

INTEGRATIVE MECHANISMS IN THE DESIGN PROCESS OF REFURBISHMENT PROJECTS

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ABSTRACT

Refurbishment is one of the most important sectors in the construction industry of most developed countries. In Malaysia, increasing number of ageing building, limited space for new development and financial constraints are the main factors that contributed to the importance of refurbishment sector. Efficient and well coordinated design process is critical to the refurbishment projects' success. Difficulty in obtaining accurate and complete information during design stage often leads to architects producing designs that are inappropriate and require extensive changes during construction stage. The main objectives of this paper are to identify the integrative mechanisms used to coordinate and improve the performance of the design process of refurbishment projects. A postal questionnaire survey was distributed to registered architects in Malaysia. The results from 349 completed questionnaires formed the database for the quantitative analysis. This study concludes that the design process of refurbishment projects is more difficult to manage compared to new build projects. This study also found that direct formal contact, scheduled meeting and the involvement of the key participants in the design process are very important integrative mechanisms in refurbishment projects.

Key Words: Refurbishment, Design Process, integrative mechanisms.

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.

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 UK for the last 30 years and the trend is now spreading over to this country. Unpublished data by Malaysian CIDB shows that refurbishment and maintenance works increased to about 7% of total the construction output in the year 2004 compared to 2% in the year 2002. Substantial growth in refurbishment projects requires deep understanding and knowledge in managing refurbishment projects.

One of the major problems identified in design of refurbishment projects is limited information available due to uncertain condition of existing building. As a result, designers will not be able to complete the design before work commence on site. The development of design for refurbishment most likely depends on designer's endeavours to gather information from exiting building, (CIRIA, 1994). Designers understanding on structural system of the building, history and how the building will be used in the future are the important aspect that needs to be emphasized during collection of information.

Research Methodology

This research designed with quantitative approached and postal questionnaires survey has been employed for data collection method. In order to get high response rate, the questionnaire was designed short and simple that did not take long time for the respondent to answer. Respondents

for this study consisted of professional architects who are registered with Board of Architect Malaysia. Recent list shows that there are 1648 architects registered with the board. After excluding architect who are abroad, a questionnaire was send to the final list of 1552 architects. The profile of the respondents are shown in table 2.0

Table 1.0: Architects' Job title

Position	Number of respondents (N=349)	Percentage
Principal	272	77.9
Senior Architect	40	11.5
Architect	18	5.2
Others	19	5.4

After filtration made of 392 replied questionnaires, 349 questionnaires were found useful for analysis that giving response rate approximately 24 percent. Almost four-fifth of the respondents were principal architects as shown in Table 1.0. It was also found that nearly ninety-five percent of them had more that 10 years experience in construction industries. Descriptive statistics such as frequencies and cross tabulation tables are used for data presentation.

The integrative mechanisms

Literature review revealed that integration in design and control process affects refurbishment's design performance. Howard et al, (1989) mentioned that the fragmented nature of the construction industry creates increased demand for coordination and integration of project

participants. In if more so for the design process of refurbishment projects which tend to be complex and uncertain.

This study asked the architects whether they agree or disagree that the design process of refurbishment projects is more difficult to manage than new build. The result is shown in table 2.0.

Table 2.0: Refurbishment design more likely to change

Status	No of respondents (N=346)	Percentage
Disagreed	82	23.7
Agreed	264	76.7

Table 2.0 shows that more than three quarter of the architects agreed that the design process of refurbishment projects in more difficult to manage than new build. Many management writers argued that refurbishment projects require integration of the key participants. This result generally support the literature review that one of the major problems in the design process of refurbishment projects is the frequent changes of design due to the lack of design information before work commence on site.

Itami (1987) characterizes integration as an ‘invisible asset’ and essential for competitiveness as the more visible corporate resources. The important of integration in handling uncertainty projects also mentioned by other researchers such as Puddicombe, (1997) who said that integration is seen as having a significant potential for improving the performance of the highly fragmented member of the industry. Integration is important in handling differentiation and fragmentation nature of activities. Refurbishment’s design is identified as complex activities that required greater integration in the process. Thus, it is believed that the use of integrative mechanisms could be able to minimize the risk of refurbishment design projects. From the literature review, the integrative mechanisms used in refurbishment projects could be categorized as follows:

- Coordination Devices i.e., scheduled and unscheduled meetings, direct formal contact, informal contact, procedures and ICT.
- Involvement of Design Key Participations

Coordination Devices

Coordination in design process is important factors especially in improving refurbishment’s design information gathering. The important optimal design performance and hence design productivity is the effective coordination in design process. Lack of coordination among building designers and inadequacy of design change management are identified significance problems in construction industry (Hegazy et al.,2001)

Complete design information are crucial and important to refurbishment’s design team for them to produce complete and accurate drawings. Problem occurred is design information in refurbishment projects are scattered and came from various sources. Therefore it needs to have

proper system and mechanisms to ensure all required information flows accordingly. McGeorge, (1998) found that coordinating the collection processing, storage and transmission of information is essential for effective design. The collaboration in architectural design can proceed effectively through structured collaboration for sharing design information, (Chiu, 2002).

Coordination in design process might be seen as an activity to coordinate design activities itself due to its own nature of uncertainty. Uncertainty in design involves the coordination of multidisciplinary professions, activities and information which continuously change during design process. Before multidisciplinary design task can be effectively organized and coordinated there is a need to integrate data of the design projects in order to make effective use of data available.

Tushman and Nadler, (1978) pointed out that as work related uncertainty had increases, it needs more amount of information and processing capacity. While Galbraith, (1973) maintained support the view says that greater task uncertainty greater amount of information that must be process in order to achieved acceptable performance level. Where nature of work is highly certain, most probably less amount of information is sufficient to perform a task. In project,

design team is required to communicate regularly with team's members for sharing and exchange related design information. New information are critical to the especially when it involve decision making process in design. Thus, the utilization of coordination devices such as lateral relations, information technology in design and standardize design process procedure are considering important to improve process of design.

Table 3.0: Integrative Mechanisms Variables Ranking by Mean

Integrative Mechanisms	Mean, N=349	Ranking
Scheduled Meeting	3.48	1
Direct Formal Contact	3.29	2
Direct Informal Contact	2.95	3
Standard Procedure	2.90	4
Information Technology (IT)	2.74	5
Unscheduled Meeting	2.65	6

Galbraith (1977) said that meetings are important coordination devices highly uncertain environments. Guevara (1979) found that meeting, plan and coordination between departments are the most important measures in improving communication among participants. Generally, there are two type of meeting in construction project namely regular scheduled meetings and unscheduled meetings (Laufer et al, 1993)

Meeting functions are to coordinate and as a mean of conveying information about current progress work and recent design changes. Meeting in design process help to interface design from one discipline with those of another disciplines where it would be able to minimize error during construction stage, (Perry and Sanderson, 1998).

This study asks the respondents how important are the following coordination devices used for obtaining design information in refurbishment projects using scale 1, least important and 4, very important. The results are shown in table 3.0.

Table 3.0 shows that scheduled meetings are the most important mechanism for obtaining information during design process of refurbishment projects. Whereas the unscheduled meeting is the least important among all coordination devices.

The unscheduled meeting is held if there is an urgent need to solve current issues related with design. This type of meeting normally takes over from scheduled meetings for design projects when work has commenced on site. Problems arise on site such as discrepancies of drawings that need to be solved urgently on site led the unscheduled meeting to be performed. The importance of unscheduled meeting needs the participants in the design process to be flexible and responsive. This implies that allocation time and overhead cost for refurbishment design work will increase if there are many unscheduled meetings conducted during work commencement on site.

However, it was found that unscheduled meeting is least important as a mean of information gathering during design process of refurbishment projects. This result contradicted with literature reviewed which argues that the uncertainty nature of refurbishment project required flexibility approach in handling the projects and unscheduled meeting is one of the most appropriate mechanisms to be used. This scenario happened most probably refurbishment projects in this country are less uncertain where most of the decision could be made and planned during scheduled meetings. Due to that, less unexpected problems occurred during contract implementation stage that required urgent decision to be made. It could also be that the designers tend to follow standard procedures which are more appropriate to new build.

Rahmat (1997) said that direct formal contact refers to the documented information that could be obtained either by letters, memos and reports. This approach is widely used as a mean of communication between different organizations. Result from the survey indicates respondents agreed that direct formal contacts are important for obtaining information in refurbishment design process. This study found that designers are more comfortable to use design information through formal channel such as correspondence, letters and others documented sources.

Any information obtained using informal conversation, telephone or discussions are called direct informal contact (Rahmat, 1997). One of the advantages of using this method is information could be gathered quickly without having any normal procedure. The flexibility of

this method make it more preferable compared to direct formal contact. On the other hand, the disadvantage of this approach is the information obtained is not recorded and could not be used in any event of litigation. Compared with formal means of communication, informal channel has been recognized that can send reasonably accurate message very quickly in all directions by furnishing informative, interpretive and affective messages to the people. This advantage cannot get through formal approach and it is observed that numerous informal means for the purpose of improvement of design efficiency, (Driskill and Goldstein, 1986; Perry and Sanderson, 1998)

Informal channels are considered to be less important than the formal methods of communication in this study. Accountability and risk in refurbishment projects such as variation claims and delays are most likely the main reasons why the architects do not want to use information from informal channel.

Bennett, (2002) noted that standardize procedures reduce the need for constant communication and help to reduce errors. The benefits mean that the design team should standardize their procedure in preparing the drawings in order to suit with nature of refurbishment works. Bennett, (2002) added that there is evident of many world's greatest architects develop personal style and refined in successive new design that essentially remain standards. It is argued that principally the design teams should always use an established approached in the procedures for handling problems of design of refurbishment projects unless the new approach could result in significant result. It is noted that the procedure must be agreed and follows by all the parties involves in the design process. Different stages had their own difficulties and constraints. Baldwin et al. (1999) in his study noted that the schematic design stage is more difficult to manage compared to detail stage in term of design changes. It is hypothesised that failing to follow the procedure would lead to inevitably bad project outcome.

Table 3.0 shows that standardization procedure is an important method of obtaining design information. The result shows that most of the architects preferred to have rigid procedure in handling design process of refurbishment projects. Flexibility is less preferred in obtaining design information of refurbishment projects.

The importance use of information Technology (IT) in construction industry had been highlighted by some researchers. IT act as an interface tool to improve project integration. The uses of computer in support system will enhance design communication, (Chiu, 2002) and it became an important tool in the process of integration of refurbishment projects. Moreover, the pressure to improve efficiency and effectiveness forced the designers to use of computer aided methods and modern software system in the design process.

IT is useful not only for coordination people in the project but it also used for producing faster and accurate drawings for the design projects. From the reviewed of literature, it is hypothesised that information technology is an important coordination device that can be used for design activities of refurbishment projects. The ability of information technology produced accurate drawings and as a tool for communication and transferring design information is much needed when handling fragmentation nature of design of refurbishment projects.

Table 3.0 reveals that the majority of the architects use IT as a means of information gathering. The result indicates that some of the architects are not comfortable in using IT in their refurbishment's design works. This condition arises most probably due to lack of IT knowledge of the architects or the IT systems they have could not be utilized in design works of refurbishment projects.

Involvement of Design Key Participants in Decision Making

In construction projects, any decision made have implications to cost, quality, durations and resource allocation of the project alternative. In producing good decisions, quality and amount of information are considerably critical to support and as a basis for decision made. A good decision making requires informative formulation, clear evaluation and quick re-formulation of alternatives beside quality of decision making depends on the basis of the information, (Kam and Fischer, 2004). Without sufficient amount of data, it is impossible for the refurbishment's design team to have good decisions especially during inception stage of design where the quantity of data available is limited. Design process is the particular phase where many key decisions are made, (Sanvido and Norton, 1994). Due to the decision made commit a large percentage of project funds, adequate and accurate information are needed in a timely manner. In refurbishment

design projects, decision making is considering complex, inter-connected and a dynamic process. The complexity in building design decisions arises from the effects of each decision depends on large number of other decisions, (Papamichael, 1999). It is believed that decision making involves more than one decision makers and also large number of interdependent factors. Due to the complexity nature of refurbishment projects, the degree of involvement of key functionalities in decision making is varies based to the phases of decision making processes. (Egbu et al., 1996)

Involvement of experienced construction personnel from the earliest stages of design process is paramount to ensure the quality of decision outcome. Participants must creative and able to contribute ideas from their area of expertise in producing best solution of any design problems. Mitropoulos and Tatum, (2000) in their study entitled ‘Management–driven integration’ suggested that integration during design phase require participations vendor and contractor as partner for change information and joint decision making. Involvement of facility users, designers, contractor and vendors could lead to early identification of potential conflicts and prevent major scope changes. Thus, it is hypothesized that greater involvement of design key participants in decision making process before and during work commence on site would improve performance of refurbishment’s design process.

This study asked the respondents to what extent the involvement of the key participants in decision making would affect the completeness of design using scale 1, very small extent to 4, very large extent. The result is shown in table 4.0.

Table 4.0: Involvement of design key participants in decision making

Scale	Percentage
Very small extent	0.3
Small extent	3.7
Large extent	32.4
Very large extent	63.5

In the design process of refurbishment projects, involvement of design key participants in refurbishment designs is crucial in order to ensure high degree of completeness of drawings before work commence on site. With out high input from participants such as contractors, client and others consultant designers, it is believed that it could give very adverse effect in completeness of drawings for refurbishment projects. This finding also confirmed that design information for refurbishment projects are inter-related and came from difference sources and key participants. Therefore, key participants in design process need to have greater team spirit so that sharing and flow of information among them easier.

Design process involved communication activities where extensive amount of information being transferred among design key participants. Baldwin et al., (1999) pointed out that communication is vital due to criticality of management of information exchange in design process. Information gathered must be communicated correctly and continuously flow during design process to the appropriate person in charged. Due to novelty of the task such as in refurbishment design projects creates the necessity of coordination and communication to achieve successful solution in design decisions.

Conclusion

Literature review revealed that refurbishment tends to be more uncertain. Questionnaires survey result also shows integration is important in the design process of refurbishment projects. All integrative mechanisms tested are used extensively in refurbishment design projects. The most important coordination devices are scheduled meeting and direct formal contacts. This finding supported the literature reviews' which argues flexibility is important in handling refurbishment projects due uncertain nature. However, high risk in refurbishment projects such as variation order claims required documented evidences most likely the reason why the architects preferred to use formal channel for obtaining design information. It could be also be that the key participants who involved in the design process are used to standardised procedures which are more appropriate for new build. It would be interesting to investigate whether this would affect the performance of the design process. Informal channel functions are most likely to cover loop holes of the formal channel and perform integrated and complementary roles in the management of uncertainty in refurbishment projects. Finding also shows that it is agreeable that higher the degree of involvement of design key participants during refurbishment design process, the more accurate and complete is the design.

References

- Andi and Minato, T., (2004), Representing causal mechanism of defective designs: Exploration through case studies, *Journal of Construction Management and Economics* 22, 183-192
- Baldwin A. N., Austin, S. A., Hassan, T. M. and Thorpe (1999), Modeling information flow during the conceptual and schematic stages of building design, *Journal of Construction Management and Economics* 17, 155-167
- Bennett J., (2002), *Construction the third way*, Butterworth-Heinmann Ltd, Oxford
- Bennett, J., (1991), *International construction project management general theory and practice*, Butterworth-Heinmann Ltd, Oxford
- Chiu, M. L., (2002), *An organizational view of design communication in design collaboration*, Design Studies, Vol. 23, 187-210
- Construction Industry Research and Association (1994), *A guide to management of building refurbishment*, CIRIA report no 133, Construction Industry Research and Association, UK
- Driskill, L.P. and Goldstein, J.R., (1986), Uncertainty: Theory and Practice in Organization Communication, *The Journal of Business Communication*, 23:3:Summer
- 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., Barbara A. Young and Victor B. Torrance, (1998) Planning and control processes and techniques for refurbishment management, *Journal of Construction Management and Economics* 16, 315-325
- Galbraith, J. R., (1973) *Designing Complex Organization*, Addison-Wesley
- Galbraith, J. R., (1977) *Organization design*, Addison-Wesley, Reading M.A.
- Guevera, J.M., (1979), *Communication in Construction companies*, PhD Thesis, University Illinois at Urbana Champaign, Urbana
- Hegazy, T., Essam, Z., and Donald, G., (2001), Discussion of 'improving coordination for building projects, *Construction Engineering and Management* Vol. 127, No. 4, 322-329
- Howard, H.C., Levitt, R.E., Paulson, B.C., Pohl, J.G. and Tatum, C.B., (1989), Computer integration: Reducing fragmentation in AEC industry, *Journal Computing in Civil Engineering*, ASCE Vol. 3(1), page 18-32

- Itami, H and Roehl, T.W. (1987), *Invisible assets, Mobilizing invisible assets*, Harvard University Press, Cambridge, Mass, page 12-31
- Kam, C. and Fischer, M., (2004), Capitalizing on early project decision making opportunities to improve facility design, construction and life cycle performance- POP, PM4D and decision dashboard approaches, *Journal of Automation in Construction* 13, 53-65
- Laufer, A., Shapira, A. and Cohenca-Zall, D.(1992a), *The process of construction planning and its product: practice in mature companies*, Research Report, National Building Research Institute, Technion-IIT, Haifa, Israel
- Laufer, A., Shapira, A. and Cohenca-Zall, D.(1993), Pre Bid and pre construction planning process, *Journal of Construction Engineering and Management*, Vol 119, No. 3, ASCE, page 426-443
- McGeroge, F., (1988), Design Productivity – A quality problem, *Journal of Management in Engineering*, Vol. 10, 350-367
- McKim, R. Tarek, H. and Attalla, M., (2000), Project Performance Control In Reconstruction Project, *Journal of Construction Engineering and Management* Vol. 126, No. 2, 137-141
- Mitropoulos and Tatum, (2000), Management-driven integration, *Journal of Management in Engineering* Vol. 16, No. 1, 48-58
- Puddicombe, (1997), Designers and contractors: Impediments to integration, *Journal of Construction Engineering and Management* Vol. 123, No. 3, 245-252
- Quah, L. K., (1988), *An Evaluation of the risks in estimating and tendering for refurbishment work.*, PhD thesis, Herriot Watt University, Edinburgh, UK
- Rahmat I., (1997), *The Planning and Control Process of Refurbishment projects*, PhD thesis, University College London. UK
- Rayers, J. and Mansfield, J. (2001), The assessment of risk in conservation refurbishment projects, *Journal of Structural Survey*, Vol. 19, No. 5, 238-244
- Papamichael, (1999), *Application of information technologies in building design decision*, Building research and information Vol. 27, No. 1, 20-34
- Perry, M and Sanderson, D., (1998) *Coordinating joint design work: the role of communication and artifacts*, Design Studies, Vol. 19, 273-288
- Pietroforte, R., (1997), Communication and governance in the building process, *Journal of Construction Management and Economics* 15, 71-82
- Sivado, V. and Norton K., (1994), Integrated Design Process Model, *Journal of Management in Engineering*, Vol. 10, 55-62
- Tatum, C. B., (1990a), Integrating design and construction to improve project performance, *Journal of Project Management* Vol. 21, No.2, 35-42
- Tushman, M.L. and Nadler, D.A., (1978), *Information processing as an integrating concept in organizational design*, Academy of Management Review, July