

## **ECONOMIC ANALYSIS ON THE SECTION DIVISION OF ENGINEERING CONSTRUCTION PROJECTS**

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### **ABSTRACT**

The section division of engineering construction projects is one of the important tasks faced by the owner in the stage of engineering project planning. Technical, cost, management ability and other factors should be fully considered in the section division of engineering construction projects. Based on the theory of new institutional economics, this paper puts forward the countermeasure of section division of engineering construction project from two dimensions——engineering transaction cost and engineering production cost.

**Keywords:** Section division; Engineering construction project; Transaction cost; Production cost

### **INTRODUCTION**

Reasonable section division has a certain role in promoting the realization of the objectives of engineering construction projects. Appropriate section division for engineering construction projects is beneficial to give full play to the technical advantages of each contractor, improve the quality of the project, and control the cost and duration of the project. The section division needs to consider the relevant factors, and there is a certain relationship between the number of sections and the project cost. Therefore, it is necessary to explore the section division before the division of the project. Therefore, based on the new institutional economics theory, from the perspective of engineering transaction cost and engineering production cost, this paper puts forward the strategy of section division of engineering construction project.

### **1. Principles and Basis for Section Division of Engineering Construction Projects**

#### **1.1 Principles for the section division of engineering construction projects**

The following principles should be taken into account when dividing the sections of engineering construction projects:

- 1) It is beneficial to construction management. Each section delimited by the project is a sub-project of a whole project. Therefore, when dividing the sections, the project arrangement, schedule, implementation area and professional division of labor must be taken into full consideration, so as to facilitate the unified management and coordination of the owner or agent and ensure the smooth progress of the project construction.
- 2) It is beneficial to the rational use of investment and the improvement of investment benefit. The project construction needs certain fund guarantee. Therefore, the section division should fully consider the saving of project investment. A better plan of dividing sections can reduce the interface friction between the contractors and reduce the investment of the project.
- 3) It can ensure the quality of the project. The section division makes the overlaps between sections easy to become the weak link of engineering quality control. Therefore, when dividing sections, this factor must be fully taken into account, and the overlaps between sections should be reduced as far as possible, so as to facilitate the control of engineering quality.
- 4) It can guarantee the project time limit. In a sense, to ensure the construction period of the project is to save the construction cost of the project and improve the investment efficiency of the project. Therefore, when dividing the sections, we must fully consider the problem of the project duration, and find a balance between the project duration and the project quality.

### **1.2 Basis for the section division of engineering construction projects**

The following factors should be considered when dividing the sections of engineering construction projects:

- 1) Features of the project. For a single project, the general contracting should be considered first, and the undertaking unit should be determined through one-time bidding. For simple projects with small quantities or concentrated sites, sections cannot be divided, but for projects with large quantities, complicated technology and large professional span, appropriate bid splitting should be considered.
- 2) The management ability of the Owner. The management ability of the owner is an

important aspect to be considered in the section division, and the management coordination ability of the owner is very important for the smooth progress of the project. Now some owners who do not have strong ability of project management will employ relevant project management companies to manage on their behalf, which is a great benefit to the management of engineering projects, at this time, more sections can be divided. On the contrary, if the owner's management ability is not strong and the project management company is not hired to manage the project, then the project should be divided into a few bidders or direct total contract;

- 3) The problem of interface overlap between sections. When dividing the sections, we must fully consider the interface between the sections, coordinate all participants, and effectively control the project.

## **2. Relationship between Number of Sections and Total Project Cost**

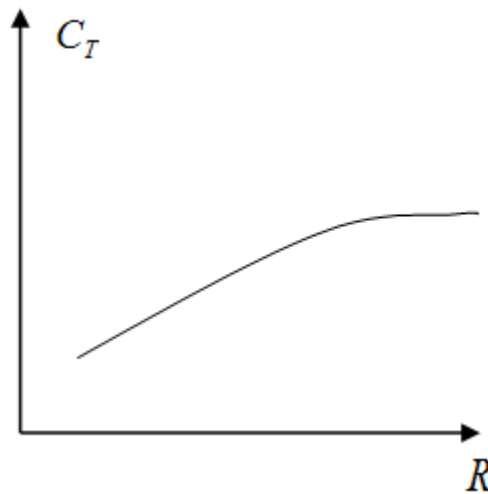
In this study, the total engineering cost ( $C$ ) includes engineering transaction cost ( $C_T$ ) and production cost ( $C_B$ ), namely  $C = C_T + C_B$

The transaction cost mainly includes two parts: one is the cost of setting up the project management organization on behalf of the owner, including the cost of engaging supervision or entrusting project management; the other is the cost of dealing with the additional cost caused by unnecessary engineering alteration and engineering claim, and the cost of coordinating and settling contract disputes; Production cost refers to the cost of construction and installation works, namely direct cost and indirect cost, which are determined in the contract.

Set the number of sections to  $R$ .

### **2.1 Relationship between the number of sections $R$ and the transaction cost of the project $C_T$**

Obviously, there is a positive correlation between the transaction cost of the project  $C_T$  and the number of sections. The more parts a project is divided into, the more management and coordination costs will be required. The relationship between the number of sections  $R$  and the transaction cost of the project  $C_T$  can be roughly described in Figure 2.1.



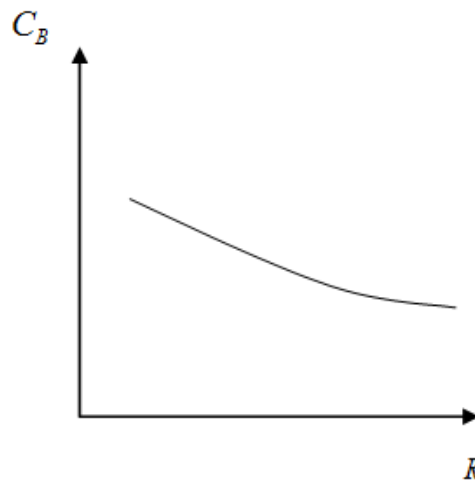
**Figure 2.1: Relationship between Number of Sections  $R$  and Project Transaction Cost  $C_T$**

## **2.2 Relationship between the number of sections $R$ and engineering production cost $C_B$**

There are two kinds of relations between the number of sections  $R$  and the engineering production cost  $C_B$ , one is that the number of sections is related to the number of bidders, the other is that the number of sections is not related to the number of bidders. The following two cases are discussed separately.

### **2.2.1 The number of sections is related to the number of bidders**

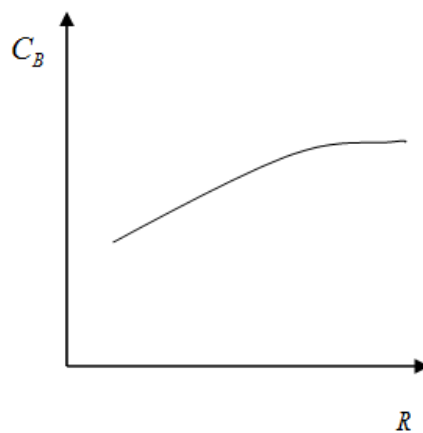
In this case, for a specific project, the more the number of sections, the smaller the size of each section  $R$ , to a certain extent, the more contractors can participate in the bidding competition for the section. According to previous research results, for the same project bidding, the more contractors participate in the bidding, the more intense the competition, the lower the contractor's quotation, the lower the project production cost  $C_B$ . In this case, the relationship between the number of sections  $R$  and the engineering production cost  $C_B$  can be shown in Figure 2.2.



**Figure 2.2: Relationship between Number of Sections  $R$  and Engineering Production Cost  $C_B$**

### 2.2.2 The number of sections has nothing to do with the number of bidders

In this case, for a specific engineering construction project, if the bidding cannot attract other contractors to participate in the bidding and competitive bidding of the project, the bidding strategy of the bidder will not change, but because the size of the bidding section becomes smaller, the cost will increase, so the bidding of the engineering construction project will be higher in this case. It can be concluded that the optimal number of sections in this case is 1. In this case, the relationship between the number of sections  $R$  and the engineering production cost  $C_B$  shown in Figure 2.3.



**Figure 2.3: Relationship between the Number of Sections  $R$  and Engineering Production Cost  $C_B$**

### 2.3 Relationship between the number of sections $R$ and the total cost of the project $C$

Total project cost ( $C$ ) includes project transaction cost ( $C_T$ ) and production cost ( $C_B$ ). It is still divided into two cases, one is the number of sections and the number of bidders, the other is the number of sections and the number of bidders is irrelevant.

#### 2.3.1 The number of sections is related to the number of bidders

According to Figure 2.1 and 2.2 and the corresponding analysis, as you can see, where the number of sections is related to the number of bidders, there is such a relationship between the total project cost  $C$  and the number of sections  $R$ . When the number of sections is small, the project transaction cost  $C_T$  will increase with the increase of the number of sections  $R$ , but at the same time, the project production cost  $C_B$  will decrease with the increase of the number of sections. Under the interaction of the two, the total project cost  $C$  will decrease. However, with the further increase of the number of sections  $R$ , the effect of the decrease of engineering production cost  $C_B$  will be smaller than that of the increase of engineering transaction cost  $C_T$ , which will lead to the increase of the total engineering cost  $C$ . There is a number of sections  $R^*$  that minimizes the total cost of the project  $C$ .

In this case, the relationship a between the number of sections  $R$  and the total cost of the project  $C$  can be shown in Figure 2.4.

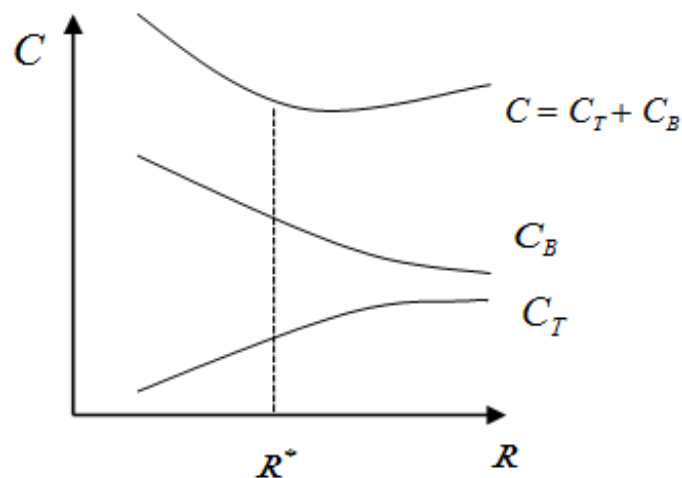


Figure 2.4: Relationship a between Number of Sections  $R$  and Total Project Cost  $C$

### 2.3.2 The number of sections has nothing to do with the number of bidders

According to Figure 2.1 and Figure 2.3 and the corresponding analysis, it can be seen that the total cost of the project  $C$  and the number of sections  $R$  show such a relationship when the number of sections is irrelevant to the number of bidders. With the increase of the number of sections, the project production cost and the project transaction cost increase with the increase of the number of sections. There is a number of sections  $R^*$  that minimizes the total cost  $C$ , and  $R^* = 1$ .

In this case, the relationship between the number of sections  $R$  and the total cost of the project  $C$  can be shown in Figure 2.5.

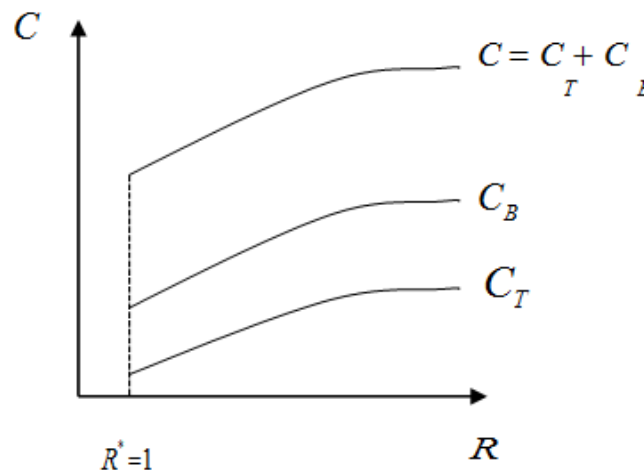


Figure 2.5: Relationship between Number of Sections  $R$  and Total Project Cost  $C$

### CONCLUSION

Based on the above analysis, for the owner, in the process of project bidding planning, should be based on the project for the contractor's attractiveness and other factors to determine whether the project needs to be divided into bidders. If the sub-bidding of the project can not attract other contractors to participate in the bidding and competitive bidding of the project, then the best plan is to contract the project as a whole; Conversely, the owner should find an optimal number of sections so that the total cost of the project is the lowest.

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