

## STUDY ON THE ORGANIZATION CHANGE OF INFRASTRUCTURE PROJECTS WITHIN THEIR LIFECYCLE

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**Abstract:** The lifecycle of an infrastructure project usually includes feasibility study, design, construction and operation phases, with each phase having its own corresponding organization form. The form of organization in each phase is relatively fixed to match the development of infrastructure projects. However, the organization changes between phases are subject to many organizational interface obstacles because of the diversities of organization and the variability of people. This paper will analyze those problems and try to find the solutions to them according to the organization theory and the characters of infrastructure projects.

**Key words:** organization change; infrastructure project; lifecycle; integrated

### 1 Introduction

Infrastructure projects often refer to transportation projects (highways, bridges, subways etc.), irrigation works and so on. Those projects help economic development, solve social and environmental problems and bear important economic, social and historic responsibility. With long operation time and huge investment which usually come from governments, many management problems may arise.

In the past, projects managements were practiced with emphasis on construction process, and the research concerned were based on the organization form and participants' organization operation. In a certain stage, the organization form was comparatively fixed; therefore, the organization change is neglected. In the recent 20 years, for the change in mode of investment and contract, project management lifecycle is prolonged greatly. Accordingly, integrated management in whole lifecycle of project is called for. The application of information technology, internet and intranet, in construction field has provided advanced management methods. With typical characteristics in different stages of a project, the organization forms vary accordingly. So it is critical to solve organization change problems in lifecycle of projects with information technology and integrated management theory.

### 2 Characteristics of infrastructure project organization

#### 2.1 Phasingness in lifecycle of infrastructure projects

For public projects of large scale with long lifecycle, governments will carry out decision process cautiously. Take subway projects for example. The decision process includes feasibility study, authorization, design, construction, operation and so on. The whole process may range from several years to several decades in which organization will change from simplicity to complexity with the establishment of project objective and technology system. Take the construction of subway invested by the government as a case study (Cheng Hu, 2002).

(1) In the preceding stage (before the feasibility study), the management is carried out in a small research organization. It is a parasitic project organization in a functional department of the government. In the stage of feasibility study, a leading group will be established with a few participants, mainly consultancy company and technology department, in linear organization form.

(2) In the design stage, the formal project organization will be set up. Because of the complex design management, functional departments will be founded in the organization as well as project participants in functional organization form.

(3) In the construction stage, over 40 subprojects are carried out at the same time. The management organization includes departments in contract, supply and consultancy and technology. The organization is carried out in matrix form.

(4) In the operation stage, the management lies in the subway company in the form of enterprises. The process of organization change in the lifecycle is as follows:

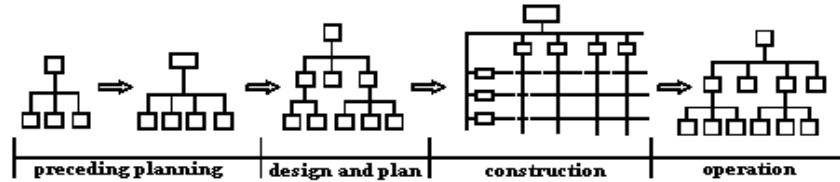


Fig 1. The process of organization change

## 2.2 Dynamic state in project organization

In the whole lifecycle, with more complex task and more participants involved, the management in four stages takes different form. With the development of the project, the loose organization will become more complex. The dynamic characteristics lie in participants as well as form. Participants come from various fields ranging from the owner, company of design, construction and supply, etc.

## 2.3 Characteristics in organization change

Change is for improvement and innovation. Organization change is what a project organization responded to the problem outside or inside for improvement. The organization change discussed above is the change within lifecycle of a project because of the change in organization form in each stage. The organization change includes planned and unplanned change. The former one is decision after careful consideration, while the latter one is the response of a project to unexpected situation outside, which is adaptive and spontaneous(W. Warner Burke, 2001).

At present, to adapt to the changing environment outside, the research of organization change focuses on the change of enterprises organization. The great environmental change outside may lead to the change in organization form. On the contrary, if the environment keeps stable, the organization form can remain unchanged. The great difference in organization change between a project and an enterprise lies in that the former will happen definitely no matter whether the environment outside changes. In the development process of project organization, the organization form is basically stable within each stage, while it changes in the whole lifecycle. The organization will take parasitic, linear and matrix form, and finally it is the form of enterprises. Therefore, the focus of the research on project organization change lies in how it happens, not in what situation it happens or what kind of form it will take.

## 3 Existing problems in organization change

A project is an organic system that consists of many subsystems. Accordingly, a project calls for integration of many subsystems with every link and every procedure associating with each other. However, for the phasingness of a project, the owner of a project takes responsibility only in a certain phase in the lifecycle of a project. This situation cuts apart the association of phases, and brings about many problems in the process of organization change.

### 3.1 Participants take actions for immediate profits for different objective.

A project has its overall objective and requirement. In the past, the research emphasizes the fulfillment of three objectives with focus on the construction of a project. With the development of lifecycle theory, there are some changes in the definition of objectives. The objective in the lifecycle is defined as the overall project objective with emphasis on function, time and expenditure. Because of the difference in task and participants in each phase, the organization objective in each phase is different. For example, in the phase of feasibility study, the social, economic profits and environment protection are concerned much, while in the construction

phase, for the three objectives, environment protection is often neglected. Furthermore, when quality objective conflicts with cost objective and time limit, the quality objective may not be satisfied, and thus, hidden peril may be brought about. In the phase of operation, the project will take the form of enterprise. The owner expects low operation cost and high profits, which is difficult to achieve if there are quality problems because of poor design. The different objective often results that the leader of the project makes decision for immediate profits, instead of the overall objectives of the project. The traditional three objective (quality, cost and time) are sometimes hard to guaranteed, let alone other objectives, such as, sustainable development, coordination with the environment.

### 3.2 The responsibility of project organization is discrete.

The another problem of phasingness of project organization is that the organization responsibility of different phases is discrete, which easily bring the “fade zone” of responsibility into project management. Take the practice of entrusting the management of feasibility study, designing, construction and operation of a project to different leader and organization as an example, if a person who do feasibility study make a mistake, he may not be responsible for that because he may not work in the project any more when the mistake happens, meanwhile, the person who is in charge when the mistake happens will not take the responsibility because he did not do it, thus, “fade zone” of responsibility appears. Another example is the owner of the construction phase has the great responsibility of executing a project smoothly and realizing the final economic benefits of a project those heavily rely on his efforts (planning, organizing and coordinating, etc), however, he may not go on operating the project, so he may not care about whether the cost of the operation is high or whether the project can be sustainable. Professor Cheng Hu has made a survey whether the owner of the construction phase keeps on operating projects. 18 projects were surveyed and the result showed 16 out of the 18 project changed the person in charge(Cheng Hu, 2002). The result showed that discrete responsibilities are the general problem of construction projects. It also tells the reason why the expectant objectives and functions cannot be realized while the organization form is proper at each phase.

### 3.3 The interface of the organizations is unclear.

The above two problems often result in shortsighted behaviors and “fade zones” of responsibility. Those cause organizational interface problems further, which often intensity by other problems, such as, the project information can't flow within different form of organizations, project works are over divided(e.g., awarding too many contracts to contractors). The interface problems blur the responsibility on the interface of organization forms and often cause low efficiency and high cost.

## 4 The possible solutions

The problems above are caused by lacking integrated and systematic thought more than by the phasingness of construction projects and interface problems. Thus, to solve the problems, the integrated and lifecycle management should be applied and the organization change of the construction projects should be studied by integrated and systematic thinking. The possible solutions are as follow:

### 4.1 The principles

#### 4.1.1 establishing unified overall objectives

To be efficient, organizations must be formed based on the clear and unified objectives which all participants must have.

(1) All participants should agree with the overall objectives, which should be defined based on the lifecycle objective system.

- (2) All participants' benefits should be considered during all procedure of the project.
- (3) The overall objectives should be incorporated into the project documents of designing, contract, planning and organizational management rules.
- (4) To realize the unified objectives, the execution of the project must be conducted under unified commands, guidelines and policies.

#### 4.1.2 ensuring the completeness of the organizational responsibility

To ensure realizing the lifecycle objectives and the strategies of the top government, the tasks of a project which are entrusted to an organization should be complete, unified and systematic, rather than break down and entrusted to different organizations.

#### 4.1.3 putting the organizational responsibility of a project into place

The highly dynamic of construction project organization easily makes the “fade zones” of responsibility. To avoid that, project organizations should be configured to implement all works and tasks of a project, that is, all works should be assigned to the people responsible without any omitting; secondly, the links of organizational interfaces also should be designed in case of the blockage of information and the discreteness and inconsistency of organizational responsibility.

#### 4.1.4 establishing reasonable and restrictive measures for organization

The close restriction has been stressed on the organizational configuration and operation of project organizations for a long term. It includes:

##### (1) Setting a distinct line between right and responsibility

Any right should be restricted by the corresponding responsibility. The distinct line between them is the basis of setting up rights and responsibilities. On the contrary, hazy line may result some consequences, e.g. some works taken by nobody, responsibility shifting, disputed rights, organizational frictions, politics playing and low efficiency.

##### (2) Setting restriction between responsibility and working procedure

That can put logical connection between the works and management, so do between the responsibilities of different participant.

##### (3) Strengthening the superintendence on procedure

It should include the checking, evaluation, superintendence and auditing of the outputs of different phases.

##### (4) Keeping the clear organizational interfaces

It should be maintained by designing good organization structure, the matrix of responsibility, the rules of project management and management information system.

##### (5) Others

Other restrictive measures also could be employed, for instance, insurance, guarantee, etc.

## 4.2 The measures

### 4.2.1 Making project breakdown system (PBS), breaking down organizational responsibilities based on PBS

A project is a behavioral system consisted of the inter-related, inter-influenced and inter-relied activities, having the characters of general systems of levels, aggregation, relativity and integration. According to the working procedure of general systems, they should be break down before a specific project work is executed, e.g. the designing, the planning, execution. All works within the project scope should be break down to the independent activities which can be easily administrated. According to break result, the cost, schedule and quality of each activity and the inter-relationship between the three could be defined, the responsibility of

completing each one could be assigned to the specific department and the person, further, the responsibility system of a project could be set up. Thus, the overall project could be under control. This result is named Work Breakdown System(WBS)in abroad. Professor Cheng Hu names it as Project Breakdown System( PBS) in the book Construction Project Management( Cheng Hu,2002) he wrote because the objective break down is the overall technical system of the project and the name of PBC can express the meaning of the breakdown system of the project.

PBS is the basic work for project management and the best tool for integrated management. To study the organization change of the infrastructure project with the lifecycle integrated management thinking, PBS is the first thing people should do. Only if organizational responsibilities are break down based on PBS, the overall objectives and the complete responsibilities could be assigned to specific department and person without any omitting assuringly. That can prevent shortsighted behaviors and “fade zones” of responsibility effectively.

The way of breaking down the organization responsibility is supposed that the overall objectives should be break down according the phases of the infrastructure project firstly, then accordingly, PBS (usually in tree diagram) in different phase is also made; secondly, the objectives should be set on each project unit, package and activity based on the PBS; the third, the organizational responsibilities should also be assigned to each project unit, package and activity according to the break down objectives, thus a complete responsibility system is formed. The overall objectives could be assured through that method because each responsibility responses to a break down objective. This procedure should be feasible by reason that the PBS come from the breakdown objective in each stage, the correspondence between them reasonable.

#### 4.2.2 Establishing a good integrated information system of projects, supporting organization system with the decision making, checking and superintendence tool

The integrated information is the key to the integrated lifecycle management of infrastructure system. Management Information System (MIS) of construction project is a powerful tool to design an integrated information system. Through a modern, practical, efficient and safe project MIS, the collection, arrangement, transferring, statistics and assembling of the information of the construction project could be done ( Xue Huacheng, 2002), and the integrated management system, which can control the construction projects on time, space and functions, could be established. This kind of integrated system, through a unified and standard management information collection and feedback mechanism of the construction projects, could turn the behavior control into program control and turn the extensive management to accurate management, as well as, it can provide a practical and basic software for routine management.

The foundation work of establishing project MIS is to set up a standard information system which involve all participants and administrative functions in the lifecycle of projects. This can be realized by using the code system of PBS that includes the code of project, project unit, package and activity directly or extending it.

The construction project MIS is not only the combination of management and the software, more important, it could decide the form of organization structure, virtual organization being a good example of how integrated information system and the internet creates a new organization form. For the traditional organization forms, it could decide whether the information communication can go smoothly. The communication goes between:

- (1) different phrases in the lifecycle of the project;
- (2) different organizations, especially between the owner and the contractor;
- (3) different function departments among the administrative organization of the project;
- (4) all parties who participate the execution of the project and social institutions that are supposed to share the construction information.

If information goes smoothly between the interfaces above, the conflicts between the interfaces could be reduced and the organizational efficiency could be improved, so that the organization form could change according to plan, with the overall objectives assuring. Otherwise, the conflicts could be accumulated and the organizational efficiency lowering, the management even losing control, in that case, the whole project would fail.

## **5 Conclusion**

Organization change of infrastructure project is a fresh research topic. The author only discusses it macroscopically and tries to find a proper thought to study it in this paper. Some detailed issues have not been analyzed, for instance, behaviors in organization change, the plan and the control of organization change, which are the important topics that the author will go on studying.

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