A preliminary survey on the understanding and application of digital and emphatic engagement of the construction constituents in Surabaya

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Abstract. This survey was actually triggered by this seminar topic, and applied to construction constituents in Surabaya. The Digital aspects derived from literature reviews are: Building Information Modelling, Augmented Reality, Mobile Technology, Sensors, Drones, Photogrammetry, Artificial Intelligence, Robotics, 3D Printing & Big Data analysis. The Emphatic Engagement aspects are in Integrated Project Delivery system and in serving the client’s needs. Survey questions were focused on the understanding on the digital aspects, and where they got the information from. Further questions on the application of both Digital and Empathic Engagement aspects. The best understanding on Digital Aspects are about Mobile Technology and Drones. Least understanding about augmented reality, robotics and smart sensors. Best application of Digital aspects is in CAD, which unfortunately is not fully a BIM technology. Least applications are on Robotics and 3D printing. Best application of Empathic Engagement is “having same vision/mission”, while the least applications are on “BIM faster work” and “BIM conflict resolving”.

1. Introduction
This survey was actually triggered by the first appearance of this DEACE seminar topic, since it is relevant and important for the future of construction. Therefore, the idea was then applied by doing a preliminary survey of the understanding and application of the construction constituents in Surabaya: the big contractors, construction industries, and real estate developers.

2. Digital aspects in construction
The Digital aspects of the advanced technology in construction were derived from [1], which are: 1) Building Information Modelling, 2) Augmented Reality, 3) Mobile Technology, 4) Sensors, 5) Drones, 6) Photogrammetry, and 7) Artificial Intelligence. Other digital aspects are taken from [2], and also [3], which added further: 8) Robotics, 9) 3D Printing, and 10) Big Data analysis.

3. The Emphatic Engagement aspects in construction
The Emphatic Engagement aspects is more difficult to find, since it is more applicable in Architecture side, i.e. in Empathic Design. Nevertheless, contractors are still obliged to serve and satisfying the client’s expectation [4] and [5]. The other possible specific area is found within the Integrated Project Delivery system, in which all participants of the project work along together starting from the beginning of the project [6]. It usually connected with BIM [7].

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4. Survey questions
The questions were focused on:
1. How far the construction constituents in Surabaya understand the digital aspects, with the understanding scale of: 1 = “do not understand”, 2 = “begin to understand”, 3 = “understand”, 4 = “understand more”, 5 = “fully understand”.
2. Where they get the understanding from, with categories of: A = “from attending seminar”, B = “from training”, C = “self-initiative”, D = “other (please specify )”.
3. How far they had applied the digital and empathic engagement aspects, with the application scale of: 1 = “never”, 2 = “seldom”, 3 = “sometimes”, 4 = “often”, 5 = “always”.

5. Survey Process
Pilot study was briefly done to ensure understanding and clarity of the questions. Questionnaires were sent in early 2021 to the construction constituents in Surabaya: the big contractors, construction industries and real estate developers. Nevertheless, only 17 constituents respond positively, during this pandemic time. Validity and reliability tests were done on the responses. Means of the scales were then calculated.

6. Survey Results
The result of the survey is shown in the Table 1, Table 2 and Table 3.

Table 1. Understanding on the digital aspects.

| No | Digital Aspects | Mean on Understanding Scale 1 to 5 |
|----|----------------|-----------------------------------|
| 1  | BIM            | 3,53                              |
| 2  | Augmented Reality | 2,29                           |
| 3  | Mobile Technology | 3,94                           |
| 4  | Smart Sensors  | 2,53                              |
| 5  | Drones         | 3,88                              |
| 6  | Photogrammetry | 3,06                              |
| 7  | Artificial Intelligence | 2,82                        |
| 8  | Robotics       | 2,29                              |
| 9  | 3D Printing    | 2,71                              |
| 10 | Big Data Analytic | 2,53                           |

Table 2. Application of the digital aspects.

| No | Digital Aspects | Mean on Application Scale 1-5 |
|----|----------------|--------------------------------|
| 1  | BIM            | 4,65                           |
| a  | 2D CAD         |                                |
| b  | 3D CAD         | 3,94                           |
| c  | All staffs     | 3,59                           |
| d  | With other parties | 2,88                       |
| 2  | Augmented Reality | 2,18                          |
| 3  | Mobile Technology | 3,12                         |
| 4  | Smart Sensors  | 1,88                           |
| a  | To measure building drift | 1,88                       |
| No | Digital Aspects                        | Mean on Application Scale 1-5 |
|----|----------------------------------------|--------------------------------|
| 5  | Drones                                 | 2.71                           |
|    | a To detect defects                    |                               |
|    | b To supervise                         | 3.24                           |
| 6  | Photogrammetry                         | 2.47                           |
| 7  | Artificial Intelligence                | 2.71                           |
| 8  | Robotics                               | 1.76                           |
| 9  | 3D Printing                            | 1.29                           |
| 10 | Big Data Analytic                     | 1.71                           |

Table 3. Application of emphatic engagement aspects.

| No | Emphatic Engagement Aspects | Mean on Application Scale 1-5 |
|----|-----------------------------|--------------------------------|
| 1  | Integrated Project Delivery | 4.59                           |
|    | a Same vision & mission     |                               |
|    | b BIM conflict resolving    | 3.35                           |
|    | c BIM faster work           | 3.12                           |
| 2  | Client’s needs              | 4.12                           |
|    | a Understand the need       |                               |
|    | b Able to communicate       | 4.29                           |

7. Conclusion

On Construction Constituents’ Understanding of the Digital Aspects:
- In general, the responses are around the middle of the scale (= “understand”), which somehow reflects the central tendency.
- The best understanding is “understand more” (around scale 4) on Mobile Technology (3.94), and Drones (3.88).
- The least understanding is “begin to understand” (around scale 2) on Augmented Reality (2.29), Robotics (2.29), and Smart Sensors (2.53).
- Most of the source of understanding of the best understanding items are from “self-initiative” (category C) rather than from “attending seminar” (category A) nor from training (category B).

On Construction Constituents’ Application of the Digital Aspects
- The responses in general are more varied, from “seldom” (scale 2) to “always” (scale 5).
- The best application is “always” (scale 5) on “2D CAD” (4.65), followed by “Often” (scale 4) on “3D CAD” (3.94) and “All Staffs” (3.65). Unfortunately, only “sometimes” (scale 3) on “With other parties” (2.88), which is in fact the real advantage of BIM.
- The least application is “Seldom” (scale 2) on “Robotics” (1.29), and “3D printing” (1.71).

On Construction Constituents’ Application of the Emphatic Engagement aspects
- The responses are more on the positive side, “sometimes” (scale 3) to “always” (scale 5).
- The best application is “Always” (scale 5) on “having same vision/mission” (4.59), followed by “Often” (scale 4) on “able to communicate well” (4.29) and on “Understanding the need” (4.12).
• The least application is “Sometimes” (scale 3) on “BIM faster work” (3.12) and “BIM conflict resolving” (3.00).

8. Concluding remark
It is suspected that respondents were too optimistic in filling in the survey, and have the central tendency in responding to new development trends in construction. A more thorough questions should be made before making more definite conclusion.

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