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ITJ

ISSN 1812-5638

# INFORMATION TECHNOLOGY JOURNAL

**ANSI***net*

Asian Network for Scientific Information  
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

## Integrated Regulatory Mechanism of Engineering Projects

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**Abstract:** The contractors of Engineering Projects (EP) are likely to take a conspiracy to obtain illegitimate interests when there is lack of external oversight. So the regulatory role of the government becomes very important. However, how to improve the efficiency of the government's supervision and reduce the supervised burden of contractors are the hot and difficult research problems. The purpose of this study is to provide a more efficient supervision model to reduce or avoid inefficiency and corruption. A new supervision mode called integrated supervision is put forward elaborating the definition, principles and three-dimensional integrated pattern. Furthermore it is emphasized on discussing the procedures designing and the key technologies. This model may provide a new perspective for optimizing management.

**Key words:** Integrated supervision mechanism, systematic complexity, engineering projects

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### INTRODUCTION

Engineering construction belongs to a kind of market behaviors but in the absence of external oversight, the contractors are prone to have selfish motives and have improper or illegal behaviours. In addition, EPs have huge investment and have relationships with the residents. Therefore, the government's supervision is necessary (Timonen and Doyle, 2007; Lan and Galaskiewicz, 2012). Some scholars also think that government should weak the intervention to the market behaviors. The optimized methods of regulatory method should be studied. Therefore it is a hot topic for many countries, especially in some developing countries, such as China (Hwang *et al.*, 2006; Wong *et al.*, 2011). To ensure the efficient of engineering projects, the government usually has different regulatory departments to supervise the various aspects of them (Wu *et al.*, 2011). However, how to coordinate the supervisory departments and to realize the multi-objective control is still a conundrum. Thus, this study explored a highly effective supervision pattern to improve the supervision transparency and Supervision Efficiency (SE) using the information and communication method.

The government supervision has different definitions in research fields. The government supervision is a kind of external administrative behaviors and legal relationship between the particular administrative subjects and objects from the view of law. And in the viewpoint of the economics it is a set of behaviors authorized by the relative government organizations to affect the social micro-economic directly through laws or administrative

permission. Its ultimate aim is to protect the public benefits and legitimate private benefits and to avoid or reduce the damage caused by individual illegal behaviors. How to ensure the SE dealing with the coordination issue is the basic starting point of this study.

**Integrated supervision mechanism:** We should first understand the concept of integration before researching the integrated regulatory mode. Many scholars defined integration from different perspectives and discussed their connotations. Dai and Hao (1997) and Zhang and Dai (2010) claimed that integration is to integrate some aspects of the complex things. Gong and Zhu (1996) explained that it is to combine with some independent parts to form a complete system.

Nowadays, the traditional supervision mode often adopts the two-dimensional control framework. The builders manage five project targets as the first dimension: quality, schedule, cost, security and environment. The second dimensional control is that the supervisors control the builders' behaviors. The traditional supervision mode is indicated in the Fig. 3 as the two internal rings. However, to keep high SE should base on the assumption that the supervisor enforces the law impartially. Otherwise, the inefficient regulation will appear and even lead to corruption. In other words, if regulators have irregularity actions, then regulatory effect of the two-dimensional will be undermined. Therefore, this study develops a three-dimensional supervision mode adding a regulatory control dimension (Fig. 1). This type of regulatory mechanism should control the regulatory effect and regulatory procedures. The left part of Fig 3 shows

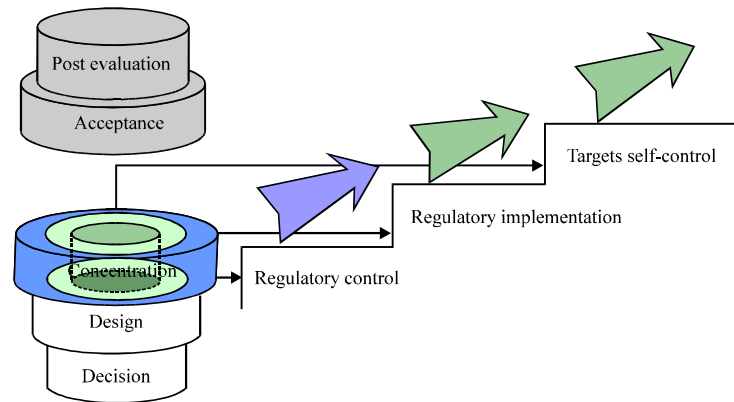


Fig. 1: Regulatory mode

that the regulatory items and frequency are different during the life cycle. In various stages, the regulatory departments should have different regulatory frequency or sampling checking ratio. For example it has the most supervision work on the construction phase than the other phase. The detail functions of three-dimensional supervision mode as follows.

The first core ring called the targets self-control dimension which requires professional contractors or construction agents manage their own project targets, including the quality, cost, security and environment targets. They record the targets' control and status information in detail.

The second core ring called supervision implementation dimension which has the regulatory responsibility to control the contractors' behavior. The supervision emphasizes on the project life cycle process. The traditional regulatory departments in some developing countries, such as China, have no regulatory effect evaluation mechanism to constrain government regulatory behaviors.

The third core ring is the supervision control dimension which controls the supervisors' actions. This ring can allocate the regulatory resource and optimize the regulatory behavior. And the resources' allocation methods can be realized by the information technologies. This dimension which plays the role in directors and the evaluators, is the organizational guarantee to realize the integrated regulatory system. And they can also receive complaints or prosecution of public and media.

We will find the biggest characteristic of three-dimensional regulatory mode is to balance the rights and obligations. So we advocate of building up the supervision schedule centralization to realize the power decentralization which can prevent the power monopoly and the power rent-seeking because of the separation of

decision-making rights, execution rights and regulatory rights. The supervision schedule centralization that plays the role as a conductor directing the orchestra need a dispatch center to coordinate professional management departments. The unification of supervision schedule may improve to reduce duplication checking and control the checking frequency on the projects. And the construction enterprises and the employers may be more satisfied with government regulatory behaviors.

The supervision control requires accepting the public supervision which makes the system more transparent. Therefore, we can conclude the superiorities of integrated three-dimensional supervision. The traditional supervision mode pays more attention on supervision results between the supervisors and constructors without regulatory control department. The typical mode is that the supervisors regular the contractors. Compared with the traditional supervision mode, the three-dimensional supervision mode introduces the role of the controller that can manage the works of supervision department. This role should have the right to allocate the supervision resource rationally. In this way, the SS can save cost while reduce the burden of contractors.

**Realization of integrated regulatory mode:** System integration thought applying to complex management fields such as military, medical, education and so on, is a crucial method to address the complexity problems. Zheng and Zhang (2010) studied government supervision issues using integrated methods and proposed a standard supervision mechanism which emphasized on government supervision, market discipline and self-monitoring mechanism. But they did not study the integrated regulatory processes and the information system. Li *et al.* (2006) analyzed the regulatory of single department method from the method of information system

construction applied to detention house. From the published literatures, the study on complexities of the regulatory system is not enough. Therefore, using the integrated approach to solve public investment projects supervision problems is a new research perspective.

To build up a more efficiency system is the connotation of the integrated supervision. The integrated SS is not a simple overlay between the regulatory units but to construct the system that can make the regulatory elements match for each other and form a more advanced order structure. The integrated system can get regulatory qualitative improvement.

**Implementation steps of integrated supervision mode:**

The government has been trying to reform in many counties. However some human factors for example, some benefit conflicts hinder the reformation. We should find the reasonable system implementation steps to weak the interference of human factors. The implementation process reengineering of integrated regulatory mainly consists of the following five stages:

**Step 1: Building the integrated and collaborative control center:**

The first step is to establish the control center to collaborate and schedule the supervision behaviors. It will have higher power than regulatory implement department. But it does not have the inspection and regulatory rights. Each regulatory function department should accept the center's commands according to the optimization regulatory schedules

**Step 2: Developing the integrated regulatory system:**

The second step is to establish the SS. The system plays the bridge roles in linking with the regulatory subjects and objects. And it is also the optimization center and scheduling center. The public, media and the constructor to be supervised can complain the regulatory behaviors to the center. The center has the rights to evaluate the supervision departments according to the investigation results. The government should clearly define the responsibility and power of government when the supervision management platform is built up. At the same time, the different regulatory departments should work coordinately

**Step 3: Gridded the projects:**

The third step is to grid the PIEP for project identification. The identification method which can quickly locate items, clearly identify the project properties and provides a basis for computer sampling inspection.

**Step 4: The Performance evaluation:** The fourth step is to evaluate the supervision performance. The objects of performance evaluation should include supervision departments and the statues of the SS mode. The aims of performance evaluation are to evaluate and optimize the system that the behaviors of various participants can be consistent

**Step 5: Regulatory feedback and improvement:** The fifth stage is to collect the evaluation results and improve the system such as regulatory quality and the satisfaction of the people who are supervised. The regulatory feedback is also the foundation of decision-making and regulatory schedules. And the decision and schedule algorithms also may be improved based on the information

**Procedures designing of integrated supervision mode:**

The main designing thoughts include regulatory schedule optimization and the procedure management through integrating the soft and hard resources. Making sure the regulatory objects coordination may save the cost and improve the efficiency.

The controlling methods of integrated regulatory mainly include critical point controlling mode and random inspection mode. Critical point controlling means that the supervised objects should comprehensively inspect the projects critical control points. The regulatory schedule centre does the regulatory optimization and arranges the regulatory people who should check the projects control points. The random inspection uses the Stratified Random Sampling method to choose the checking samples which are just noticed the superior people near the checking date. It may reduce the interference of personal relation that is easy to result in collusion behaviors.

The regulatory thoughts express in the regulatory schedule algorithm which can achieve the resources optimization and the regulatory synergies and regulatory process management which uses the information technology to make the supervision process transparent. The information system need record relative information completely which includes not only written form report but also the visual and sound information sent to the regulatory controlling center. At the same time, the schedule controlling center can locate the supervisors and track the regulatory behaviors using the handheld machines having GPS and wireless communication functions.

The new regulatory procedures overcome the defects that the government makes the conclusion only based on the regulatory reports. And the optimized regulatory

procedures can promote the transparent of regulatory procedures and deal with the problems such as the information delayed, the information distortion and the fuzzy regulatory procedures. At the same time, the regulatory procedures incarnate the open characteristics which mainly reflect on the information exchange between internal system and the external society. The procedure reengineering is the criterion and restriction for the behaviors. The standard system also can improve the credibility of the government.

The supervision object should propose the inspect application to the supervision schedule center by the phone or the network after achieving the goals self-controlling.

The schedule center coordinates the inspection schedule through the computer probabilistic algorithm and informs the related department to prepare the inspections. But the supervision objects are noticed one day in advance for avoiding the previous communication and risk-rending actions. Meanwhile, the supervision subjects need to prepare the related documents. The supervisors inspect the projects conditions with the handheld devices that have some functions, such as data collection and GPS. It is video and audio that can be collected for auxiliary materials with the inspect reports to guarantee the authenticity. Furthermore it has the GPS function to make sure that the supervisors are at the normal work position.

When the contractors who are received illegal supervision actions, they can give the complaints on net to the schedule centre. The complaints rate is a significant criterion to evaluate the supervision department performance. The schedule centre is in charge of handling complaints.

In summary, we design the schedule control center in the integrated supervision flow to optimize the supervision actions. The computer and communication techniques are introduced to reduce the human disturbance during the implement processes.

### **CONCLUSION**

This study develops an efficient supervision mode to reduce or avoid inefficiency and corruption. The integrated supervision mechanism is elaborated. Then we consider the reliable implement route by information and

communication technologies to apply the integrated supervision mode in practice. The estimate outcome shows that the integrated supervision mechanism can save national capital and improve supervision efficiency.

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