6	7
6. It would require effort on my part not to do all that is needed to recycle at work.	1	2	3	4	5	6	7
7. Doing all that is needed to recycle at work without realizing I'm doing it.	1	2	3	4	5	6	7
8. I would find it hard not to do all that is needed to recycle at work.	1	2	3	4	5	6	7
9. I do all that is needed to recycle at work without needing to think about it.	1	2	3	4	5	6	7
10. I frequently do all that is needed to recycle at work.	1	2	3	4	5	6	7
11. Doing all that is needed to recycle at work is something that's typically "me."	1	2	3	4	5	6	7
12. Doing all that is needed to recycle at work is something I have been doing for a long time.	1	2	3	4	5	6	7
	Never			Always			
1. How often your work habits helped recycle at work?	1	2	3	4	5	6	7
2. How often the routines you follow helped recycle at work?	1	2	3	4	5	6	7
3. How often the standard operating procedures helped recycle at work?	1	2	3	4	5	6	7
4. How often doing the tasks the same way helped recycle at work?	1	2	3	4	5	6	7

On each scale below indicate how you feel about recycling at work. For example, if you think it would be very bad, you might circle "1," whereas if you think it would be somewhat good, you might circle "5" or "6." Please use the same way to respond when you see scales like this for the rest of the questionnaire.

**Recycling at your workplace**

Bad	1	2	3	4	5	6	7	Good
Undersirable	1	2	3	4	5	6	7	Desirable
Harmful	1	2	3	4	5	6	7	Beneficial
Useless	1	2	3	4	5	6	7	Useful
Unfavourable	1	2	3	4	5	6	7	Favourable

**How often you recycle different types of construction and demolition waste?**

	Never						Always	
Concrete	1	2	3	4	5	6	7	
Brick	1	2	3	4	5	6	7	
Timber	1	2	3	4	5	6	7	
Plastic	1	2	3	4	5	6	7	
Metal	1	2	3	4	5	6	7	
Glass	1	2	3	4	5	6	7	
Paper	1	2	3	4	5	6	7	
Others (please specify: _____)	1	2	3	4	5	6	7	

1. People who are important to me think I should recycle at work. Strongly disagree 1 2 3 4 5 6 7 Strongly agree
2. Other people whose opinion I value the most think it is a good idea if I recycle at work. Strongly disagree 1 2 3 4 5 6 7 Strongly agree
3. How much control do you have over recycling at your workplace? Very little control 1 2 3 4 5 6 7 Complete control
4. For me to recycle at work is: Very easy 1 2 3 4 5 6 7 Very difficult
5. I want to recycle at my workplace. Strongly disagree 1 2 3 4 5 6 7 Strongly agree
6. I intend to recycle at my workplace. Strongly disagree 1 2 3 4 5 6 7 Strongly agree
7. I plan to recycle at work. Strongly disagree 1 2 3 4 5 6 7 Strongly agree
8. I will recycle at my workplace. Strongly disagree 1 2 3 4 5 6 7 Strongly agree

The following questions are about your work environment.

Do people work with you recycle at work?

- ☐ People work with me usually recycle
- ☐ People work with me sometimes recycle
- ☐ They rarely or never recycle
- ☐ I don't know if people I work with recycle or not

Did you usually recycle in the same location each time at work in the past week?

- ☐ Usually in the same location
- ☐ Sometimes in the same location (and sometimes in different places)
- ☐ Rarely or never in the same location (typically in different places)
- ☐ I never recycle at work

Do you usually recycle at the same time of the day at your workplace?

- ☐ It was usually at the same time of the day
- ☐ It was sometimes at the same time of the day
- ☐ It was rarely at the same time of the day
- ☐ I never recycle at work

Do you usually recycle in the same mood at work?

- ☐ I was usually in the same mood
- ☐ I was sometimes in the same mood
- ☐ I was rarely in the same mood
- ☐ I never recycle at my workplace

Is your employer supportive of recycling at work?

- ☐ My employer is very supportive of recycling and do all they can to help.
- ☐ My employer is supportive of recycling but can do more to help.
- ☐ My employer says they are supportive of recycling but not much help is given.
- ☐ My employer is neutral in recycling (they do not address the issue).
- ☐ My employer thinks recycling is not necessary/appropriate.

The following questions are for classification purposes only.

(1). Your company is in the industry of:

- ☐ Developer
- ☐ Contractor
- ☐ Suppliers
- ☐ Consultant
- ☐ Subcontractor
- ☐ Others (please specify: \_\_\_\_\_)

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