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A Theoretical Survey on Implement Status Diagnosis Index System for Large-scale Construction Projects

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Abstract

The macro and the meso diagnosis results obtained by the current diagnosis system cannot satisfy the actual management requirements in Large-scale construction projects due to the lack of systematic connotations in the implementation status index system. This paper carries out a comprehensive study on the layer classification method for Large-scale construction projects based on the analysis of the system structure composition and the problem causes. The whole work employs the systematic science theory and takes into account the actual management requirements to set up the scientific and logical diagnosis index system for the implementation status monitoring. This work provides not only a new approach to solve the systematic connotation problem of the index system, but also a new method to ensure the established index system to be systematic, logical, and self-consistent.

Keywords

Systematic Science; Large-scale Construction; Index System; Establishing Method.

1. Introduction

The large construction project is a typical open system which may frequently be influenced by many factors from inside to outside. In order to make the project procedure fluently go on, it is significant to figure out the bad-side factors for the proper measures.

Recently, many large construction projects employed the IMS (Information Management System) to detect the implement status and find out the abnormal factors based on the index parameters. The target is to offer effective monitoring on the practical projects [1] and it does provide active consequence in discovering particular issues and abnormal factors from the micro-aspect.

However, when it comes to the status detection in the mid-aspect and the macro-aspect, the results are still far away from the actual practice. Consequently, strict problems are produced for the scientific management of the large construction projects [2]. How to effectively solve this type of problems has become a significant issue which needs special consideration and investigation.

Many scholars have carried out different researches on this problem. It is found that the lack of systematic connotations of the diagnosis indicators leads to the miss of the intrinsic recurrence mapping relationships among the indicators for the macro and the meso states. Consequently, regardless of the qualified micro diagnosis result obtained by the diagnosis system, the macro and the meso states of Large-scale construction projects still cannot be scientifically and correctly assessed [3].

Many scholars have proposed dozens of diagnosis index systems, which have different levels and varied-amount indicators, to improve the correlations among the macro and meso diagnosis indicators in Large-scale construction projects [4]. Generally, the methods to solve

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this problem can be divided into two categories. One is the critical thinking based method, and the other is the reference based method.

The critical thinking based method is mainly used by the managers who determine the diagnosis indicators of the implementation status based on their experience. However, due to the limitation of personal experience, the selected diagnosis indicators and the established index system are obviously incomplete [5].

The reference based method is mainly used by the theoretical researchers who pick the diagnosis indicators in advance according to their research experience as well as the project requirements and the large amount of academic references. Then, the corresponding index system is constructed based on the hierarchical structure of the project management object. Nevertheless, the application effect of is not so satisfied, since the indicators extracted from different citations are not targeted for the monitoring objects and the established index system is lack of scientific and rigorous system logic [6].

Although neither of the aforementioned two methods is qualified enough, they still indicate the key information to establish a comprehensive and effective index system of the implementation status in Large-scale construction projects. The proper way is to start from the overall perspective of the engineering system and employ the more scientific approaches to study and deal with this problem.

2. System Composition of Large-scale Construction Project

Different from other projects, the Large-scale construction projects primarily take the construction entities as the management objects and perform a systematic management to obtain the scheduled goals by following the scientific methods and procedures subjected to certain conditions [7]. During the management, the whole project can be classified into three levels, namely the unit project, the departmental project, and the sub-project. The detailed management contents include the project planning, the project preparation, the project implementation, and the project acceptance check. Generally, the whole project can be divided into four stages, namely the decision-making stage, the preparation stage, the construction stage, and the completion stage. Each stage includes different contents, as described below.

(1) Decision-making Stage

This is the initial stage of an engineering project. The main work of this stage is to analyze and assess the feasibility of the project, while the contents include the determination of the construction target, the compiling of the project proposal, the pre-survey, the submission of the feasibility report, and the project approval and permission. The landmark achievement is to obtain the authorized construction license.

(2) Preparation Stage

In this stage the construction project has been authorized and needs to carry out the further work of the management department setup, the engineering design, the construction plan preparation, the invitation for bids, the operator team selection, the material purchase, the land requisition and demolition, and the temporary facility construction. All of these work contents are in order to establish a rigid basis for the further construction implementation.

(3) Construction Stage

This is the most important stage which focuses on making full use of all kinds of resources to obtain the scheduled goals and turn the sketch into reality. Since in this stage the managers are requested to overcome all of the difficulties and complete all of the construction work with a satisfied quality and cost in time through the scientific organization and management, it is the very stage that contains the most work, the most problems, and the most resources.

(4) Completion Stage

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In this stage the subsequent work after construction, such as the acceptance check, the charge settlement, the test running, the project transfer, and the remaining problem solving, needs to be carried out.

Based on the previous analysis, it is suggested that the management contents of the four stages are related but meanwhile different. On one hand, the work carried out in the former stage is the precondition and basis of the later one. On the other hand, the work in the later stages is the extension of the former one. All of the work in different stages is closely connected and forms a comprehensive system to fulfill the whole project function and obtain the scheduled goals. The classification of the stages as well as the work contents in each stage are illustrated in Figure 1.

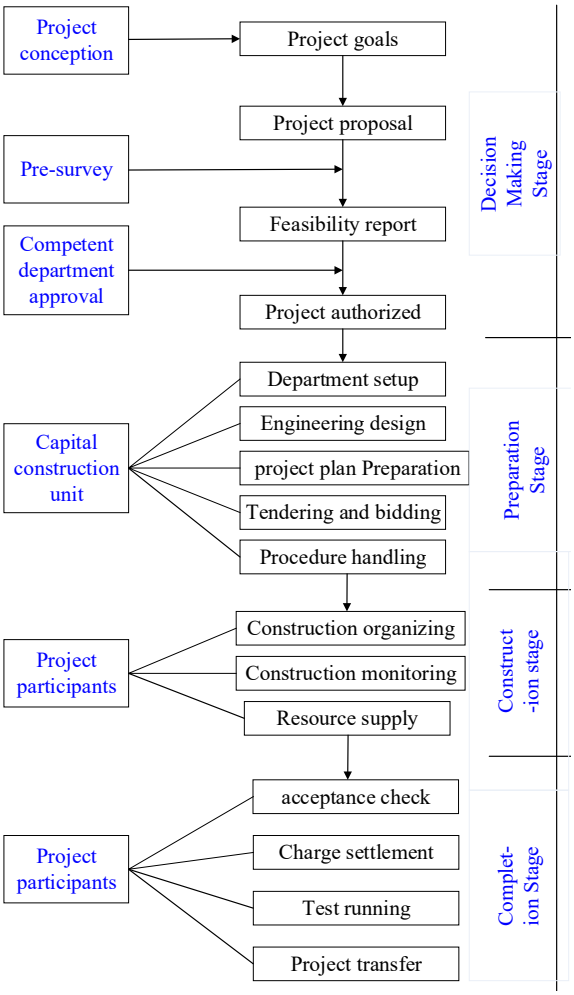

Figure 1. Stage classification and detailed work contents in each stage

3. System Science and System Management of Engineering Projects

The system science studies the relationship between the system structure and the functions. It takes the complex systems in different fields as the research objects and investigates the essences of the factors from inside to outside. Significantly, it represents the essential relations among these factors and provides the scientific references for the systematic problems by revealing the developing rules of the system [8]. Since such developing rules as well as the problem solving methods proposed by this science is universal, the system science has been widely used in many fields of the natural and the social sciences such as engineering, information, biology, humanities, etc.

In the system science, the most popular method to analyze and assess the structure and the composition of a system is the systematic theory. Such theory treats all of the systems as the

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multi-level networks with different degrees, varied scales, and different layers. However, no matter for what kind of system, the study should begin with the general analysis on the function relations among the overall system, the departmental system, and the sub-system. Then, the further relationship analysis should be carried out at both the macro and the micro levels, in both the local and the general aspects, from both the nearby and the remote views, and with both the same type and similar type comparisons. Finally, the comprehensive and logical multi-level networks can be established through the step by step modeling. Such multi-level networks have the micro layers to represent the behavior properties, the meso layers to indicate the function properties, and the macro layers to express the value properties. Consequently, there is a strictly logical recurrence between the micro contents and the macro items, and the contents of different layers are in a perfect consistency [9].

Therefore, the systematic science theory has become an indispensable tool to figure out the essential relationships among the closely related management contents of different layers for the Large-scale construction projects which have multi levels and complex management objects.

Table 1. Three Scheme comparing

Numble	Scheme 1	Scheme 2	Scheme 3
1	456	456	123
2	789	213	644
3	213	654	649

4. Diagnosis Index System Framework of Large-scale Construction Project in View of Systematic Science

A Large-scale construction project is an aggregation composed of multiple unit projects. Each unit project also consists of several departmental projects, while each departmental project further includes many sub-projects which are composed of the detailed work that completed by the operators with specific materials and techniques [10]. Therefore, the sub-projects are the detailed behavior components of the whole project, while the departmental projects are the functional parts, and the unit projects and their integration are the value express.

Based on this logical relationship, the whole system structure of a Large-scale construction project can be divided into three levels, namely the macro, the meso, and the micro layer, as illustrated in Figure 2.

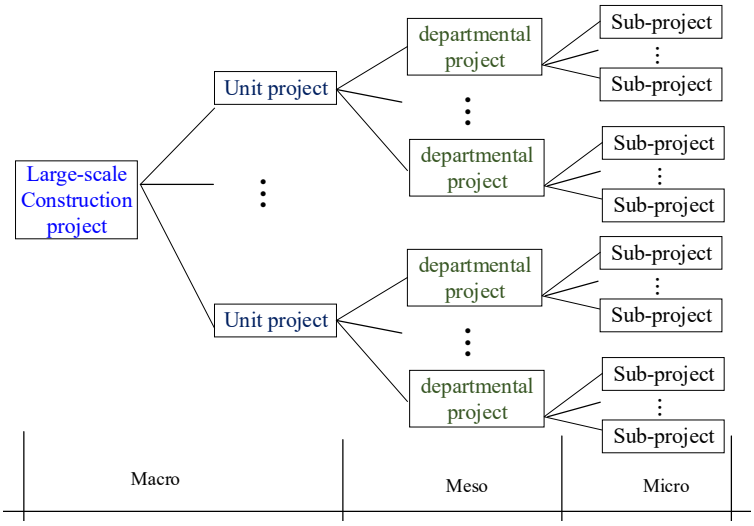

Figure 2. Stage classification and detailed work contents in each stage

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Since the micro level refers to the specific contents such as the construction quality, the construction progress, the cost, the safety, the personnel, the materials, the techniques, the environments, etc., the indicators of these factors are meanwhile employed as the micro-level indexes to diagnose the implementation status of the construction project. Similarly, the indicators to monitor the departmental projects are also employed as the indexes for the meso level diagnosis, while the indicators to assess the unit project are employed as the indexes for the implementation status diagnosis in the macro level. Significantly, the indicators/indexes between two layers are of recurrence and can be used to form the complete diagnosis index system of the Large-scale construction projects.

However, during the construction, the work contents are varied and carried out step by step in different stages. The practical management requests the particular indicators corresponding to these work contents. Consequently, regardless the proper expression of the management objects and contents indicated in Fig.2, it is still inconsistent to the actual management requirements [11]. Therefore, it is not appropriate to construct the diagnosis index system by completely following the thought illustrated in Fig.2. This conclusion has been valid by many scholars, since the very diagnosis index system has shown an unsatisfied effect in practical engineering.

Alternatively, the more appropriate approach to establish the diagnosis index system for Large-scale construction projects is to employ the indicators of the overall control object as the macro level indexes, while use the indicators of the detailed management objects as the meso level indexes, and select the indicators of the specific problems as the micro level indexes, as illustrated in Figure 3.

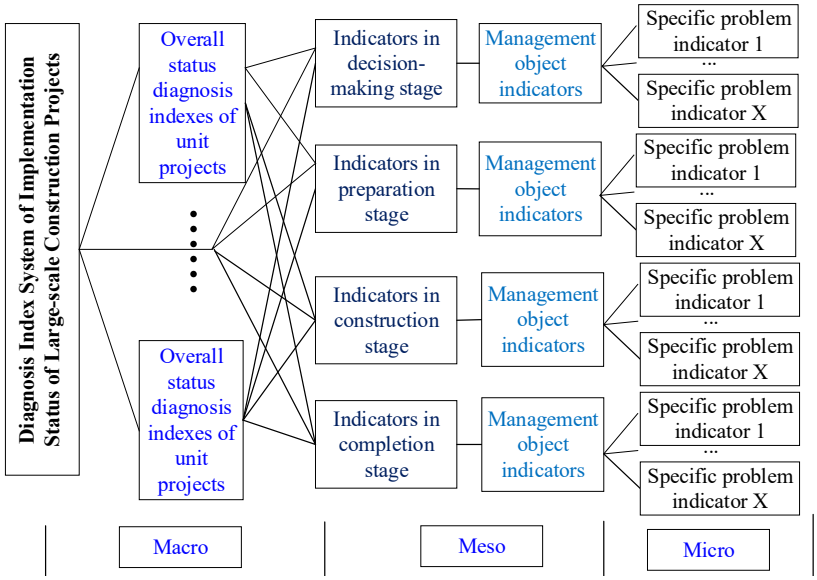

Figure 3. Index system framework of implementation status diagnosis in large construction project

5. Conclusion

Currently, during the implementation status management of Large-scale construction projects, the lack of systematic connotation of the diagnosis index system lead to the invalid macro and meso management and the negative impact on the scientific analysis and decision-making.

This paper presents the proper approach to construct a scientific, systematic, and comprehensive diagnosis index system for the implementation status in Large-scale

construction projects from the perspective of systematic science. Then, the detailed diagnosis index system which satisfies the actual requirements is proposed. The achievements obtained in this paper provide a new thought and a valuable reference for the diagnosis index system setup of the implementation status monitoring in Large-scale construction projects and therefore this work is a good supplement to the current management base.

Acknowledgments

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