



Malaysian Carbon Reduction and Environmental Sustainability Tool (MyCREST) Qualified Professional Training Assessment

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Abstract: In assessing the green building application, Construction Industry Development Board (CIDB) has introduced the Malaysian Carbon Reduction and Environmental Sustainability Tool (MyCREST) which will be fully implemented for government project starting in the year 2018. In order to spread the awareness of MyCREST implementation and train the MyCREST assessor, and TVET workforce, CIDB has conducted series of MyCREST training every year. This research aims to investigate the overall performance of MyCREST training through the training objective assessment method. This research was carried out during the MyCREST in-house training by CIDB involving 33 trainees from all over Malaysia. A questionnaire survey has been developed for this research, and the data has been analyzed using descriptive statistical analysis. Result from this research determined that the majority of the respondents who completed this training have acquired new knowledge on MyCREST. It can be concluded that MyCREST training has achieved the objectives set out by the CIDB. However, in order to improve and to richen the data, observation during the training is suggested to be added in future research.

Keywords: MyCREST, assessment, training and training evaluation

1. Introduction

The green building initiative was born from the urgency and commitment towards energy efficient and environmentally friendly construction practices. The green building approach brings together a collection of practices, techniques, and skills to reduce the greenhouse effect and ultimately minimise the impacts of buildings on the environment and human

health. Green building application yield huge benefits towards the environment, economic and social (CIDB, 2016) and it is crucial that this initiative can move forward and become the standard of practice in the near future.

The Malaysian government intends to reduce its greenhouse gas emissions intensity by 45% (scaled by GDP) by the year 2030 from its 2005 intensity (Gene-Harn Lima et al., 2017). The reduction which are to anticipated would derived from the energy, building, transportation and waste management sectors. Buildings consume about one-third of the world’s energy, and therefore it is important to encourage that the buildings being constructed, operated and maintained in a manner that reduces the energy by introducing various environmental related policies and programs (Yong Razidah Rashid et al., 2011).

Table 1. Green Building Benefits

Environmental Benefit	Economic Benefit	Social benefit
Enhance and protect biodiversity and ecosystem	Creates, expands, and shapes markets for green product and services	Enhances occupant’s comfort and health
Improve air and water quality	Reduces operating costs	Improves aesthetic qualities
Reduce waste stream	Improves occupant productivity	Improves overall quality of life
Conserve and restore natural resources	Optimises life-cycle of economic performance	Minimises strain on local infrastructure

Source: CIDB, 2016

Moving towards the green building application requires the tools to assess its effectiveness. In assessing the green building application, there are seven (7) rating tools which have been developed in Malaysia. The tools are the Green Building Index (GBI), GreenRE (REHDA), Melaka Green Seal (Melaka), CIS20 – GreenPASS (CIDB), Penarafan Hijau (PH-JKR), MyCREST (CIDB-JKR) and CASBEE Iskandar (IRDA-Japan) (CIDB, 2016). These green building rating tools, also known as certification tools are used to assess and recognize buildings which met certain requirements or standards. The used of these rating tools, which is often voluntary, recognize and reward companies and organisations who develop and operate greener buildings, thereby encouraging and incentivizing them to push the boundaries of sustainability.

In promoting and governing the green building initiative for the Malaysian construction industry, CIDB has introduced the Malaysian Carbon Reduction and Environmental Sustainability Tool or also known as MyCREST. The development of this tool serves as a commonly recognised assessment tool, and it is supposed to be generally accepted by the construction industry as the main tools for assessing the carbon release in construction projects. Through the application of this tool, it is hoped that the government can contribute to the Sustainable Development Goals (SDG) which has been set out by the United Nation (UN). Nevertheless, aside from state of the art tools, each individual effort is crucial in making the sustainability initiatives a success and the role TVET has been instrumentally recognized as a strategic entry point for ensuring a world of work that contribute social cohesion and promotes environmentally sound sustainable development (Pavlova, M., 2019).

This study aims to assess the MyCREST qualified professional training in order to identify whether there is a lacking in the training implementation. This report provides information obtained through training objective analysis, mainly on the overall performance of MyCREST training. The result focused particularly on the achievement of the training objectives and has highlighted major strengths and weaknesses while offering some explanation for observed changes. Comments on the prospects of the training and recommendations that would improve MyCREST current performance also has been highlighted at the end of this study.

2. Malaysian Carbon Reduction and Environmental Sustainability Tool (MyCREST)

Green building is significant in contributing to sustainable development (Yigitcanlar & Teriman, 2015). Green Building is redefining and revolutionising building practice and emerging as a response to growing concern over pollution and environmental damage, increasing awareness and acceptance of climate change, decreasing natural resources, increasing energy cost, and increasing demand for sustainability in building design and construction (Aliagha, 2013). Buildings have a significant and continuously increasing the impact to the environment through Carbon Dioxide (CO²) releases (Montoya, 2009). Building also created the most waste, use most of non-energy related resources, and as a source of major pollutions (sound, air and water) (Bahaudina, 2013). According to a report in United State of America, residential, commercial, and industrial buildings produce CO² emissions more than 38% as compared to 10% of world’s CO² emissions (Elias & Chong, 2015).

Malaysian construction industries growth is considerable rapid among other countries in the world. With the introduction of the United Nation Sustainable Development Goals (SDG’s), Malaysian government has put forth a green development agenda which has becomes a new drive in the construction industry in Malaysia. In the effort to realizing this agenda, CIDB has introduced MyCREST as a performance-based standard for green building design, construction, and operations (JKR & CIDB, 2016). MyCREST is a building rating tool that links sustainability indicators to carbon emission criteria (JKR & CIDB, 2016). MyCREST aims to guide, assist, quantify and thereby reduce the built

environment's impact regarding carbon emissions and another environmental impact. It also aims to integrate socioeconomic considerations related to the built environment and urban development. MYCREST essentially combines three basic tools in order to construct a 'scoring plan' which is then used to assess a building for certification. MYCREST basic tools are represented of how the assessment, recognition, and award are given separately according to the three basic stages of the building lifecycle (CIDB, 2015).

Table 2. Basic Stages for MyCREST Assessment and the Tools

Design Stage	Construction Stage	Operation and Maintenance Stage
<ul style="list-style-type: none"> ● Design tool ● Design stage scorecard ● Reference guide for design stage ● Design stage carbon calculator 	<ul style="list-style-type: none"> ● Construction tool ● Construction stage scorecard ● Reference guide for construction stage ● Construction stage carbon calculator 	<ul style="list-style-type: none"> ● O&M tool ● O&M stage scorecard ● Reference guide for O&M stage ● O&M stage carbon calculator

Source: CIDB, 2015

Each tool produces a rating for each stage of the project lifecycle. The individual rating will be combined and produced the cumulative rating. Based on the cumulative rating, a 'star' will be given, and the higher the ratings, more star will be given up to maximum 5 stars. This way, the ratings not only reflect the overall performance but also the breakdown of three stages of the specified project lifecycle can be identified.

2.1. MyCREST Qualified Professional Training

CIDB introduced MyCREST training which guides the parties involved in the design, construction, operation & maintenance of building to adopt sustainable development practices. It also aims to provide tools to quantify the actual carbon emission at every stage of the building lifecycle. In making sure the practice and implementation of MyCREST in construction project achieved the desired result, CIDB has made an initiative for the parties to attend MyCREST training. This training aims to:

- (a) Expose on the general assessment structure of MyCREST.
- (b) Impart the knowledge for correct interpretation of the pre-requisites and requirements stipulated in the MyCREST reference guides.
- (c) Provide guidance in preparing the required submittals objectively.
- (d) Assist in completing the scorecard and using carbon calculator.
- (e) Share good practices in implementing MyCREST.

3. Methodology

This research adopted the objective assessment method which is one of the proven practice of assessing and evaluating training. The instrument for the evaluation uses questionnaire survey which has been given to the trainees to obtain the overall perspectives on the overall performance of MyCREST training. The questionnaire form comprised of two parts which are the demography of the respondent and the training evaluation. Part B consists three parts which cover the pre-training evaluation, trainees' knowledge of MyCREST and post-training evaluation. Test specification table has been developed based on 10 topics learned during MyCREST training. However, only nine topics with 3 cognitive levels and 16 questions were validated by the expert from CIDB, to be conducted in this research (refer to Table 3). Thirty-three MyCREST trainees have been taking part in this assessment. These trainees are the MyCREST training participants for the year of 2017 training which was held by CIDB.

Table 3. Test Specification Table

Section	Topic	Cognitive						Question number	Total
		LEVEL 1		LEVEL 2	LEVEL 3				
		Knowledge	Understanding	Applying	Knowledge	Understanding	Applying		
1	Introduction								
	Course Objectives								
	Historical Background								
	What is MyCREST	1						1	
	Aim & Objectives of MyCREST								
	Comparison of MyCREST with other conventional green tools								
	MyCREST vs. Traditional Design				1			2	
2	Key Definition								
3	Fundamentals of MyCREST								
	- Fundamentals Elements of Green Building		1					3	
	- MyCREST Key Features			1				4	
	- Carbon Assessment								
	- Building Carbon Impact								
	MyCREST Building Life Cycle			1				5	
	MyCREST Framework					1		6	
	MyCREST certification path					1		7	
4	An Overview of MyCREST Components								
	What is Reference Guide, Scorecard and Carbon Tool?								
	How to use?								
	Criteria in Scorecard		1					8	
	General format of reference guides								
	Understanding pre-requisites, requirements and submittals		2				1	9, 10, 11	
5	Assessment Criteria-Pre Design	1						12	
	Infrastructure & Sequestration								
6	Assessment Criteria-Energy Performance Impact	1						13	
	Occupant & Health								
7	Assessment Criteria-Lowering the Embodied Carbon	1						14	
	Water Efficiency Factor								
8	Assessment Criteria-Social & Cultural Sustainability	1						15	
	Demolition & Disposal Factors								
9	Assessment Criteria-Waste Management & Reduction	1						16	
	Sustainable Facility Management								
	Sustainable & Carbon Initiatives								
10	MyCREST Project Assessment								
	Application of MyCREST								
	Criteria for Qualified professional, Criteria for assessor & Criteria for Trainer								
	Roles and Responsibilities of QP								
	Sharing Good Practices								
TOTAL ITEM		6	4	2	1	2	1	16	
Total By Level			10		3		3	-	

Table 4. Item and Person Reliability

SUMMARY OF 33 MEASURED PERSON								
	TOTAL			MODEL	INFIT		OUTFIT	
	SCORE	COUNT	MEASURE	ERROR	MNSQ	ZSTD	MNSQ	ZSTD
MEAN	71.0	32.0	-1.42	.41	.91	-.4	.98	-.1
S.D.	11.4	.0	1.97	.05	.48	2.0	.61	1.9
MAX.	90.0	32.0	1.39	.50	2.13	4.0	2.32	4.0
MIN.	48.0	32.0	-5.87	.35	.08	-4.1	.04	-3.4
REAL RMSE	.43	TRUE SD	1.92	SEPARATION	4.43	PERSON RELIABILITY	.95	
MODEL RMSE	.41	TRUE SD	1.93	SEPARATION	4.73	PERSON RELIABILITY	.96	
S.E. OF PERSON MEAN = .35								
PERSON RAW SCORE-TO-MEASURE CORRELATION = .99								
CRONBACH ALPHA (KR-20) PERSON RAW SCORE "TEST" RELIABILITY = .95								
SUMMARY OF 32 MEASURED ITEM								
	TOTAL			MODEL	INFIT		OUTFIT	
	SCORE	COUNT	MEASURE	ERROR	MNSQ	ZSTD	MNSQ	ZSTD
MEAN	73.2	33.0	.00	.39	.95	-.4	.98	.0
S.D.	26.6	.0	3.68	.02	.46	1.6	.73	1.4
MAX.	110.0	33.0	4.26	.43	2.92	5.9	3.24	5.6
MIN.	43.0	33.0	-5.08	.35	.56	-2.1	.43	-2.1
REAL RMSE	.42	TRUE SD	3.66	SEPARATION	8.78	ITEM RELIABILITY	.99	
MODEL RMSE	.39	TRUE SD	3.66	SEPARATION	9.30	ITEM RELIABILITY	.99	
S.E. OF ITEM MEAN = .66								

The instrument developed for this research has been validated and tested for its reliability (Table 4). This process have been carried by the CIDB experts which have validated the instrument content and construct. Based on the Rasch Model result, the reliability results show the value of the person and item reliability for trainees are excellent (.95 and .99) to be used as an instrument for this research.

4. Finding and Discussion

The analysis of the data has been carried out using descriptive analysis (frequency). The descriptive statistics are presented to provide insights on the self-assessment of trainee's knowledge gained during the training. This section presented the evaluation of the training which consists of three parts. The discussion covered the pre-training evaluation, trainees' knowledge on MyCREST and also post-training evaluation. The expected findings as any trainings would be on the pattern of knowledge gain

4.1 Pre-training Evaluation

In the pre-training evaluation part, the trainees have been asked about their expectations on the training and what are the expected new skills that they would like to obtain once they have completed the training.

4.1.1 Trainees Expectation Before Training

In this section, trainees have been asked about their expectations before attending MyCREST training. The findings have been specified, as the respondents' initial expectations on the skills and knowledge.

Table 5. Respondents' Initial Expectation on MyCREST Training

Training Element	Respondents' Expectation
Skill	To apply MyCREST To identify the areas that can help and design short courses to compliment MyCREST Obtain Qualified professional Able to use the tools to be MyCREST qualified professional to provide consultancy to client Become MyCREST Assessor. I expect to be one of the qualified people to issue MyCREST certificate
Knowledge	To understand more about the scope of sustainability and how to improve the situation. To understand more about MyCREST The training will provide the essential knowledge of the program and its cumulative integrated working technique in other tools To gain and get more info about MyCREST To know more in-depth regarding the carbon reduction and environmental sustainability To know more about the operation and maintenance system To be able to know assessment criteria. Understanding how MyCREST works and submission for certification Knowledge of MyCREST and its requirement. Comparisons with others tools Understand the requirement to certify "green building status/certified under myCREST." Learn LCA. Better knowledge of sustainable assessment Learn more about green building in construction To increase knowledge about sustainability and MyCREST what is about To have better knowledge of environmental sustainability To understanding all criteria, element, and principle about MyCREST Mengetahui/memahami MyCREST dapat membantu ke arah penambahbaikan pertubuhan sesuatu Mengetahui untuk kearah penambahbaikan sesuatu To understand and apply MyCREST To gain knowledge and pass the exam Know clearly about MyCREST application Understanding the assessment criteria. Green building characteristic Excited about green building characteristic Waste and carbon control in construction phase during development A new experience for MyCREST The requirement for green building My expectations are how MyCREST can support in operation and maintenance How MyCREST can be applied in the geotechnical scope of work in the construction industry

Table 5 shows the respondents expectation from MyCREST training program. Based on the results, it can be concluded that most of the respondents expect to improve their knowledge about MyCREST and obtained the skills to become MyCREST assessor. This is due to the national agenda to make Malaysia's construction industry environmentally sustainable and to be a model for the emerging world, especially ASEAN country by 2020 (CIDB, 2015). Therefore, most of the contractors need to fulfill their sustainability requirements within the development process for public building and infrastructure. Moreover, most importantly, the construction practitioners need to understand how MyCREST work in order to implement the rating tools in their project.

4.1.2 Additional Skills to be Developed After Training

In this section, the trainees have been asked, what are the additional skills that they would like to obtain once they have attended this training? The findings that have been summarised focused on the calculation of carbon emission and MyCREST application.

Table 6. Skills to improve upon during this training

Skills	Trainees Responses
Carbon Calculation	Yes. Carbon calculation Carbon identification and calculation LCA calculation Carbon reduction calculation. Carbon and OTTV calculation Practice the tools Understanding and ability to assess environment scorecard Able to apply MyCREST assessment Carbon control
My CREST Application	To understand the applicability of MyCREST on various project and assessment techniques Factors that increased carbon emission. The detail on MyCREST related to works. Management on environmental sustainability Knowing the principle of MyCREST and the fundamental elements of green building To know how to apply and used MyCREST in my institution MyCREST, Element in green building and waste management Yes, in management especially in green scope. MyCREST characteristic Yes, I want to improve advanced knowledge in environmental scope Waste management and building sustainability To the understanding of My CREST tool, user-friendly usage of My CREST
Others	Would love to know more as the training goes on Not sure. Depends on what skills to this MyCREST Don't even know about this; we are more focusing on the commercial role. Will incorporate MyCREST in our design & built of referring treatment plant payment Any other compliances/ certification training?

Table 6 shows the skills which the trainees want to improve upon during MyCREST training. It can be observed that the majority of the trainees want to know on how MyCREST work in reality does and also to know the extent on how the application of MyCREST can benefit them in the real practice. Relatively, the findings is what to be expected when any new rating tools is being introduced to the industry. The general aims of any green rating tools is quite similar which is to reduce carbon footprint and improved energy consumptions. However, different rating tools has different assessment criteria. MyCREST has been developed using local expertise without relying on the international standards to suit our local construction industry. Based on an critical overview by Mattoni et al. (2018), development of green tools is varied in developed and developing countries which relatively not regulated by any international standards.

4.2. Trainees' Knowledge on MyCREST (before and after attending training)

In this section, the trainee's knowledge has been assessed before attending the training and after completing the training. The element of inquiry consisted of the trainee's knowledge before attending the training and the trainee's knowledge after attending the training. The result is as shown in Table 7.

Table 7: Trainees’ Knowledge on MyCREST (before and after attending training)

No.	Trainees Knowledge.	Scale (Percentage)							
		None		Low		Moderate		High	
		Before	After	Before	After	Before	After	Before	After
1.	Knowledge on what is MyCREST	54.5%	0	39.4%	3.0%	6.1%	60.6%	0	30.3%
2.	Understanding the assessment criteria for Waste Management and Reduction	54.5%	0	39.4%	12.1%	6.1%	60.6%	6.1%	27.3%
3.	Ability in differentiating between MyCREST and Traditional design (GBI, NABERS, BREEAM, Greenmark)	66.7%	0	27.3%	21.2%	3.0%	57.6%	3.0%	21.2%
4.	Understanding the assessment criteria for Social and Cultural Sustainability	60.6%	0	39.4%	27.3%	0	57.6%	0	15.2%
5.	Understanding the fundamental elements of green building	27.3%	0	42.4%	3.0%	18.2%	60.6%	12.1%	36.4%
6.	Understanding the assessment criteria for Lowering the Embodied Carbon	63.6%	0	36.4%	21.2%	0	63.6%	0	15.2%
7.	Ability in applying the principle of MyCREST criteria	63.6%	0	33.3%	21.2%	3.0%	63.6%	0	15.2%
8.	Understanding the assessment criteria for Energy Performance Impact(EPI)	69.7%	0	30.3%	21.2%	0	69.7%	0	9.1%
9.	Ability in applying the element in building life	54.5%	0	39.4%	18.2%	6.1%	66.7%	0	15.2%
10.	Understanding the assessment criteria for pre-design (PD)	69.7%	0	30.3%	18.2%	0	66.7%	0	15.2%
11.	Ability in explaining the MyCREST framework	66.7%	0	33.3%	18.2%	0	66.7%	0	15.2%
12.	Ability in composing MyCREST submittals	66.7%	0	33.3%	24.2%	0	63.6%	0	12.1%
13.	Ability in planning the MyCREST certification path	66.7%	0	33.3%	15.2%	0	69.7%	0	21.2%
14.	Understanding MyCREST requirements	66.7%	0	33.3%	18.2%	0	60.6%	0	22.2%
15.	Understanding all the criteria in the MyCREST scorecard	66.7%	0	33.3%	15.2%	0	69.7%	0	15.2%
16.	Understanding MyCREST pre-requisites	66.7%	0	33.3%	18.2%	0	66.7%	0	15.2%

From Table 7, it can be seen that less than 40 percent of the respondents have a slight understanding of what is MyCREST is all about before attending the training program. However, at the end of the training only about roughly 20 percent respondent fully understand what MyCREST is and the rest only have a moderate understanding of it. The least understand element is on the understanding of the assessment criteria for Energy Performance Impact (EPI) which shows only 9.1 percent of the respondent fully understand the element. Even after attending the training, there is still respondent who has a low understanding on MyCREST which cover almost 20 percent of the total respondent. As overall, every respondent shows improvement in their knowledge of MyCREST after completing the training program.

4.3 Post-training Evaluation

This section reports on the post-training evaluation from the MyCREST trainees. In this section, the feedback from the trainee has been captured and theme into the main element of the training objective. The evaluation is focusing on identifying the skills that have improved after the training. The finding is as shown in Table 8.

Table 8: The Most Important Skills That Have Been Improved During Training

Training Element	Trainees Responses
Scorecard	Ability to use and understand the scorecard. Using scorecard. Calculating the scorecard content. Assessing the project under any sustainability tool.
Knowledge of My CREST	Knowledge about MyCREST, from starting from design to operation. Think outside the box when comes to saving the environment(in term of using MyCREST) I get to know more about MyCREST and the criteria of this MyCREST Knowledge of MyCREST criteria Understand criteria for MyCREST assessment Know the aim and how to achieve MyCREST Star Understand the importance of carbon reduction in the construction industry Ability in composing MyCREST submittals Know more about green items Understand better on the criteria and strategy for submittals Must understand about 'Baseline' in MyCREST Environment control in construction phase To improve knowledge about controlling waste material at the site The requirement to be certified
Carbon Calculation	Using carbon calculator Calculating the OTTV and RTTV Knowledge to use carbon reduction Carbon reduction Knowledge how to investigate the carbon reduction The awareness of Carbon Emission for building water and waste Energy-related to carbon How to reduce carbon emission Knowing that LCCF, water consumption will be given higher marks in MyCREST. OTTV
Others	Assessment skill. Improve in applying knowledge to practical

From Table 8, it can be observed that the trainees have obtained new knowledge on the MyCREST, MyCREST scorecard, carbon calculation, and other additional knowledge. The new knowledge obtained was largely on the MyCREST system itself and how it can be applied in real projects. This finding is quite similar to any other training on introduction to new green tools which the main general consensus is to gauge on how will this works in real practice and how does it will benefit the environment. Notwithstanding the general aims of green tools in sustainability, there is no universal tools (Say & Wood, 2008) that can measure every element within projects since every projects is unique and different area needed different tools. Other than that, the trainees also gain the skill on how to calculate the carbon release in projects. This will help the trainees in planning the projects which will incorporate carbon reduction strategies.

5. Conclusion

MyCREST is relatively a green rating tools that gauge the carbon emissions in buildings which is aims to reduce the carbon footprint in any construction projects. CIDB as the owner of this rating tools aims to make this tool compulsory for any new projects in the near future. It is beneficial for the industry players TVET labour workforce to understand the assessment element of this rating tools so that any planning on future development should already incorporate the requirements for the rating tools. It is also important for the society to know that Malaysia has its own green rating tools to assessed our buildings, and its shows the government initiatives in supporting the sustainability movement by the united nations.

The assessment result of buildings will be a good source of information to gauge the construction industry efforts in practicing sustainability through carbon reductions and energy efficiency. This source of information can be a good baseline for our construction industry to move forward in improving the practice to be more sustainable. In the future, CIDB will need assessors to assess the buildings in Malaysia, and this provide opportunities for TVET practitioners and training providers under construction technology fields to venture into providing the training for the labour workforce.

Generally, from this research, it has been observed that the majority of the respondent having completed this training has acquired new knowledge on MyCREST. It can be concluded that this training has achieved the objectives set out by the CIDB. However, the presentation of this research only considering the respondent responses literally. In order the

get an accurate presentation on how the training performs, a more structured assessment and critical analysis need to be done with the assist of statistical software. Additionally, it is suggested, further research can be done by adding an assessment of the trainer and observation during the training which can help to improve and richening the data. Furthermore, a study can be made on the application of MyCREST by the trainees in order to identify their understanding in implementing MyCREST in their project.

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