Toward sustainable practices in building project at Indonesian local government: a case study of construction failure and building failure (defects) in Central Java – Indonesia

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TOWARD SUSTAINABLE PRACTICES IN INDONESIAN BUILDING PROJECTS: CASE STUDIES OF CONSTRUCTION BUILDING FAILURES AND DEFECTS IN CENTRAL JAVA

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ABSTRACT

Addressing building failures and defects has become as a strategic importance for the development of Indonesian Construction Industry in this decade. In the local government building projects, building failures and defects caused by various factors, notably the variations of contract value, element structures and the lack of sound document management system. These factors and others that cause and provide a significant potential for improvement building failure and defects considered unsustainable practice. This study aims to identify unsustainable practice in building projects in local government using case study approach. The cases undertaken from 34 building projects and focusing into five cases that is represent the various kind of building type. The result indicates a significant deviation until 12.61%. Furthermore, the quality of structural elements such as the roof, foundation, utilities and finishing works frequently felt below predetermined standards. The factors influencing these unsustainable practices attitudes towards government procurement system and budget limitations, lack of capacity in construction activities of local government, and violation of building control system. This research outcome also provided three proposition in accordance the goals of the study to depict the symptoms of building failure and defects.

Keywords: Sustainable, Unsustainable Practice, Building Failure, Construction Failure.

INTRODUCTION

Buildings failures and defects causing e.g. the roof structure collapse, leaking bathroom after handover are persistent problems in local government projects in the last few decades. There seems to be no concerted effort to resolve these problems, leading to unsustainable practice. There problems cannot carry on, as construction industry will face a more stringent procedures and regulation and more intense competition nationally and internationally. It is important to identify common factors causing building failures and defects in order to minimise the long-term impact on and improve quality. It will also promote the feasibility of implementing principle of sustainability in the Indonesian construction industry. A study of 34 building projects in Central Java presented. The nature of defects detected during construction is discussed. The study was performed during 1999-2010 in a collaboration between Semarang Polytechnic State, and Department of Civil Engineering, Diponegoro University and Construction Industry Development Board (LPJK) of Central Java. This study has an ultimate aim in sustainable practices in building projects, which administered by Indonesian local government and develop strategies for enhancing the sustainability of such projects.

Defining Building Failure and Construction Failure (Defects)

In principles, a good building should be able to protect the occupants from various weather conditions. Importantly, building elements, such as windows, pipe line (plumbing) and temperature conditioning system should provide serviceability throughout the intended lifespan of the facilities. Further, the structure should ensure safety and be able to bear gravity loads, earthquake and wind load (Ahzahar et al. 2011:250)
Building Failure

This paper defines that the building failures and defects in accordance Act No. 18 in 1999 (Indonesian Law of Construction Service), Article 1, part 6. It is stated that building failure is defined as the malfunctions of the building condition, partially or whole part and/or it does not meet with contract’s requirements of construction work after project hand over (FHO). In addition, Government Regulation (Peraturan Pemerintah) No. 29 in 2000, article 4 defines that building failure is malfunction of building condition, partially or whole part, in term of technical, usefulness, safety and healthy and or general safety as a result of inappropriate manner (faults) by the contractor or consultant after Final Hand Over (FHO) of the construction project. It is clear that the building failure focused in term of period after FHO term time. In other words, the contractor or consultant should make sure their construction products should meet technical specification and be safely occupied after FHO. Regarding the range insurance time to occupied the construction product as stated at Act No. 18 in 1999, article 25 part 2, maximum for 10 years or according to the life span of construction.

Construction Failure (Defects)

Construction failures or defects, have a numerous definitions. Ahzahar et. al (2011) cited from Webster’s Dictionary, describes the term of defects briefly. Defect is defined as imperfection; fault; blemish or deficiency. These conditions can be affected by the lack of design, manufacturing process or improper installation of materials by practitioners (architects, engineers or contractors). The point is that defects will reducing value, in term of quality of materials, time and cost. However, to proof a building defects, it is requires ‘the hiring and testimony’ by an expert, such as engineer or architect. The expert who have the extensive experience and is well trained, will be able to identify defects through assessment by the design, materials or workmanship (Ahzahar et al. 2011:250). Nevertheless, it is difficult to state in simple way, and to define the accurate meanings of building defects. For instance, imperfection condition of the construction would be able identified in order to provide the progress report for granting the contractor to withdraw the term-cash payment (Richardson 2001). However, different perceptions and expectation between contractor and supervision consultant or building control exist on the ground. It is important to contact an attorney to find out exactly what is happening on the building, and need to take care of it and to protect your rights. It is concluded that the proper regard should be given to the terms of contract (Archifact 2013). This paper defines the defects given to the term time perspective put into that occur at any time from signing contract to FHO. The term time of building failures and construction failure (defects) is illustrated in Fig. 1.

There are 4 objectives of the project: economy (minimise cost), satisfaction of quality, meeting targeted and safety requirements. Unsuccessful performance of all objectives indicates project failure. The building failure or construction failure exist following the long process of project life cycle that enacted by contractors which is the performance indicators unachievable (Husen, 2009). Moreover, Ahzahar et al. (2011: 251-252) point out eight factors that influence the building failure and defects: climate conditions, building location, material of construction, type of building and functional changes, building maintenance, design fault, corruption and lack of supervision.

Regarding sustainable construction in New Public Management (NPM), accountability is crucial concern when the government facing the barrier such as corruption issues. Local government as the result of decentralisation should encourages the promotion for accountability and reducing corruption in the government (Ostrom, Schroeder, and Wynne 1993). However, dealing with sustainable practices within the context of this study, sustainable construction should be describe the root causes from planning, design stage and continues after the construction team have left the site of project (Hill and Bowen 1997: 237).
Fig. 1: Time term of construction failure and building failure within project life cycle
(Developed from Act No. 18 1999)

METHODOLOGY

Research Methods
Case study strategy is appropriate for exploratory phase of investigation (Yin 1994: 3). Furthermore, Yin (1994) argues that case study is far for being exploratory strategy. However, some of the prominent case studies could be descriptive and explanatory. This examination method have a distinctive place in evaluation research (Cronbach et al. 1980, Guba and Lincolnd 1981, Yin 1993).

The analysis will be conducted iteratively throughout process of data collection. Collected data are going to be examined by multi case studies from different perspectives in order to develop comprehensive explanation of phenomena being studied. The case study, like other research strategies, is a way of investigating an empirical topic by following a set of prespecified procedures.

Regarding mode of analysis, the multiple case studies analitical strategy preferably special pattern-matching by explanation-building. This mode of analysis similar with exploratory case study which has been commonly cited. However, the strategy goals is to develop ideas for further study rather than to conclude the cases. (Yin 1994, Glaser and Strauss 1967). Considering the validation stage, such review is more than a matter of professional courtesy. Different conclusion and interpretation between participant and investigator is normal. But we should not have disagree with the actual facts of the case. It does not matter disagreement emerges from these situation, then researchers should produces further evidents to review the draft of case study report.

Data Collections and Method
The data collection undertaken by field observation and document review of building projects of Indonesian local government between 1996-2008. There are 5 stages regarding data collections: administration data, field observation, building inventory survey, material sampling and field test, laboratory analysis, analysis and conclusions and reporting for each case study.

- Administration data
  administration data consist of a set of contract document (design and shop drawings, contract value, amendements and related correspondencies between client, contractor and supervision consultant, and other related documents), minute of meeting from appraisal process until FHO, direction books, report performance of the projects.

- Field observation
Field observation undertake after investigation the administration data. Pattern-match method between data and reality on the field preferably undertake in this stage. The initial findings from this stage will continuing detail proofing by building inventory survey.

- Building inventory survey
  Continuing the initial findings from field observations. The investigation conducts the inventory survey by attorney investigator as representative from local government, independent team investigator, contractor and supervision consultant to proof the project performance from design and construction which accomplished.

- Material sampling and field test
  Material sampling undertaken in regard proved the quality of construction material. Construction material is important because it used to determine the behaviour of construction (Ahzahar 2011: 254). The sample materials carried on the laboratory for further test. For the element which unable to tested in laboratory, the investigation undertake insitu test. For instance the concrete test material by hammer test, soil density by sand cone test, otherwise the another soil properties should be conducted in laboratory.

- Laboratory analysis
  The samples materials which carried out from material sampling stage will tested in Material Laboratory. The result of the material test will be analysed and discussed by investigation team.

As case study research method, the analysis will be conducted iteratively throughout process of data collection. Collected data are going to be examined by 34 case studies from different investigations and this study will selected five case studies to discussed. The five cases that are represent the various kind of building type, which significantly indicated the building failure or defects.

The investigation undertaken from 34 building projects from various types of buildings and differences in Grade of Project Company (as shown in Tab. 1). Historically, the buildings established by three term time order, before reformation order (before 1999), transition-reformation order (1999 to 2003) and post-reformation order (2003 until now). However, the investigation conducted by their own order, particularly the regulation references, such as building code or procurement regulations. A study of five building projects expected to maps the pattern of unsustainable practices to develop the framework theory.

RESULTS AND DISCUSSION

Determined from Tab.1 shown that 12 of 34 investigation of the building projects are indicated the building failure or construction failures (defects). These projects which is determined, exist on 9 different local government. Each of local government have less amount of certified building expertises with a various fields (Less than 500 experts), except the capital city Semarang (+ 3000 experts) and municipal city Semarang (+1000 experts). More over, Certified skill labour is less than 750 workforce. It is conclude that low quantities or capacities of the expertises and skilled labours significantly contribute the quality performance on the construction projects.

In facts, from the 12 projects which is identified building failure or defects did not provide monthly reports, minute of meeting and direction book for communication between client, contractor and supervision consultant along the construction activities. The projects seems lack of supervision and discontinued on evaluation stages. Unavailability of accurate data results in decision-making and significantly increase likelihood of construction failures. This mean that the local government should be aware regarding sustainability performance and goals prior to the procurement arrangements in the future. It is concluded to concern the organisational culture to motivate the sustainable decision-making (Epstein and Buhovac 2010).
Tab.1: Characteristic of buildings projects in Indonesian local government

<table>
<thead>
<tr>
<th>No</th>
<th>Building</th>
<th>Date Construction</th>
<th>Complete</th>
<th>Time Completion</th>
<th>Status</th>
<th>Frequency</th>
<th>Defect of Contract</th>
<th>Failure</th>
<th>Score</th>
<th>Regroup Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>School</td>
<td>2015</td>
<td>2017</td>
<td>On time</td>
<td>Suitable</td>
<td>11.91</td>
<td>Fixed Price</td>
<td>11.91</td>
<td>8.00</td>
<td>Grade 3</td>
</tr>
<tr>
<td>2</td>
<td>Hospital</td>
<td>2016</td>
<td>2018</td>
<td>Late</td>
<td>Suitable</td>
<td>4.68</td>
<td>Fixed Price</td>
<td>4.68</td>
<td>4.68</td>
<td>Grade 4</td>
</tr>
<tr>
<td>3</td>
<td>Stadium</td>
<td>2017</td>
<td>2020</td>
<td>Late</td>
<td>Suitable</td>
<td>0.66</td>
<td>Fixed Price</td>
<td>0.66</td>
<td>0.66</td>
<td>Grade 5</td>
</tr>
<tr>
<td>4</td>
<td>School</td>
<td>2018</td>
<td>2020</td>
<td>On time</td>
<td>Suitable</td>
<td>0.48</td>
<td>Fixed Price</td>
<td>0.48</td>
<td>0.48</td>
<td>Grade 5</td>
</tr>
<tr>
<td>5</td>
<td>School</td>
<td>2019</td>
<td>2021</td>
<td>On time</td>
<td>Suitable</td>
<td>0.25</td>
<td>Fixed Price</td>
<td>0.25</td>
<td>0.25</td>
<td>Grade 5</td>
</tr>
</tbody>
</table>

The deeper study regarding building practices conducted through selected five projects which have a similarity case that the project is not meet with their contract. These buildings represent the various type of buildings as public facility, district health unit (Puskesmas) and public school. A study of five buildings emerges the information as shown at Tab.2. All projects gained from the procurement process by a competitive price bidding around 70-80% of the owner price estimation (OE). Nevertheless, the deviation have occurred around 7-8 % on average. The building failures (defects) exist by the element of the building item of works. The highest rated failure found at Structural element (11.91%). The second rated come from roof element (4.68%), then foundation (0.66%), utility (0.48%) and finishing element (0.25%). Unsustainable practices have depicted from these phenomenon in the local government projects and justifying the previous facts that supervision seem violation exist on the building control system.

Tab. 2: Focus study on Five Building Projects

From the result of Tab.2 emerges the curiousity regarding symtoms of building failure and defects. The analysis recall Tab.1 to measure the affect of time term through the building failure and defects, Cost construction and type of contract. The author attempt to quantifying approach by correlation analysis from attributes Time, Project Failure, Cost and Type of Contract. Result of correlation analysis in order to depict the symptoms of building failure and defects. As shown at Tab.3, there are three significant correlations could explained attributes the symptoms of building failure and defects. First, construction period (Time) has a very strenght negative correlation due to Project Failure ($r = -0.562$, sig. = 0.001 < $\alpha = 0.05$). Meanwhile, the construction period has a strenght positive correlation due to Cost of construction ($r = +0.497$, sig. = 0.003 < $\alpha$). Nevertheless, period of construction is very weak correlate due to the type of contract ($r = +0.025$, sig. > $\alpha$).
Tab. 3: Correlation analysis of building failure and defects

<table>
<thead>
<tr>
<th></th>
<th>Correlation Coefficient</th>
<th>Budget Period</th>
<th>Time of Construction</th>
<th>Cost of Construction</th>
<th>Construction Failure</th>
<th>Type of Contract</th>
<th>Building Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget Period</td>
<td>Pearson Correlation</td>
<td>0.84</td>
<td>-0.54</td>
<td>-0.34</td>
<td>-0.42</td>
<td>-0.59</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Significant)</td>
<td>0.45</td>
<td>0.36</td>
<td>0.31</td>
<td>0.43</td>
<td>0.53</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>0.84</td>
<td>0.54</td>
<td>0.34</td>
<td>0.42</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>Time of Construction</td>
<td>Pearson Correlation</td>
<td>-0.34</td>
<td>-0.54</td>
<td>-0.34</td>
<td>-0.42</td>
<td>-0.59</td>
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<tr>
<td></td>
<td>(Significant)</td>
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<td>0.43</td>
<td>0.53</td>
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<tr>
<td></td>
<td>N</td>
<td>0.84</td>
<td>0.54</td>
<td>0.34</td>
<td>0.42</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>Cost of Construction</td>
<td>Pearson Correlation</td>
<td>-0.10</td>
<td>-0.49</td>
<td>-0.39</td>
<td>-0.44</td>
<td>-0.59</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Significant)</td>
<td>0.45</td>
<td>0.36</td>
<td>0.31</td>
<td>0.43</td>
<td>0.53</td>
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<tr>
<td></td>
<td>N</td>
<td>0.84</td>
<td>0.54</td>
<td>0.34</td>
<td>0.42</td>
<td>0.59</td>
<td></td>
</tr>
<tr>
<td>Construction Failure</td>
<td>Pearson Correlation</td>
<td>-0.70</td>
<td>-0.66</td>
<td>-0.59</td>
<td>-0.55</td>
<td>-0.39</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Significant)</td>
<td>0.87</td>
<td>0.70</td>
<td>0.66</td>
<td>0.59</td>
<td>0.39</td>
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<td></td>
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<td>0.84</td>
<td>0.54</td>
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<td>0.42</td>
<td>0.59</td>
<td></td>
</tr>
</tbody>
</table>

**CONCLUSION**

Based on the results and discussion above, it was found that the low quality of construction material is most common factors that lead building defects and failures. The sustainable construction gradually changes, based on the historical phenomenon of the building investigation findings. At least around the period 2003 until 2010, construction industry being manageable in term of regulation and innovation methods. From the study of five building projects investigation indicated that element of structure most rated cause the building failure or defects. The symptom of the building failures should be indicated from the contracts document and written document such as project’s direction book, progress report and visual performance of the building since occupied. Moreover, sustainable practices emerging from the motivation of the project organisation. Developing the sustainable practice as an attitudes process learning, starting from questioning what the benefit for and who involved the process.

For further research, the author point out 3 proposition to be crossed over the similar case studies.

- **Proposition 1:** the shorter implementation time has a negative correlation to the greater risk of projects failure
  
  There was a restrictive time that induce to many construction projects. In facts, any public building project started around August to September due to cashflow budget. Naturally, this term time acknowledge as the beginning of wet season particular in Indonesia. It is sense that some field works often delayed by the rainfall, then so many working hours were lost at the moment. The replacement of working hours by overtime works seems provide another excess of the worker productivity. This situation argued that the decline of productivity of the workforce is an early symptom of the building failure.

- **Proposition 2:** the duration of construction projects significantly correlate to the increasing risk of cost
  
  Some cases showed that contractors who request for an extension of time to accomplish the projects of implementation through the addendum, since they are not be able to complete the project that is being carried out on time according to the contract. The situation potentially allows the contractors to do the work that is left behind. But there are consequences associated with increasing time of implementation, where the costs, both direct and indirect will be increasing anyway.

- **Proposition 3:** unsignificant correlation between duration of the project by the type of contract
  
  The types of contracts generally do not affect the time of completion of the project. Most of the building failures have types of fixed price contract. This proves that the service provider is not able to understand and apply the process of the implementation of the construction will be carried out properly. This phenomenon is becoming worse as service providers in place the price bargaining is smaller or less than 70% of Owner price Estimation. Unstandardized contract emerge indirect effects and probably prolong to the dispute resolution.
From these propositions, the further research will looking at the other perspective from building practices in organisational context. Since defects arise on the building projects in local region, the problematic colouring by political issue against corruption on the ground. Although the procurement have been setting up properly, it is contradictory with supervision records on five building project which is focused in this study. Tendering project seems have a good arrangement, and supervision entail on the project life circle. The future challenge is capabilities to meet the projects successful, whether the building failure and defects could be identify on the projects more earlier. However, we are considering that building project divers in nature of works and the efforts to accommodate the heterogeneity in the Indonesian’s national culture on the context of project organisation. Strategy to respond the environment is needed to fuse together among the sustainable practices by the government, contractors, engineers and procurement system.

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REFERENCES


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Chair, CECAR 6

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Chair, Executive Committee ACECC

Hosted by: Co-Hosted by:
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