

Project Management Skills in Green Construction Among Workers at Public Works Department (PWD) in the Construction Industry

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Abstract: Project management skills in green construction should be mastered by workers in the construction industry. There are several problems related to readiness in managing projects as well as lack of skills in handling green construction. To maintain the sustainability of construction, skills in the construction of green buildings are introduced to the whole world widely especially in the construction industry. The purpose of this study was to examine the skill needs and level of readiness in the management of green construction projects among employees in PWD Johor. The objectives of this study are as follows: determine the workers' skills needed in green construction project management, determine the level of work readiness in green construction during the project management among the PWD workers, investigate steps taken by the PWD in ensuring green construction is carried out in Johor. The approach of this study is to use quantitative methods by distributing study questions to PWD workers consisting of engineers, assistant engineers, project managers, assistant project managers, site supervisors, assistant site supervisors, contractors. The overall response rate is 70% from 30 respondents and the data had been analyzed using IBM SPSS Software Version 26. From this research, the dominant skills from the respondents are transferable skills and the highest level of work readiness in managing a green construction project is project team related. The most beneficial method used to ensure green construction was completed are to increase the use of green materials in a construction project.

Keywords: PWD, Green Construction, Project Management, Skills Project Management.

1. Introduction

Work readiness should contain skills related to the work done that the workers must possess to succeed in Public Works Department (PWD). The department needs to hire new employees with strong technical skills as well as strong soft skills. It is critical to identify the level of job preparedness among employees, as well as the project management abilities required for employees to become competent department employees. The backdrop of the research, the problem statement, the research goal and objectives, the significance of the study, and the scope of the investigation are all covered in this chapter.

Public Works Department (PWD) is one of the Malaysian Local Government that responsible for the construction and maintenance of public infrastructure in west Malaysia and Labuan. PWD has endowed with infrastructure and a better atmosphere for day-by-day life also trustworthy for building roads which is the main mechanism in the socio-economic expansion of the country (JKR, 2016). This company provides training programs to produce skilled and knowledgeable workers to implement quality construction projects, to achieve the objective of developing a generation with 21st-century skills. Workers must master the different skills in parallel with green technology or be precise in the green skills (CEDEFOP, 2018).

To balance the development of the country with Mother nature, the green practice has been introduced worldwide widely across many industries including construction (Zulkefli & Leo, 2017). Green construction is a type of construction that dynamically benefiting that preserves the natural environment. The main aim of sustainable development is to meet current housing needs and protect the environment and resource for the future not only to build considering future requirements. PWD workers must have skills in the aspect of green construction project management so that the planning implemented by Malaysia in the future is towards sustainable development. Green skills are also known as sustainable skill refers to skills, knowledge, and attitudes needed by the workers to improve the environment development friendly.

In project management, work-ready skills encompass both core perceptive and behavioural abilities. Personal traits such as reading for project management knowledge, problem-solving, critical thinking, and soft skills are examples of perceptive skills. Behavioural skills, on the other hand, are abilities like flexibility, integrity, cooperation, and discipline that improve an individual's interactions, job performance, and career visions.

To present, there are no established levels of work readiness among new PWD employees in terms of their ability to participate competently in green project management (Ismail, 2015). In performing green project management, it is critical to establish the level of job preparedness among new entrants as well as workers. It's because the department's objective and vision are to provide world-class service and a centre of excellence in asset management, project management, and engineering for the development of national infrastructure based on human capital and creativity, and innovation.

Malaysia is a developing country with a rise of the population to 41.5 million by the year 2040 (Statistic Department, 2016). With the growing population that means more waste is produced, more energy consumption, lack of resources and landmass, and decreasing living quality. Tun Dr. Mahathir Mohamed (Malaysia's Prime Minister 2020) has stated that Malaysia's commitment to Sustainable Development must by the year 2020. Construction industries need to prepare for the inevitable fourth industrial revolution (4IR), as Malaysia strives to developed towards the nation by the year 2020, workers need to master the digital economy, the internet of things (IoT), artificial intelligence (AI), cross-border e-commerce, and many more (Salleh *et al.*, 2020).

In need rapid of infrastructure development, the ever-growing urban population creating the saturation of the areas builds waterproof and reduces green area (Zahir, 2014). Various environmental problems, such as the effects of urban heat archipelagos and flash floods, especially to the people due to the existence of this concrete forest. Thus, the green building (GB) concept was established by the government to produce sustainable development.

Nevertheless, it will be difficult if the workers with lack skills parties in green technology especially in the green construction project management and takes time to achieve sustainable development construction in Malaysia. A piece of new skills must be implemented throughout the workers with a focus by the government to develop technical skills including green skills through a training program by JKR. This research was conducted to identify the skills of the workers in ensuring that the project management can be carried out properly to develop sustainable construction.

According to Jollands *et al.* (2012), new workers lack preferred traits such as project management expertise, problem-solving, communication abilities, and report writing capabilities, and several skill gaps have been discovered. This can be demonstrated by the fact that JKR's administrators got several complaints from department heads claiming that new admission personnel lacked communication, writing abilities, and technical expertise (Ismail, 2015).

The objectives of this study are to determine PWD workers' skills needed in green construction project management, to determine the level of work readiness in green construction during the project management among PWD workers and to investigate steps taken by the PWD in ensuring green construction is carried out in Johor

This research focuses on the skills in green construction project management among PWD workers. This research is concentrated around the state of Johor, used quantitative methods which gained feedback from the PWD workers that will be listed and analyzed by using the questionnaire method. The quantitative method is data obtained through the distribution of questionnaires to respondents that will be conducted with PWD workers, consisting of engineers, assistant engineers, project managers, assistant project managers, site supervisors, assistant site supervisor, contractors.

2. Literature Review

The literature review refers to a summary of a piece of writing or a study that was carried out. The objective of the literature review is to aid in the identification of the problems to be investigated, as well as to illustrate the results of previous studies that may be utilised as a guide and to expose gaps in the research. This section will briefly describe the skills needed in project management based on green construction as well as the level of work readiness of PWD workers in implement green skills in construction project management. Furthermore, this section briefly about what the steps taken for ensuring green construction have to be carried out by the workers.

2.1 Green Construction

Green construction is a type of green technology that incorporates sustainability into all parts of its design. Green construction entails numerous adjustments to the construction process, both large and little. The following are some examples of green construction methods stated by Forestell K. (2019):

- (a) Using more eco-friendly construction materials
- (b) Using newer, more fuel-efficient equipment to reduce gasoline consumption
- (c) Find non-toxic substances to use on the job
- (d) Toxic waste should be disposed of in a responsible and safe manner
- (e) Using technologies such as modular building to reduce waste as much as feasible
- (f) Construction trash, concrete, wood, and other materials should be recycled as much as feasible.

2.2 Green Construction Project Management

The advancement of sustainable development through the responsible administration of portfolios, programs, and projects to develop environmentally-friendly structures is known as green construction management (Wu *et al.*, 2019). The management of a construction project in a sustainable manner should focus on the entire cycle, from the early planning stages through the final product, as well as the

benefits, including the negative aspects that might be expected during the facility's lifetime. This is corroborated by Hwang *et al.* (2013), who apply sustainable construction throughout the full construction life cycle, from preconstruction through demolition. As a result, sustainable construction emphasizes a holistic approach. It considers the construction process, the initial expenses of ownership, and the long-term interests of owners and tenants.

2.3 Skill Needed in Green Construction Project Management

The attributes and characteristics required to be a successful project manager are known as project management skills. However, further research is required to determine the feasibility of green technology for use in Malaysia. ILO (2011) describes the main skill's responses for each occupational cluster identified. The main skill's responses for the clusters of occupations in green building as attached in Appendix A. According to the skill responses that have been shown in Appendix A, PWD workers should have covered all the main skills. However, workers can continue training to achieve the next level skills to be professional and high skilled workers.

Both technical, occupationally specific talents and generic, soft skills are required for the green transition. In terms of technical skills, renewable energy is a good example of the vast range of abilities that can be necessary. According to contemporary technology, there are a few knowledge and abilities that could be used in Malaysia. As a result of the research that has been conducted, research analysis of the study was conducted to investigate more about skills that workers need to be prepared namely in project management.

Tables 2.1 (Appendix B) illustrate the abilities that workers need to be ready for green construction, as defined by the researcher in terms of green construction project management. As previously stated, the abilities necessary are relevant and critical in obtaining qualified PWD professionals. Knowledge refers to facts, information, and abilities gained via experience or education; it also refers to a person's theoretical or practical grasp of a subject (Rajadurai *et al.*, 2018). Furthermore, according to Markom *et al.*, (2014), skills activities involving green environmental energy are considered as a medium to assist humans in preserving the environment, which may be implemented through the green technology industry.

2.4 Skills Needed for Work Readiness

A person who is "work ready" has the fundamental abilities required to be minimally qualified for a certain occupation, as defined by a job analysis or occupational profile. The following are the skills required for employment readiness according to Act 2014:

1. They are both fundamental and occupation-specific.
2. Varied vocations have different levels of value and importance
3. Rely on the important tasks determined through a job analysis or a work description.

Work readiness standards are specific descriptions of the knowledge and abilities that persons must have to be minimally qualified for a specific occupation, and are based on the level of skills profiled for a nationwide representative sample of employment in that occupation. Personal qualities and behavioral abilities that improve an individual's interactions, job performance, and career prospects in a variety of circumstances are referred to as soft skills. Adaptability, communication skills, cooperation, discipline, and integrity are examples of soft skills. National employer surveys have revealed that soft skills are highly appreciated by employers and are frequently found to be missing in entry-level workers, highlighting the need of measuring soft skills in evaluating work readiness (ACT, 2014).

2.5 Challenges faced for work readiness in green construction project management

Workers must be ready to face any challenges in managing green construction project. Based on table 2.10, there are top challenges faced in green construction project, analyzed by Hwang and Ng (2013) in Appendix C. In terms of readiness, workers must be ready to overcome any challenges and obstacles to maintain the development of the construction project and make sure the green construction project management can be carried out.

2.6 Green construction initiative in Malaysia

Construction procurement methods include traditional systems, design and build, project management, and collaborative relationship-based systems, which are all commonly used in construction projects. According to Masrom, Salehudin & Mohamad Bohari (2020), among the measures taken to ensure green construction in Malaysia are:

- i) Government Green Procurement (GGP)
- ii) Construction Industry Transformation Plan (CITP) 2016-2020
- iii) GGP 2.0 Guidelines
- iv) National Green Technology Policy
- v) Hijau Acquisition
- vi) pH-JKR
- vii) Green Technology Training by CIDB

Although the reality is that the government's green procurement has not yet been formally applied in any construction project in Malaysia, but this initial effort needs to be upheld consistently and comprehensively (Masrom *et al.*, 2020). Close cooperation from the government, industry players, and academics need to be further strengthened. This is important to remove obstacles in efforts to strengthen the government's green procurement practices in the country more effectively.

2.7 Steps taken in ensuring green construction is carried out

According to Snook (2020), one of the measures taken by ensuring the green construction is carried out is by using the tools of green construction, which consist of:

- i) Biodegradable Materials
- ii) Solar energy as a sustainable energy source
- iii) Passive House: One of the most advanced green building techniques
- iv) Technology Efficiency
- v) Prefabrication/Modular Construction

3. Research Methodology

In this study, the research is about the project management skills based on green construction to identify the level of work readiness among the workers. Quantitative methods are employed in research to attain objectives. Employees working in construction project management at PWD are among the respondents for this research in the state of Johor, which is one of the states with green construction. Different types of question structures were used in the survey. The primary goal of this questionnaire is to obtain answers to questions that occur during the construct research objectives. The use of quantitative methods in this study is to obtain a large number of respondents to facilitate the determination of the level of job readiness in terms of skills in green construction also to determine the skills of workers.

3.1 Research Design

(a) First Stage: Identifying Study Problems

The first stage is for identifying research problems. In this study, the title selected is related to project management skills in green construction conducted in the state of Johor. The purpose of the selected area is to study skills among PWD workers in realizing the vision of sustainable Johor. The purpose of the study area was selected based on the main problem that occurs in the area of study i.e., the impact of the construction on the environment.

(b) Second Stage: The Objective of The Study

The second stage is to form the objectives of the study after issues and problems in the study area have been identified. The objective purpose of the study was to determine the direction of a study that must be related to problem statements. Success or failure in achieving the objective of the study formed will affect the implementation of the study. This study was conducted with a focus on three departments of JKR, which are PWD Johor Baharu, and PWD Batu Pahat.

(c) Third Stage: Literature Review

This literature study is the collection of information relevant to the title of the study. The collection of this information is obtained through secondary data for example through articles, journals, books, newspapers, websites, and through previous theses. Through this study, it was able to obtain more detailed theories and information on the impact of the construction of tiered interchanges during the construction process in the study area.

(d) Fourth Stage: Data Collection

In data collection, data is defined as a factual collection of something consisting of a figure, word, or picture. Data consists of information that has been processed and unprocessed general information (Chua, 2014). A researcher-made the collection of data sources obtained through two forms i.e., secondary and primary forms.

(i) Primary data

Primary data collection is carried out through the distribution of questionnaires. Quantitative research requires data measurement to gain trust and validity towards information (Chua, 2006). Furthermore, the survey method is a quantitative method that involves numerical data and precision and refers to a discrete number expressed precisely (Chua, 2014).

(ii) Secondary data

Secondary data is gathered through the reading of articles, journals, books, newspapers, and websites, as well as past theses, to gain more thorough theories about the research (Chua, 2014). In this research, the information on project management skills as well as green construction will be studied more depth. Most of the reference books can be obtained from the library University of Tun University Library Hussein Onn Malaysia (UTHM). Municipal Council, UTHM website, E-Journal UKM, Prep UKM, Google Web Scholar Online, and Web Science Direct Online are examples of unpublished information. The primary goal of collecting data via secondary approaches is to strengthen the study at an early stage.

(e) Fifth Stage: Data Analysis

This stage where all primary and secondary data collection obtained from respondents will be analysed and processed. For analysis of data obtained through interviews will use ascriptive analytical methods while thematic analysis is used in analysing data obtained from interview methods. Descriptive analysis is one of the analytical methods for data collection using quantitative methods in reflecting the main features of the data collection. Meanwhile, inferential analysis is to conclude the population

represented by data (Graziano & Raulin, 2014). This research can be carried out through scriptive studies or inference studies.

(f) Sixth Stage: Recommendation and Conclusion

The level of proposals and conclusions used to provide recommendations to the PWD workers involved in sustainable construction project management in Johor. In conclusion, to summarize all problem statements, the question of the study, and the objectives of the study undertaken to facilitate the understanding of the findings.

3.2 Data Collection

Quantitative analysis is carried out as part of this study to gather more complete and accurate information and data. Based on Flowchart in Appendix E, study data and information were obtained through questionnaires involving PWD employees. In addition, additional information such as organizational data can be obtained from the PWD website.

3.2.1 Questionnaire Method

The questionnaire form is divided into three (3) parts; A, and B.

Part A: Demography or respondents

- Part B:
1. Project Management Skills Needed in Green Construction
 2. Level of Work Readiness in Green Construction Project Management
 3. Steps Taken in Ensuring Green Construction is Carried Out

The Likert Scale is as in Appendix F that will apply to collect responses from respondents on how they agree with their understanding.

3.3 Data Analysis

The analysis of the data acquired is a critical component of the study that has been carried out. According to Burhanuddin (2013), once all of the data has been collected, it will be analyzed depending on the factors and types of responses. Descriptive statistical analysis will be used in this investigation. In the data analysis procedure, IBM SPSS software version 26 will be used.

4. Results and Discussion

The results and discussion section presents data and analysis of the study. This section can be organized based on the stated objectives, the chronological timeline, different case groupings, different experimental configurations, or any logical order as deemed appropriate.

4.1 Results

According to Dulaimi *et al.*, (2003), the normal response rate for questionnaires in the construction industry is between 20 to 40%. In this research, 30 sets of questionnaires were distributed to the PWD Johor Bahru and PWD Batu Pahat. Only 21 surveys were returned for this research, although 30 questionnaires were sent out. The overall response rate is 70% which is considered acceptable according to Dulaimi. So, the total of population is 30 respondents, while total sample is equal to 21 respondents and the data had been analyzed by the researcher.

Table 1: The response rate of questionnaire

Questionnaire	N	Response Rate
Questionnaire Distributed	30	100%
Questionnaire Received	21	70%
Questionnaire Not Received	9	30%

Table 2: Respondent's Background

Item	Frequency	Percentage (%)
Gender		
Male	12	57.1
Female	9	42.9
Age Group		
20 – 30 years old	5	23.8
30 – 40 years old	7	33.3
40 – 50 years old	8	38.1
Above 50 years old	1	4.8
Academic Qualification		
Secondary	1	4.8
Diploma / Certificate	15	71.4
Bachelor	5	23.8
Work Experience		
0 – 5 years	3	14.3
6 – 10 years	5	23.8
11 – 15 years	8	38.1
16 – 20 years	2	9.5
21 – 25 years	1	4.8
More than 26 years	2	9.5
Position in The Company		
Engineer	3	14.3
Assistant Engineer	2	9.5
Project Manager	2	9.5
Assistant Project Manager	2	9.5
Site Supervisor	7	33.3
Assistant Site Supervisor	3	14.3
Contractor	2	9.5

(a) Respondent Demography

Section A, which is the section in which the respondent's demographic are inquired about, contains 5 questions, which are gender, age group, academic qualification, work experience and position in company as shown below Table 2. Based on the table, the results show that the majority of respondents who answered the questionnaire for this research are male, with 57.1% of the total number of respondents from this research being male. Mostly respondents, accounting for 38.1% of the total, are between the ages 40 and 50 also majority of the respondents, which is 15 (71.4%) of the respondents, hold a diploma or certificate qualification is used. The largest percentage of respondents with the most work experience is 38.1%, which corresponds to 8 respondents with 11 to 15 years of experience. Majority of respondents (33.3%), or 7 respondents, are site supervisors. It shows that mostly respondent is male, hold a diploma, have 11 to 15 years work experience and mostly supervisor. Hence it shows that majority PWD workers who involve in managing green construction project are male, site supervisor, and have 11 to 15 years experiences also have diploma or certificate for academic qualification which valid to answer the questionnaire.

(b) Workers' Skills in Green Construction Project Management

According to the findings in the Table 3, the highest ranked type of skills in construction project management among the PWD workers is transferable skills with a mean of 3.98. It was discovered that the following were the respondents' rankings for the skills required to manage a green construction project: Able to take action or use appropriate judgment in solving problems (with the mean of 4.33 and

it ranked at 1); Able to manage well-planned time (with the mean of 4.24 and it ranked at 2); Able to build and maintain a strong project team throughout project management (with the mean of 4.05 and it ranked at 3); Able to think analytically in understanding, monitoring, evaluating, and diagnosing things, also Able to work with many employees and can coordinate tasks as well as ensure effective collaboration (both with the mean of 3.95 and ranked at 4); Able to handle a project or program (with the mean of 8.86 and ranked at 5); Able to share documents and knowledge with all workers (with the mean of 3.81 and it ranked at 6); Able to present a project clearly and confidently in influencing the audience (with the mean of 3.67 and it ranked at 7). In research from Team (2020), workers can learn and develop transferable skills that will enable them to manage teams, take the lead on a construction project, or provide constant assistance to a team. Hence, transferable skills are crucial that can open up a lot of possibilities in green construction project management.

Table 3: Worker's Skills Needed in Construction Project Management

	Item	Mean		Ranking
Transferable Skills	Able to take action or use appropriate judgment in solving problems	4.33	3.98	1
	Able to build and maintain a strong project team throughout project management	4.05		
	Able to present a project clearly and confidently in influencing the audience	3.67		
	Able to think analytically in understanding, monitoring, evaluating, and diagnosing things	3.95		
	Able to share documents and knowledge with all workers	3.81		
	Able to handle a project or program	3.86		
	Able to work with many employees and can coordinate tasks as well as ensure effective collaboration	3.95		
	Able to manage well-planned time	4.24		
Technical Skills	Proficient in using project management software	3.48	3.74	3
	Able to plan and forecast projects well	3.67		
	Able to responsible for the risk of each project undertaken	3.90		
	Able to re-evaluate all methods of problem-solving	3.95		
	Able to manage and make financial budgets	3.71		
	Able to track and monitor project performance to ensure the project runs according to plan	3.71		
Interpersonal Skills	Able to gain the trust and confidence of other employees throughout the life cycle of the project	3.95	3.96	2
	Able to negotiate to reach an agreement quickly and effectively with other workers	3.95		
	Able to adapt to unexpected changes and obstacles	4.0		
	Able to give views and prioritize views from other workers	3.95		
	Able to give effective feedback in every discussion	3.95		

(c) *Level of Work Readiness in Green Construction Project Management*

The results of the data collection by questionnaire, as depicted in Table 4, revealed that workers possessed very high skills, which was reflected by their mean scores for each variable. The first ranked with a mean of 3.79, which were project-team related as follows: Able to communicate well among project team members (mean: 3.96; rank: 1). Both of project team-related statements, “Able to resolve conflicts of interest between the consultant and the project manager”, and “Able to organize information findings from green consultants well” ranked in second place with a mean of 3.76. To overcome the challenges of lack communication, conflict or frustrating, meeting with environmental specialist, because when it comes to green building projects, an interviewee acknowledged that there is an increase in the number of meetings required since a strong alliance with green professionals is essential to fine-tune emerging concerns (Hwang, 2013). Thus, mostly workers, are approaching level of work readiness in managing green construction project based on the mean score.

Table 4: Level of work readiness in green construction project management

	Item	Mean		Ranking
Project team-related	Able to resolve conflicts of interest between the consultant and the project manager	3.76	3.79	1
	Able to communicate well among project team members	3.86		
	Able to organize information findings from green consultants well	3.76		
Material and equipment-related	Able to manage and describe the finances required for a green construction project	3.71	3.69	3
	Able to identify every resource, material, equipment, and component needed for green construction	3.71		
	Able to give recommendations and decisions on the resources, use of equipment, and different green construction materials	3.62		
	Able to manage construction waste well to create sustainable construction	3.90		
	Proficient in the use of BIM (Building Information Modelling).	3.52		
External	Know every rule related to green construction in the guidelines set by the government	3.67	3.74	2
	Able to identify each of the criteria outlined in creating green development	3.81		

(d) Steps Taken in Ensuring Green Construction is Carried Out in Johor

Based on the information gathered from the questionnaire and shown in the Table 5, it was determined that increasing the use of green materials in construction projects is the most important factor to consider in ensuring green construction is carried out in Johor, which ranked for highest place, with a mean score of 4.43. Environmentally friendly building materials provide specific benefits to the building owner and the building occupants, including lower maintenance and replacement costs over a building's lifetime, energy conservation, improved occupant health and productivity, and improved occupant health and productivity (Green Building Materials, 2019). Hence, green materials are crucial to develop the sustainable construction.

Table 5: Steps Taken in Ensuring Green Construction Is Carried Out

Item		Mean	Ranking
Planning-related	Understand the green specifications in the contract	3.62	2
	Able distinguish method, design, orientation, and structure between conventional construction ad green construction	3.81	
	Know the processes involved at each phase in green construction management	3.76	
Project-related	Able to assess the progress of completion in green construction	3.67	1
	Able to evaluate the selection of subcontractors in providing green construction services	3.76	
	Able to organize time in implementing green construction practices on site	3.81	
	Able to face variation changes with the design during the construction process	3.76	

4.2 Discussions

According to the data collection and analysis technique, the researcher could declare that every research objective listed in the Literature review, including the skills needed, level of work readiness, and measures in ensuring green construction is carried out, was met or exceeded in every case study. The relationship between the results of the Literature Review and the data from respondents who have the highest mean score is shown in Table 6.

Project management skills in green construction are the qualities and characteristics needed to be successful for the manager. However, more research is needed to evaluate green construction skills for application in Malaysia. According to the research, transferable skills are critical and can open up a wide range of opportunities in green construction project management. Workers can learn and build transferable abilities that will enable them to manage teams, take the lead on a construction project, or give constant help to a team, according to a study from Team (2020). Hence, it shows that transferable skills are crucial that need be implemented in managing a green construction project.

According to the mean score, the majority of workers are approaching the level of work preparedness in managing the green building. This research proves that project team related was the first ranked for the level of work readiness. It shows that workers are ready in terms of project team related, especially regarding communication among the workers. Meeting with environmental specialists to overcome the challenges of lack of communication, conflict, or frustration, because when it comes to green building projects, an interviewee acknowledged that the number of meetings required has increased because a strong alliance with green professionals is essential to fine-tune emerging concerns (Hwang, 2013). Thus, it shows that communication is crucial in managing the green construction project.

Materials are vital in adopting green construction project management, according to the researchers. Construction projects necessitate a large number of building materials and energy, and the most important part of the project's life cycle is pollution. Instead of only accounting for initial construction costs, assessing the environmental impact of building materials at each phase allows for a cost-benefit analysis across the project's lifetime (Sigh, 2018). Thus, materials are one of the high rankings for implementation the of green construction to be successful.

Besides, based on the literature review and the data acquired, it was necessary to conclude and expound on the accomplishment of the objectives. Research objective 1: To determine the PWD workers' skills in green construction project management. There are 19 items of skills that had been categorized into 3 categories. Data from the 19 items was then calculated into a mean value to obtain an average response from each question that was responded to by the participants. Aside from that, the

three categories were also converted into an average mean value, which was then used to analyze the ranking. It is necessary to analyze the mean of each question to determine whether or not there is a high degree of agreement among the respondents.

From Table 3, it can be seen that the Transferable skills category has the highest mean score, which is 3.98, out of the three categories evaluated. This is the skill that the PWD workers have the greatest experience with. Technical abilities, on the other hand, are the least favorable or least used category of talents, with a mean score of 3.74 out of 5. The difference in mean between the greatest and lowest values is around 0.24. In general, the mean of skill types is approximately 3.89.

However, more research is needed to assess green construction abilities for use among the workers in PWD Malaysia. Transferable abilities, according to the study, are crucial and can open up a wide range of prospects in green building project management. According to a study by Team (2020), workers can learn and develop transferrable skills that will enable them to manage teams, take the lead on a construction project, or provide constant assistance to a team. As a result, it demonstrates transferable skills in line with the literature review, and it is crucial in managing green building projects.

Research objective 2: To determine the level of work readiness in green construction during the project management among PWD workers Based on data obtained from the questionnaire, there are 17 items of work readiness in green construction project management. As shown in the table 5.2, the items are divided into 5 categories, which are, Project team-related, project-related, External, planning-related, and Materials and equipment-related. The analysis of the mean is crucial for each question to test the relative agreement among the respondent. Table 4, shows that the first rank skills are project-team related which is workers must be able to communicate well among project team members with the highest mean score of 3.86. Meanwhile the least favourable or less of readiness is, workers able to resolve conflicts of interest between the consultant and the project manager also in organize information findings from green consultants well, with a mean score of 3.76. The difference between the highest and the lowest mean is about 0.1. Literature reveals that there are different types of skills in managing a project. Researchers found that workers at PWD in Batu Pahat and Johor Bharu are already approached the level of work readiness. Mainly, workers in PWD can communicate well among the project team. Data that had been collected are in line with the previous research. Based on the literature review, it stated that communication is one of the most crucial parts of managing the project. Hence, great communication will bring the success of the green construction project.

Research objective 3: To investigate steps taken by the PWD in ensuring green construction is carried out in Johor. The main objective is to investigate steps taken by PWD in ensuring green construction is carried out in Johor. Based on the analysis, there are 14 items of steps in ensuring green construction is carried out. As shown by table 5, it stated that the highest mean is 4.43, which is increasing the use of green materials in project construction. Meanwhile, the lowest rank with the score means at 4.10, is initiatives from the government in implementing full green construction to develop smart cities. Many green products, unlike traditional construction materials, may not be readily available. Understanding the legal regulations of several countries may be one of the issues coming from imported material. Furthermore, significant testing may be required to confirm that an imported substance is compatible for usage in Malaysia. The general design of a structure should also contribute to the long-term sustainability of the materials utilized. To minimize wasting energy on heating, cooling, and lighting, buildings should be built to be as energy efficient as feasible. Architects can substantially minimize the amount of energy required for a building's operations by selecting the correct material. Hence, it is demonstrated that material is a crucial part of the green construction as revealed by literature.

Table 6: Summary of Findings

Item	Mean	Ranking	
Directions and policies	Initiatives from the government in implementing full green construction to develop smart cities	4.10	6
	Provide more practice for safe and sustainable building design and construction	4.24	5
	Ensure that all workers know the green construction policies	4.38	2
Technologies	Ensure the use of green technology during construction	4.24	5
	Enhance the use of smart technology in construction	4.33	3
	Implement rainwater and greywater collection systems	4.33	3
Energy	Increase the use of renewable energy resources in building and during construction	4.29	4
	Enhance energy conservation in buildings and during construction to reduce energy consumption	4.29	4
	Efficient in using energy, water, and other resources	4.29	4
Materials	Increase the use of green materials in project construction	4.43	1
	Enhance in research, evaluate and make selection criteria of green materials suitable with the construction project	4.29	4
	Implement appropriate methods to manage demolition materials that generate waste during construction	4.29	4
Construction practices	Increase the use of BIM software throughout the construction phase	4.29	4
	Increase the green construction project management programs	4.33	3

5. Conclusion

In conclusion, the three research objectives, which were to determine PWD workers' skills needed in green construction project management, determine the level of work readiness in green construction during the project management phase among PWD workers, and finally to investigate steps taken by the PWD to ensure green construction is carried out in Johor, had been met with success. The data analysis and discussion in Chapter 4 had given the data gathering method, which was through a survey questionnaire. In addition, this research seeks to benefit and give references to a variety of stakeholders, such as university researchers, local contractors, and municipal governments. It is believed that the relevant academic experts will use the linked topic in the future to support the related field of academic study in the future.

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References

ACT (2014), Work Readiness Standards and Benchmarks, Retrieved from <https://files.eric.ed.gov/fulltext/ED546848.pdf>

- CEDEFOP (2012). European Centre for the Development of Vocational Training 2012. Greener Skills and Jobs: European Synthesis Report. Luxemburg: Publication Office of the European Union.
- CEDEFOP (2018). European Centre for the Development of Vocational Training. Skills for green jobs: an update [unedited proof copy]. Publication Office of the European Union.
- Chua, Y. P. (2006). Kaedah dan Statistik Penyelidikan: Kaedah Penyelidikan. Edisi Pertama. Malaysia: Mc Graw Hill Education.
- Chua, Y. P. (2014). Kaedah dan Statistik Penyelidikan: Kaedah Penyelidikan. Edisi Ketiga. Malaysia: Mc Graw Hill Education.
- Forestell, K. (2019). Green Construction Vs Green Building: Understanding the Important Different. North America: DOZR.
- Graziano, A. M. & Raulin, M. L. (2014). Research methods: a process of inquiry. 4th. Harlow, Essex: Pearson Education.
- Green Building Materials*. (2019). CalRecycle. Retrieve from <https://www.calrecycle.ca.gov/greenbuilding/materials#:~:text=Green%20building%20materials%20offer%20specific,Improved%20occupant%20health%20and%20productivity>.
- Goedknecht, D. (2012). Sustainability in Project Management; A case study at University of Applied Sciences Utrecht. PM World Journal, I (IV).
- Hamid, Z. A., Anuar, K, and Kamar, M. (2012), "Aspects of off-site manufacturing application towards sustainable construction in Malaysia," Construction Innovation, vol. 12, pp. 4-10
- Hua, A. K. (2016). Pengenalan Rangka Kerja Metodologi dalam Kajian Penyelidikan: Satu Kajian Literatur, 1(1), 17-24.
- Hwang, B. G., & Ng, W. J. (2013). Project management knowledge and skills for green construction: Overcoming challenges. *International Journal of Project Management*, 31(2), 272–284. <https://doi.org/10.1016/j.ijproman.2012.05.004>
- Hwang, B.-G., Leong, L. P., Huh, Y. K. (2013). Sustainable green construction management: schedule performance and improvement, Technological and Economic Development of Economy 19(Supplement 1): S43–S57.
- Hwang, B.G., Zhao, X. and Tan, L.L.G. (2015), Green building projects: schedule performance, influential factors and solutions, *Engineering, Construction, and Architectural Management*, Vol. 22 No. 3, pp. 327-346
- Jabatan Kerja Raya, 2016 retrieved from <http://www.kkr.gov.my/ms/node/118>
- Jollands M., Jolly L., and Molyneux (2012), Project-Based Learning as a Contributing Factor to Graduate’s Work Readiness, *European Journal of Engineering Education* Vol. 37, No. 2, 143-154.
- Khadri, M. F. A. (2014). Kajian Mengenai Kepuasan Penduduk Terhadap Penyelenggaraan Landskap Di Kawasan Kediaman Pura Kencana, Batu Pahat, Johor. Universiti Tun Hussein Onn Malaysia: Tesis Sarjana Muda.
- Khair, K. (2006). Training Employable Graduates: Innovation in Training Methodology, Paper presented at National Conference on Continuing Technical Education & Training 2006, Challenges in Technical Education and Training; Enhancing Employability among Graduates 28-29 July 2006, The Katerina Hotel, Batu Pahat Johor.
- Lapinski, A. R., Horman, M. J., & Riley, D. R. (2006). Lean processes for sustainable project delivery. *Journal of construction engineering and management*, 132(10), 1083-1091.
- Li, Y. Y., Chen, P. H., Chew, D. A. S., Teo, C. C., & Xu, Y. Q. (2013). Project Management Factors Affecting Green Building Projects: Case Study of Singapore. *Applied Mechanics and Materials*, 357, 2346-2352.
- Lim, S. V. (2011), The use of Green Building Materials in the Construction Industry in Malaysia
- Lippaiová, R., & Sebestyén, Z. (2006). Green Constuction Project Management.
- Marcelino-Sádaba, S., González-Jaen, L. F., & Pérez-Ezcurdia, A. (2015). Using project management as a way to sustainability. From a comprehensive review to a framework definition. *Journal of cleaner production*, 99, 1-16.
- Markom, R., & Hassan, N. (2014). Kelestarian Alam Sekitar Dan Pembiayaan Teknologi Hijau Dari Perspektif Undang-Undang Syariah. *Jurnal Kanun* 26(2).
- Miklosik, A. (2015). Improving Project Management Performance through Capability Maturity Measurement. *Procedia Econ. Finance*, IISES 3rd, and 4th Economics and Finance Conference 30, 522–530. [https://doi.org/10.1016/S2212-5671\(15\)01264-2](https://doi.org/10.1016/S2212-5671(15)01264-2)
- Pavlova, M. (2011). Economic competitiveness and green skills“ development: Issues and concerns for research. Presented at the international conference, Green Korea 2011 September 15, Seoul.
- Project Management Institute, (2020). What is Project Management? New Town Square. Retrieved at <https://www.pmi.org/about/learn-about-pmi/what-is-project-managemt>
- Rajadurai, J., Sapuan, N. M., Daud, Salina and Abidin, N, (2018) The Marketability of Technical Graduates from Higher Educational Institutions (HEIs) Offering Technical and Vocational Education and Training (TVET): A Case from Malaysia, *Asia-Pacific Edu Res* (2018) 27(2):137–144.

- Robichaud, L. B., & Anantatmula, V. S. (2010). Greening project management practices for sustainable construction. *Journal of Management in Engineering*, 27(1), 48-57.
- Salleh, F., Yatin, S. F. M., Radzi, R. M., Kamis, M. S., Zakaria, S., Husaini, H., Zaini, M. K., & Rambli, Y. R. (2020). Malaysian's New Digital Initiative to Boost E-Commerce – Where We Are. *International Journal of Academic Research in Business & Social Sciences*. 10(11), 1138-1154.
- Senaratne, S., & Hewamange, P. R. (2015). The role of team leadership in achieving LEED certification in a green building project. *Built Environment Project and Asset Management*, 5(2), 170-183.
- Shi, L., Ye, K., Lu, W., & Hu, X. (2014). Improving the competence of construction management consultants to underpin sustainable construction in China. *Habitat International*, 41, 236-242.
- Sim, Y. L., & Putuhena, F. J. (2015). Green building technology initiatives to achieve construction quality and environmental sustainability in the construction industry in Malaysia. *Management of Environmental Quality: An International Journal*, 26(2), 233-249.
- Singh, C. S. (2018). *Civil Engineering Research Journal. Green Construction: Analysis on Green and Sustainable Building Techniques.* https://internationalgbc.org/wp-content/uploads/2021/06/0131_CERJ.MS_ID_555638.pdf
- Statistic Department, (2016) retrieved from <https://www.dosm.gov.my/v1/index.php>
- Shahadan, F. (2008). *Kaedah Analisis Dalam Penyelidikan.* Fakulti Ekonomi dan Perniagaan. Universiti Kebangsaan Malaysia.
- Team, G. C. (2020). The top 10 transferable skills to get you a job in construction. *Go Construct.* <https://www.goconstruct.org/why-choose-construction/whats-happening-in-construction/top-10-transferrable-skills-1/>
- University of Illinois System (2020). *Project Definition Recommendations.* Retrieved at https://www.aits.uillinois.edu/services/professional_services/pmo/project_management_toolkit/project_definition_recommendations/
- Walker, A. (2015). *Project Management in Construction 6th Edition.* United Kingdom. John Wiley & sons copyright. ISBN978-1-118-50040-8
- Wang, N., Yao, S., Wu, C. C., & Jiang, D. (2015). Critical factors for sustainable project management in public projects.
- Wu, X., Zhao, W. and Ma, T. (2019) Improving the Impact of Green Construction Management on the Quality of Highway Engineering Projects. *Sustainability* 2019, 11, 1895; doi:10.3390/su11071895
- Zahir, M. M. H., Rahman, S. N., Mohamed, M. F., Jamil, M. & Nopiah, Z. M. 2014. The perception of Malaysian architects towards the implementation of green roofs: a review of practices, methodologies and future research. *E3S Web of Conferences* 3: 1-8.