CONSTRUCTION INDUSTRY DEVELOPMENT BOARD (CIDB) MALAYSIA

VALIDATION SURVEY ON DEVELOPMENT OF INDUSTRY 4.0 ROADMAP FOR MALAYSIA CONSTRUCTION INDUSTRY

One of the key thrusts in the Construction Industry Transformation Program (CITP) is productivity. While being part of a crucial sector in helping to develop the Malaysian economy, the construction industry has been reported among the low productivity sectors (Malaysia Productivity Corporation, 2016). Under the CITP program, the government aims to double the rate of productivity.

Industry 4.0 is seen to drive the construction industry in the development of infrastructure, buildings and cities in Malaysia. CIDB is developing a roadmap to assist the construction industry players to transform towards Industry 4.0. In this initial stage, CIDB aims to have industry perspective on moving towards industry 4.0 for the construction industry.

Research Objectives

i. To survey the adoption and application of Industry 4.0 in Malaysia construction industry.
ii. To assess readiness and formulate baseline of current technology practice in Industry 4.0 towards Construction Industry.

It is hoped that the respondents can provide relevance information as to facilitate the data collection process. It is our gratitude if you can help us to answer the following questions and kindly submit the survey form through following address:

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50350 Kuala Lumpur
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Tel: 03 – 4040 0040

The results of this survey will be used solely for the CIDB research purpose and all personal information is guaranteed to be confidential.

Section A (Respondent's demographic profile)
Instruction: Please tick (/) in the relevant box.

1. Gender

Male	
Female	

2. Age (Years old)

20-30	
31-40	
41-50	
>50	

3. Working discipline

Client	
Developer	
Consultant	
Manufacturer	
Supplier	
Contractor	
Other	Please specify:

4. Highest level of education

Certificate	
Diploma	
Bachelor's Degree	
Master Degree	
PhD	

5. Work experience

<5	
5-10	
11-15	
16-20	
21-25	
>25	

6. Management Level

Junior Executive	
Middle Executive	
Senior Executive	

7. No of employee in your company?

<5	
5-19	
20-50	
>50	

8. CIDB company grade (skip if not relevant)

G1	
G2	
G3	
G4	
G5	
G6	
G7	

Section B (Technology Adoption in Malaysia based on Integrated Construction Life cycle)
Instruction: Please tick (/) in the relevant box.
Based on previous focus group discussion, few technologies had been identified as possible to be applied for each lifecycle. A validation needed to recheck the result obtained. You may not agree with the result from previous discussion. Thus, feel free to give comment.

SCALE	LABEL
1	Not Practical
5	Best Practice

	Technology	Level of Practicality					Comment
		1	2	3	4	5	
Concept and Initiation	Cloud computing						
	AR/VR/MR/Simulation/Volumetric Display						
	Cybersecurity						
	BIM						
	Drones						
	Other:						

	Technology	Level of Practicality					Comment
		1	2	3	4	5	
Definition and Planning	Cloud computing						
	AR/VR/MR/Simulation/Volumetric Display						
	Cybersecurity						
	BIM						
	Prefabrication						
	Big data						
	Other:						

	Technology	Level of Practicality					Comment
		1	2	3	4	5	
Launch and Execution	Robotics						
	3D/4D Printing						
	Cloud computing						
	BIM						
	Cybersecurity						
	RFID						
	Prefabrication						
	Modularization						
	AR/VR/MR/Simulation/Volumetric Display						
	Drones						
	Other:						

	Technology	Level of Practicality					Comment
		1	2	3	4	5	
Performance and control	Cloud computing						
	BIM						
	Cybersecurity						
	BIM						
	Drones						
	3D Scanning						
	Other:						

	Technology	Level of Practicality					Comment
		1	2	3	4	5	
Project close	Cloud computing						
	BIM						
	Cybersecurity						
	BIM						
	Drones						
	Other:						

	Technology	Level of Practicality					Comment
		1	2	3	4	5	
Operation	BIM						
	Drones						
	AR/VR/MR/Simulation/Volumetric Display						
	IoT						
	Other:						

	Technology	Level of Practicality					Comment
		1	2	3	4	5	
Maintenance and Optimization	BIM						
	Smart sensor						
	Cybersecurity						
	Drones						
	Other:						

Section C (Technology Cluster)
Instruction: Please tick (/) in the relevant box
Based on previous focus group discussion, all the technologies mentioned had been classified into a cluster of C1, C2 and C3. A validation needed to recheck the result obtained. You may not agree with the result from previous discussion. Thus, feel free to give comment or new suggestion.

Note:
C1 – Simulation and Modeling (A method of using models of a real or imaged system to better understand or predict the behaviour of the modelled system or process)
C2 – Digitilization and Virtualization (The use of digital technologies to change a business model and provide new revenue and value-producing opportunities. It is the process of moving to a digital business)
C3 - Smart Construction (It is where everything is done through interactions between products and machines, and between the machines themselves, all linked together over a network)

Technology	Cluster	Validation		Comment
		Yes	No	
Information sharing	C2			
Multilevel customer interactive	C1			
Cloud computing	C2			
AR/VR/MR/Simulation/Volumetric Display	C2			
Cybersecurity	C2			
Apps	C1			
BIM	C1			
Drones	C3			
Sustainable Modelling	C1			
Geospatial technology (localization)	C3			
Geospatial technology (Simulation with drones)	C1			
Mooc/Interactive Learning	C1			
Smart sensor	C3			
HCI	C2			
Prefabrication	C3			
Modularisation	C3			
3D printing	C3			
RFID	C3			

Technology	Cluster	Validation		Comment
		Yes	No	
Advanced Materials	C3			
5G	C1 C2 C3			
AI/Machine Learning	C3			
Advanced Materials	C3			
Big Data	C2			
3D Scanning	C2			
IoT	C2			
LCC	C1			
Blockchain	C2			
Robotic	C3			
E-Procurement	C1			
Mass Customisation	C1			
CDE	C2			
Interactive Design	C1			
Supply Chain Management (SCM)	C3			
Product Lifecycle Management	C3			
Smart Heavy Machine	C3			
Self-Procuring	C3			
Autonomous vehicle	C3			
Geofencing	C3			
Smart product (thumbprint)	C3			
SAM	C3			
Track n Trace	C3			
Asset Management	C2			
Predictive maintenance	C3			
Improve asset utilisation	C2			

Section D (Readiness of Technology)

Instruction: Please tick (/) in the relevant box

Based on your opinion, specify the technologies according it possible implementation time (by considering Malaysia Construction Industry) and rank it according to the scale given. If the technology that you think possible to be implemented are not listed, please fill in the "other" column.

SCALE	LABEL
1	Strongly Disagree
5	Strongly Agree

Technology / Tool	<1					<3					>5					Comment
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
Cloud computing																
AR/VR/MR/Simulation/Volumetric Display																
Cybersecurity																
BIM																
Drones																
Prefabrication																
Big data																
Robotics																
3D/4D Printing																
RFID																
Modularization																
3D Scanning																
IoT																
Smart sensor																
Other(s):																

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One of the key thrusts in the Construction Industry Transformation Program (CITP) is productivity. While being part of a crucial sector in helping to develop the Malaysian economy, the construction industry has been reported among the low productivity sectors (Malaysia Productivity Corporation, 2016). Under the CITP program, the government aims to double the rate of productivity.

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Research Objectives

i. To survey the challenges of Industry 4.0 in Malaysia construction industry.
ii. To assess the strategies towards implementing Industry 4.0 in Malaysia Construction Industry.

It is hoped that the respondents can provide relevance information as to facilitate the data collection process. It is our gratitude if you can help us to answer the following questions and kindly submit the survey form through following address:

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Section B (Strategy to overcome challenges of Construction 4.0)

Based on previous focus group discussion, strategies to overcome challenges of construction 4.0 for every enabler have been highlighted. A validation needed to recheck the result obtained. You may not agree with the result from previous discussion. Thus, feel free to give comment and new suggestion of strategy.
Instruction: Please tick (/) in the relevant box

SCALE	LABEL
1	Strongly Disagree
5	Strongly Agree

Enabler	Challenges	Strategies	Level of agreement					Comment
			1	2	3	4	5	
Talent	Low awareness of Industry 4.0 and its applications among companies	Promote IR4.0 through media						
		Open multiple channels of diverse integrated technology learning						
		Other:						
	Low rate of collaboration between academy and industry	Aligning the academic standard to meet industry needs						
		Other:						
	The use of new technologies requires enhanced skills	Build and entrepreneurial skilled workforce with integrated technology capabilities						
		Promote and provide training centre						
		Other:						
	Process-dependent systems that make greater use of technology may prove to be a major challenge for existing employees	Pilot survey towards the published industry with industry 4.0 oriented						
		Other:						

Enabler	Challenges	Strategies	Level of agreement					Comment
			1	2	3	4	5	
	Major concerns of employees about the adoption of new technologies is the job-loss, as they might be replaced by machines, computers or robotics	Build and entrepreneurial skilled workforce with integrated technology capabilities						
		Apply and focus on core technologies only						
		Other:						
	The absence of a digital culture and the right training	Funding and Incentive						
		Nurture an active community of integrated technology adopters						
		Other:						
	Require retraining or further training in operating these new applications if they want to make full use of them	Open multiple channels of diverse integrated technology learning						
		CIDB to promote and provide training centre						
		Other:						
	Lack of understanding the interplay between technology and human	Training program						
		Other:						

Enabler	Challenges	Strategies	Level of agreement					Comment
			1	2	3	4	5	
Resilient	Production of metal	Management of hazardous construction waste						
		Other:						
	Unknown potential impact on sustainability and environment	Implementation of life cycle assessments						
		Implementation of reliable and transparent sustainability reporting on-demand parts manufacturing services						
		Other:						
	The infrastructure to maintain and provide secure data transfer will concentrate a large amount of resources and energy	Management should promote to utilize the technology for targeted projects only						
		Other:						
	Negative effect on Energy use, global warming and climate change	Management of hazardous construction waste						
		Apply technology that produces less impact on environment						
		Other:						

Enabler	Challenges	Strategies	Level of agreement					Comment
			1	2	3	4	5	
Integrated Technology	Unreliable broadband connectivity or the lack of access to high-bandwidth connectivity for collaboration applications	Improve broadband infrastructure capabilities						
		Other:						
	Technology changes over time and has to be adapted constantly	Create a portal to provide the current technologies in construction						
		Create awareness and understanding by adopting new technologies						
		Other:						
	Interoperability	Create an open source/Interoperability platform						
		Increase data creating and sharing activities						
		Other:						

Enabler	Challenges	Strategies	Level of agreement					Comment
			1	2	3	4	5	
Integrated Technology	Do not have the technology	Promote and influence the use of integrated technology in targeted business sectors and projects						
		CIDB to provide a portal to provide the current available technologies in construction						
		Establish Institute such as technology development program						
		Other:						
	Need a full implementation and it will take a lot of time	Crete awareness and understanding						
		Buy-in construction industry players who have an expertise to adopt the new technologies						
		Assess the practicality of technology						
		Provide incentive and training						
		Other:						

Enabler	Challenges	Strategies	Level of agreement					Comment
			1	2	3	4	5	
Policy and Process	Lack of public policies designed to promote industry 4.0	Draft new policy to cater integrated technology						
		Develop a conducive integrated technology policy environment						
		Other:						
	Requires the re-evaluation and re-engineering of business practices	Create a scalable tool to measure the readiness						
		Implementation of reliable and transparent sustainability reporting on-demand parts manufacturing services						
		Other:						
	Lack of a clear digital operations vision	Pilot the champion / case study the best practice						
		Develop or align the standard that meets the industry need						
		Develop a conducive integrated technology policy environment						
		Provide guideline						
		Other:						
	Lack of understanding of the strategic importance of Industry 4.0	Provide guideline or standard						
		Provide the case study that achieved best practice industry 4.0						
		Other:						

Enabler	Challenges	Strategies	Level of agreement					Comment
			1	2	3	4	5	
Policy and Process	Construction companies are hesitating to adopt due to the unclear benefits	Enforcement and regulation on big project. Ex: 100 million and above						
		Other:						

Enabler	Challenges	Strategies	Level of agreement					Comment
			1	2	3	4	5	
Legislations	Concerns around loss of control over your company's intellectual property	Formulate appropriate regulations						
		Other:						
	Lack of consistent BIM standards	Develop or revised the standard available						
		Formation of working group consist of high level of certification to revised the available standard						
		Implementation of reliable and transparent sustainability reporting on-demand parts manufacturing services						
		Other:						
	Data theft, industrial espionage and attacks by hackers	New legislation (cybersecurity)						
		Other:						
	Lack of digital standards, norms and certification	Provide guideline or standard which specifically for industry 4.0 project						
		Upgrade the guideline to secular						
		Formation of working group to establish standard and provide high level certification						
		Align the standard that meet the industry needs						
		Other:						
	Weak support to inventions and patent registration							
		Other:						

Enabler	Challenges	Strategies	Level of agreement					Comment
			1	2	3	4	5	
Economic	High cost for implementation	Local government to subsidise the cost						
		Tax incentive for new technologies that have proven to improve life cycle cost						
		Low bank interest rates for projects that implement IR 4.0						
		Other:						
	Limited capabilities for investments in new technologies	Engage private participation						
		Implementation of reliable and transparent sustainability reporting on-demand parts manufacturing services						
		Other:						
	Benefits do not outweight the cost	Repurpose of the implementation industry 4.0 in construction						
		Other:						
	Unclear economic benefit of digital investments	Search or survey the marketability						
		Other:						

Section C (Action Plan – Short, Medium, Long)

Instruction: Please tick (/) in the relevant box

Based on previous focus group discussion, action plan programmed prior to strategies suggested had been discussed. A validation needed to recheck the result obtained. You may not agree with the result from previous discussion. Thus, feel free to give comment or new suggestion.

SCALE	LABEL
1	Strongly Disagree
5	Strongly Agree

Talent

Strategies	Planning	Action Plan	Level of agreement					Comment
			1	2	3	4	5	
Promote and provide training centre	**SHORT**	Introduce integrated technology educational and training programmes						
		Create a set skill mapping database						
		Other:						
	MEDIUM	Set skill migration through training or accreditation						
		Other:						
	LONG	Create a community of Integrated Technology Interest Group						
		Other:						

Resilient

Strategies	Planning	Action Plan	Level of agreement					Comment
			1	2	3	4	5	
Management of hazardous construction waste	**SHORT**	Usage of advanced material						
		Other:						
	MEDIUM	Prepare and establish a guideline or standards on hazardous waste management						
		Other:						
	LONG	Monitor the implementation of hazardous waste by service provider and make improvement to the latest Malaysian/ International standards						
		Other:						

Integrated Technology

Strategies	Planning	Action Plan	Level of agreement					Comment
			1	2	3	4	5	
Technology changes over time and has to be adapted constantly	**SHORT**	Provide an indicator or measuring tools of construction 4.0						
		Other:						
	MEDIUM	Influence the market (buy-ins)						
		Other:						
	LONG	Increase innovation						
		Other:						

Policy and Process

Strategies	Planning	Action Plan	Level of agreement					Comment
			1	2	3	4	5	
New policy to cater integrated technology	**SHORT**	Draft new policy to cater integrated technology						
		Other:						
	MEDIUM	Implementation of policy created						
		Other:						
	LONG	Review and enhance the policy						
		Other:						

Legislations

Strategies	Planning	Action Plan	Level of agreement					Comment
			1	2	3	4	5	
Concerns around loss of control over your company's intellectual property	**SHORT**	New legislation to cater technology adoption						
		Other:						
	MEDIUM	Create a platform on the mechanisation of construction 4.0						
		Other:						
	LONG	Procurement startegies by goverment and private sector compliance with						
		Other:						

Economic

Strategies	Planning	Action Plan	Level of agreement					Comment
			1	2	3	4	5	
High cost for implementation and maintenance	**SHORT**	Incentives scheme/Matching grants						
		Increase total contract						
		Other:						
	MEDIUM	CIDB/Ministry create a platform of negotiation for Contractors and Technologies enablers with MOF, Bank Negara and Bankers						
		Funding Introduction by cabinet						
		Other:						
	LONG	Speed up to export to international/oversea						
		Significant investment by major construction player						
		Establish policy with Bankers on the incentives						
		Establish the requirements and criteria for contractor and technologies enablers to entitle incentive						
		Other:						