

The designer in refurbishment projects: Implications in the compatibility of design

Abstract

Purpose - In refurbishment design, the individual designer is the one who ultimately determines the quality and performance of a project, but not his or her organization. Hence, various specific attributes are essential in the designers undertaking refurbishment projects. This directly influences the refurbishment project performance. The aims of this paper are to identify the important designer's attributes of refurbishment works and to develop prediction models for designer selection.

Design/methodology/approach - The study started with the identification of an important designer's attributes through literature review followed by a questionnaire survey. A set of questionnaires was distributed to 100 selected designers who handled refurbishment projects in Malaysia.

Findings - In conclusion, the study identified six key designer's attributes in refurbishment projects. The associative test shows that to improve a refurbishment project performance, the designers need to have knowledge, enthusiasm, commitment and coordination skills. From the initial result, two prediction models were produced for the compatibility of design to an existing site.

Originality/value - By identifying the important designer's attributes, this article contributes a reference about the basic requirements that a designer should have in refurbishment projects.

Key words: Refurbishment; Designer's Attribute; Malaysia.

Introduction

Designers play an important role in achieving superior design constructability and in producing good quality design. This relies mostly on the experience and knowledge of the designer, which could potentially reduce the amount of design information needed (Schaub & Franfenberger, 1999). Some of the documents used by the designers in refurbishment design are not reliable because they are often not updated, nor linked to the site conditions. Hence, the personal attributes of designers are of considerable important in the refurbishment projects. Since refurbishment projects are unique and uncertain, it is vital to investigate what are the important attributes that designers need to have in handling refurbishment designs. Individual designers have different ways of approaching design work, as this may affect the outcome of refurbishment projects. In Ling's (2002) view, the outcome of the design relies on the ability of the architects involved.

By identifying the important designers' attributes, greater recognition of the key characteristics of the designers is obtained. This assists clients in an understanding of the degree of risk and uncertainty that must be mitigated in the future. In literature reviews, there is no empirical study of designers' attributes that affect the performance of refurbishment projects. Therefore, the main objective of this paper is to identify the dominant designers' attributes and to show their relationship to the refurbishment project performance.

The Attributes of Designers

The attributes of designers in a refurbishment project could influence the performance of the project. For example, the World Bank Guideline (1997) pointed out that an individual designer is the person who ultimately determines the quality of performance of a project, not his or her organization. Ling (2003) listed the important attributes of designers as below.

Job Experience

Young et al. (1996) mentioned that job experience is measured in terms of length of experience in the construction industry, length of time in refurbishment sectors, number of similar type of projects and age of refurbishment personnel. Their study found that the majority of personnel involved in refurbishment projects were experienced. Furthermore, Ling (2003) noted that job experience is used in evaluating performance of the designers. In the study, job experience of the

designers was measured by the adequate number of years of practice in the construction industry and the designers experience with similar types of projects. Gray and Hughes (1994), Kincaid (2003) maintained that selection of designers should be based on experience of designing similar projects. This would help the designers to provide creative solutions in solving the design problems.

In addition, job experience is vital in refurbishment projects. This is different from new-build projects because designs are based on existing conditions of a building. Egbu (1997) emphasized that unlike new-built work that is primarily client-driven; refurbishment work is mainly site-driven, which requires site management to make most of the vital decisions. Meanwhile, Friedman and Oppenheimer (1998) maintained that most designers learn renovation design techniques on the job and not in school. On the job, might be seen as collecting tricks rather than consolidation of basic ideas. Furthermore, the experienced designers have a good relationship with well reputed refurbishment specialists, so that they can work together to improve the project performance (Kangwa et al., 2010). Thus, experience is an important determinant of the success of refurbishment projects.

Design Knowledge

Ling (2003) and Lee et al. (2003) highlighted the importance of design knowledge among the designers who provide services to clients, since it is believed that the designers could bring the knowledge of acceptable practices and customs. Knowledge on such matters as material specifications, legislation, constructability in design and contract management are found to be important for designers in the design process. The view was supported by Spiegelman (1989) and Graves (1993) who mentioned that one of the factors in selecting the right designers is their qualification and their knowledge of the codes and special expertise in their area. Furthermore, Cooper and Press (1995) highlighted the need for having design knowledge and education. This could encourage significantly more inspiration, experimentation with ideas, solutions to design and construction problems and concern with creative thinking, which could lead to significant design resolutions. Meanwhile, Boyle (2003) emphasized that the nature of design requires the design personnel to have sufficient design knowledge, education and creativity in their work. Then, Kangwa et al. (2010) demonstrated that knowledge on the condition of a building and techniques to be used in a refurbishment project closely influences the project outcome. Ali (2010) further explained that it is important to obtain design information by conducting a site condition survey during the design process. Without

proper knowledge, it is difficult for the designers to mitigate errors in their design propositions.

Many design errors occur due to lack of design skill and knowledge on the part of the designers. Josephson and Hammarlund (1996) said that poor design knowledge of the designers is a factor contributing to the need to rework and design changes. Furthermore, Rounce (1998) and Curtis et al. (1998) noted some causes of design fault, such as misinterpretation of the client's needs, poor communication between designers, using incorrect or out-of-date information, producing inadequate specifications and misinterpretation of the design standards are due to lack of knowledge. Designers with poor knowledge would tend to put more assumptions in the design. This influences the amount of the provisional sum allocated in the contract. Okoroh and Torrance (1999) proved that estimators (an important part of a design team) often make decisions based on incomplete and imprecise information during the tender preparation. This increases the risk and uncertainty in refurbishment projects.

Enthusiasm in Design Works

Scotter and Motowildlo (1996), Ling (2002), who conducted studies concerning the degree of enthusiasm, found that a high level of enthusiasm in tackling a difficult assignment is likely to produce better individual performances. Therefore, this could improve refurbishment design performance.

The designers should have a sense of enthusiasm when performing their work. Ling (2003) cited the importance of having enthusiastic architects, so that they will be more likely to put in sufficient effort into their work, pay attention to important aspects of the design, tackle a difficult assignment thoroughly and ensure that the constructed work is in line with the approved specification. The study also revealed that level of enthusiasm is one of three important attributes used in a model predicting the performance of architects and engineers.

Commitment Given To the Project

Ling (2003) pointed out that committed architects would perform better and could fulfill the client needs. The researcher further explained that committed designers are found to be loyal to their client. They revise their design as requested to achieve project objectives and because they are interested in their job assignment. CABE (2003) maintained the importance of commitment and participation of the designers

in projects by emphasizing that job commitment is equally important to decision-making, which needs to be made in a timely manner. Thamhain (2004) discovered that commitment is a significant driver to a high project performance. Committed personnel would make an effort to ensure the project is completed within the approved budgeted cost.

Initiative to Improve Design

Ling (2003) found that initiative by the designers is regarded as an important criterion in decision making for the selection of a designer. It is important to have a designer who is willing to give suggestions for the improvement of the design. To produce a good design, the designers are responsible to provide necessary advice to the client, since the clients have a relatively limited understanding or experience in handling a construction project (Wallace, 1987).

Coordination Skill of the Designers

Hill (1983) discovered that the most important role of the design team leaders is the management of the uncertainty of a project. One of the design team leader's tasks in projects is to coordinate design tasks (Tatum, 1987; Chiu, 2002). According to Rahmat and Ali (2010), most of the tasks of the key participants are interdependent to each other in a refurbishment project. The weakness of the leader in the project team would cause an uncontrolled situation and the leader's role could be taken over by another design team personnel. The leader should be able to control the situation. Hence, the designers as design team leaders are involved in coordination, preparation and control of design to achieve the project objectives.

Ling (2003) included the factor, of coordination skill for designers, in the conceptual model for the selection of a designer as design team leader by a project manager in Singapore. In this study, the measurement of the coordination level of a designer by using the ability to lead and coordinate the contractor and other consultants in a project. This is because coordination is one of the important tasks that need to be performed by a designer. The view was supported by Hegazy et al. (2001) and Crawshaw (1979) who mentioned the importance of coordination in construction projects. The study found that a lack of coordination among building designers and inadequacies of design change management are serious problems in the construction industry. The design process of refurbishment projects cannot run smoothly without a skilled coordinator.

Research Methodology

The main research method involved the distribution of questionnaires and engaging in interviews with building occupants. Data collection and analysis were carried out by quantitative techniques. A total of 100 questionnaires were distributed, mainly to architects involved in refurbishment projects. From those questionnaires distributed, 81 were found to be valid enough to form a database for data analysis. The collected data was analyzed using the Statistical Package for Social Science (SPSS) computer software. Descriptive and inferential statistics such as frequency tables and associative tests were used to analyze the data.

The mean scores computed from the descriptive statistics of SPSS were used to formulate the ranking of designers' attributes. Basically, the mean is used to describe the average score or central tendency of variables. The formula of mean is derived as below:

$$\text{Mean} = \Sigma X / N$$

Where, ΣX = sum of the X scores; N = total number of scores

Then, a correlation test was used to measure the relationship between designers' attributes and performance. In this study, the Spearman rank-order correlation was employed for analysis. Generally, a correlation of -1.00 or +1.00 is a perfect negative or positive relationship respectively. A correlation of zero means that no linear relationship exists. The correlation test calculated using the following formula:

$$1 - \left(\frac{6\Sigma d^2}{n(n^2 - 1)} \right)$$

The findings of relationships between designers' attributes and performance were referred to provide information for the prediction of design performance. The prediction of the value of a dependent variable from the value of an independent variable is called regression. In this study, there was more than 1 significant independent variable identified. Thus, multiple regression was used as it is a method of analyzing collective and separate contributions of two or more independent variables to the variation of a dependent variable. The multiple linear regression is formulated as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + \varepsilon$$

Where,

Y is dependent variable (Y = compatibility of design to existing site)

X_1, X_2, \dots, X_k are independent variables (X_1 = knowledge on assessing the condition of a building; X_2 = enthusiasm in refurbishment design work; X_3 = coordination skill)

$Y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \dots + \beta_kX_k$ is the deterministic portions of the model

B_i determines the contribution of the independent variable X_i

ϵ is random error

Data Analysis and Discussion

Six characteristics for designers were found to be dominant in the literature review.

The results of the questionnaire survey were discussed in-depth.

Refurbishment Job Experience

In the present study, the designers' job experience was measured by the number of refurbishment projects handled.

The results showed that about 80 percent of the respondents in the survey had experience in handling at least 5 refurbishment projects, with a mode of more than 15 projects. Experience of refurbishment projects had been accumulated over a number of projects handled previously. This implied that the architects who took part in the survey had sufficient experience before handling the selected refurbishment projects. The results indicated that a majority of the architects who were involved in the refurbishment projects had appropriate experience in handling such projects. The findings reconfirmed the position of Gray and Hughes (1994) and Ling (2003) who pointed out the importance of having experience in design works before designers could handle any projects independently.

Refurbishment Job Knowledge

The second attribute investigated was the job knowledge of the architects. For that purpose, the respondents were asked two questions. The questions were the record of formal training attended measured on a dichotomous 'yes' or 'no' scale and a question on the architects' knowledge of assessing the condition of a building, which was measured using a five-point scale. Formal training referred to training that was conducted by the authorized training bodies such as CIDB, CIOB, ISM, universities and colleges.

The result indicated that the majority of the respondents had not attended any formal training concerning refurbishment projects. 18.5 percent claimed that they had attended formal training. The training primarily came from a post-graduate program. This shows that the majority of designers who were involved in refurbishment projects had minimum formal knowledge about such projects. The result obtained contrasts with the statement of Ling (2003) and Lee et al. (2003) who stated that job knowledge is important in design works. The results suggested that the designers believed that the knowledge of refurbishment projects is more appropriately gained through on-the-job training rather than formal training. Secondly, it could be that few opportunities were available to attend courses conducted on refurbishment, since more emphasis is given to new-built projects. As a result, most of them had used their knowledge about new-build projects to obtain experience on refurbishment projects. However, the designers could be mistaken in thinking that the approach in managing refurbishment is the same as managing new-built projects. It was generally agreed that refurbishment projects differ in many significant ways compared with new built projects (Quah, 1988; Egbu, 1997; Daoud, 1997). Every refurbishment projects is different in the way its problems and difficulties are processed. The failure to differentiate between these two types of projects could end up with a lack in clarity in the approach used, which could influence the performance of refurbishment projects.

In addition, the majority of designers claimed that they had a high or very high level of knowledge (55.6 percent) in assessing the condition of a building before starting the selected refurbishment project. This supported statements of Daoud (1997), Friedman and Oppenheimer (1998) who suggested that designers need to have appropriate skills and knowledge before refurbishments can be carried out, since the work is unique in many significant ways. A possible implication of the result was that the syllabi of courses in institutions of higher education may need to be revised in order to fulfill the market's needs. A survey on the market's need pertaining to job knowledge for refurbishment projects is required so that the training could be most beneficial to the designers.

Enthusiasm in Design Work

The designers were asked to rate their enthusiasm in refurbishment design work using a five point scale from very low to very high enthusiasm.

The result indicated that about 65 percent of the respondents rated themselves as having high and very high enthusiasm, while the mode recorded very high

enthusiasm regarding refurbishment design works. Almost 10 percent rated low and very low enthusiasm for this type of project. This indicated that some of the designers were not enthusiastic about design work for refurbishment projects, and the lack of enthusiasm may be due to several reasons.

Firstly, refurbishment projects are more challenging, especially when dealing with historical buildings. In such projects, the availability of design information is limited due to in absence of an “as-built” document. Furthermore, in some projects, the designers face problems in matching up the old and new materials because many materials are no longer in production. This contributes to a complexity and uncertainty in refurbishment projects. Secondly, the fragmented nature of refurbishment projects requires more of an integrated and flexible approach (Rahmat, 1997). This needs the architects to allow more time for coordination with many parties, even though the quantity of work may be small. The small size of projects reflects the small amount of fees received by the architects in refurbishment projects. Although the percentage of the fees paid from the total contract value is higher, the amount is still considered by many to be unattractive.

Commitment to the Refurbishment Project

In the study, the commitment of the designers was measured by obtaining data on the average response time taken by the designers to take action on the client’s instruction in a project. The question was asked using a five-point scale.

For the question about response time taken by the designers, about 30 percent of the respondents claimed that the response time was ‘long’ and ‘very long’. According to Ling (2003), committed designers should respond faster when the client instructs them. The statement implied a lack of commitment on the part of the architects who were handling refurbishment projects. The results might assume that majority of designers had many jobs in hand, so they had to segregate the working time based on the priority or the size of the projects. The designers tended to allocate more time to larger projects that could give more income to them. If the size of the refurbishment project handled is small, probably less time would be allocated.

Initiative to Improve Design

Initiative taken by the designers was measured using suggestions made to improve the client’s brief as implemented by Ling (2003). The result obtained from a five-point scale.

The result showed that 75.3 percent of the respondents claimed that they had high amount of initiative to improve on the client's brief. The mode and median for the finding recorded 'high'. This indicated that the majority of designers had performed their job as thoroughly as possible to achieve a design that complied with the regulations. However, it was noted that, many architects would not admit that they had low initiative. The possibility of bias in this case, could not be discounted.

The results implied that it is important for designers' to show initiative in convincing the clients regarding the various aspects of design. This is to ensure that decisions made would not influence the project outcome. The client often has limited understanding, knowledge and experience in handling construction projects (Wallace, 1987). Thus, it becomes the designers' obligation to demonstrate their initiative to improve the situation.

Coordination Skill

The degree of coordination with key design participants was measured on a five-point scale, as suggested by Ling (2003).

The result show that about 70 percent of the respondents claimed that they had a high degree of coordination in the design process. It indicated that the designers showed some coordination skill in handling the design team. The results supported arguments by Cheung et al. (2001), Ling (2003) and Thamhain (2004) who emphasized the importance of coordination skills in the design process and Hill (1983) on the designers' role in the management of uncertainty in a project.

The results implied that considerable teamwork occurred among the design team's members. Valkenburg (1998) highlighted the advantage of having teamwork in any interdisciplinary design work and that a high quality of leadership is critically needed to achieve that. Probably, the designers realized that refurbishment projects need more communication among the key design participants. The management of uncertainty becomes an important consideration in all refurbishment projects. The contractual and pricing considerations for refurbishment projects are more difficult compared to those applicable for new-built projects. The design team's leader must make an effort to identify potential risks and to make preparations in the early stages of projects. It is essential that various programs be properly coordinated, with some

kind of workshop, for design review exercise and all key participants implementing the change in management.

Ranking of Designers' Attributes

The data collected was computed from the descriptive statistics of SPSS for ranking analysis of designers' attributes and the results are shown in Table 1. According to the results of the ranking analysis, it was identified that the majority of the designers did have good coordination skills, initiative and enthusiasm to perform their responsibilities during the design process of the refurbishment project.

Table 1: Ranking Analysis of Designers' Attributes

Rank	Designers' Attributes	Mean (N=81)	Standard Deviation
1	Coordination skill	4.07	1.010
2	Initiative to improve design	4.01	0.829
3	Enthusiasm in design work	3.94	1.076
4	Commitment to the project	3.25	1.337
5	Job Experience	2.75	1.199
6	Job Knowledge	1.19	0.391

However, the designers were lacking of in knowledge and experience in the design of refurbishment projects. Unlike the UK, Malaysia is a developing country and most of the projects are new construction projects. Refurbishment projects were introduced to the locals recently. Thus, the designers were more knowledgeable and experienced in new construction projects rather than in refurbishment projects.

The Effect of Designer's Attributes to Design Performance

Five significant correlations were detected between designers' attributes and refurbishment project performance as shown in Table 2. They were:

- knowledge through formal training could not reduce the amount of the provisional sum?
- knowledge in the building condition survey could improve design compatibility at the existing site
- the designers enthusiasm improves the design compatibility to site
- committed architects response faster to design changes
- designers coordination skill reduces the occurrence of design changes

Table 2: The Correlation Matrix between Coordination Devices and Design Performance

	Changes of design during the construction stage	Provisional Sum to Contract Value	Compatibility of design to existing site
Designers' Attributes			
1) Job Experience	.021	.132	.014
2) Job Knowledge			
- Formal training	.208	.278*	-.172
- Assess bldg.	-.141	.211	-.299**
3) Enthusiasm	-.024	-.037	-.381**
4) Commitment			
- Response time	-.338**	-.055	-.117
5) Initiative	.037	.040	-.026
6) Coordination Skill	-.064	.028	-.328**

* Correlation at 5% significance level

** Correlation at 1% significance level

It is important that designers have knowledge and understanding about the existing building conditions. This helps them to produce an accurate design by having a better understanding of the building systems, materials and method of construction used. The significant correlation supported the findings of Andi and Minato (2003), which highlighted the need for having design knowledge that could significantly contribute towards the design solution and minimize discrepancies in the design outcome. The result implied that designers may need to attend training in building assessments. Knowledge in this area can help designers achieve high accuracy in the design for refurbishment projects. Alternatively, the designers could also use qualified building surveyor services to ensure that the building condition report is complete with all the required information.

Time spent by the designers significantly correlated with the compatibility of design and existing sites. Thus it is expected that more time spent in the preparation of the design would enable more site information that can be obtained and therefore the higher the compatibility of design to the existing site can be achieved. The results support Ling (2003) and CABE (2003) on the need to spend design time to complete design work. A significant correlation was detected between designers' commitment and faster response time to reduce changes during the construction stage. The designers responded quickly to any instructions given by the client or to update the design when new information was discovered from the site. Hence, changes in design during the construction stage could be avoided.

The result implied that designers need to increase their effort in design preparation

during the pre-bid period. Even though refurbishment designs are sensitive to changes, more time needs to be allocated to collect design information, coordinate among the design team members and respond faster by updating the design with any new information discovered. This requires the designers to commit more resources and effort to the projects. Moreover, design needs to be as complete as possible before the work starts on sites in which refurbishment projects that adopt traditional procurement methods. Otherwise, many changes during the construction will lead to cost variations. Many clients would not be happy when this happens.

The coordination skill of the designer refers to their ability to coordinate with other key design participants in the design process. Coordination helps to increase efficiency of the flow and exchange of design information among the key participants. It is expected that coordination skills could improve the completeness of the refurbishment design. An efficient flow of design information is achieved by greater coordination of key participants in the design process. The results support Hegazy (2001) and Ling (2003) who referred to the importance of coordination in project performance. The higher coordination achieved by interfacing and cross checking of designs among the interdisciplinary design team helps designers to obtain accurate information and produce highly compatible design in refurbishment projects.

The results imply that coordination skill is important for designers to enhance integration among the key participants. The designers who demonstrate a high level of coordination skill acted as an integrator who could assist the other designers in performing their work. Secondly, good coordination skills among the designers help to induce team spirit in a design team. Teamwork can contribute to more effective results. Greater teamwork in design could influence the compatibility of design. The design produced would not only be completed but also be accurate and compatible with the existing building. Thirdly, designers with good coordination skills are more likely to be able to foresee potential design problems in refurbishment projects. The designers would be able to closely monitor the progress of design work, identify potential risks and carefully interface the interdisciplinary designs with the condition of the existing building to ensure that the design produced is free from error during the construction stage.

Multiple Regression

Among the three aspects of design performance, compatibility of design to existing site was more suitable in showing the relationship between design performance and

designers' attributes. Thus, the "compatibility of design to existing site" (CD) was selected to be the dependent variable for a multiple regression model. Meanwhile, the independent variables were those significant including "knowledge on assessing the condition of a building" (AC), "enthusiasm in refurbishment design work" (ED), and "coordination skill" (CS). The regression model for the research was produced as follows:

Model 1(Enter Method)

$$CD = 4.262 - 0.148 AC - 0.141 ED - 0.199 CS$$

Coefficient of multiple regression, $R^2 = 0.172$ (17.2%)

However, the analysis results determined that the predictors were not significant with p-value of more than 0.05. So, another regression model to eliminate the non-significant predictors was produced as follows:

Model 2 (Stepwise Method)

$$CD = 3.630 - 0.309 CS$$

Coefficient of multiple regression, $R^2 = 0.120$ (12.0%)

In order to ensure that the regression models were not violated, the validity of the regression model was checked. Data tabulated in Table 3 and Table 4 had proven that there was no problem of multicollinearity. Whereby, the tolerance value should not be less than 0.1 and variance inflation factor, VIF should not be greater than 10.

Table 3: Checking assumption of Model 1 (Enter Method)

Variable	Collinearity Tolerance (> 0.100)	VIF (< 10.000)
Knowledge on assessing the condition of a building	0.900	1.111
Enthusiasm in refurbishment design work	0.662	1.510
Coordination skill	0.701	1.426

Table 4: Checking assumption of Model 2 (Stepwise Method)

Variable	Collinearity Tolerance (> 0.100)	VIF (< 10.000)
Coordination skill	1.000	1.000

Conclusion

The refurbishment design process is one of the most challenging tasks faced by the designers. Refurbishment design is restricted by the existing condition of the building, which makes the task more complex and tedious. From a review of literature, six

designers' attributes were found dominant and important in managing the refurbishment projects. Of those attributers, four were found to be significantly correlated with the refurbishment project performance. They were designer's knowledge, commitment, enthusiasm and coordination skill. The identification of important designers' attributes in the design process of refurbishment projects should be able to help clients and designers to formulate strategies in their design process. Furthermore, there were two prediction models generated using SPSS. The independent variables of Model 1 were not significant predictors. Thus, another model was produced by using the Stepwise method. As a result, only one independent variable was selected by SPSS in Model 2, which was more significant compared to Model 1. This article opens a research opportunity for the researchers to further study the types of knowledge required by designers in refurbishment projects, as well as the effective approaches to coordinate the project team.

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