

# A Literature Review on the Organizational Adaptability of Lean Construction Projects

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**Abstract.** With the advances in information technology, intelligent technology, computer simulation technology and network technology, as well as integrated integration applications between various methods, project management will be Pushed toward to intelligent, integrated, real-time and networked. Breaking through traditional project management to form Intelligent -refinement management model. Because of the large scale of the project, the large number of units involved, and the unpredictable external environment constraints, the project has become complicated and difficult, and new management concepts and management methods are urgently needed. In the later stage, the one-time planning method of traditional projects, due to rework and changes in demand and the implementation environment, the project planning and implementation are seriously out of touch, and it is more difficult to form refined management. Under the new digital design and intelligent framework, the real-time full-section information of the project can be fully obtained, and the planning and implementation can be integrated to make lean delivery possible. The thesis starts from three aspects: lean project, project organization dynamic adaptability and project organization research method (NK model and social network analysis method), and combs the research results and proposes the key research directions in the future. After all, the research directions are forecast in the future research.

**Keywords:** NK; real-time; computer simulation technology; network technology; new management concepts.

## 1. Introduction

How to effectively deal with the complexity of engineering project management is a hot issue that has been closely attention by the academics and engineering practice for a long time. In recent years, Because the rapid changes in the external environment and the uncertainty of the project itself, the traditional project tools are difficult to describe the changes in project requirements quantitatively, the complexity and uncertainty of external environment are resulting in a huge gap between the project planning and the project implementation, which makes the project plan fall through; traditional project management pay close attention to the design, Although a single design will reduce costs during the design phase, but it will cause a lot of changes and waste in the later stage; The traditional project management mode adopts sub-module management to form an island of project information, and the information utilization rate is low, and it is difficult to achieve information integration, which leads to chain effects such as delays in project duration, idle resources, and increased costs, the core of the Lean thinking is to improve production processes, improve labor productivity, reduce waste, eliminate all activities in the production process that cannot add value. Therefore, the dynamic adaptability of lean projects in complex and uncertain environments has become a key research content in the field of project management, attracting the continuous attention of many experts, scholars and project implementation personnel.

## 2. The Connotation and Dynamics of Lean Project Management

In the 1950s, with the successive application of Toyota Production System (TPS), Just in Time (JIT) and Constraint Theory (TOC), Lean was gradually accepted. Lean is defined as an improved philosophy, primarily to continuously improve the efficiency of the waste discharge systems [1]. Lean management has many management tools, such as Kan ban, zero inventory management, total production maintenance (TPM), pull system and replenishment system, and continuous improvement.

Lean thinking focuses on improving the production process, improving labor productivity, reducing waste, and eliminating all activities that cannot be added in the production process. Compared with the traditional push project plan, the lean project develops a pull production plan, the traditional project implements a top-level decomposition plan, and the lean project implements the final planner system (LPS).

Today, “lean” may no longer be popular, but its core principles (flow, value, pull, waste reduction, etc.) have become examples in many manufacturing and service. Papalexi [2] improves lean manufacturing for health-care, reduces turnaround time, and reduces waiting by improving patient flow and greater discharge efficiency. Michael [3] combines normative theory and critical theory with the actual situation of enterprises based on the perspective of enterprise lean production and literature resources, the research indicates that lean production can support enterprises to gain competitive advantage. As organizations become more involved in sustainable development, they are under increasing pressure. Vachon [4] pointed out that organizational lean management is a potentially important determinant of corporate performance and it helps to improve corporate practice. Oluwatosin [5] holds that the coordination of complex and fragmented activities in the planning, design and construction stages was relatively cumbersome due to the numerous complex and scattered activities involved. Gabriel [6] introduced the lean approach to project management to make the project a great success and meet the quality, time and cost requirements of the customer. In the worldwide range, the overall management level of construction projects is relatively lagging behind, there still exist some problems in low efficiency, high waste, and high engineering cost [7]. Lean construction theory can solve this problem, and it is also an important factor hindering the improvement of construction management. Compared with developed countries, the research and application of lean construction in China is still in the exploratory stage, and the relevant theories and methods are still not perfect. When introducing lean production methods, enterprises need to adapt the local conditions [8] to improve the production efficiency of construction projects. Due to the different cultural backgrounds of the company, people have different understandings of the implementation of lean thinking [9].

To grasp the essence of lean production, enterprises must reconstruct the project management process and compare and analyze the management principles of traditional project management authority, management behavior, decision-making methods, execution methods, value and continuous improvement methods (traditional projects are based on entity theory). Management model. Lean process design is equivalent to traditional project management schedule, quality, cost and other parameter calculation methods, as well as lean thinking downstream continuity, value continuity, schedule reliability and other quantitative parameters. Lean thinking also believes that the dynamic nature of the project environment (customer needs, resource conditions, etc.) is inevitable, so the dynamic adaptability of the production system itself is the basis of the normal operation of the entire production system.

### **3. Lean Project Organizational Adaptability**

At present, the dynamic capability of organizational change is the key to business survival and performance improvement. At one time, people thought that adaptability was the sustainable system (the core of individuals or organizations). Although dynamic organizational capabilities have been closely watched by researchers and practitioners over the past few years, relatively few have focused on creating a system model of dynamic capabilities and how to effectively measure the problem of organizational adaptability [10]. With the increasing demand of customers and the unpredictability of business environment, companies must constantly meet customer needs and become more competitive. The failure rate of New Product Development Project (NPD) is as high as 59% [11], contingency theory points out that organizations meeting environmental requirements can adapt to the environment well; strategic management theory believes that the key to organizational success is to maintain a high degree of consistency with the environment. Only adapt to the environment, can the organizations survive better. McCarthy [12] pointed out that companies should learn from nature

to make decision, treat organizational and managerial decisions as a complex adaptive system, and seek solutions while systems and environments is evolving continuously. With the deepening of the research on project organization ability, researchers have adopted different measurement methods, which can be classified into the complexity theory NK model and the social network analysis.

#### **4. The Complexity Theory of Project Organizational - NK Model**

The theory of fitness landscape, which was proposed by Wright in 1932, are used as the basic framework for the evolution of graduate objects. Solid landscapes are used to study adaptability in evolutionary organisms with strong selection of weak variants [13]. Based on this, Comanf introduced a mathematical concept to propose the NK model. The NK model is a kind of subject-based computer simulation method for researching that how the system can quickly and efficiently search for and obtain the optimal performance value [14]. Numerous studies have shown that one of the important factors affecting the complexity of the system is the interaction between the internal elements of the system and how it affects the overall adaptability of the system. It usually shows that it is difficult to measure with empirical data. The biggest advantage of the NK model is that it can handle these problems that cannot be studied empirically with relatively simple methods [15], such as how system complexity affects the overall adaptability of the system.

The process of the successful projects or enterprises constantly adjust and change their own elements to achieve to adapt the external environment, it is like the elimination mechanism in natural evolution. Construction project, as an open system, is constantly affected by the external market environment. Since Levinthal [16] used the NK model to study the relationship between self-organizing behavior and natural selection, the model has been widely used in organizational and strategic management research. In China, some scholars have applied NK models to HTVIC knowledge innovation [17], project team members' relationship [18], large-scale uncertainty engineering organization strategy management [19], and managerial cognitive representation in complex scenarios [20], system emergency management [21] and other research. Later, the theory of fitness landscape was widely used to study physics problems, and then gradually extended to other complex systems.

#### **5. The Relations Theory of Organizational Stakeholder ----Social Network Analysis**

The fluency of information between some uncertain and complex social nepotism is often the key to project failure. Social network analysis is a social research method for studying the relationship between organizational stakeholders. Sociological theory holds that society is not composed of individuals, but is composed of various network relationships. In 1993, Jacob Moreno introduced social network analysis in the context of a "community map", which uses dots to represent people in society and uses lines to represent relationships between people [22]. Due to the long cycle, large scale and complex environment of large-scale engineering projects, there are often many stakeholders in the project, and the cooperation between the parties constitutes the social network of the project.

The core of project governance theory is the regulatory relationship between project stakeholders. The traditional stakeholder management theory considers the binary relationship between a single project and a single stakeholder, that is, each benefit of the project and the project. Relevant parties will influence the success of the project in the process of realizing their own project needs. Scholar Zhang Ning [23] used the social network analysis method to study the social network relationship model of large-scale engineering stakeholders, and used the big data network to carry out deep demand mining for various stakeholders. Large-scale iconic cultural buildings are a symbol of citizenship as a tool for promoting cultural and economic benefits. In fact, many of the pitfalls of developing large-scale cultural construction projects (CBPS) are related to stakeholders. Therefore, addressing the complexity of stakeholders and understanding the main pitfalls of stakeholders in CBPs is the key to successful management of these projects, Mok [24] Apply social network analysis

and surveys and interviews to study the complexity and relevance of stakeholders in CBPS. Social Network Analysis as an improved theory of social risk analysis, based on 66 social case studies, Kaiwen [25] summarized eight stakeholders and 16 social risk factors for conflicts in construction projects with high complexity and uncertainty. It also provides a structured framework to analyze social risks and propose countermeasures and reduce the social impact of China's construction projects.

## 6. Summary and Outlook

Lean Construction solves many problems faced by China's construction industry, it is of great significance to raise the overall level of China's construction industry. The research on the uncertainty and complexity of lean project organization is a hot and difficult issue that has arisen in recent years. As an important branch of organizational adaptability and organizational stakeholder relationship, many research results have emerged, but a complete knowledge system has not yet been formed. This paper summarizes the relevant research contents and methods of lean project organization, so that readers have a preliminary understanding of this research field, and hope to provide certain reference value for future research and work. Through the above literature review, it can be concluded that there are several aspects worthy of attention for the future research direction of tissue adaptability and tissue nepotism:

(1) In order to standardize enterprise construction production technology, improve enterprise construction capacity and the overall level of the construction industry, the evaluation study of lean construction project management level provides a reference for enterprise project lean construction management capacity.

(2) There are relatively few research results on the relationship between stakeholders in lean construction project management both at home and abroad. It can be considered that using the method of organizational stakeholder relationship in Sociology for reference and application in lean construction project.

(3) At present, the researches on organizational adaptability mainly focus on the single-objective model. Obviously, lean construction project activities are interfered by many factors at the same time, and other uncertainties may appear. Therefore, using the theory of Evolution (NK model) to describe these new uncertainties and how to deal with the organizational adaptability of lean projects in complex environments, considering the interference of other types of uncertainties, lean construction projects are also worthy of in-depth study.

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