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PRESENTATION OF CAPSTONE PROJECT
MAB 2404

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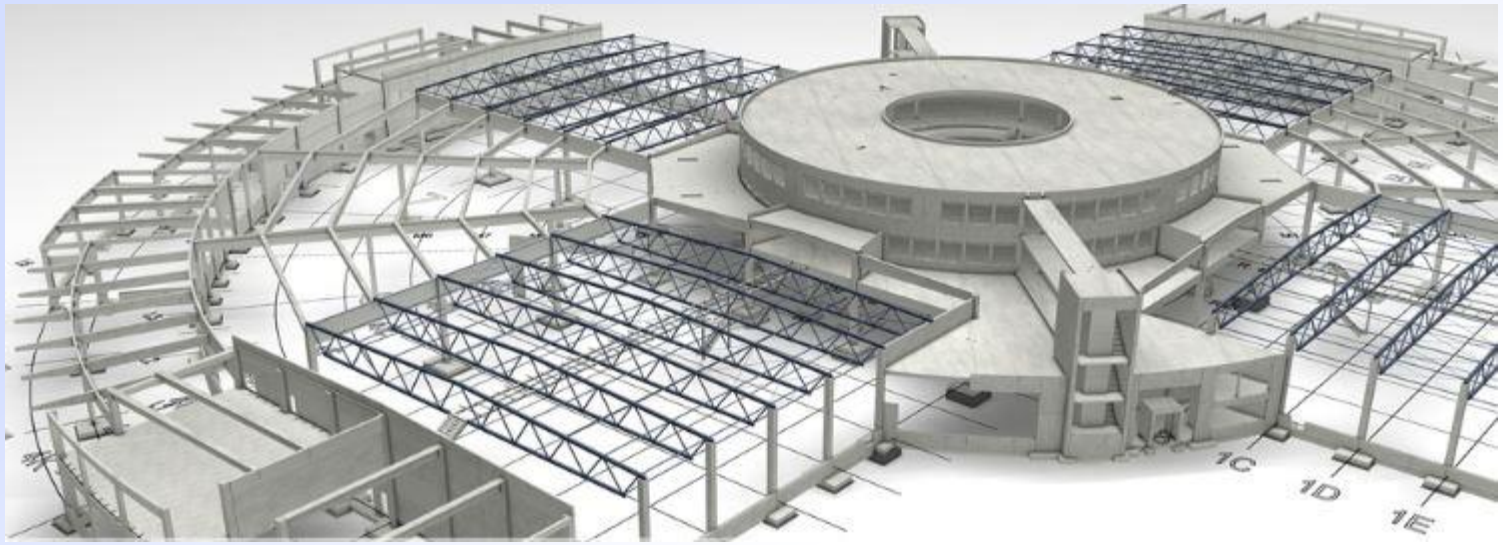
JKR

BUILDING INFORMATION MODELLING AWARENESS AND READINESS AT JKR



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STRUCTURE OF PRESENTATION

JKR

CHAPTER 1 : Introduction, Problem statement, Objectives, Scope of Study, Significance of Study

CHAPTER 2: Literature Reviews, Previous Studies, Theoretical Framework/Model

CHAPTER 3: Research Methodology

CHAPTER 4: Analysis of Data, Results and Discussion

CHAPTER 5: Conclusions, Recommendation to JKR and future research

REFERENCES

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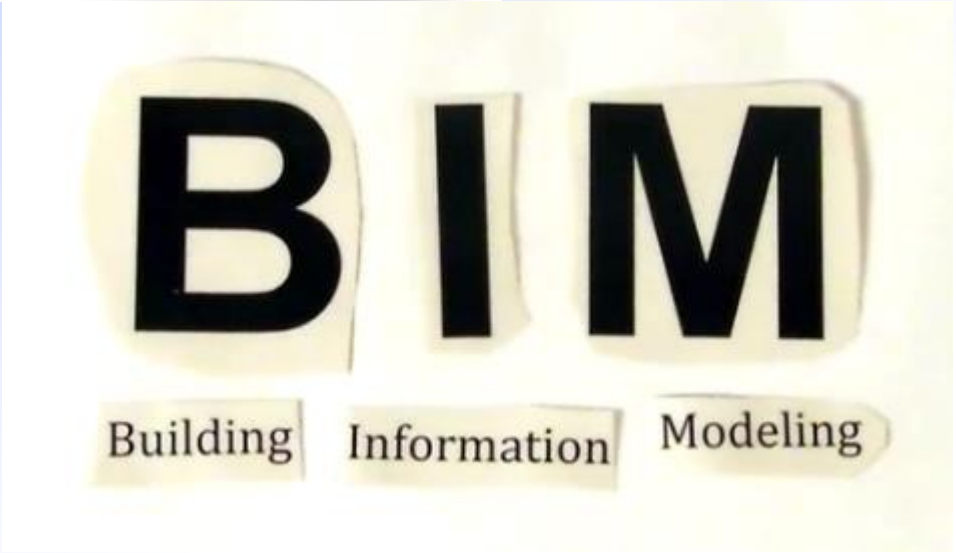

What is BIM?

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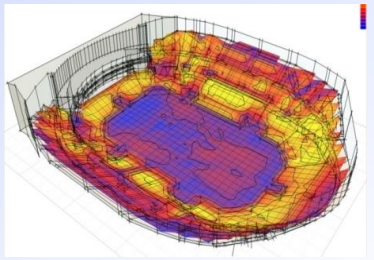
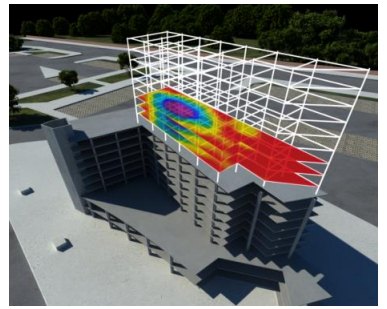
BIM is an integrated process that allows professionals to explore a project's key physical and functional characteristics digitally – before it's built.

Autodesk (2012)





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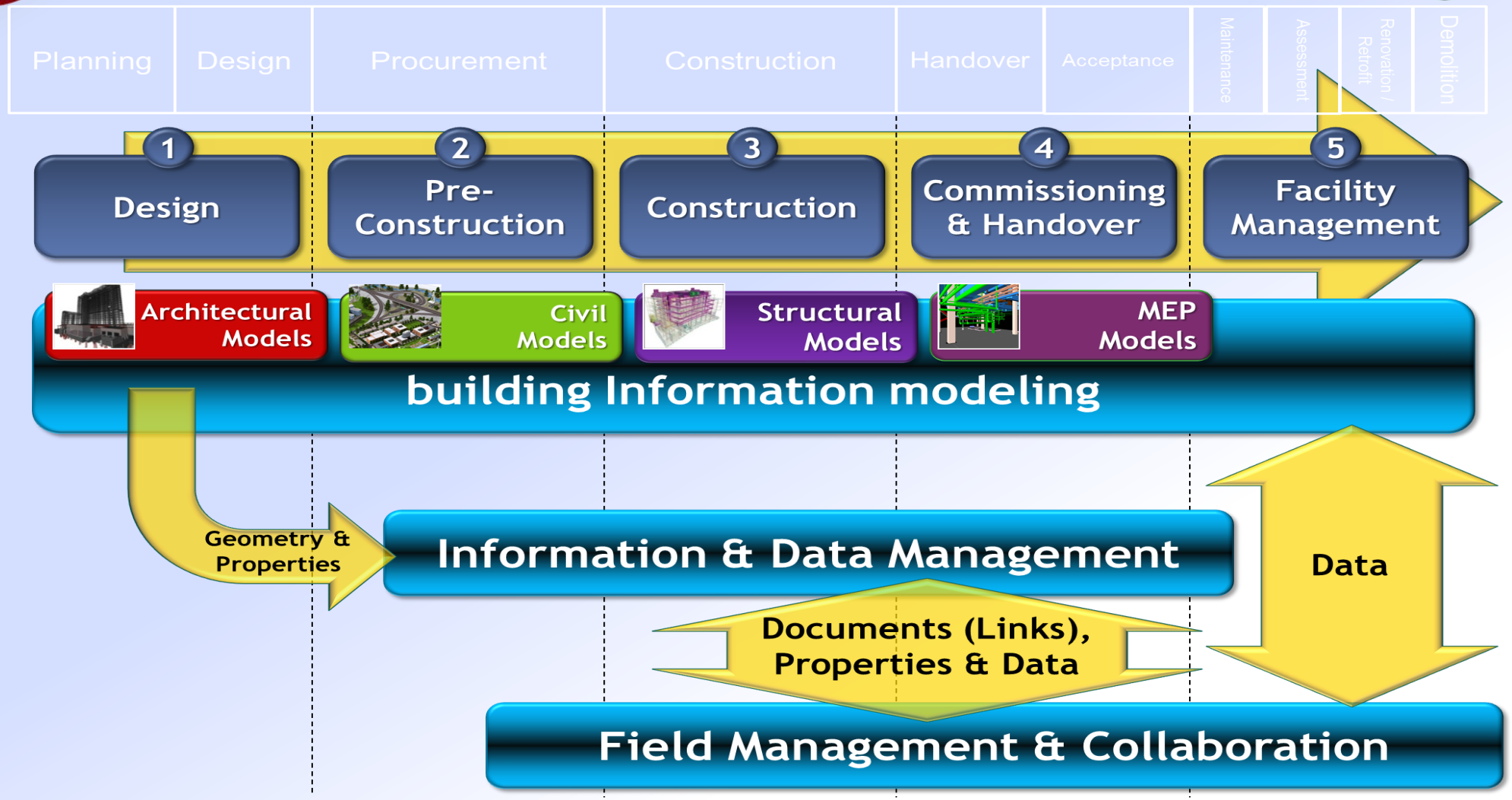

BIM around the world

NORTH AMERICA

Industry –wide adoption surged from 28% 2007, 49 % 2009 to 71 % in 2012

FINLAND

State property services agency mandates BIM for projects since 2007

UNITED KINGDOM

Increase BIM usage over 5-year period by 2016

NORWAY

Government committed to use BIM in 2010

DENMARK

Various agencies mandates BIM in projects

SOUTH KOREA

BIM compulsory for projects > USD50mil & public sector projects by 2016

CHINA

BIM in high profile projects

INDIA

Many talented BIM professionals but projects are overseas.

SINGAPORE

BIM e submissions for Architectural in 2010, Structural and MEP in 2011.
Targeted for 80 % in 2015

JAPAN

BIM developed by individuals and not by all trades

HONG KONG

Housing Authority targets to apply BIM in new projects by 2014

PHILIPPINES

Large talent pool using BIM in projects of all sizes

AUSTRALIA

Widespread adoption of BIM in construction and FM sectors.

Sources: Various BIM adoption reports

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Overview of BIM at JKR

2007 → 2013

2007 - Initiated by DG of JKR (Also appointment of BIM Committee)

↓

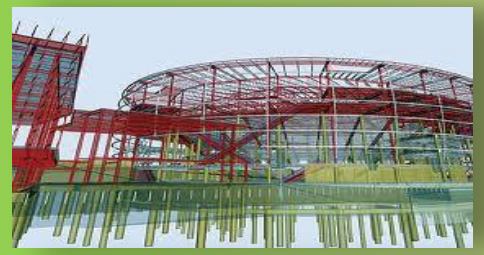
August 2008- Establishment of BIM platform (Autodesk Revit)

↓

Jan 2012 - BIM unit established

JKR BIM ROADMAP

roll out 2013 -2016



In-House Design

- All JKR projects > RM10 mil
- Selected RP4 projects RM10 mil – RM50 mil
- Pilot Projects & Selected RP3 projects

2013 2014 2015 2016

Conventional Consultant & Design - Build

- Stakeholder engagement sessions
- Communicate requirement to stakeholders

PROPOSED

- All JKR projects > RM10 mil (conventional consultant)
- All JKR Design & Build projects

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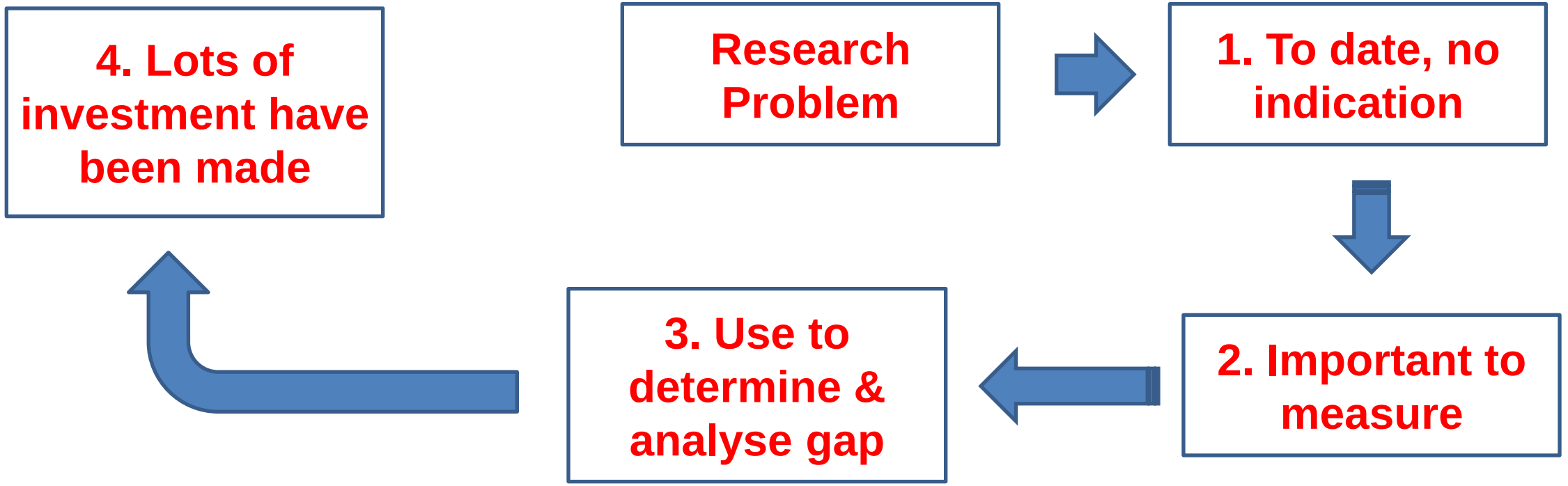
RESEARCH PROBLEM



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PROBLEM STATEMENT, RESEARCH QUESTIONS & OBJECTIVES

The research questions relevant for the study are:

RESEARCH QUESTION	RESEARCH OBJECTIVE
1. What is the level of awareness at JKR towards BIM implementation?	To determine the level of awareness at JKR towards BIM implementation.
2. What is the level of readiness at JKR towards BIM implementation?	To determine the level of readiness at JKR towards BIM implementation.
3. What is the current BIM implementation at JKR?	To assess the current implementation of BIM at JKR.

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SCOPE OF STUDY

The scope of the study:-

- JKR's project teams that implementing BIM
- JKR BIM Committee members
- officers at JKR headquarters that involved with BIM.

LITERATURE REVIEW

In the context of this study,

- the definition **Awareness** is knowledge or understanding of a subject, issue, or situation and the ability to notice things **(MacMillan Dictionary, 2012)** is the suitable for the study of BIM at JKR.
- the definition **Readiness** is a state of being ready and able to deal with what might or will happen and the state of being willing to do something **(MacMillan Dictionary, 2012).** is the suitable for the study of BIM at JKR.

LITERATURE REVIEW cont.

In the context of this study,

- **Building Information Modeling** (BIM) is a digital representation of physical and functional characteristics of a facility. A BIM is a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life- cycle, defined as existing from earliest conception to demolition. A basic premise of BIM is collaboration by different stakeholders at different phases of the life cycle of a facility to insert, extract, update or modify information in the BIM to support and reflect the roles of that stakeholder (AEC-ST, 2007).

LITERATURE REVIEW (cont.)

- **Previous Studies**

1. Value from BIM Use

Kunz and Giligan (2007) conducted a questionnaire survey to determine the value from virtual design and construction (VDC) or BIM use and factors that contribute to success. The main findings of their study are as follows:

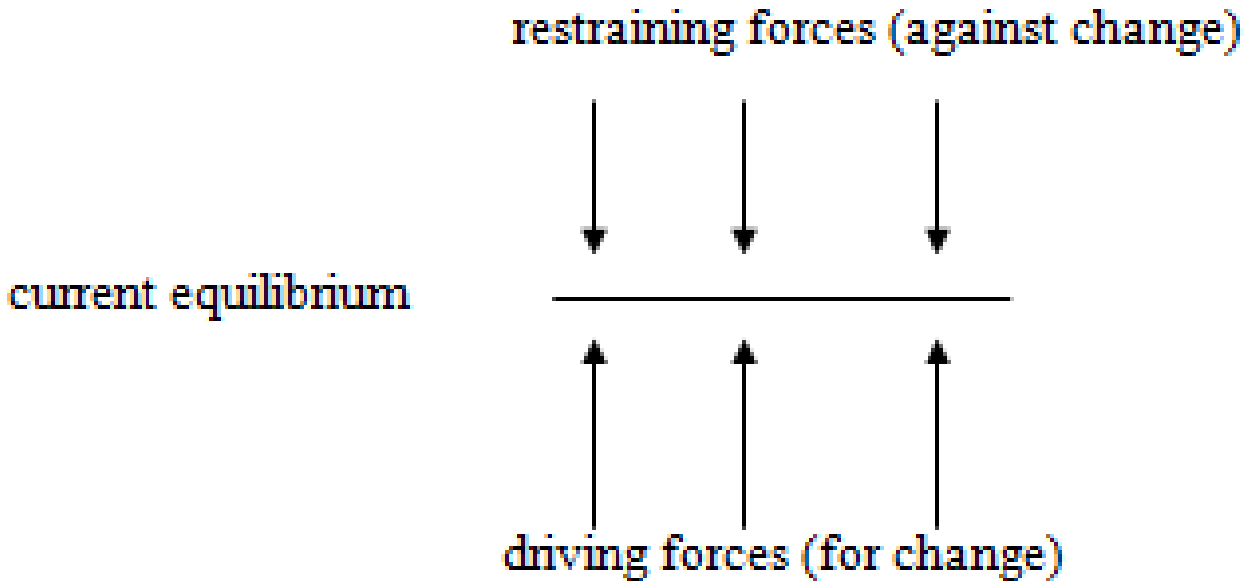
- BIM lowers overall risk distributed with a similar contract structure
- Most companies use BIM for 3D/4D clash detections and for planning and visualization services.
- The use of BIM leads to increased productivity, better engagement of project staff and reduced contingencies.
- Shortage of competent building information modellers in the construction industry

LITERATURE REVIEW (cont.)

- Theoretical Model/Framework
- 1. Kurt Lewin Change Management Model

LITERATURE REVIEW (cont.)

- Theoretical Model/Framework
- 2. Forcefield Analysis - Kurt Lewin's model



LITERATURE REVIEW (cont.)

- **Theoretical Model/Framework**

3. Kotter's 8 Steps to Successful Change (1998)

3. Managing Transitions Making the Most of Change - William Bridges (2005).

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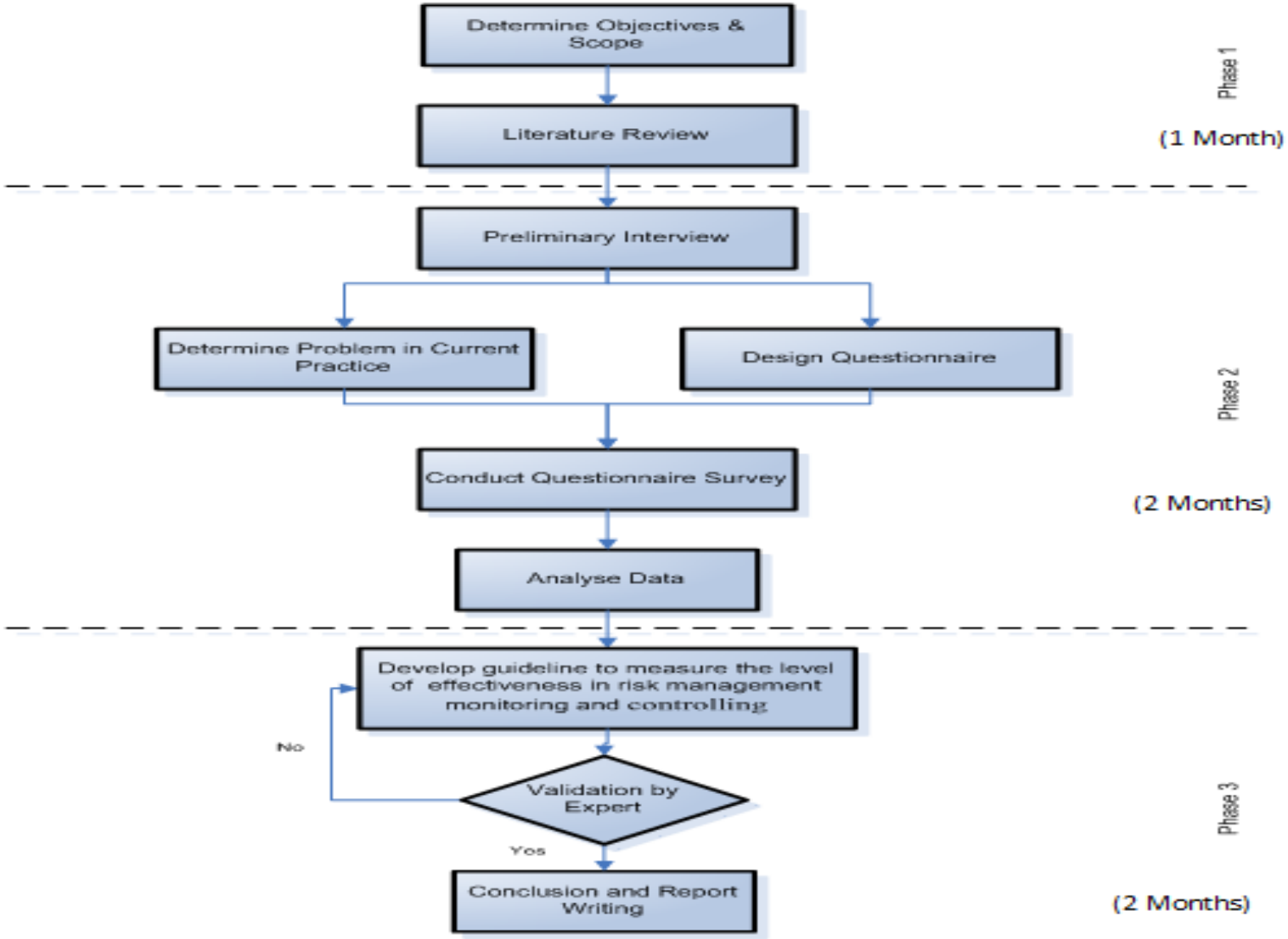
MEHODOLOGY



RESEARCH DESIGN

Data Collection

Primary Data Collection

1. Interview
2. Questionnaire Survey

Secondary Data Collection

- Abstracted data from the theories & principles.
- Source : previous research, books, papers, journals.

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RESEARCH DESIGN

Population & Sample

Population = About 100 people BIM users at JKR HQ

IDENTIFIED

- Seventy (70) respondents
- Non random sampling method
- Distribute questionnaire survey

- Five (5) respondents - Interview
- BIM unit
- JKR BIM committee

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RESEARCH DESIGN

Research Instrument

Interview

- Semi structured question.
- Questions related to current BIM implementation at JKR.

Questionnaire Survey

- Part A – Demography data (5 Questions).
- Part B – Awareness (15 Questions).
- Part C – Readiness (15 Questions).

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RESEARCH DESIGN

Measurement

Data Analysis

Constant comparative analysis (Interview)

- Data collect from interviews.
- Sort, compare and create answer themes to classify answer.

Descriptive analysis (survey)

- Data from questionnaire survey
- The result is then will be converted into percentage format .
- Calculate minimum value; maximum value and the mean value (using SPSS software).
- Mean score statistic will be used to analyze.

RESEARCH DESIGN

Feedback	Scale
Strongly agree	5
Agree	4
Somewhat agree	3
Disagree	2
Strongly disagree	1

Likert scale used in the questionnaire survey

Awareness

Readiness

Mean score level indicator for analysis

Level	Mean Score Range
High	3.68 – 5.00
Medium	2.34 – 3.67
Low	1.00 – 2.33

Indication of level by mean score

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RESULT - Interview

Expert	Position	Function	Expertise	Years of Experience
E1	Chief Assistant Director	Head of BIM Unit, PROKOM	BIM, Project Management	20
E2	Senior Assistant Director	Head of Architect, BIM Unit PROKOM	BIM, Architecture Design	20
E3	Senior Assistant Director	Head of Civil & Structure, BIM Unit PROKOM	BIM, C&S Design & Forensic	13
E4	Senior Assistant Director	Head of QS, BIM Unit PROKOM	BIM & Project Management.	12

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RESULT - Interview

BIM Implementation Benefit		
a. Improve the effectiveness of project delivery which to achieve the department's vision to be a centre of technical excellence.	d. Collaborative working environment effectively	g. Some quantities can be abstracted from the model to help QS to prepare BQ
b. Helping engineering professionals and project stakeholders in every segment of the building and infrastructure industries	e. Work culture change	h. Fasten a project delivery
c. Develop excellence and environmental friendly design	f. Can reduce variation order (VO) for a project	

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RESULT – Interview cont.

Obstacles and Challenges		
a. Lack of support from top management and project team.	d. Lack of software, hardware, internet speed connection, file sharing management and work space	g. Lack of funding to engage external expert for training
b. Lack of experience in BIM implementation	e. Lack of awareness program	
c. The current work culture show less interest in BIM	f. Not enough BIM expert for reference	

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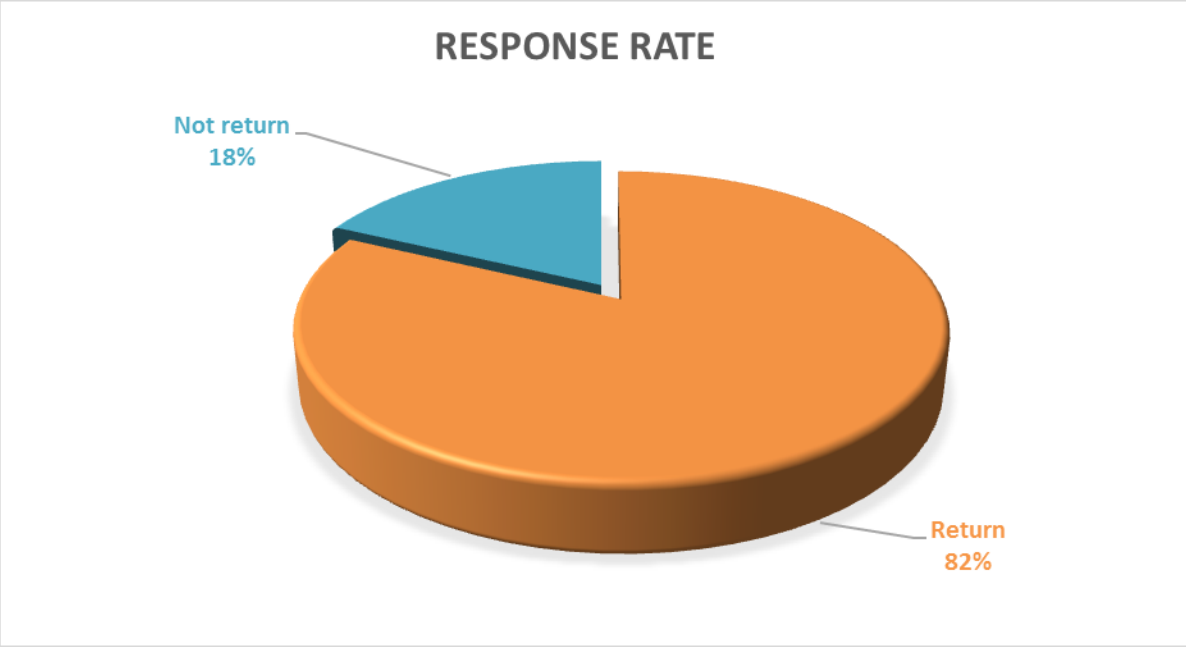
RESULT – Survey (Sampling)

100 questionnaires were distributed

82 respondents has answer all the question and return back the questionnaire

Using email platform and hard copy which distributed during meetings, courses and conference by using non-random sampling techniques.



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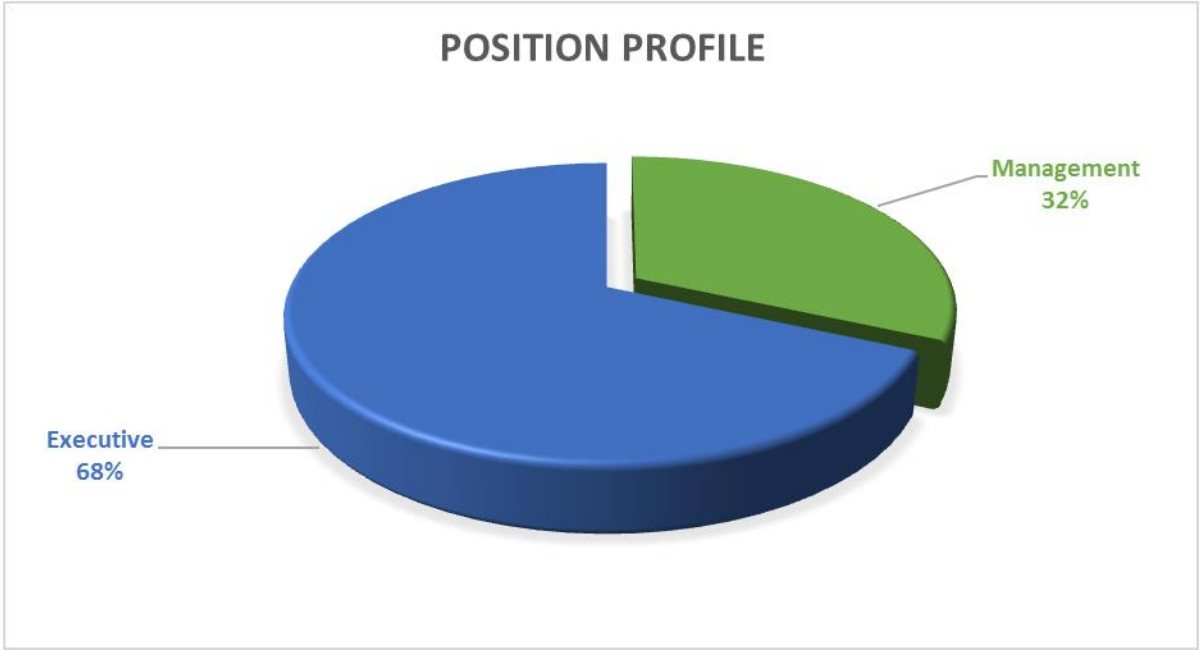
RESULT – Survey (Demographic)



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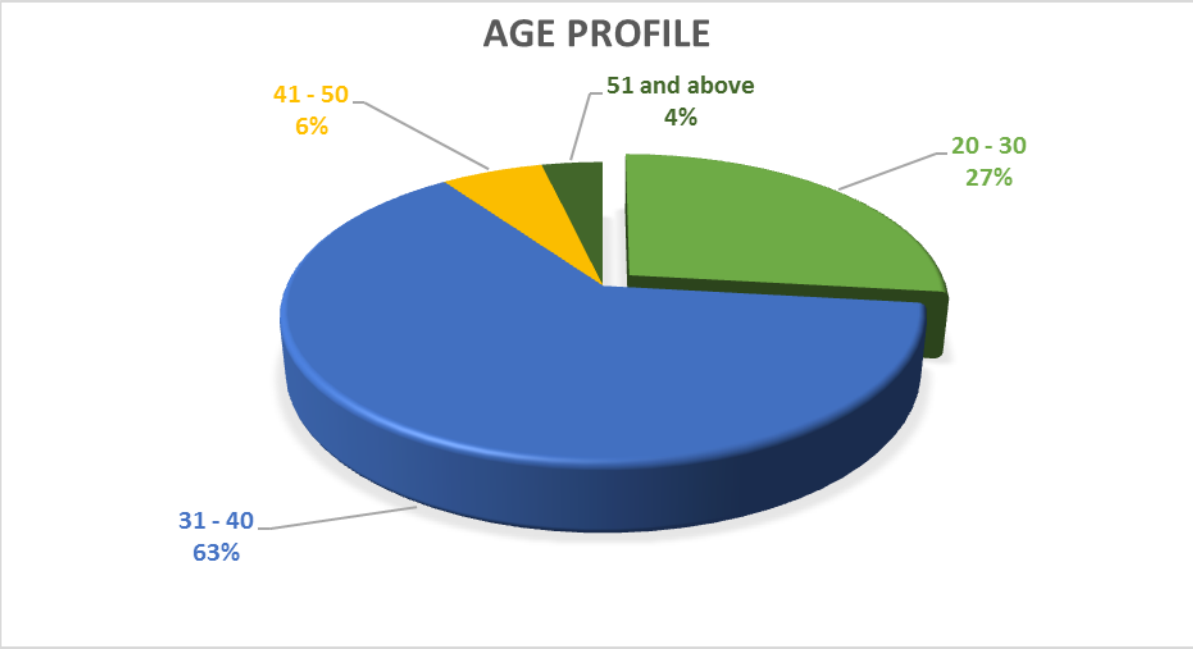

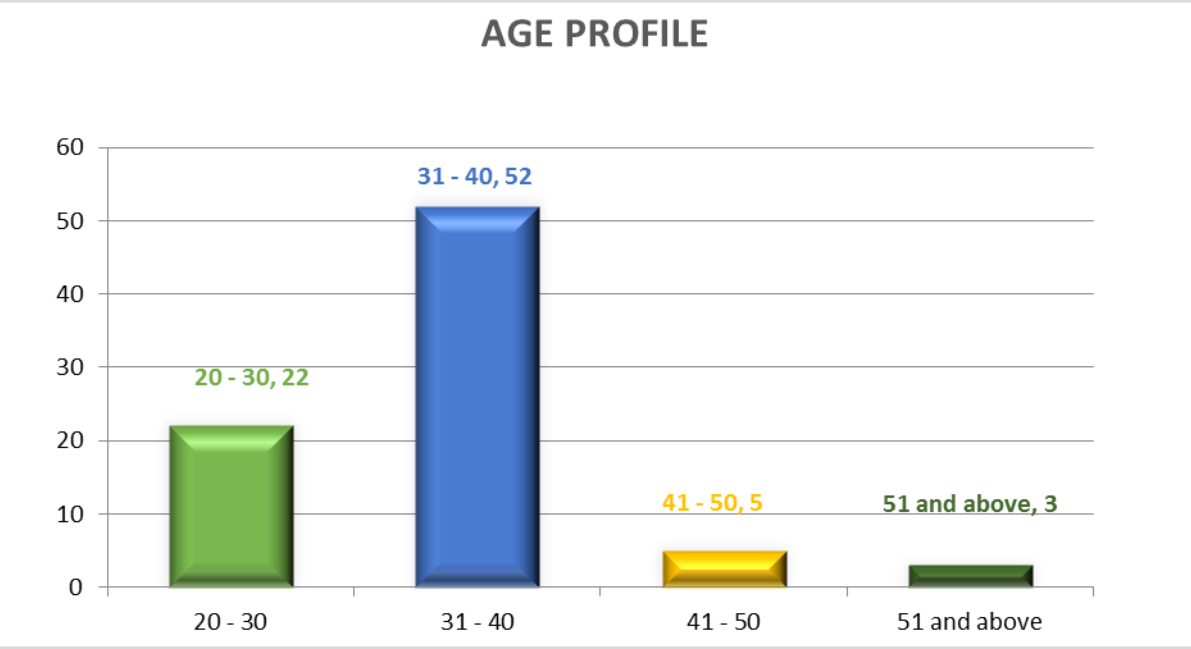

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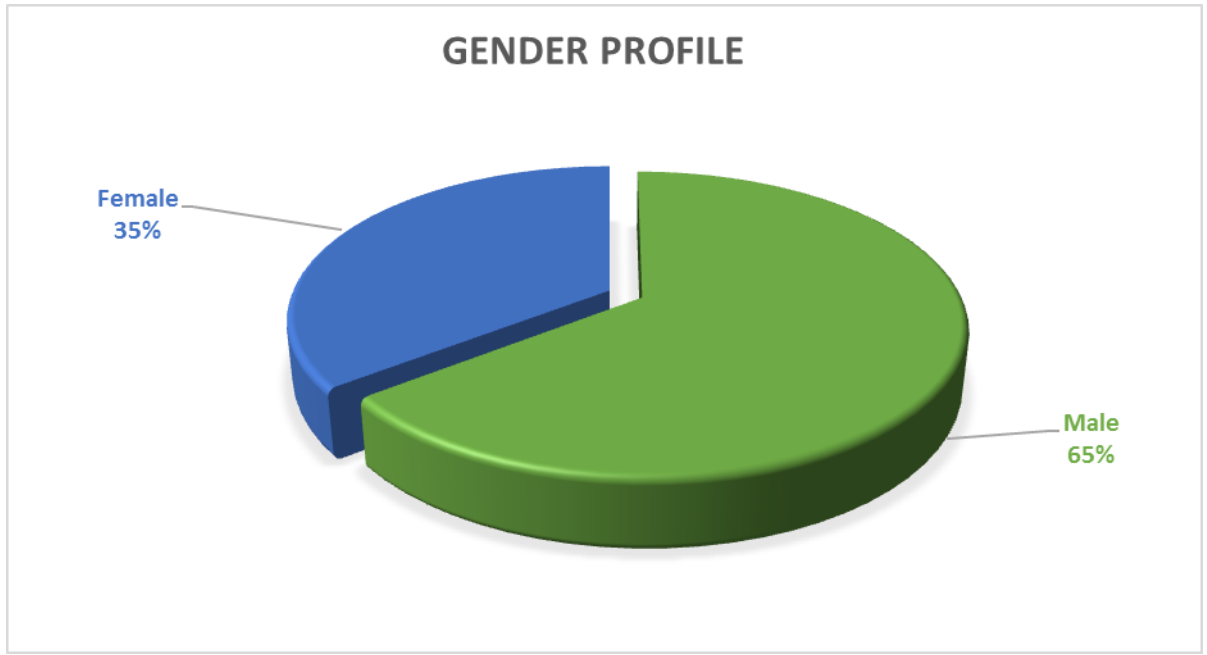
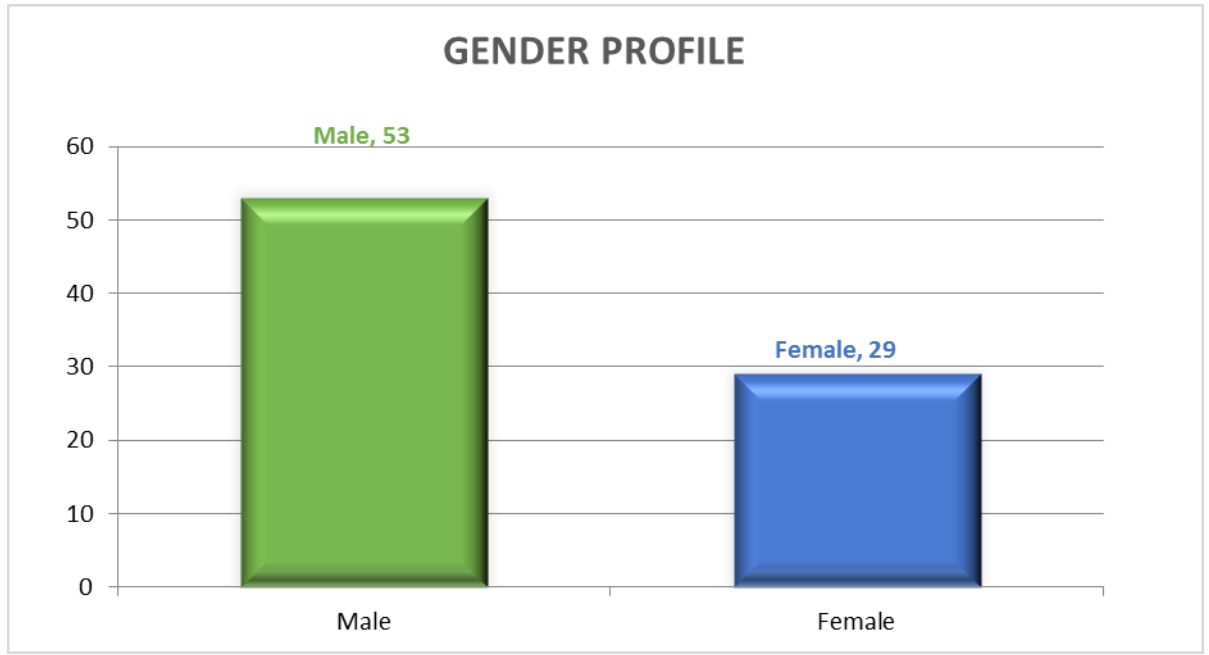
RESULT – Survey (Demographic)





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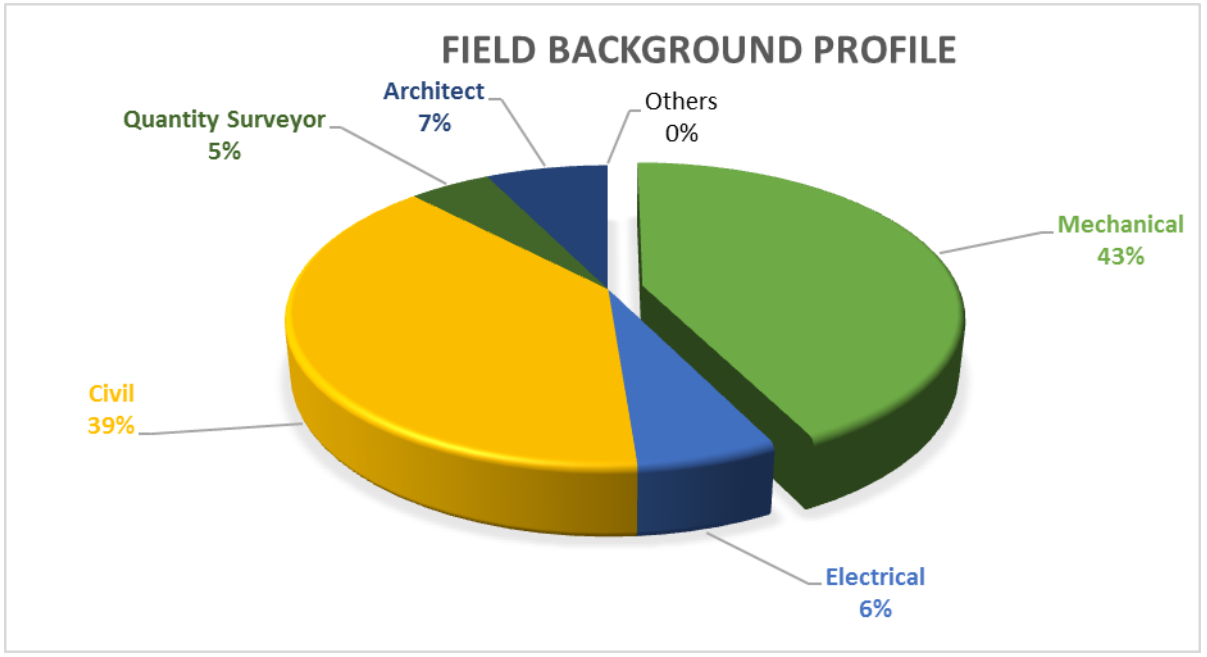
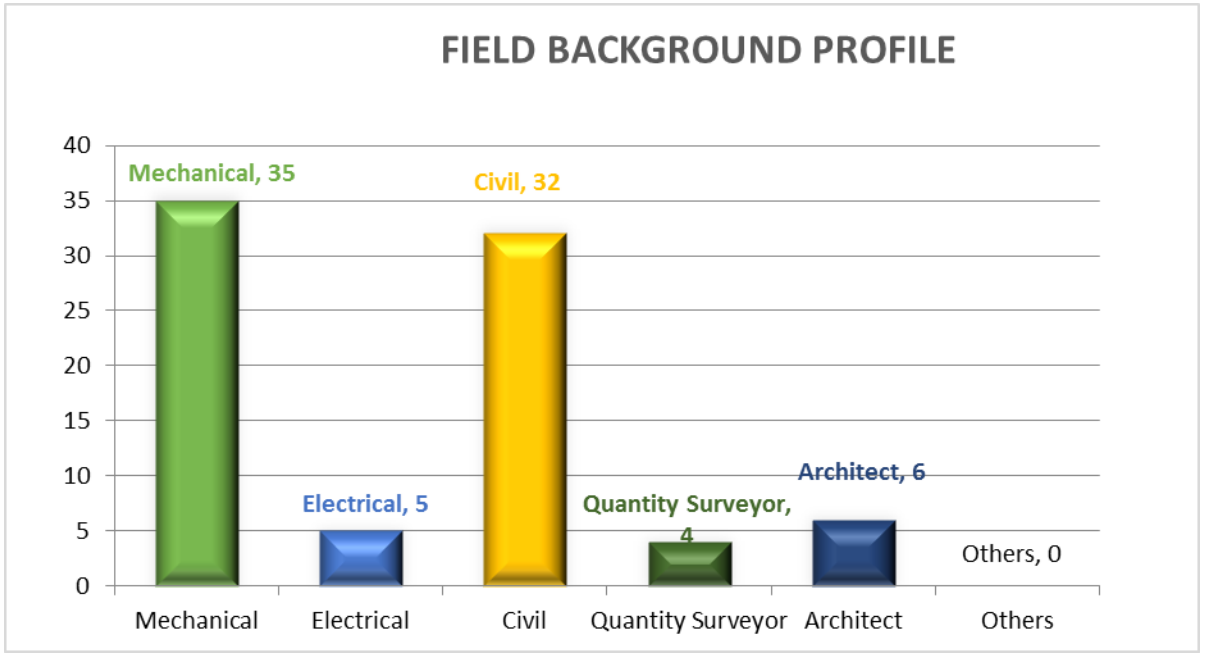
RESULT – Survey (Demographic)





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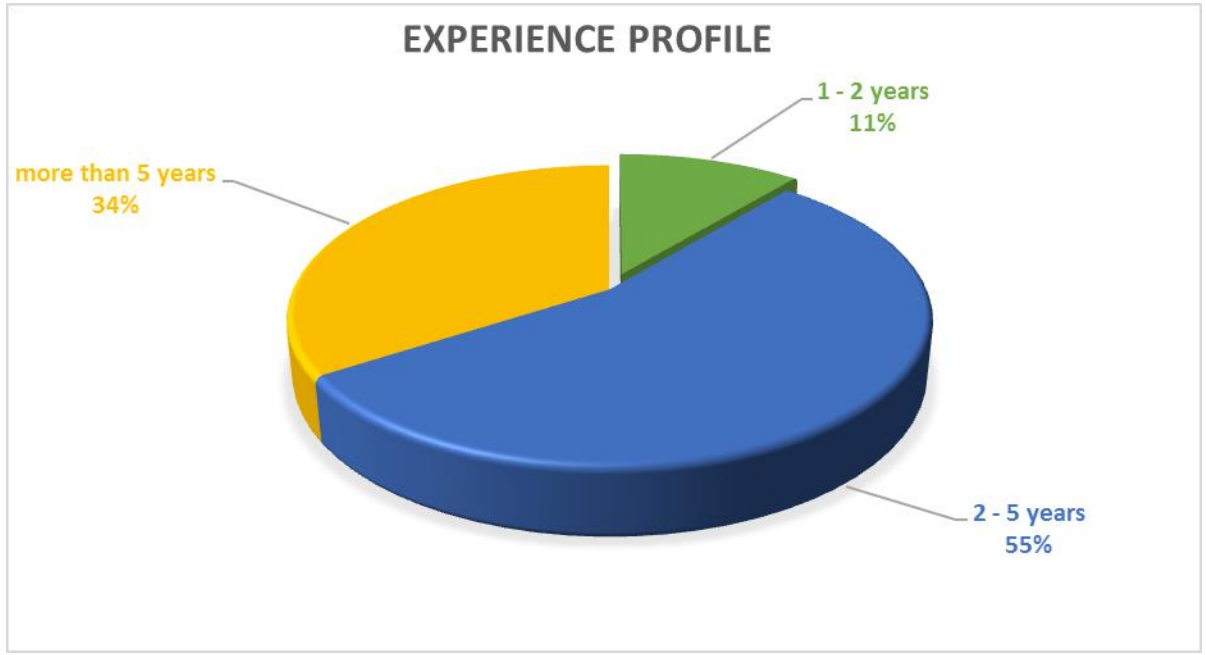
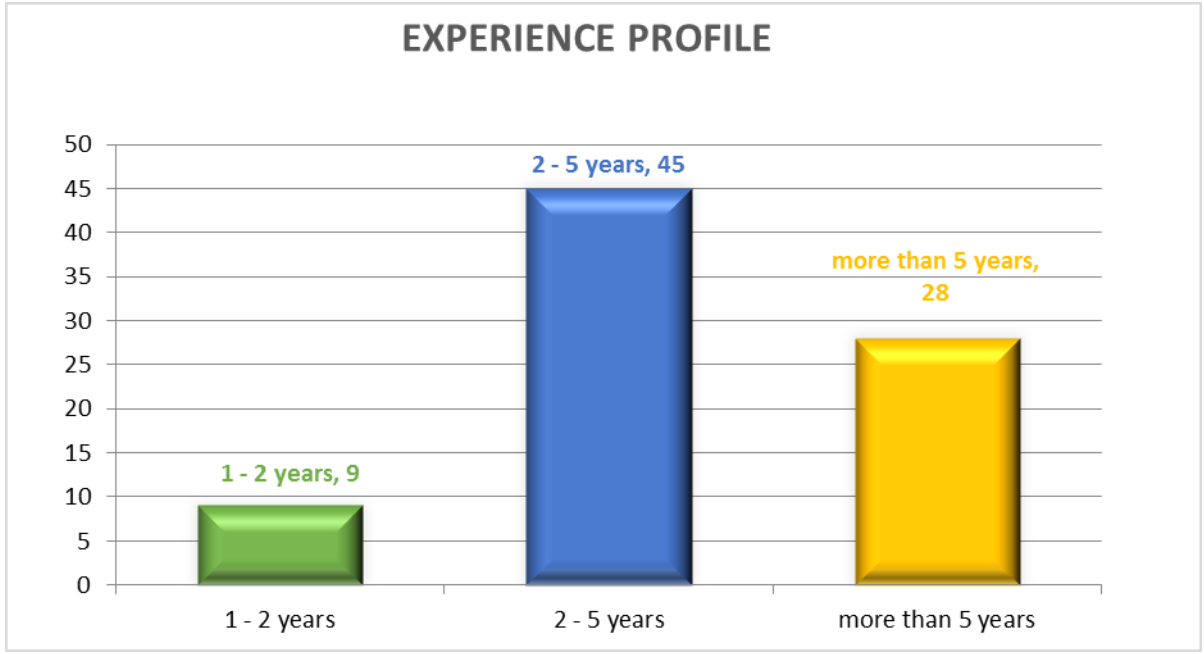
RESULT – Survey (Demographic)





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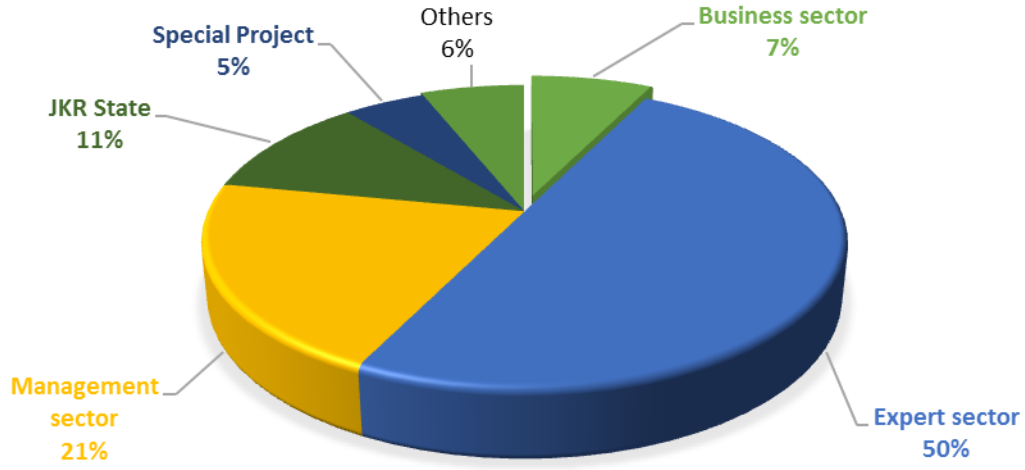
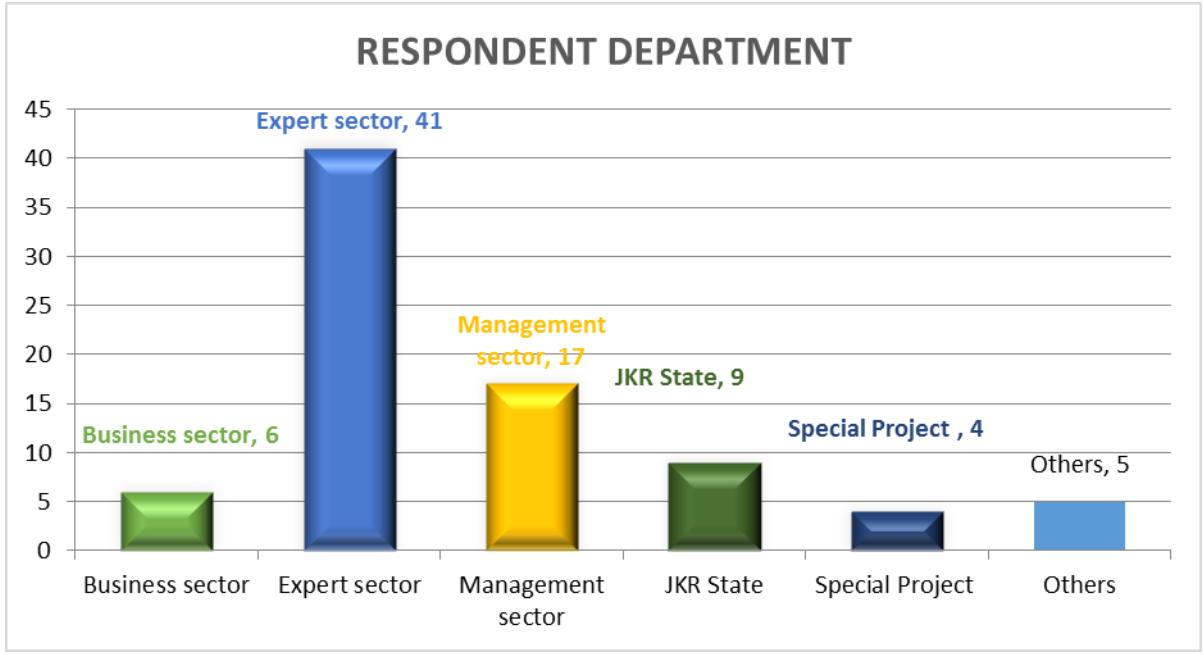
RESULT – Survey (Demographic)





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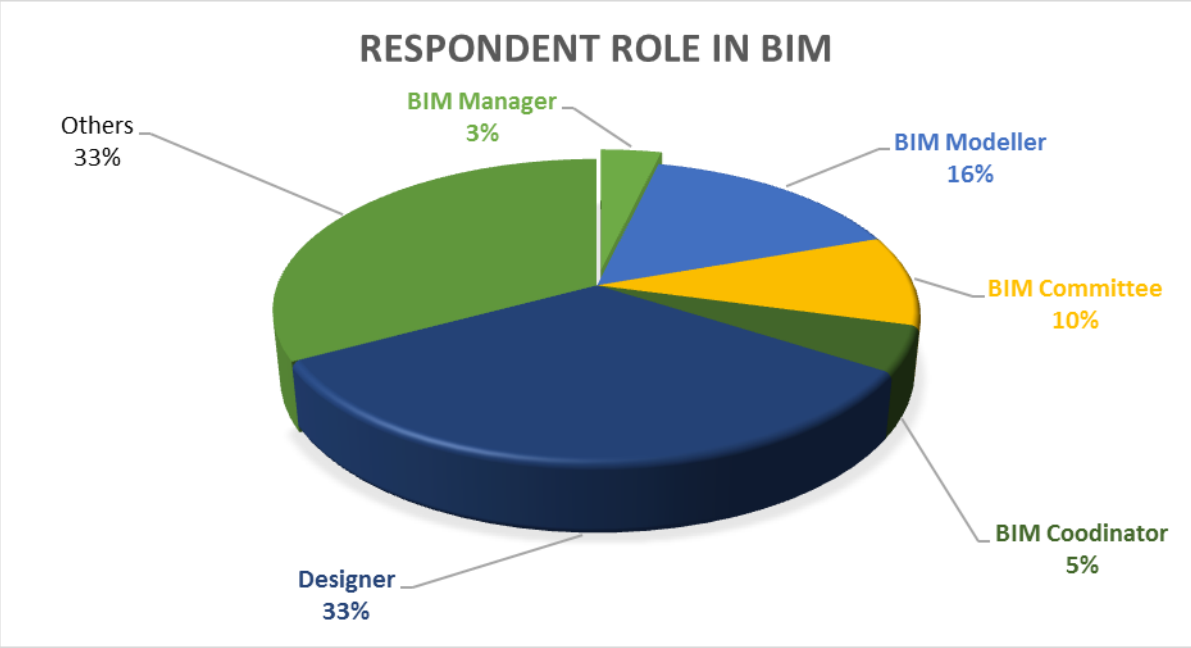
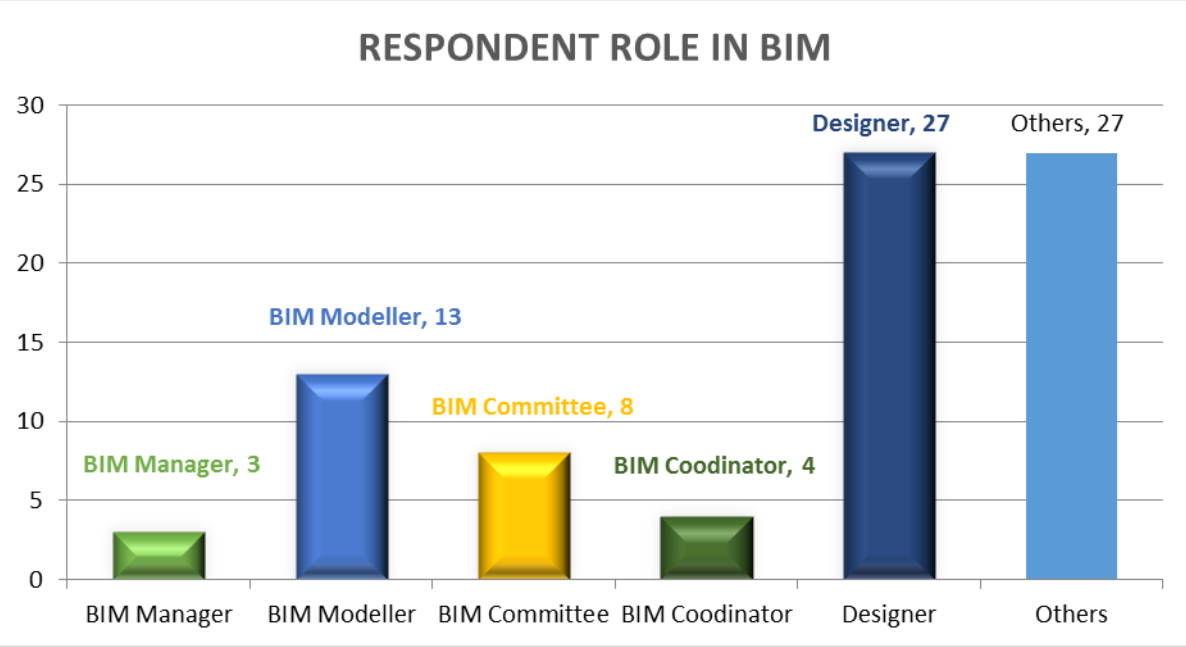
RESULT – Survey (Demographic)





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RESULT – Survey (Reliability Test)

- The reliability of the data was determined by using Cronbach's Alpha.
- obtained Cronbach's alpha with 0.962 and 0.968 which is more than 0.8. This indicates that the set of data have **relatively high internal consistency and reliable to be tested**.

No.	Section	Number of Items	Cronbach's Alpha
1	BIM Awareness at JKR	27	0.962
2	BIM Readiness at JKR	37	0.968

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RESULT – Survey (Awareness)

Stage	Mean score
Feasibility stage	3.978
Design stage	3.953
Construction stage	3.702
Maintenance and Operation stage	3.843

- **The mean score at all project phase is in the range of high value which is more than 3.68.**
- **The respondents is already aware that BIM is been implemented in JKR and what is BIM and its benefit.**

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RESULT – Survey (Readiness)

Aspect	Mean score
Technology	3.413
People	3.227
Process	3.374
Management	3.470

- **The mean score at all project phase is in the range of medium value which is between 2.34 to 3.67.**
- **The respondents agreed that BIM implementation is not totally ready yet in terms of technology, people, process and management.**

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Conclusion

1. The respondents agreed and already **aware** what is BIM and BIM is been implemented in JKR and its benefit; but BIM implementation is **not totally ready** yet in terms of technology, people, process and management.

2. The study showed that BIM could bring benefit especially during at feasibility stage of a project more than other stages measured. That's mean BIM could help the client in decision making in design, good in pre- estimation, easy to manage design changes and good work integration among the project team.

3. The study revealed that JKR is not ready to implement BIM due to the employees are not familiar with BIM and do not have skills with the right attitude to change and use BIM. Lack of hardware, software, infrastructure and commitment from the top management are the factors that make JKR not ready to use BIM.

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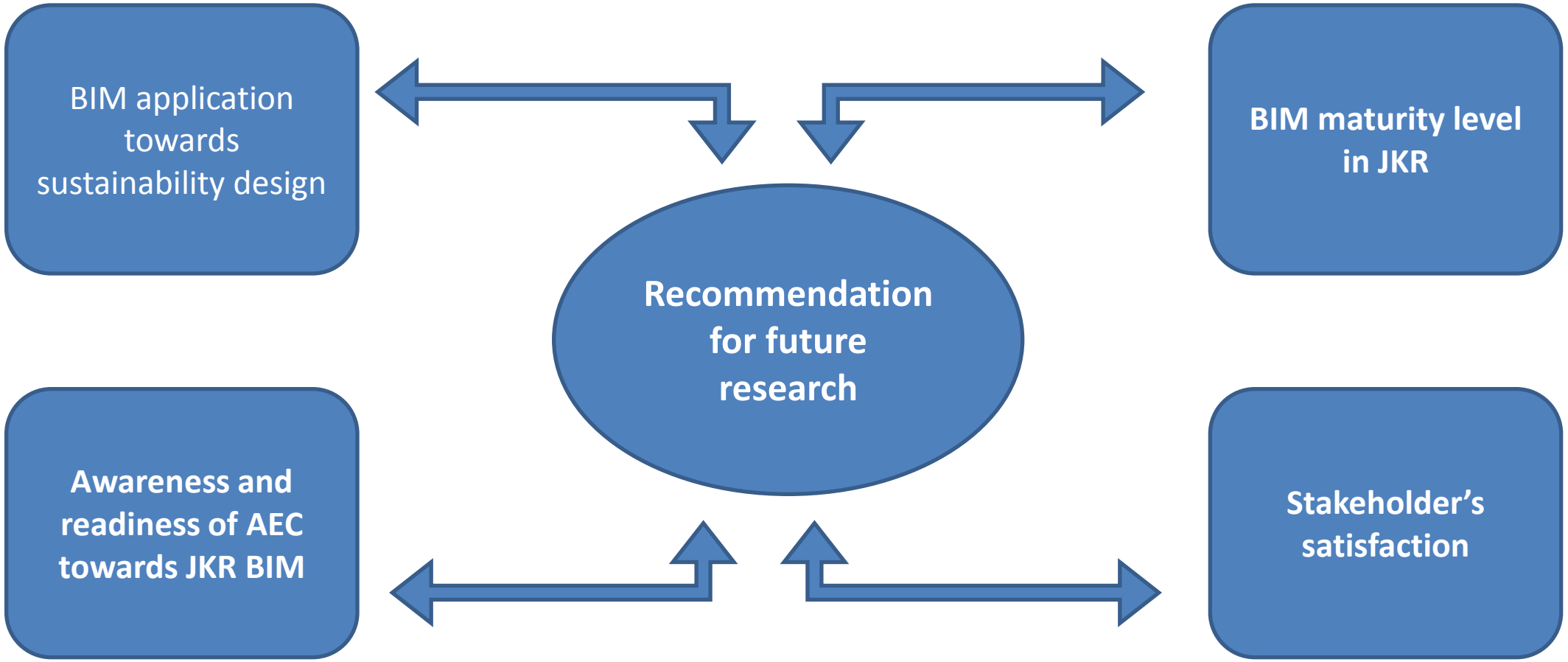
Recommendation for future Research



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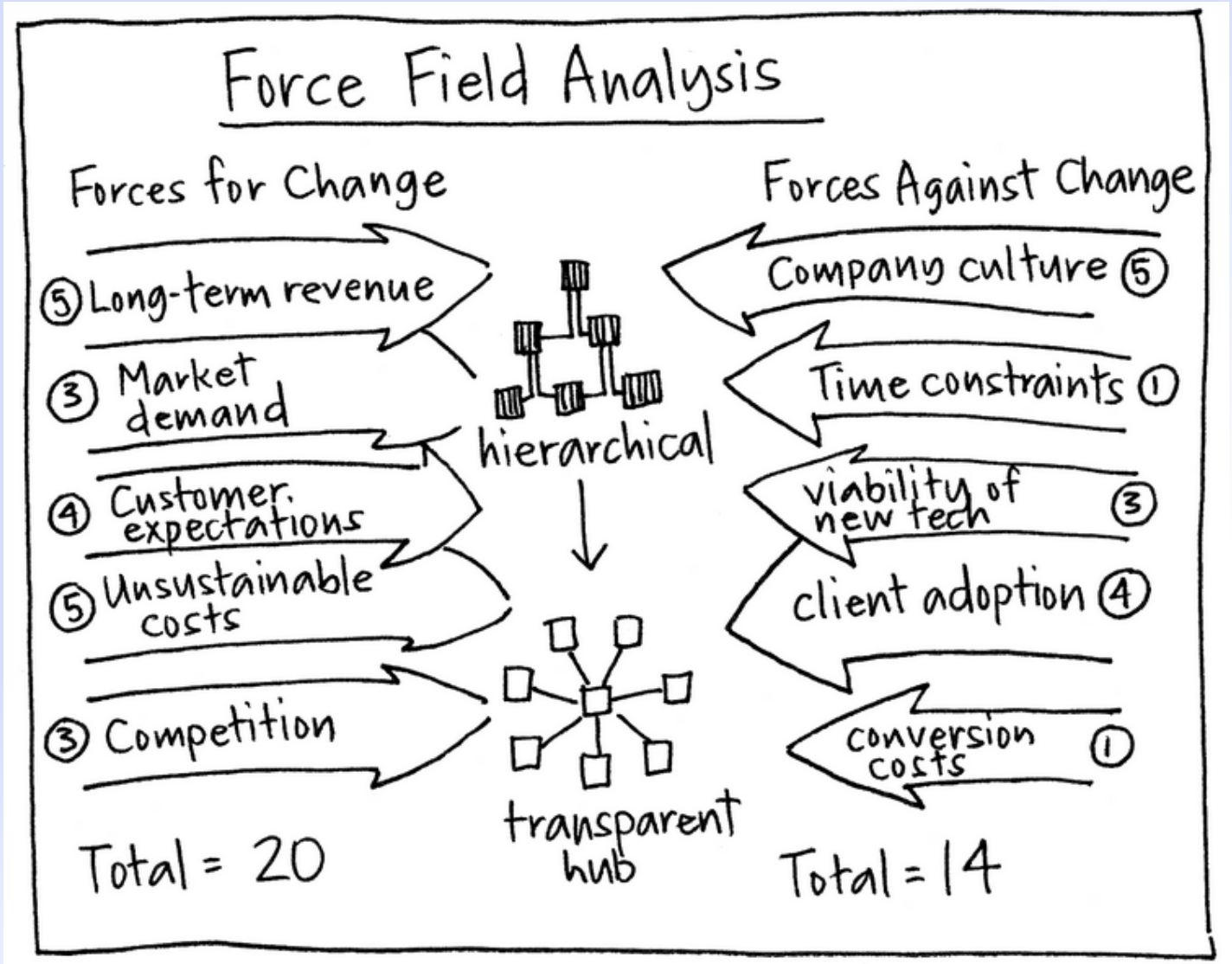
No.	Interview Question
1.	Based on your experience, please describe a brief description of BIM and its implementation in JKR.
2.	Who involved in BIM implementation in JKR at the moment and until what extend?
3.	What are the benefits of using BIM in projects?
4.	What challenges or hurdles that you faced in implementing BIM at JKR?
5.	What is the difference of using BIM in project comparing the conventional method?
6.	Can you identify any improvements in BIM implementation at JKR?
7.	How do you see the uses of BIM at JKR in another 10 years?
8.	What should JKR do to widespread of using BIM in projects?


Force Field Analysis
Forces for Change
Forces Against Change
5 Long-term revenue
3 Market demand
4 Customer expectations
5 Unsustainable costs
3 Competition
Company culture 5
Time constraints 1
viability of new tech 3
client adoption 4
conversion costs 1
hierarchical
transparent hub
Total = 20
Total = 14

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BIM AWARENESS DATA

JKR

No.	Question	Percentage					Mean Score
		1	2	3	4	5	
1	Client are able to make a better decision with the projected design or model	1.2	3.7	25.6	40.2	29.3	3.926
2	A brief design or model can be projected at early stage	0	6.1	17.1	45.1	31.7	4.024
3	Pre-estimation can be identified within a shorter period	1.2	6.1	31.7	39.0	22.0	3.743
4	Any changes in the design will give effect to the pre-estimate	0	1.2	22.0	45.1	31.7	4.073
5	Forming a better integration between designers and client	0	0	24.4	39.0	36.6	4.122

Feasibility stage

Design stage

No.	Question	Percentage					Mean Score
		1	2	3	4	5	
1	It converts 2D drawings into 3D models	2.4	1.2	15.9	41.5	39.0	4.134
2	It serves as an information center to provide better communication among construction team members	1.2	1.2	15.9	50.0	31.7	4.097
3	It is a platform that links all the data from different software such as AutoCAD, Tekla, Vico and etc.	0	2.4	28.0	45.1	24.4	3.914
4	It reduces discrepancies between architect and engineer drawings	0	2.4	20.7	39.0	37.8	4.122
5	It detects clashes between structures and ducting for services	0	1.2	12.2	41.5	45.1	4.304
6	Provide information such as building's natural lighting system, building's components and etc. For example, the door carries information about its fire rating, construction, glazing and also information about suppliers	0	1.2	18.3	41.5	39.0	4.182
7	It can automatically quantify every element and generate Bills of Quantities	2.4	6.1	25.6	46.3	19.5	3.743
8	It is able to cut short the duration of tendering by eliminating the taking off process	4.9	11.0	39.0	31.7	13.4	3.378
9	Heading towards paperless technology by storing records in digital form	1.2	9.8	32.9	29.3	26.8	3.707

BIM AWARENESS DATA

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No.	Question	Percentage					Mean Score
		1	2	3	4	5	
1	Able to reduce construction wastage	1.2	8.5	31.7	43.9	14.6	3.622
2	Able to shorten the construction period	1.2	6.1	42.7	32.9	17.1	3.585
3	Able to reduce variation orders	1.2	2.4	36.6	40.2	19.5	3.743
4	It reduces the probabilities of extension of time due to variation orders and disputes	1.2	6.1	41.5	34.1	17.1	3.597
5	It is able to ease the project management procedures by following up project activities, cost and time schedule	1.2	3.7	34.1	41.5	19.5	3.743
6	It reduces dispute due to discrepancies	0	3.7	32.9	43.9	19.5	3.792
7	The end product able to meet clients' requirements	0	2.4	34.1	41.5	22.0	3.829

Construction stage

No.	Question	Percentage					Mean Score
		1	2	3	4	5	
1	It is able to store historical data as references for new projects	1.2	4.9	19.5	43.9	30.5	3.975
2	Able to obtain pre-estimation on maintenance cost	1.2	4.9	28.0	37.8	28.0	3.865
3	Able to reduce the energy wastage based on the energy reading provided by BIM	1.2	1.2	28.0	51.2	18.3	3.841
4	Maintenance can be done at the correct timing and spot	1.2	6.1	41.5	30.5	20.7	3.634
5	Able to retrieve the building data for renovation and replacement purposes	1.2	2.4	25.6	46.3	24.4	3.902

O & M stage

BIM READINESS DATA

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

JKR

No.	Question	Percentage					Mean Score
		1	2	3	4	5	
1	We use collaborative system to record all transactions during a project and all the information required (i.e. integrated project delivery)	1.2	12.2	36.6	42.7	7.3	3.426
2	We use integrated system to enables all the data needed by any of the participants interlinked.	1.2	9.8	39.0	41.5	8.5	3.463
3	We adopt ICT to improve communication, closer relationships, and overcome the geographical problem.	1.2	8.5	37.8	43.9	8.5	3.500
4	We have adequate information technology infrastructure in place and available to the people in the company.	2.4	15.9	46.3	30.5	4.9	3.195
5	We do focus on ICT skills development and/or employing ICT experts (i.e. either outsourcing or appointing in-house staff to be an IT Manager etc).	2.4	15.9	32.9	40.2	8.5	3.365
6	We have the basic internet requirements to go online, such as modem, service provider etc.	1.2	2.4	37.8	47.6	11.0	3.646
7	We will install the necessary software that meets the minimum requirements to run the BIM software.	2.4	4.9	40.2	45.1	7.3	3.500
8	We have sufficient hardware with minimum requirements to run the BIM software.	3.7	17.1	40.2	32.9	6.1	3.207

Technology

People

No.	Question	Percentage					Mean Score
		1	2	3	4	5	
1	Our employees are 'ready' or have the correct skills and the right attitude to use the BIM software when it is introduced in our organization.	7.3	24.4	41.5	25.6	1.2	2.890
2	We are willing to adopt innovative approaches, using proven technologies, tools and practices.	1.2	14.6	39.0	39.0	6.1	3.341
3	Our employees are willing to change their way of work to avoid work inefficiency, disorganization, low morale, and no motivation when introducing BIM in our organization.	3.7	18.3	43.9	31.7	2.4	3.109
4	Our firm will provide specific training and available resources to employees in implementing BIM.	0	11.0	39.0	36.6	13.4	3.524
5	Our firm will provide technical assistance to our employees in implementing BIM.	0	11.0	37.8	41.5	9.8	3.500
6	Our firm has the employees with prior experience in collaborative environments.	2.4	18.3	41.5	32.9	4.9	3.195
7	We are confident in dealing with the education and training requirements of potential BIM users within our organization.	1.2	15.9	37.8	35.4	9.8	3.365
8	We will assist our workforce in re-skilling and to capitalize on the rapidly emerging technologies.	1.2	13.4	41.5	39.0	4.9	3.329
9	Our employees are familiar with the BIM.	7.3	31.7	37.8	20.7	2.4	2.792

BIM READINESS DATA

UTM
UNIVERSITI TEKNOLOGI MALAYSIA

No.	Question	Percentage					Mean Score
		1	2	3	4	5	
1	We do not have problem in absorbing information systems (IS) and ICT into our work practices.	1.2	15.9	46.3	30.5	6.1	3.243
2	We allow technology to be slowly absorbed into the current organizational business processes when implementing new technology into current processes.	1.2	7.3	46.3	40.2	4.9	3.402
3	We will conduct a self-evaluation within the organization before the implementation of BIM.	2.4	14.6	42.7	36.6	3.7	3.243
4	We believe that standard models will help QS in the measurement process	0	7.3	35.4	50.0	7.3	3.573
5	We are confident that the BIM system will provide adequate security for exchange of information or documents throughout the process.	0	9.8	40.2	41.5	8.5	3.487
6	We are confident that there is sufficient law and regulation to protect our rights when using the BIM software.	0	13.4	50.0	30.5	6.1	3.292
7	We believe that BIM process is compatible with the current legal status regarding electronic transmissions	0	9.8	48.8	32.9	8.5	3.402
8	We believe that BIM software does meet current evidentiary requirements legally.	1.2	7.3	50.0	35.4	6.1	3.378
9	We believe that appropriate legal policies and processes are developed to deal with any problem incur by BIM.	1.2	13.4	42.7	35.4	7.3	3.341

Process

Management

No.	Question	Percentage					Mean Score
		1	2	3	4	5	
1	We believe that BIM can help increase our business performance or revenue.	0	4.9	32.9	39.0	23.2	3.804
2	Our organization hierarchical structures will be able to support BIM implementation.	1.2	15.9	25.6	46.3	11.0	3.500
3	We will introduce BIM into our company after planning and evaluation on our capability to implement it.	1.2	7.3	31.7	46.3	13.4	3.634
4	We are aware that technology can help in making ICT investment decisions.	1.2	8.5	20.7	58.5	11.0	3.695
5	We prefer to learn how BIM may be used to effectively re-engineer the processes rather than continue with the conventional/traditional methods.	0	4.9	30.5	41.5	23.2	3.829
6	Our senior managers are experience in ICT adoption when introducing BIM into our organization.	3.7	18.3	45.1	25.6	7.3	3.146
7	We have sufficient resources for research, development and training relating to BIM implementation.	4.9	23.2	40.2	25.6	6.1	3.048
8	We are willing to spent additional time to familiarising ourselves with the software due to lack of experience about BIM.	0	8.5	45.1	34.1	12.2	3.500
9	We are willing to support the necessary maintenance cost during BIM implementation.	0	18.3	43.9	28.0	9.8	3.292
10	We are able to quantify and measure the actual cost of creating and distributing information electronically.	1.2	15.9	40.2	31.7	11.0	3.535
11	We are able to conduct cost assessment in order to judge or appraise whether using the BIM process is financially viable.	1.2	12.2	41.5	39.0	6.1	3.365