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PLANNING FOR REFURBISHMENT PROJECTS: THE EFFECTS OF ORGANIZATIONAL COMPLEXITY AND INTEGRATION ON PROJECT PERFORMANCE

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ABSTRACT

This paper measures the influence of the complexity of organizational structure of construction firms and the integrative mechanisms used in the planning process of refurbishment projects. The approach takes the form of a literature review of published journals and textbooks, a postal questionnaire survey with planning engineers and contract managers. Ninety-four construction companies were selected for the postal questionnaire survey. Fifty-four (57%) of returned questionnaires were considered to be useful for statistical analysis. This paper found that all construction firms extensively use integrative mechanisms in the planning process of refurbishment projects. Complex construction firms use integrative mechanisms more extensively than simple construction firms, thus less efficient. However, the project performance of complex construction firms is not significantly better than simple construction firms. The study is limited to medium and large refurbishment projects, with contract value above £500,000 pounds. This paper helps the construction firms to design appropriate organizational structure for refurbishment projects. It also identifies the integrative mechanisms to be used in the planning process of refurbishment projects. It suggests that the organizational structure for construction firms undertaking refurbishment projects should be simple and flexible. This paper determines the types and the extent of use of integrative mechanisms in the planning process of refurbishment projects. It shows how efficiency in the planning process can be affected by the complexity of the organizational structure and the use of integrative mechanisms of the construction firms.

Keywords: refurbishment, complexity, integrative mechanisms, project.

1. INTRODUCTION

Refurbishment is defined as making use of what is usable in the ageing building stock, the skilful adaptation of building shells (which is valuable in its own right and not due to any historic mystique) to a new or an updated version of its existing use [1]. This includes repair, conversion, renovation, restoration, retrofit and extension works. It excludes scheduled repair and maintenance, though it may include opportunistic work of this nature.

Since there is no official statistics on the actual value of refurbishment work, it is difficult to determine its' importance in the U.K.'s construction industry. The Department of Environment categorized refurbishment under repair and maintenance. Therefore, most researchers use repair and maintenance's statistics for monitoring trends in the refurbishment sector [2]. From 2000 to 2008, the proportion of the repair and maintenance output constituted around 40 percent of the total output of building sector in the United States [3]. If illegal and unreported refurbishment works carried out by house owners were included, the actual value of refurbishment work in the U.K. would be higher.

Egbu [4] found that planning is the most difficult function facing refurbishment managers. It has to be done under uncertainty, i.e., with insufficient and incomplete information, under constantly changing conditions. Okoroh [5] pointed out that the inadequacy of specifications from the architects makes it difficult for contractors to define the exact scope of work in advance. Boyd and Weaver [6] argued that refurbishment needs a flexible approach. However, this is not easy to be achieved, as many refurbishment projects are carried out by firms with complex organizational structure that have many specialized functions or departments. Such firms tend to be bureaucratic and inflexible.

Bresnan [7] maintained that the more the construction project requires a flexible form of organization, the less likely it is to get it. One reason for this is that the conflicting needs between the firm and the project. Bresnan [7] said that project organizations commonly face something of a dilemma. On the one hand, there is a need to devise a structure that directs activity towards the achievement of specific, but non-recurring, objectives (in projects). On the other hand, this structure should allow for the maintenance and development of functional specialization (in firms). In other words, organizations need to be oriented towards both projects and firms. The projects require integration, whereas the firms require specialization. Specialization tends to make the organizational structure more complex because many specialized units within the organization need to be critical. Thus, it would be interesting to investigate how firms undertaking refurbishment projects resolve the conflicting needs.

The objectives of this paper are:

a) To establish the complexity of organizational structure of the construction firms and the integrative mechanisms used in refurbishment projects.

b) To measure the associations between the complexity of construction firms and the extent to which the integrative mechanisms are used in the planning process of refurbishment projects.
c) To measure the association between the complexity of the organizational structure of the construction firm and the planning performance.

2. THE COMPLEXITY OF CONSTRUCTION FIRMS

Many construction firms start as one or two-man operations carrying out small construction works and limited in scope [8]. The production methods are based on craft work with little mechanization. The firms are informally organized. Rules and norms of behavior are not standardized. There is no sharp distinction between functions. The organization, therefore, is essentially centralized. Under these conditions, a craft administration seems to be a more efficient than a bureaucratic form [9].

According to Lawrence and Lorsch [10], organizations are created to solve environmental problems. Hence, construction firms, like other organizations, have to deal with various aspects of environment. Furthermore, construction firms have long-term objectives such as increasing productivity and improving service, and therefore have to design their organization structure accordingly [11]. As the construction firms become larger and use more advanced technology in order to deal with the environment, a greater degree of interaction between the people in the organization is generated. This leads to greater complexity of tasks, which in turn leads to the creation of additional departments or divisions. The additional new departments helped by economies of scale tend to increase the complexity of the organization structure of the firms [12]. The greater complexity of the organization structure leads to greater formalization and bureaucracy. This tends to make the organization less flexible. Thus, in planning for refurbishment projects, project managers do not only have to deal with the uncertainty derived from the projects, but also the complexity of the organization structure of the firms.

Winch [13] argued that since a project is a temporary organization, while a firm is a more permanent one, the needs for the firms normally is given a greater emphasis, to the detrimental of the projects. Many construction firms would not be unwilling to make significant changes to the long established organization structure of the firm to suit the needs of individual construction projects. Walker [11] said that the temporary nature of the project provides few opportunities for the construction firms to get use to each other at both corporate and individual levels, which hinder the setting up of the appropriate organization structure for the projects. The temporary nature of construction projects may discourage the construction firms from investing much time and money in making construction process more effective. As a result, a construction project may not get the appropriate organization structure it requires.

Thus it can be hypothesized that firms with complex organizational structure would be less efficient and effective in managing refurbishment projects. Boyd and Weaver [6] found that the project performance of refurbishment project is poor, with many exceeded the budget and targeted time. Faniran *et al*., [14], and Kabaskal *et al*., [15] suggested that the organization structure of the firms influence the effectiveness of construction planning efforts. Therefore, it would be interesting to test to what extent the complexity of the organizational structure affect the project performance.

To overcome the problem of inflexibility of the organizational structure, construction firms use various integrative mechanisms in the planning process of their projects. Winch [13] observed that the choice of integrative mechanisms is to bring about coherence between the goals for which the organization exists and the type of uncertainty faced by the organization. An organization needs to be integrated to act as a unified whole to achieve its objectives [10] [16] [17] [6].

3. THE INTEGRATIVE MECHANISMS

Corzier [18] argued that uncertainty produces vague scope of works and confers power. In uncertainty, each participant makes their own assumptions with regard to who is responsible for the tasks. Hence, their activities need to be integrated in order to foster an understanding of the decisions made by others [19] [20].

Integration is facilitated by effective formal channels of communications and through reliable and accessible information for staff about their jobs and their firms [21] [22] [10] [23]. Galbraith [23] identified lateral relations, rules, codes of conduct, standard procedures and appointed co-ordinators as the integrative mechanisms.

According to Bennett [24], procedures provide co-ordination by predetermining decisions. Given the discretion to make their own choices, separate participants will decide, often arbitrarily, on different approaches. This creates extra work, as each participant needs to reconcile inconsistent information obtained from different sources. However, Bennett [24] warned that procedure is only suitable for dealing with situations which can be anticipated and which recur sufficiently frequently.

The rigidity imposed by standardized procedures requires the managers in the planning process of refurbishment projects to be in constant communication with each other to convey the plan of actions. Modern communications, however, employ diverse media, from oral to letter and memos to information technology. Egbu [4] found that the majority of refurbishment managers perceived that the use of computer technology is one of the most difficult tasks in managing refurbishment projects. The use of computers, however, may be indispensable in uncertain refurbishment projects. The lack of compatibility of the computer systems and the knowledge of the key participants in computer technology would impede the effectiveness and efficiency of information technology as an integrative mechanism [25] [26].

The many participants involved and the interactive nature of the planning process demands

increased informal communication amongst managers. Therefore, human contact is important. Face-to-face meetings provide richness of communication, instantaneous feedback and enables immediate correction. Bennett [24] maintained that direct meetings are generally effective in providing integration. The managers who involved directly in the process would know the relevant information and generally have a real interest in sharing it with others working at the same level in the same project. When no formal arrangements are built into project organization, informal lateral meetings emerge. The main concern of using informal meetings, however, is to ensure that the information obtained directly from a particular participant is not in conflict with the interest of other participants or the project as whole. In an uncertain refurbishment project, the needs of each participant are in a state of constant change. What is relevant to one participant, at a particular time, may no longer be relevant to the others. Thus, informal meetings are two-edged swords, it may be effective in speeding up information flow, but may cause conflicting information in the process. The above statements from the literature review suggest that even though there are various ways of achieving integration, each method has its limitations. It appears that providing a solution to one problem raises problems in another. This gives some credence to the argument that the interrelated issues of uncertainty and integration need to be tackled holistically. It also suggests that in planning for refurbishment projects, a combination of integrative mechanisms need to be employed. However, the extent to which the integrative mechanisms should be employed is not totally clear. Therefore, it is imperative to establish the most appropriate integrative mechanisms in refurbishment projects and to determine how to use the integrative mechanisms in construction firms with different degrees of complexity.

4. RESEARCH METHODOLOGY

This study adopted the opinion research methodology, which is a combination of literature review and research postal questionnaire survey.

Since the emphasis of this study is on medium and large refurbishment projects, only project managers, planning engineers and contract managers from construction firms undertaking refurbishment projects with a contract value of more than £500,000 were involved.

Ninety-four construction companies were selected for the postal questionnaire survey. Fifty-four (57%) of returned questionnaires were considered to be useful for statistical analysis. The size of the construction firms is shown in Table-1. The size of the refurbishment projects is shown in Table-2. Spearman's correlation coefficient test was used to measure the relationships between the independent and dependent variables. The independent variable is the complexity of the organizational structure. The dependent variables are the integrative mechanisms and the planning performance. The null hypotheses were rejected at the 5% significant level

Table-1 reveals that the size of the construction firms carrying out refurbishment projects is varied, ranging from less than 10 million pounds per annum to more than 100 million pounds per annum. More than 70 percent of the construction firms carrying out the refurbishment projects are large/very large. The high percentage of large/very large construction firms undertaking refurbishment projects reflects the growing importance of refurbishment sector to large construction firms.

Table-1. The size of construction firms: based on the average annual turnover.

Size	**Construction firms** (N=54) %
Medium (£1 to £10 Million)	29.6
Large (£11 to £100 Million)	53.7
Very large (more than £100 Million)	16.9

Table-2 shows that nearly half of the refurbishment projects investigated are of less than £1.5 Million. It shows that most refurbishment projects tend to be small in size, less than 10 percent above £5 Million.

Table-2. The size of refurbishment projects.

Project contract value (in million pounds)	**Refurbishment projects** N=54)	**Percent**
0.5 - 1.0	13	24.1
1.1 - 1.5	13	24.1
1.6 - 2.0	6	11.1
2.1 - 2.5	3	5.6
2.6 - 3.0	2	3.7
3.1 - 3.5	5	9.3
3.6 - 4.0	2	3.7
4.1 - 4.5	2	3.7
4.6 - 5.0	3	5.6
Above 5.0	5	9.3

5. RESULTS AND ANALYSIS

In this study, the complexity of the organizational structure of the construction firms was measured by asking the respondents to indicate which of the 23 departments or divisions listed in the final postal questionnaire survey existed in their firms at the time when the refurbishment project was carried out. The listed departments are shown in Appendix 1. The more departments/divisions existed in a construction firm, the more complex would be the organization structure of the firm.

The construction firms were grouped under three different categories, based on the complexity of the organizational structure, i.e. simple, moderate and complex. The construction firms with less than 10

departments were categorized as simple, 11-14 departments were categorized as moderate and more than 15 departments were categorized as complex. The percentage of the construction firms in each category is shown in Table-3.

Table-3. The categories of the construction firms.

Categories	No. of departments /divisions	Construction firms (N=54), %
Simple	Less than 10	32.1
Moderate	11 to 14	41.9
Complex	More than 15	26.0

Table-3 reveals that the complexity of the organizational structure of the construction firms undertaking refurbishment projects is varied. About 70 percent of the construction firms are moderate/ complex. Only about a third of the construction firms are simple. This result indicates that there is a tendency to specialize activities in the construction firms. However, it must be pointed here that the construction firms participated in this study were those undertaking refurbishment projects of contract value more than £500,000. Hence, the construction firms tend to be medium or large and with many departments.

Six integrative mechanisms used in the planning process of refurbishment projects were measured. Four of them classified under lateral relations, i.e., scheduled meeting, unscheduled meeting, direct formal contact and direct informal contact. The other two are procedures and Project Management Computer Software (PMCS).

The respondents were asked to what extent the lateral relations were used in the planning process. The responds were recorded on a five-point scale ranging from (1) not use, to (5) extensively used. The mean value of each method was calculated and used for comparison. The result is shown in Table-4.

Table-4. The extent of lateral relations used in refurbishment projects.

Lateral Relations	Refurbishment projects (N=54) mean
Scheduled meeting	4.1
Unscheduled meeting	3.7
Direct informal contact	3.6
Direct formal contact	3.5

Table-4 shows that all the lateral relations were extensively used in the planning process of refurbishment projects. Meetings, both scheduled and unscheduled were found to be more important than direct contacts.

In the postal questionnaire survey, the extent to which the construction firms' procedures were used in the planning process was sought. The result is shown in Table-5.

Table-5. The extent to which procedures were used in the planning process of refurbishment projects.

Extent of use	Refurbishment project (N=54) percent
Very small extent	7.4
Small extent	22.2
Neutral	25.9
Large extent	33.3
Very large extent	11.1

Table-5 shows that in 44.4 percent of the construction firms, the procedures were used to a large/very large extent in less than half of percent of refurbishment projects. Thus it could be concluded that procedures are also extensively used in planning process.

The respondent in the postal questionnaire survey were asked whether they used Project Management Computer Software (PMCS) in the planning process of refurbishment projects. The result is shown in Table-6.

Table-6. The Use of PMCS in the planning process of refurbishment projects.

The use of PMCS	Refurbishment projects (N=54) percent
Did not use PMCS	25.9
Use PMCS	74.1

Table-6 shows that almost three-quarter of the refurbishment projects used project management computer software. Thus computer software was an important integrative mechanism in the planning process of refurbishment projects.

The planning performance of refurbishment projects was measured in terms of cost variance and time variance. Cost variance is the ratio of actual construction to target construction cost. When the value of cost variance is more than (1), it means that the actual cost is more than the target cost. Similarly, time variance is the ratio of actual construction time to target construction time. When the value of time variance is more then (1), it means the actual construction time is more than the target time. Table-7 shows that slightly more than half of the refurbishment projects exceeded the target cost. About 30 percent of the projects, the actual cost exceeded the target cost by more than five percent.

Table-7. The cost variance of refurbishment projects.

Cost variance	Refurbishment projects (N=54) percent
Less than 0.9	20.9
0.91- 0.95	9.3
0.96 - 1.00	18.6
1.01 - 1.05	20.9
1.06 - 1.10	20.9
More than 1.10	9.3

Table-8 shows that more than half of the refurbishment projects were exceeded the target time. Like the cost variance, close to 30 percent of the refurbishment project exceeded the target time by more than 5 percent. Therefore, it can be concluded that the planning performance of refurbishment projects is generally unsatisfactory, with more than half of them exceeded the target cost and target time. This result also supports the argument that refurbishment projects are uncertain, and difficult to plan and to determine the outcome.

Table-8. The time variance of refurbishment projects.

Time variance	Refurbishment projects (N=54) percent
Less than 0.9	7.8
0.91- 0.95	5.9
0.96 - 1.00	33.3
1.01 - 1.05	25.5
1.06 - 1.10	15.7
More than 1.10	11.8

The Spearman's correlation technique was also used to establish the relationship between the complexity of the organization structure of the construction firm and the integrative mechanisms used in the planning process of refurbishment projects. The result is shown in Table-9.

Table-9. The correlations between the complexity of the organization structure construction firms and the integrative mechanisms.

Co-ordination devices	Complexity
Scheduled meeting	.30*
Special meeting	.08
Direct formal contact	-.02
Direct informal contact	.43**
Planning procedures	.51**
Project management computer software	0.47**

* 0.05 significant level *** 0.01 significant level

Table-9 shows that the complexity of the organizational structure of the construction firms is significantly associated with four integrative mechanisms. These results show that as the organization structure become more complex, greater integrative mechanisms are being used.

This study hypothesized that the organization structure of the construction firms affects planning performance. The results from the Spearman correlation technique are shown in Table-10.

Table-10. Correlation between organization structure and planning performance.

Planning performance	Complexity
Cost variance	.14
Time variance	.20

Table-10 reveals that there is no significant correlation between the complexity of the organizational structure of the construction firms and the planning performance.

6. DISCUSSIONS

The results above show that:

a) The degree of complexity of construction firms undertaking refurbishment projects varied. Moderate complexity constitutes the largest group.
b) The integrative mechanisms are extensively used in the planning process of refurbishment projects. Meetings, both scheduled and unscheduled, are two of the most important integrative mechanisms.
c) Complex construction firms used integrative mechanisms more extensively than simple ones.
d) No significant correlation between the complexity of the organizational structure of the construction firms and the planning performance.

The first result shows that refurbishment projects, despite being generally small in size, are not the domain of small construction firms. Large and very large construction firms also undertake refurbishment projects. This is not altogether surprising. Refurbishment sector constitutes 40% of construction output, hence, a very important sector. Large construction projects cannot possibly ignore it.

The pertinent question is that can complex/large construction firms compete with simple/small construction firms? It has been argued, that building refurbishment, due to inherent uncertainty, require flexible organization. Literature review revealed that simple construction firms tend to be more flexible than complex ones. A more complex organization requires greater coordination, hence greater use of integrative mechanisms.

The results of this study concur with the literature review. Integrative mechanisms are extensively used in refurbishment projects. However, complex construction firms used them more extensively than simple ones,

especially scheduled meetings, direct informal contact, planning procedures and Project Management Computer Software. There are four plausible reasons.

First, the information required for planning refurbishment projects in complex construction firms tends to be more dispersed among the managers located in various departments. There is a greater need for the information to be co-ordinated, hence greater need for the integrative mechanisms to be used. Scheduled meetings, for instance, is important to provide regular and efficient flow of information between different departments.

Second, unexpected changes, which need prompt decisions, frequently occur during the execution refurbishment projects. Complex construction firms, with a higher degree of specialization, tend to be more rigid than simple ones. Therefore, they require increased direct informal contacts among the participants involved in the planning process.

Third, the problem of co-ordination in complex construction firms tends to be higher because of higher differentiation of tasks. More people need to be involved from various departments. To avoid conflicts between the different departments and to provide efficient supervision and control, the key participants are required to use and follow the standard planning procedures.

Fourth, complex construction firms have more resources available and more likely to employ planning engineers and to invest in information technology. They also tend to undertake more complex construction projects, which necessitate the use of project management computer software to increase information processing capacity.

Since, complex construction firms use more integrative mechanisms; it also means that they use more resources in the planning process. Therefore, it could be concluded that the complex construction firms are less efficient than the simple construction firms in the planning process of refurbishment projects. This conclusion concurs with Galbraith's (1977) observation who maintains that more information is needed to be processed in complex organizations where more people are involved in performing a task than in a simple organization. This requires them to use integrative mechanisms more extensively.

Although complex construction firms use more resources in the planning and control process, their planning performance is not found to be significantly better than the simple construction firms. This reinforces the argument that the more complex construction firms should create an autonomous refurbishment department or a subsidiary firm in order to be more efficient and possibly, more effective.

Thus, in complex construction firms, the problems uncertainty derived from the refurbishment projects is compounded by the problems of complexity derived from the organizational structure of the construction firms. In other words, the efforts used in the complex construction were not fully directed to the refurbishment projects, but some were diverted to tackle the complexity of the organization structure of the construction firms.

Since complex construction firms are less efficient than simple ones, it would also mean that their profit margin in refurbishment projects would be smaller. In order to compete with simple construction firms, which tend to more nimble, the complex construction firms must provide flexible organizational structure for refurbishment projects. This could be achieved by creating an autonomous refurbishment division. In fact, many complex construction firms are using this strategy to compete with simple construction firms.

7. CONCLUSIONS

The literature review reveals that the construction firms face the dilemma of satisfying the needs of the firm and the needs of the projects in the planning process. The needs of the construction firms are reflected in the complexity of the firms' organizational structure and that the needs of the refurbishment projects are reflected in the use of integrative mechanisms in the planning process. The construction firms have to satisfy these needs with the limited resources available to them.

The construction firms undertaking refurbishment projects are varied ranging from simple, with less than 10 departments to complex, with more than 15 departments. The complex the construction firms use integrative mechanisms more extensively than simple ones, therefore, less efficient. Despite using integrative mechanisms more extensively, the performance of complex construction firms is not significantly better than the simple ones. It is suggested that complex construction firms should create an autonomous refurbishment department or refurbishment subsidiary which could provide a more flexible structure in order to compete with simple construction firms.

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