

Research on Project Managers' Cross-Level Cognition and Three-Primary-Color Time Management

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Abstract

The construction engineering industry is undergoing a triple transformation: the deepening of regulatory systems, market-oriented restructuring of post allocation, and the profound embedding of information technology. Project managers face the dual dilemmas of narrowed cognition and fragmented time. This paper proposes a “cross-level cognitive framework” and a “three-primary-color time management model,” attempting to fill theoretical gaps in existing research at the levels of project managers’ individual cognition and time management. The cross-level cognitive framework constructs pathways for cognitive transition and integration across three levels—institutional, functional, and informational—to overcome cognitive limitations caused by dependence on regulations, post solidification, and algorithmic cocoons. Based on the dimension of “ownership of control,” the three-primary-color time management model divides working time into the three primary colors of red, green, and blue, as well as the two mixed categories of magenta and cyan, thereby providing project managers with an intuitive tool for time classification and optimization. The study shows that the two together constitute core dimensions of objectified research on excellent project managers, providing theoretical support and practical pathways for industry talent cultivation, institutional design, and informatization development.

Full Text

Research on Project Managers’ Cross-Level Cognition and Three-Primary-Color Time Management

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Abstract: The construction engineering industry is undergoing a triple transformation: the deepening of the regulatory system, market-oriented restructuring of position allocation, and the deep embedding of information technology. Project managers face the dual predicament of cognitive narrowing and time fragmentation. This paper proposes a “cross-level cognition framework” and a “three-primary-color time management model,” attempting to fill the theoretical gap in existing research at the level of project managers’ personal cognition and time management. The cross-level cognition framework constructs pathways for cognitive migration and integration from three levels—institution, function, and information—in order to break through the cognitive limitations brought about by regulatory dependence, position solidification, and algorithmic noise. Based on the dimension of “ownership of control,” the three-primary-color time management model divides working time into the three primary colors of red, green, and blue, as well as the two mixed types of magenta and cyan, providing project

managers with an intuitive tool for time classification and optimization. The study shows that the two together constitute the core dimensions for objectified research on outstanding project managers, and provide theoretical support and practical pathways for industry talent cultivation, institutional design, and information-based construction.

Keywords: construction engineering; project management; project manager; cross-level cognition; three-primary-color time management

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Study on Project Manager' s Cross-Layer Cognitive Management and Tri-Color Time Management

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Abstract: The construction engineering is undergoing triple transformations—deepening regulatory systems, market-driven restructuring of job positions, and the pervasive integration of information technology. Project managers are confronted with the dual challenges of cognitive narrowing and temporal fragmentation. This paper proposes a “Cross-Layer Cognition Framework” and a “Tri-Color Time Management Model”, to address the theoretical gap concerning project managers’ personal cognition and time management. The Cross-Layer Cognition Framework establishes pathways for cognitive transition and integration aiming to overcome cognitive limitations. The Tri-Color Time Management Model classifies working hours into three primary colors and two mixed colors based on the dimension of “control ownership”. These suggest that two frameworks jointly constitute core dimensions of an objectified study of outstanding project managers.

Key words: construction engineering; project management; project manager; cross-layer cognition; tri-color time management

1 Introduction

1.1 Problem Background

Quality management in construction engineering has historically been grounded institutionally in a system of norms and standards. From the *Unified Standard for Construction Quality Acceptance of Building Engineering* (GB50300) [1] to

the acceptance specifications for various disciplines, a rigorous network of national standards constitutes the institutional framework for engineering quality control. For practitioners, GB50300 is not only a technical document, but also a tool for training cognition. This reverse-tracing capability of “phenomenon—sub-item—sub-division—division” forms the core characteristic of the systematic thinking of construction engineering managers.

The staffing standards for key positions are implemented in Shanghai in accordance with the *Guidelines for Staffing Key Positions in Project Management Organizations on Construction Sites of Shanghai Construction Enterprises* [2]. In actual work, however, the staffing of construction-site management personnel has become increasingly flexible and elastic. Standard personnel are in effect covered by the responsibilities of the project chief engineer; the functions of mechanics and holders of the Safety C1 certificate tend to converge; and the work of document controllers and labor administrators is often undertaken by the same person.

At the same time, the algorithmic recommendation mechanisms of information technology lock practitioners into personalized information flows and continuously push homogenized content, artificially creating cognitive silos and making it difficult for most practitioners to grasp the overall picture of the industry from a macro level.

In addition, the complexity of construction engineering projects determines the multiplicity of the project manager’ s role [3]. Project managers must comprehensively manage project quality, cost, schedule, and safety [4], yet their working time faces the dilemma of fragmentation and uncontrollability.

1.2 Research Questions and Core Concepts

The cognitive training embedded in the above-mentioned normative system, the market-oriented reconfiguration of post allocation, and the algorithmic silos of the information environment are not isolated from one another; together, they constitute the phenomena of current transformation in the field of construction engineering management. Meanwhile, the work of construction engineering project managers is highly fragmented, and they may face dozens of interruptions on an average day. Such fragmentation not only weakens project managers’ capacity to devote themselves to deep work, but also increases the risk of work pressure and occupational burnout.

However, most existing studies focus either on the technical details of standards implementation or on the institutional logic of position setting, or else are confined to the technical effects of information dissemination. At the same time, traditional time-management research mainly concentrates on project schedule management, concerning itself with “project time” rather than “the project manager’ s individual working time.”

It is precisely on the basis of these two theoretical gaps that this paper pro-

poses a “cross-level cognition framework,” drawing on geology, and the mixing principle of the “three primary colors,” drawing on chromatics, to construct a cross-level model applicable to cognitive management in construction engineering project management and a five-color time-classification model for work-time arrangement.

Hierarchy refers to the cognitive ability of the practicing subject to move actively and integrate coordinatively among the institutional level, functional level, and information level; to sink down into the norms, merge into reality, and leap out cognitively.

The three-primary-color time-management model, according to “attribution of control,” uses red, green, and blue as the three primary colors to represent the three basic types of time: uncontrollable, fully controllable, and neutrally determinate; these are then combined to form a five-color time-classification system.

The above cognitive management and time management constitute part of an embodied study of outstanding project managers.

2 Cross-Level Cognitive Mechanism

2.1 Concept of Cross-Level Cognition

This paper defines “cross-level cognition” as the comprehensive ability of a practicing subject to actively move and integrate among the institutional level, functional level, and information level, thereby breaking through cognitive limitations.

This concept contains three core dimensions: level-recognition ability, that is, accurately judging the cognitive level at which one is situated; level-transition ability, that is, actively moving upward from the current level to a higher level to obtain a new cognitive perspective; and level-integration ability, that is, integrating information obtained from different levels to form systematic cognition.

2.2 Evolution of Normative-System Thinking and Position Integration

The value of GB50300-2013 lies in the convenience it brings to technical management and in providing a framework of “decomposition—classification—positioning.” However, this framework cannot control path dependence in thinking, and under the new trend of position integration this limitation is further amplified. This is precisely the practical premise for proposing the “cross-level cognition” framework.

The “eight major personnel” system was largely formed around 2010; in theory, it created an ideal pattern in which “each performs his own duties and mutual checks and balances are maintained.” However, the gap between ideal and reality

appeared at the very beginning of the system's operation. On small and medium-sized projects, staffing all eight positions is almost an extravagant management predicament.

Current position integration on construction sites appears in multiple forms^[5]. For ease of analysis, some scholars classify it into three typical models. The most typical case of functional substitution-type integration is that the duties of the standard officer are replaced by the project technical lead; the typical case of functional convergence-type integration is the machinery officer and the safety C1 certificate; the typical case of concurrent-function-type integration is the combination of the document controller and the labor service officer.

Position integration is based on: first, cost-pressure driven factors. As the number of employees in the construction industry continues to decline^[6] and the number of projects continues to shrink, implementing one person for multiple positions has become a rational choice for enterprises. Second, transformation in the management paradigm. Flattened management has become a trend, and position integration is its manifestation in human-resource allocation.

Position integration requires practitioners to undergo a cognitive transformation from "vertical deep cultivation" to "horizontal integration," and this cognitive gap is precisely the issue that the "cross-level cognition framework" seeks to resolve.

2.3 Cognitive Alienation Predicament and Tension of the Times

The popularization of information technology has brought efficiency improvements to construction engineering, but it has also created cognitive difficulties: erroneous estimation of facts and systematic erosion of judgment. Cognitive tension therefore arises: the normative system requires practitioners to engage in in-depth, systematized, deep-cultivation thinking, while the algorithmic age has continuously disintegrated this habit of deep-cultivation thinking.

2.4 Structure and Practice Path of the Cross-Level Framework

The cross-level cognition framework can be further specified as the following analytical model:

The first dimension is crossing institutional levels, from implementers of norms to interpreters of norms; the second dimension is crossing functional levels, from position guardians to functional integrators; the third dimension is crossing information levels, from information consumers to cognitive constructors.

Based on the above three-dimensional model, the practice path of the cross-level cognition framework comprises the following three levels.

At the individual level, practitioners need to cultivate habits of “hierarchical questioning” (confirming the level of their own understanding), “cross-boundary reading” (understanding related fields and fields of interest), and “reverse thinking” (actively and critically reflecting on the content provided).

At the educational level, education departments should, on the one hand, continue to retain core normative teaching such as GB50300, and, on the other hand, add courses such as “information literacy” and “algorithmic cognition” to help students understand the cognitive traps of the information age.

Managers’ cross-level cognitive guidance is also embodied in four progressive paths.

First, critical review. The current institutional system has obvious lag. For example, basic standards such as the *Measures for the Assessment and Recognition of Professional Qualifications of Second-Class Constructors* (2007) and the *Code for Design of Building Water Supply and Drainage* (2002) leave most practitioners lacking reflective awareness of these deficiencies, whereas cross-level practitioners proactively submit institution-revision suggestions based on practice to policy-making bodies.

Second, the mechanism of cognitive boundary crossing. Cross-level practitioners maintain the ability to actively adapt during technological iteration through high-quality cross-domain reading, while also using AI to acquire systems of common-sense capabilities across different industries.

Third, micro-trend insight. From specific organizational phenomena, they extract macro-trend signals and complete a shift in logical thinking from “function subdivision” to “process integration.”

Fourth, cross-domain transfer and innovation. By establishing analogies among different knowledge domains, they activate innovation amid isomorphic target problems.

2.7 Contributions of the Cross-Level Cognition Framework

The theoretical contribution of the cross-level cognition framework lies in breaking through the 范式 that discusses “normative thinking,” “position allocation,” and “information environment” separately, and in proposing an integrated framework:

First, the implementation of flexible position-allocation policies requires supporting cognitive-capability development. Simply allowing concurrent positions, without a mechanism for cultivating compound talents, may lead to a decline in quality.

Second, industry informatization development should include a dimension of cognitive literacy. When using information systems, it should help project department members understand the logic and limitations by which information is generated.

3 Three-Primary-Color Time Management

3.1 Concept of Three-Primary-Color Time Management

A project manager's time is divided into five categories of the three primary colors: red time as completely controlled time, green time as completely self-controlled time, blue time as neutral pending time, magenta time as a small amount of self-controlled time, and cyan time as a large amount of self-controlled time.

3.2 Cases of Three-Primary-Color Time

Red time refers to working time over which the project manager has no control at all. Typical manifestations include project regular meetings organized by Party A, monthly business analysis meetings convened by the company headquarters, and inspection receptions by competent government departments.

Green time refers to work and life time over which the project manager has complete control. Typical manifestations include sleep and rest time, personal exercise time, family-life time, and so on. These activities are necessary to maintain the project manager's physical and mental health, yet are most easily squeezed out.

Blue time refers to working time whose control authority remains unclear or pending. Typical manifestations include time spent waiting for Party A's approval, time spent waiting for design-change drawings, and so on. Blue time is the most common source of waste in time management.

Magenta time is derived from a combination of red (completely controlled) and blue (neutral pending), representing the project manager's possession of a "small portion" of control authority. Typical manifestations include internal meetings organized by the project manager himself or herself (such as project morning meetings and crew coordination meetings), inspections of the construction site, communication with members of the project department, signing and issuing documents, studying policy trends, and so forth. This type of time is similar to important but non-urgent matters in four-quadrant management: it may be interrupted, delayed, or even canceled because of red time. This time is the focus of the project manager's management of the project department of each participating party.

Cyan time is derived from a combination of green (completely self-controlled) and blue (neutral pending), representing the project manager's possession of a "large portion" of control authority. Typical manifestations include information-sorting time before officially starting work in the early morning (checking news, emails, and WeChat messages), and review-and-summary time before leaving work (organizing photos, WeChat records, updating schedules), etc. Making reasonable use of cyan time for information organization, knowledge management, and planning for the next day can improve overall efficiency.

3.3 Three-Primary-Color Time Management Strategies

For red time, because it cannot be avoided, it is necessary to manage expectations and emotions, while also identifying which matters can be negotiated and which must be accepted.

For green time, the management focus is firm protection and no arbitrary sacrifice; this is extremely important for the project manager's long-term physical and mental health.

For blue time, the management focus is active transformation. Through operations such as synchronizing work items, blue time can be transformed into cyan time in order to improve time-use efficiency.

For magenta time, the management focus is to create value within the framework and do some important—but not so urgent—things.

For cyan time, the management focus is planned thinking. Using 1 h in the early morning for information acquisition and same-day planning, and 1 h in the evening for review, summary, and preparation for the next day, can ensure the efficient use of time of other colors during this uninterrupted period.

3.4 Theoretical Significance of Three-Primary-Color Time Management

The three-primary-color time management model provides project managers with an intuitive tool for time cognition and analytical reminders. Conducting weekly and monthly review analyses can generate continuous self-awareness and momentum for improvement, and is an extremely important link in project managers' self-management and in influencing the effectiveness of project department members.

The sorting out of three-primary-color time management also promotes understanding of the time-management systems of synchronous participating parties, and has reference value for improving the allocation of time resources for communication among all parties.

4 Conclusion

The core contributions of this paper can be summarized in the following four points:

First, it reveals that thinking training in the normative system, elastic reorganization of position allocation, and information narrowing in algorithmic recommendations are not isolated phenomena; rather, they shape the structural constraints of the project manager's work environment, and the three together constitute the root causes of "cognitive differences."

Second, it constructs a cross-level cognitive framework. This paper proposes that project members should achieve active transition and integration among the institutional level (normative system), the functional level (position boundaries), and the information level (algorithmic environment). This framework includes three core dimensions—level-identification ability, transition ability, and integration ability—and guides practice through four paths: critical examination, cognitive iteration, micro-level observation, and cross-domain migration. It thereby breaks through the fragmented perspective of traditional cognitive analysis and realizes transformations from “norm executor” to “institutional participant,” from “position defender” to “functional integrator,” and from “information consumer” to “cognitive constructor.”

Third, it proposes the three-primary-color time management model. In response to the pain points of highly fragmented and uncontrollable project-manager working time, this paper takes “attribution of control rights” as the sole classification dimension and divides time into five categories: red (completely controlled by others), green (completely self-controlled), blue (neutral/undetermined), magenta (partially self-controlled), and cyan (mostly self-controlled). The value of this model lies in transforming abstract time allocation into a visualized color classification, enabling project managers to intuitively identify imbalances in time structure and to adopt differentiated optimization strategies in a targeted manner, such as “managing expectations,” “resolute protection,” “active transformation,” “creating within the framework,” and “forming habits.” This has referential significance for all participating parties in jointly constructing cognition of the time management system and coordinating the allocation of time resources, and can thereby improve project-department performance to a certain extent.

Fourth, it reveals that cross-level cognition and three-primary-color time management are not only tools for improving individual capabilities, but should also become dimensions to be considered in industry-level institutional design. The combination of the two provides an operable analytical framework for research on the objectification of outstanding project managers, including cost and human-resource management.

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Author contribution statement:

Cui Lei: proposed the research ideas, drafted the paper, and revised the final version.

Note: Figure translations are in progress. See original paper for figures.

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