INFORMATION IN THE DESIGN PROCESS OF REFURBISHMENT PROJECTS

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ABSTRACT

Refurbishment projects had been implemented rigorously in developed countries such as in UK and Europe. Recently, significant numbers of ageing building in Malaysia had changed their function drastically due to limited space for new development. Therefore refurbishment work is an important addition to Malaysia construction industry.

Efficient and well coordinated design process is critical to refurbishment projects’ success. Lack of accurate and complete information during design stage often leads to architects producing designs which are inappropriate and require extensive changes during construction stage.

The main objective of this paper is to presents the method of obtaining information used by the architects in the design process of refurbishment projects and to show how the selected methods would affect performance of the design process.

Final questionnaire survey result from 229 architects in Malaysia agreed that refurbishment design is more difficult compared to new build design. In the survey also revealed that site survey is the most important method used by the architects for obtaining design information followed by client’s brief respectively. Association test shows that design team’s input and testing had correlated with percentage of completeness of design before work started on site for refurbishment projects.

INTRODUCTION

In a highly competitive construction market, designers need to respond efficiently in order to meet client requirements. Efficient management in design process is paramount to provide quality design within budgeted cost and to ensure project running smoothly. The management of design process is an important and difficult task. The way it is manage can affect the performance of the refurbishment projects.

For the purpose of this study, refurbishment refers to upgrade, major repairs work, renovations, alterations, conversions, extensions and modernization of existing building, but exclude routine maintenance and cleaning work (Quah, 1988). Refurbishment project is one of the most risky, complex and uncertain within the construction industry (Egbu, 1998, 1996; Rahmat, 1997; McKim et. al., 2000; Rayers and Mansfield, 2001). Even though the difficulties characteristic in managing refurbishment projects, it’s had grown rapidly in most developed countries. Malaysia has also shown the same trend. Substantial growth in refurbishment project required deep understanding and knowledge in managing refurbishment project. According to Quah (1988) and Young and Egbu (1996) the study of refurbishment relatively ignored and more focus had been given to research for new building.

This research studies on the methods used by the architects in obtaining design information for refurbishment projects and how its affects the performance of the design process.
INFORMATION IN DESIGN PROCESS OF REFURBISHMENT PROJECT

Information in design process is vital toward successful of refurbishment project. Performance of design much depends on quality of information available during schematic stage of the design process. A high proportion of design information in majority of refurbishment projects could only be obtained during the construction stage, (Rahmat et al., 1998). In most cases, the information needed for design is normally incomplete due to the uncertainty of the existing building. Hence, the decision made in a design depends vary much on the experience of the designer involved, (Daoud, 1997)

Many authors in construction management agreed that refurbishment project is generally different from new build project (Quah, 1992; Egbu, 1992, 1996, 1997; Rahmat, 1997). It had been identified that refurbishment project is the most difficult compared to new build project (Quah, 1988; Egbu, 1994) and the main characteristics of refurbishment work which are unique, high risk, full with uncertainty make it difficult to manage. (Hoffmann, 1978; Harrington, 1979; Koehen and Tower, 1978; Chapman, 1980; Hertz and Thomas, 1983; Teo, 1990; Flanagan and Norman, 1993; Boyd and Weaver, 1994; CIRIA, 1994; Boothroyd and Emmett, 1996; Rahmat et al, 1998; Brandon et al., 1999; McKim et. al., 2000; Rayers and Mansfield, 2001)

Availability of information during design process is vital. Baldwin, (1999) highlighted that more than 50% of the problems on building site were related to design problems. Performance of design works relies much to quantity and quality of design information. According to Sivado and Norton (1994), variety of problems may arise in design process due to inaccurate, incomplete and untimely information. Choo et al., (2004) in his research also confirmed that the success of design project depend on quality of available information. The criticality of design information happened due to the designer whom needs design input from each other as a basis for their design solutions between them (Lahdenpera and Tanhuanpaa, 2000). Observation made by Pietroforte, (1997) found that the design team gradually releases information (drawings) to construction team that is incomplete and tentative due to lack of availability data. Thus, management of design information is critical in order to minimize problems occurred during construction stage. These strongly indicate the importance of accurate information in the design process for successful of construction project. The situation becomes more complex due to relevant information does not come on time.

Study conducted by Egbu (1998), shows that less than 10 percent of the designs for construction refurbishment project were completed for more than 75 percent before project started compared to ship refurbishment, that about 32 percent. This finding was confirmed by Rahmat (1997) who found that only about 20 percent of refurbishment project in the UK started with more than 80 percent design being complete. The majority of refurbishment projects commenced with only 60 percent of design complete. The majority of refurbishment project a high proportion of design information could only be obtained during the construction stage. These show that most of the refurbishment projects commenced on site with high degree of uncertainty due to incomplete documentations.

In order to ensure the required data flow accordingly, management of information need to be efficient. According to Baldwin, (1999) the management of information exchange in design process is critical and design change or late supply information to construction team is costly. Baldwin added that the Information needs to be exchanged in effective and timely manner so that the designers can have maximum benefit from it.

Literature review also revealed that the importance of availability of design information affects quality of decision making made. Kam and Fischer, (2004) said that quality of decision making depends on its information basis. Decisions made at the early stage of design have major influence on overall project cost, Baldwin, (1999). According to Howard, (1996), decision is irrevocable allocation of resources where information, preference and choice are the parts of ‘Decision Basis’ which allow analysis and appraisal of alternatives decisions. Due to incomplete
information during design phase, more assumptions are made which allowed provisional and contingencies cost allocations (Rayers and Mansfield, 2001). This directly could result high number of variation during construction stage.

For refurbishment projects, request for design changes at the very late stage of the design process is not uncommon, (Gillear and Lee, 1998). In majority of refurbishment projects, the work commenced on site with design being incomplete due to complexity and uncertainty nature of refurbishment project. This situation may happened from lack of complete drawings to guide the designer and contractor (Boyd and Weaver, 1994; Egbu et. al., 1998)

The reviewed of literature revealed the importance of availability of information during design process. The degree of criticality increase for refurbishment projects due to the existence of element of uncertainty. One of the unique characteristic of refurbishment projects is dealing with the existing building. This is different compare to handling new build project. Problems arises in existing building are lack of clarity where most of the information is ‘hiding’ somewhere. As a result design issued by the designers is incomplete where much of the information is based on their ‘gut feeling’ Quah (1988). McKim et. al., (2000) in his studies revealed that the main factor contributed to cost overruns is unforeseen site condition, where concealed services such as piping and ductwork and inaccurate as built drawings are major element of unforeseen site condition.

RESEARCH METHODOLOGY

Postal questionnaire survey becomes the methodology of this study where 229 questionnaires were sending to the selected respondents. After 3 weeks the author manages to get 51 replied questionnaires that is approximately 22 percent response rate.

In order to get high response rate, the questionnaire was designed short and simple that not take long time for the respondent to answer. Respondents for this study are professional architects who are registered with Board of Architect Malaysia. Respondents were selected based on certain criteria sets by the author. According to Ahmad (2003), even though this method of data collection is most popular in Malaysia, chances to get good response rate very low. Due to the size of population, this method was used for data collection.

After filtration made of 51 questionnaires, 46 questionnaires found useful for analysis giving response rate approximately 20 percent. The rest of the replied questionnaires were rejected due to respondents did not follow instructions given. For data transformation purposes, the author had used Software Package of Social Science (SPSS) version 13.0 for analysis data. Descriptive methods of statistical such as frequencies tables and cross tabulation table were used for the purpose of data analysis and association test was employed to find out any correlation between method of obtaining information and performance of the refurbishment project.

To determine the important of method of obtaining information used, ‘relative importance index’, (RII) was employed. Five point scale used in the questionnaire was transformed to relative importance index to determine ranks of each variables. The relative importance index, (RII) was employed using the following equation: (Chan & Kumaraswamy, 1997)

\[
\text{Relative importance index, RII} = \frac{\sum w}{A \times N}, \quad (0 < \text{index} < 1)
\]

Where : 
- \( w \) = weighting given to each factor by respondents; (1 to 5)
- \( A \) = highest weight; 5
- \( N \) = Total number of respondents

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RESULT AND DISCUSSION

Table 4.1: Architects’ Job title

<table>
<thead>
<tr>
<th>Designation</th>
<th>Frequencies</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principle</td>
<td>30</td>
<td>73.2</td>
</tr>
<tr>
<td>Senior Architect</td>
<td>4</td>
<td>9.8</td>
</tr>
<tr>
<td>Architect</td>
<td>3</td>
<td>7.2</td>
</tr>
<tr>
<td>Others</td>
<td>4</td>
<td>9.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>41</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Table 4.2: Architects’ Experience

<table>
<thead>
<tr>
<th>Length of Experience</th>
<th>Frequencies</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 – 10 years</td>
<td>3</td>
<td>7.3</td>
</tr>
<tr>
<td>11 – 15 years</td>
<td>6</td>
<td>14.6</td>
</tr>
<tr>
<td>&gt; 15 years</td>
<td>32</td>
<td>78.1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>41</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Survey result revealed that almost 75 percent of the respondents are principal architects and almost 80 percent of them had more than 15 years experience in construction industries as shown in table 1 and 2. This data strongly indicate that the data collected from this survey are quality and reliable.

Table 4.3: RII Result Of Method Obtaining Information

<table>
<thead>
<tr>
<th>Method Obtaining Information</th>
<th>RII</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Survey</td>
<td>0.97</td>
<td>1</td>
</tr>
<tr>
<td>Client’s Brief</td>
<td>0.84</td>
<td>2</td>
</tr>
<tr>
<td>Contractor’s Input</td>
<td>0.77</td>
<td>3</td>
</tr>
<tr>
<td>Design Team’s Input</td>
<td>0.74</td>
<td>4</td>
</tr>
<tr>
<td>Archive Document</td>
<td>0.71</td>
<td>5</td>
</tr>
<tr>
<td>Destructive &amp; Non Destructive Testing</td>
<td>0.70</td>
<td>6</td>
</tr>
</tbody>
</table>

This result reconfirmed finding from previous authors of the importance of site survey to refurbishment projects. Site survey is important since it would determine actual scope of work that had ambiguity in documents. Study conducted by Andi and Minato (2004) and Mitropoulos and Howell, (2002) found that one of the method to minimized problem of unreliable information and no information by conducting site survey. Problems arise on site such as discrepancies of drawings that need to be solved urgently on site led the site survey to be performed. The importance of site survey needs the participants in the design process to be flexible and responsive. Condition assessment survey was carried out in order to get information and to confirm the existing building could adapted for the proposed new uses. (Aho et al., 1998). It has been identified that site survey may be the only source of information since the available documents do not necessarily confirm accurately actual condition of building (Daoud, 1997).

Daoud added that one of the advantage having this exercise is common problems could be avoided if more thorough survey was conducted of the damaged building at the initial design stage. Quah (1988) suggests that feasibility studies and refurbishment projects design should not commence without detail condition surveys of the existing building in order to avoid unnecessary error. The characteristic of refurbishment projects which is mainly site driven (Egibu, 1997) demand the condition survey exercise for better understanding of the existing building.

It is interesting to note that contractor’s input score fairly high, in fact higher than design’s team input. This reflects the importance of integrating site team with design team. Contractor’s input considered important as a source of information for refurbishment projects. It could be that experience by the contractor is needed in some aspect in design especially on the aspect of...
constructability for existing building. Mitropoulos and Tatum (2000) in their study pointed out that participation of vendor and contractor as partner for change information and joint decision making is important for successful of construction project. Involvement of them enables early identification of potential conflicts and prevents major scope changes. Post (2000) maintained the view that integration of general contractor and major sub-contractors during schematic or conceptual design can create more integrated design information.

However, it was found that destructive and non destructive tests are least important as a mean of information gathering during design process of refurbishment projects. This result contradicted with literature reviewed (Quah, 1988; Highfield, 2000) which argue that the uncertainty nature of refurbishment project required the usage of non-destructive diagnosis technique capable of reducing time and cost for the survey and at the same time increase the accuracy of the survey result. This scenario happened most probably refurbishment projects in this country are less uncertain where most of the decision could be made and confirm with site observation only. It could also be that no budget was allocated by the client for carry out any testing for a means to obtain information.

Archive documents such as reports, as build drawings and manual are not a preferable way for architect to use in information gathering for refurbishment projects. It could be the information from this source is unreliable and not up dated. Clancy (1995) and Daoud (1997) explained that refurbishment project with regard to uncertainty is intensified, where available documents are not reliable and up to date. With limitation amount of information available, more assumptions need to be made at the early stage of the refurbishment project especially during the design phase. Changes that lead to time and cost overrun occurred during construction stage when the contractor had used drawings and specifications that come from unreliable sources.

Result in table 4.3 shows that design team’s input is ranked number 4 in the RII for method of obtaining design information. The result shows that most of the architects preferred to not rely much to the other consultants in refurbishment projects. It could be due to portion of engineering and specialist design is small and least complex in majority of refurbishment projects in this country that makes the architects trust on their effort in obtaining design information of refurbishment projects.

Client’s brief is ranked number 2 in RII analysis that considered important as a method of obtaining information during design process. This finding reconfirmed statement by Boyle (2003) who said that briefing is one of the factors that contributed to successful of design. Refurbishment projects dealing with existing building and required much information from the client who is more knowledgeable compare with others. Poor briefing by the client need to be avoided due to it is identified as a major factor interfere the production of competent design and information for construction. (Nicholson and Naamani, 1992)

The author has carried out association test for methods of obtaining information with performance of refurbishment projects. Three variables has been list down under category of performance that is time variance, cost variance and percentage of completeness of design before work started on site. Since the data use for the test is ordinal data, Spearman rank correlation coefficient was employed in the test with null hypothesis will be rejected at 5% significant level. Before that, reliability test was carried out to check weather the data collected is reliable for data transformation. Result for Cronbach Alpha test give the answer of 0.751 which mean that the data collected is reliable and free from random error due to the reading is more than 0.70 (Nunnaly,1978)

Result in table 4.4 shows that 2 variables that are ‘design team’s input’ and ‘destructive & non destructive test’ have positive correlated with percentage of completeness of design before work started on site at the 5% significant level. This explained that the higher design team’s input and testing carried out to get design information the higher percentage of completeness of design before work started on site for refurbishment projects. There is no association for method of
obtaining information with cost and time variances for refurbishment projects. This result contradicted with RII result above where site survey and client brief are the most important methods in obtaining design information.

Table 4.4: Spearman’s Correlation Matrix Between Performance Of Design Process And Method Of Obtaining Information

<table>
<thead>
<tr>
<th>Method Obtaining Information</th>
<th>Cost variance</th>
<th>Time variance</th>
<th>% completeness of design before work started on site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archive Document</td>
<td>.101</td>
<td>.019</td>
<td>.105</td>
</tr>
<tr>
<td>Site Inspection</td>
<td>-.038</td>
<td>-.038</td>
<td>.058</td>
</tr>
<tr>
<td>Client’s Brief</td>
<td>-.175</td>
<td>-.175</td>
<td>-.175</td>
</tr>
<tr>
<td>Design Team’s Input</td>
<td>-.247</td>
<td>.435</td>
<td>.435*</td>
</tr>
<tr>
<td>Contractor’s Input</td>
<td>.270</td>
<td>-.075</td>
<td>.285</td>
</tr>
<tr>
<td>Destructive &amp; Non Destructive Testing</td>
<td>.070</td>
<td>-.170</td>
<td>.339*</td>
</tr>
</tbody>
</table>

* Correlation is significant at the 0.05 level

CONCLUSION

Literature reviews show the importance of information in design process of refurbishment projects. Nevertheless, it has been hindrance by limitation of availability of information due to uncertainty nature of refurbishment projects. Analysis result using relative importance index (RII) approach revealed that site survey and client brief are the most important methods used by the architects whereas testing is the least important among the methods of obtaining design information in refurbishment projects. However, result of association test shows the design team’s input and testing had positive correlated with performance of design process that is percentage of completeness of design before work started on site.

REFERENCES


Construction Industry Research and Association (1994), A guide to management of building refurbishment, CIRIA report no 133, Construction Industry Research and Association, UK


Egbu, C. O., Barbara A. Young and Victor B. Torrance, (1996), Refurbishment management practices in shipping and construction industries- lesson to be learned, Building research and information Vol. 24, No. 6, 329-338


Egbu, C. O., (1994), Management education and training for refurbishment work within the construction industry, PhD thesis Department of Civil Engineering, University of Salford

Galbraith, J. R., (1977) Organization design, Addison-Wesley, Reading M.A.


Manavazhi M.R. (2004), Assessment of propensity for revisions in design projects through the dichotomous characterization of designer effort, Journal of Construction Management and Economics 22, 47-54


Naoum, S. and Mustapha, F.H., (1994), Influences of the client, designer and procurement method on project performance, Proceeding of CIB-92 Procurement System Symposium, 4-7 December, University of Hong Kong, 221-8


Rahmat, I. Torrance, V.B. and Ezanee, A. H., (2003), Refurbishment cycles and the management of refurbishment projects, UiTM Research Centre, Shah Alam, Selangor, Malaysia


Young, B.A. Torrance, V.B. Egbu, C.O., (1996), Management in refurbishment works in the construction and shipping industry, Project reference CMR 236, The Bartlett Faculty of Built Environment, University College London, UK