Application Flexibility Strategy to Organizational Structure Design in China’s International Construction Enterprises

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Abstract: Current China’s international construction enterprises organization structure condition, modifying, and management practices regarding uncertainty can unadapted environment turbulence by fails to exploit opportunities to improve enterprises performance. Based on analysis of the restructure of China’s construction industry and international market situation, emphasis is placed on the structural barriers and culture barriers, respectively, which are two critical factors impeding application of flexibility. The study attempts to develop a flexible organizational structure framework under multi-level environment using flexibility strategy theory, which is suitable for China’s international construction enterprises.

Keywords: flexibility strategy; organizational structure and design; environment turbulence; construction industry; China

1 Introduction

As with China’s entry to the World Trade Organization (WTO), the globalization of the construction industry provides tremendous opportunities for China’s contractors to expend into the new market. According to the annual survey conducted by Engineering News Record (ENR), more than 30 of China’s construction enterprises were included within the top 225 international contractors in terms of their operational revenues generated on oversea market from 2000 up to now. China’s international construction enterprises (CICEs) play a strong competitor role in the domain after contractors from the United States, UK, Japan and several European countries, at the same time, CICEs’ development was heavily influenced by the international business environment in all respects as well as domestic, such as China’s State Owned Enterprises (SOEs) reform, joint venture developing, adapting multiprocurement routes (Tianji Xu, 2002) etc. for a certain contractor, facing international competitive market, it should be involved regional conditions such as currency devaluation, currency exchange restrictions, cross-cultural differences management, or change in low or regulations, several authors have studied the uncertainties to international constructional projects (Ashley and Bonner 1987; Demacopoulos 1989; Seminar 1995; Kalayjian 2000; Seubg H. Han 2002). The growing importance of the international sector means that the environment for all construction enterprises has become extremely complex and competitive as well as more operational risk increasing. With facing uncertainty domestically and globally, how CICEs cope with and respond to environmental uncertainty and instability. Seung H. Han and James E. Diekmann (2002) developed risk-based go/no-go decision for international projects model; Liyin Shen et al (1997) analyzed kinds of uncertainties in vary contract model; Low Sui Pheng and Christopher H. Y. Leong (2000) study focused on cross-cultural project management etc. However, there is few articles that examined the uncertainty from CICEs’ organization structure (OS).

In order to analyze the OS of CICEs and develop more suitable OS models, flexibility concept is introduced for coping with the uncertainty in this paper, combing with China’s SOE reform and CICEs’ feature, we apply flexibility theory to OS restructure following by an analysis of major OS patterns. A model for how to adapt suitable OS is also proposed in this paper.

2 Flexibility

Kreiner (1995) points out that the traditional focus on stability in project management becomes challenged under uncertainty, which creates what calls “drifting environment”. A number of scholars, including Mintzberg (1994) and Bettis&Hitt (1995), argue that flexibility is necessary in order to face the changes,
uncertainty and turbulence in the business environment.

Henk W. Volberda (1998), who is awarded a prize of Igor Ansoff Strategic Management Award, defines four different types of flexibility. Steady–state flexibility concerned with the static proceeding of optimizing enterprise performance if the nature and level of firm production capability maintain a long-term stability, the concept highlights the external stable environment and static proceeding, that is, the essence of Steady–state flexibility.

Operational flexibility is the common flexibility in enterprise operation, which based on enterprise organizational structure status quo, it represents the capability of tackling frequent changes in enterprise’s routine operation activities, especially in temporary changes such as equipments deploying rapidly, variation in human resource. Operational flexibility can be categorized into internal flexibility and external flexibility, the former represents the capability of construction, shortening project duration, reducing material inventory. In addition, imitating advancing technology, adaptation new engineering management models are also internal operational flexibility. The goal of developing operation flexibility aims at deal with temporary changes with higher efficiency and lower cost. While external flexibility represents keeping relevant works and facilities along with construction schedule, multi-channel material supply etc. the way to acquisition external flexibility is that project outsource, temporary works etc.

Operational flexibility is often the consequence of activities of cross hierarchy and aims at enhancing the existing “organization commitment”, but if emprises develop operational flexibility excessively, structural inertia will be produced that impeding organization change (Volberda, 1998).

When organization faces revolutionary change, the management level needs action space so as to existing organizational structure and work process redesign, internal structural flexibility includes vertical or horizontal work extension, organization responsibility change, control system change, establishing project team etc. External flexibility tends to support the promotion of advancing technology or organization action space with respect to developing new markets.

Strategic flexibility is composed of the capability of organizational goals and the capability of management to external and internal environment. When enterprise faces new change and requirement that have profound influence for achieving its goals, the enterprise should respond well to the changes. However, it is difficult to judge the relationship between strategies for the indirect and fuzzy information and its feedback (Volberda, 1998).

![Fig.1. types of flexibility](image)

**3 Organization structure and its flexibility**

An organization structure defines how job tasks are formally divided, grouped, and coordinated (Stephen P. Robbins, 2003). Richard L. Daft summary three key components in the definition of OS are: (1) OS designates formal reporting relationships, including the number of levels in the hierarchy and the span of control of managers and supervisors. (2) OS identifies the groups together of individuals into departments and of departments into the total organization. (3) OS includes the design of systems to ensure effective communication, coordination, and integration of effort across departments. These three element of structure pertain to both vertical and horizontal aspects of organizing. As for example, the first two elements are the structural framework, which is the vertical hierarchy (Stuart Ranson et al., 1980; Hugh Willmott, 1981). The third element pertain to the pattern of interactions among organizational employees. An ideal structure
encourages employees to provide horizontal information and coordination where and when it is needed.

3.1.3 3G structure of CICEs—a variety of functional structure

In a functional structure, business activities are classified by their function and allocated from the bottom to the top of the organization, all engineers are located in the engineering department, and the vice president of engineering has charge of all engineering activities, the function structure of a certain CICE is shown in Figure 1.

![Diagram](image)

Fig. 2. A Functional OS Sample of CICEs

In some CICEs, 3G is prevalent in small or medium-sized specialty contractors and many regional-level firms. 3G, which is abbreviation of General engineer, General economy master and General chartered accountant, is more highly centralized than ordinary functional structure. All operational activities is divided into three parts (operation, technology, and finance) and is charged by General engineer, General economy master and General chartered accountant respectively. This kind of “tall structure” (Khandwalla, 1997), makes tasks grouped into 3G, centralized authority, narrow spans of control.

Table 1. Characteristic of functional structure

<table>
<thead>
<tr>
<th>Background</th>
<th>Internal system</th>
<th>strengths</th>
<th>weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment: stability, less uncertainty, external environment</td>
<td>Goal of operation: lay stress on functional goals</td>
<td>a) allows economies of scale within functional department</td>
<td>a) Slow response time to environment change</td>
</tr>
<tr>
<td>Technology: routine mature technology, less interdependent</td>
<td>Plan and budget: budget based on cost</td>
<td>b) enables in-depth knowledge and skill development</td>
<td>b) may cause decisions to pile on top, hierarchy overload</td>
</tr>
<tr>
<td>Scope: small and medium-sized enterprise</td>
<td>Formal authority: Managers of function depart.</td>
<td>c) enables organization to accomplish functional goals</td>
<td>c) lead poor horizontal coordination among department</td>
</tr>
<tr>
<td>Goal of strategy: high internal efficiency Tianji Xu, 2002y, high technical quality</td>
<td></td>
<td>d) is best for enterprise with few kinds of projects</td>
<td>d) results in less innovation</td>
</tr>
</tbody>
</table>

Source: adapted from Robert Duncan, “What is the right organization structure? Decision tree analysis provides the answer” Organization Dynamics (Winter 1979):431;
With a functional structure, all works are grouped by functional-engineering, human resource, production, procurement, and finance. Functional grouping of employee is most widely used and accepted form of departmentalization. As a characteristic of CICEs, 3G is always used as a kind of functional form. (JiangZhiQing, 2004). A functional structure has both advantages and disadvantages. On the positive side, it can promote economy of scale with functions. Centralized allocation of equipments and materials reduces duplication and waste, and it can also promote in-depth skill development of employees. The main disadvantage of the functional structure is low responses to environmental uncertainty, coordination across functional departments often become difficult with the organization develop new projects and new kind of engineer. The vertical hierarchy becomes overloaded. Decisions pile up and top manager do not respond fast enough. Functional form acquires steady-state flexibility from its high efficiency, economy of scale and in-depth skill; however, it has low operational flexibility. Only in a long production life cycle, produce-market combinations (PMCs) and steady circumstance, functional structure is available, however, conflicts with respect to priority will be occur as well as prolong communication channel in a shaky environment (Ansoff&Brandenburg, 1971), hence, lack of structural flexibility and strategic flexibility is inherent in functional structure.

3.2 Divisional Structure

With divisional structure (sometimes called strategic business units), divisions can be organized in terms of individual projects, services, major engineer or programs, area of project, or profit centers. Each division is smaller and can meet with the needs of its environment; in addition, this structure decentralized decision making; that is, action can be taken more quickly to solve problems, more people provide input into decisions, consequently, the divisional structure develops operational flexibility, nevertheless, the acquisition of this kind of flexibility is at the cost of economies of scale (Richard. Daft, 2002), figure 2 shows a certain CICEs’ structure that group all business into six departments according to engineer category.

Fig. 3. A certain Division Structure Of CICEs

Application background, feature of internal system, strengths and weaknesses of divisional structure are summarized in table 2, the enterprise with divisional structure, by contrast, is better at achieving coordination across functional departments. It operates well when enterprise can no longer be adequately controlled with vertical hierarchy, and when enterprise goals are oriented toward adaptation and change (Richard. Daft, 2002), comparing with functional form manager, divisions managers can place more strength on strategic issues as well as structure issues, however, the divisions tend to resist organizational strategy and structure changes for their internal interest, therefore, when seeing the divisions as a whole, division structure’s structural flexibility
is still in the medium degree for inadequately adaptation among divisions; at the same time, the loose coupling feature of divisions impedes long-term strategy goals change while facilitating partial change, hence, the divisional structure possesses low strategic flexibility.

Table 2. Characteristic of divisional structure

<table>
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<th>strengths</th>
<th>weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment: uncertainty</td>
<td>Goal of operation: lay stress on divisions goals</td>
<td>a) adapt to turbulent environment</td>
<td>a) Eliminates economies of scale in functional department</td>
</tr>
<tr>
<td>from medium to high degree</td>
<td>Plan and budget: profit center based on cost and income</td>
<td>b) lead to owner satisfaction because engineers responsibility and contact point are clear</td>
<td>b) lead to poor across projects</td>
</tr>
<tr>
<td>technology: non-routine</td>
<td>Formal authority: Managers of divisions.</td>
<td>c) allow divisions to adapt difference in project, regions, owners</td>
<td>c) eliminates in-depth competence and technical specialization</td>
</tr>
<tr>
<td>mature technology,</td>
<td></td>
<td>d) involves high coordination across functions</td>
<td>d) make integration and standardization across engineer difficult</td>
</tr>
<tr>
<td>more interdependent</td>
<td></td>
<td>e) best in large organizations with several projects</td>
<td></td>
</tr>
<tr>
<td>scope: large-scale</td>
<td></td>
<td>e) decentralizes decision making</td>
<td></td>
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<tr>
<td>enterprise</td>
<td></td>
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<tr>
<td>goal of strategy:</td>
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<td></td>
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<tr>
<td>adapt to turbulent</td>
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<td></td>
<td></td>
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<tr>
<td>environment, satisfy owner</td>
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Source: adapted from Robert Duncan, “what is the right organization structure? Decision tree analysis provides the answer” Organization Dynamics (Winter 1979):431;

This structure is adapted to fast change in an uncertainty environment. Because each project (or engineer) is a separate division, coordination across functions is facility and excellent. The divisional structure typically operates best in the enterprise that posses multiple projects or services and adequate professional staff separate functional teams (units).

There are several disadvantages besides loses economies of scale, such as project become separate from each so that coordination across projects can be difficult; construction equipments and machinery can not sharing across divisions.

3.3 Matrix Structure

The matrix structure is best when environment changes is high and when goals reflect a dual requirement, the dual authority structure facilitates communication and coordination to cope with rapid environment change and enables an equal balance between project and functional manager. The matrix structure facilitates discussion and adaptation to unexpected issues. Essentially, the matrix structure combines two forms of departmentalization-functional and project (), in which division and functional structure (vertical and horizontal) can implemented simultaneously, as shown in fig.3. The project managers and functional managers have equal authority within the enterprise, and staff report to both of them.
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Fig. 4. Matrix OS Of CICEs

Table 3. Characteristic of matrix structure

<table>
<thead>
<tr>
<th>background</th>
<th>Internal system</th>
<th>strengths</th>
<th>weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>environment: with high uncertainty tech: non-routine mature technology, more interdependent among units scope: large-scale enterprise goal of strategy: adapt to turbulent environment, satisfy owner</td>
<td>Operation goal: project and function of equal importance Plan and budget: binary system based on function or project authority: cooperation between function managers and project managers</td>
<td>a) achieves coordination necessary to meet dual demands from customers b) flexible sharing of human resources across projects c) suited to complex decisions and frequent changes in unstable environment d) provides opportunity for both and functional and production skill development e) best in medium-sized enterprise with multiple projects</td>
<td>b) Causes participants to experience dual authority, which can be frustrating and confusing b) means participants need good interpersonal skill and extensive training c) is time-consuming: involves frequent meeting and conflict resolution sessions d) requires great effort to maintain power balance</td>
</tr>
</tbody>
</table>

Source: adapted from Robert Duncan, “what is the right organization structure? Decision tree analysis provides the answer” Organization Dynamics (Winter 1979):429;

However, with breaking the unity-of-command concept, the matrix creates confusion and frustration, and the stress it places on individuals.

Under the unstable operational level circumstance, for example, when the project duration of program is delayed or prolonged, the staff and management model can shift rapidly from one project to another with low cost, from this point, the matrix possesses high operational flexibility, furthermore, the capability of seeking to suitable organizational structure for each program unit can facilitate strength organizational structural flexibility; the available staff and management model can be disposed within different program, this capability ensures a certain strategic flexibility. Nevertheless, for need to dispose varied function, experts and management tools corresponding to varied projects, the matrix is lacking in steady-state flexibility.
The strength of the matrix lies in its ability to facilitate coordination when the enterprise has multiple complex and interdependent activities. The other obvious strength is that the matrix can make a balance of power; namely, environment pressure exists for two or more critical outputs, such as for in-depth technical knowledge and frequent new projects, this dual pressure means a balance of power is needed between two sides, and a dual-authority structure is need to maintain that balance (Richard. Daft, 2002).

3.4 Geographical Structure

Another basis for structural grouping is the organization’s users or customers, the most common structure is geography (Richard L. Daft). Each region of the country may have distinct characteristics and needs. Each geographic units include all function required to meet the projects needs. For a international constructor, self-contained units or branches are created for different countries and regions.

Figure 5 contains a partial organization structure illustrating the geographical thrust of CSCIE (China State Const. International Engineering Crop). CSCIE used this structure to focus managers and employees on specific geographical projects, each with its own president and staff functions such as human resources and legal.

The advantage and disadvantage of a geographic divisional structure are similar to the divisional organization characteristics listed in Table 2. In terms of benefits, geographical units are easier to dispose of or downsize in case of changes in the market outlook. Exiting from a certain geographical market is potentially less chronic and less costly than receding from a market segment altogether. It is also easier to consolidate a few geographical operations into one, as opposed to integrating functional structure and divisional structure (Charles Y.L. et al, 2004). Hence, geographical structure possesses higher structural flexibility than divisional structure. Conversely, the disadvantages of a geographical structure derives from its difficulty in pooling knowledge and expertise under one roof in order to create innovative solutions for complex engineering issues.

The organization can adapt to special needs of its own region, and employees identify with regions goals rather than with national goals. Horizontal coordination within a region is emphasized rather than linkages across regions or to the national office.

4 Increasing flexibility to organization structure

4.1 The way to developing flexibility in functional structure-horizontal linkage

Horizontal linkage refers to the amount of communication and coordination horizontally across organizational departments. Horizontal linkage mechanism often are not shown on the organizational chart, but belong to part of organization structure. The following devices can enhance horizontal communication and coordination as well as flexibility.

Information system. Computerized information systems can enable managers or front-site workers through the routinely exchange information about problems, opportunities, activities, or decisions.

Direct contact. Direct contact is a higher level of horizontal linkage between managers or employees
affecter by a problem. The common way to promote direct contact is to create a special liaison role located in one department but has responsibility for communicating and achieving coordination with another department.

Task forces. Task force is a more complex device than the above two due to them usually link only two departments. A task force is a temporary committee composed of representatives from each department affected by a problem. Each member represents the interest of a department and can carry information from the meeting back to that department. It is an effective horizontal linkage for temporary issues. They solve problem by horizontal coordination and reduce the information load on the vertical hierarchy. Typically, they are disbanded after their task have been accomplished.

Full-time integrator. Full-time integrator is a stronger horizontal linkage device that frequently named project manager, program manager. Unlike the preceding liaison person, the integrator need not report to one department being coordination, this position created is outside the department and has the responsibility for coordination other departments. The integrator spans the boundary between departments and should be able to confront problems and resolve conflicts with his expertise and persuasion.

Teams. Project teams are frequently regarded as the strongest horizontal linkage device. Teams are permanent task forces and are often used in conjunction with a full-time integrator. When activities among departments need strong coordination over a long period of time, a cross-functional team is commonly required.

These devices provide choices that a organization can select to increase flexibility. The higher-level devices provide more horizontal information capacity with higher operational flexibility, although the cost to the organization in term of time and human resources id greater. There is another way to change flexibility for functional structure, which is to reorganize from functional structure to divisional structure.

4.2 Developing flexibility through organization structure reorganizing-a case analysis

Different organization structure can apply with different phase of a project life cycle. Namely the organization structure of project is changed in terms of project stage changes. Fig.7. represents a BOT (built-own-operate) project’s organization structure changes within its life cycle. This kind of change coincides in project environment change, on the other hand, increases the strategic flexibility. The following is an analysis of organizational structure change in different project phase.

1. In the pre-feasibility study, it is necessary to establish a temporary project team engaged in the research of project goals and opportunities. In this phase, the team is often in a subordinate to functional department of government with a small size.

2. In project feasibility study phase, a small-scale project management team is required, which involved primarily consulting company and reconnaissance technology company. In this phase, it is often adopt line-functional organization.

3. In the design phase, due to the complexities of design management, project organization is set up with several functional departments, in this phase; it is suitable for adapting functional structure.

4. In construction phase, amount of sub-project proceed simultaneously involved contractors, supplier,
consultation, and technology service. It often adapt matrix structure.

(5) After transfer, as an operation company, functional structure is optimal one.

![Fig. 7. Organizational structure changes within project cycle of a CICEs](image)

5 Conclusion

With the environment changes becoming increasingly undefined, fast moving, and numerous. It is risky to rely on conventional management approaches and organization structure for CICEs. Although, organization are conservative and actively resist change, there are numerous forces that can to resist change, such as communication, participation, providing support, and creating a learning organization. In addition, increasing flexibility in existing organization structure and achieving organizational change gradually is an alternative, especially in CICEs. Flexibility is not only seen as a help to make enterprise adapt uncertainties but also to achieve project value-added.

References

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