STUDY ON COST CONTROL IN THE CONSTRUCTION INDUSTRY BASED ON VALUE CHAIN THEORY - TAKE CHANG'AN CONSTRUCTION COMPANY AS AN EXAMPLE

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In the face of scarce resources and the law of competition for survival of the fittest, cost control is an eternal topic for enterprises. In traditional accounting, people tend to pay too much attention to the cost of product production. The control of cost is concentrated on the manufacturing cost within the enterprise, and only a single driving factor is the cause of the cost. This causes the traditional cost control to be more and more unable to adapt to the development of modern enterprises.

The research objectives of this paper were:

1. To analyze the structure of Chang'an Construction Company's value chain.

2. To analyze the cost control of Chang'an Construction Company when doing a project based on its value chain structure.

This paper adopts the case study method, starting from the theoretical foundation of value chain cost control, to study the cost control system based on the value chain of Chang'an Construction Company. It seeks to gain relevant insights and draw conclusions from the analysis.

Through the in-depth study of value chain cost control in Chang'an Construction Company, several important conclusions have been drawn. A professional bidding process lays the foundation for cost-effectiveness and project profitability. The region-specific strategy adopted by Chang'an Construction makes bid preparation relevant and effective. The division of cost management into preparation and construction phases is critical. Careful cost planning, based on comprehensive site analysis, guides spending during the construction phase. Ongoing monitoring and timely adjustments are critical to align with that plan. Post-completion is not only an end point but also a phase of reflection and optimization of strategy. Efficient resource allocation and regular stakeholder engagement at the end of a project not only reduce future costs but also enhance a company's reputation.
Introduction

Research background

The socialist market economy has gradually improved, and the process of economic globalization has been accelerated. The rapid flow of capital has made market competition more intense, and the pressure for the survival of enterprises has been increasing rapidly. It is a major problem faced by every enterprise to seek a new mode of operation and management to maximize the wealth of shareholders. To adapt to the needs of modern management, people have been exploring time and again since the last century.

Theories and methods such as operation cost management, target cost management, total quality management, and soon have begun to appear in people's vision. The use of these methods has enabled enterprises to gradually get rid of the constraints of traditional management concepts.

In terms of the essence of Chang’an Construction Company's competitiveness, no matter what kind of competitive strategy is adopted, cost advantage is always an important measure for obtaining core competitiveness. It is always an important guarantee for the sustainable development of enterprises. China's construction enterprises have long had low-profit margins, mainly due to two reasons.

First, the external environment, market norms are not sound, laws and regulations are not perfect, and the bidding process of all kinds of backdoor operations occurs frequently. The completion of the project is also a common phenomenon of arrears of construction payments.

Second, the internal reasons for the enterprise, the construction enterprises have long had sloppy management and did not pay attention to cost control. High cost and low revenue have been a common phenomenon. Therefore, if construction enterprises want to gain profits and seek long-term development, they must increase the strength of cost control and improve the sloppy operation and management mode.

The construction industry is the pillar industry of China's national economy, playing an important role in promoting national economic growth and social progress. From 2002 to 2013, the gross output value of the construction industry increased from 185.27 billion yuan to 159.313 billion yuan, with a compound annual growth rate of 21.6%.

The added value of the construction industry increased from 646.5 billion yuan to 3,899.5 billion yuan, with a compound annual growth rate of 17.74%. From 2002 to 2013, the added value of the construction industry accounted for a stable proportion of GDP between 5% and 7%, becoming an important force driving the rapid growth of the national economy. In the coming period, the process of China's urbanization will be gradually accelerated, and the contribution rate of cities to the national economy will rise steadily along with urbanization.

The development of metropolitan areas, city clusters, city belts, and central cities will provide good opportunities for the development of the construction industry.

Today, in the rapidly developing knowledge economy and information economy, the competition among enterprises, including those in the construction industry, is intensifying. China's construction industry has a massive market scale.

From 1985 to 2012, the number of enterprises in China's construction industry increased from 11,150 to 75,280, and the number of employees increased from 9.115 million
to 42.672 million (Zhou, 2013). The intense market competition has led to constant profit compression for building construction enterprises, forcing them to adapt to the increasingly competitive environment through the innovation of cost control theory and the application of new cost control techniques and methods.

**Research problems**
Currently, some construction enterprises in China lack systematic management of costs, with cost control being limited to internal operations and short-term in nature (Cheng et al., 2007). The deficiencies in cost control within the companies are mainly reflected in three aspects. First, management fails to recognize the importance of cost control. Enterprises often focus solely on results, neglecting prior control, long-term development, and overall cost control.

As a result, they fail to establish a complete cost control system. Second, cost control has a lagging effect. Traditional cost control in construction enterprises relies heavily on the financial department's preparation of final accounts reports, which have a lag in data availability and lack systematic control. This leads to short-term cost control behavior.

Third, there is a lack of global cost management. Traditional cost management in construction enterprises mainly focuses on the manufacturing process, neglecting the relationship with upstream suppliers and downstream customers. It fails to consider the cost of competitors within the scope of cost management analysis and does not break through the company's barriers.

**Objective of the study**
This study aims to identify a new approach to cost control by analyzing the value chain cost control of Chang'an Construction Company. It aims to provide assistance in addressing the existing problems in cost control within China's building construction enterprises.

**Specific objectives include:**
1. Analyzing the structure of Chang'an Construction Company's value chain.
2. Analyzing the cost control of Chang'an Construction Company during project implementation based on its value chain structure.

**Scope of the study**
The study of cost control has always been a prominent issue in both theoretical and practical circles. Achieving sustainable development in the face of limited resources is an ongoing topic for enterprises, including non-profit organizations. Throughout history, the evolution of accounting practices and the development of management accounting have been fueled by the commodity economy and the Industrial Revolution.

Over the past century, various cost control methods, such as standard cost, target cost, operation cost, and strategic cost, have emerged alongside theories of standardization, target management, operational management, and strategic management.

In the current economic environment, research on value chain management, logistics management, and supply chain cost management is deepening, making them emerging and hot topics in cost control research.
Research significance
The construction industry often faces cost overruns, impacting both profitability and infrastructure affordability. Traditional cost control methods have been more reactive than proactive.
However, the application of Porter’s value chain theory, which breaks down organizational activities into primary and support, offers a strategic approach to pinpoint and manage costs effectively in the construction domain. By integrating this theory, inefficiencies in processes like procurement and logistics can be identified and addressed.
With the rise of sustainable construction and technological tools like Building Information Modelling (BIM), a value chain-focused approach ensures informed, data-driven decisions, optimizing cost-efficiency and delivering maximum project value.
This study, therefore, holds the potential to significantly transform cost control strategies in the construction sector.

Literature review

Construction industry:
The construction industry is a production sector specializing in civil engineering, building construction, equipment installation, engineering survey, and design work. Its products include factories, houses, railroads, mines, roads, bridges, ports, pipelines, public facilities, buildings, structures, and facilities (Sun, 2013).
Compared to other industries, construction enterprises have many significant characteristics that determine the unique accounting for construction enterprises. Construction products are characterized by their fixedness, long-term nature, and long construction periods, which determine the following characteristics of the construction industry:
First, production is mobile. One of the characteristics of the construction industry is that projects are fixed, but personnel and equipment are mobile. When a new project begins, a new project management team is established, and personnel and equipment are mobilized (Ma, 2014). Once the project is completed, the project team is disbanded. Throughout the production and operation process, personnel and equipment move with the construction object, continuously transitioning to new locations. When a project is completed, the relevant personnel, machinery, and equipment are transferred to the next construction object.
Second, each product is unique. Each project has its own unique program, and each customer has specific requirements for the product's structure, shape, design, materials, and use. This necessitates the organization and design of the construction process to meet the partner's requirements. As a result, separate costing is required. This uniqueness of engineering projects means that each project is not standardized, and it is not possible to carry out large-scale batch manufacturing as in the case of production enterprises. Each product has its own specific characteristics and cannot be copied.
Third, the production cycle is long (Zhang, 2003). Building products involve various stages, from foundation, main structure, to roofing and outdoor decoration. Some projects may last a few months to a year, while others may require three to five years or longer. In the production process, significant human, material, and financial resources are occupied. Project management not only necessitates the overall direction but also coordination and cooperation.
with project implementation, financial management, and personnel and equipment arrangement to ensure successful completion of the project.

**Value chain theory:**

In 1985, Harvard Business School professor Michael Porter introduced the concept of the value chain in his book Competitive Advantage. In order to identify an enterprise's competitive advantage, Porter broke down the enterprise into a collection of activities that are combined to form the enterprise's value chain. Each activity within the value chain is considered a link in value creation.

According to Prof. Michael Porter, an enterprise's value activities can be categorized into basic activities and support activities.

![Porter's value chain](image)

**Figure 1 - Porter's value chain**

The concept of the value chain was introduced as an analytical tool by Professor Michael Porter. He explains that a firm can gain a competitive advantage by performing strategically related activities more efficiently or effectively than its competitors. Value management combines an enterprise's production, marketing, financial, and other resources to create an interconnected whole.

Prof. Porter categorizes the value activities of an enterprise into two types: basic activities and auxiliary activities. Basic activities involve the production, sales, and after-sales service of products, while auxiliary activities include technology, human resources, and other functional activities.

Peter Haines expanded on Porter's concept, defining the value chain as a transportation line that integrates the value of materials. He included raw material suppliers and customers in the value chain system, extending it from inside the enterprise to outside. In contrast, Porter's value chain only focuses on production-related behaviors.

The concept of the virtual value chain was introduced in 1995 by Jeffery F. Rayport and John J. Sviokla. They emphasized the importance of the intangible virtual world, which consists of information and e-commerce.
The virtual value chain involves the collection, organization, and distribution of information, while the tangible value chain focuses on procurement, production, and sales. As information technology has advanced, the concepts of value chain strategic alliance and value network have also contributed to the research of value chain theory. In China, scholars have started to study and understand value chain theory in depth, contributing to its development.

Cost control theory aims to systematically calculate and regulate the expenses of an enterprise to achieve established objectives and ensure profitability. It involves identifying cost weaknesses, analyzing them, and implementing measures to reduce costs. Cost control includes processes such as cost prediction, decision-making, planning, control, analysis, and assessment.

Traditional cost control revolves around the "product" and is based on cost bookkeeping. The main user of information is the shareholders, who are concerned about consumption in the production process. With the shift towards modern cost control, the focus has shifted to "management" and the definition of cost has become broader. Cost control is now seen from a management perspective, emphasizing cost control methods such as target cost control, cost planning, and strategic cost control.

Modern cost control is an open system that consists of multiple methods, moving away from the traditional single-method approach. It emphasizes cost management before and during the production process, rather than just after-accounting.

The concept of operation cost control is a stage of cost control that focuses on "operation." The job cost control method starts with analyzing the cost drivers of a job and then transitions to a multi-driver cost control view, ultimately forming the job cost control view. In the operation cost control view, enterprises no longer focus on product cost, but on financial cost and management cost.

The focus of cost management shifts from controlling costs during transportation, after accounting, and analyzing reports to forecasting, making decisions, and planning costs. This represents a multi-cost view of control.

The production process, based on the operation chain, exists to create value for the customer. Only operations that add value and necessary non-value-added operations have any meaning to survive (Sun, 2002).

The value chain view of cost control, which has become popular in recent years, utilizes value chain analysis to reduce corporate costs and achieve cost control. In the value chain cost control concept, the cost control scope of an enterprise is based on the value chain. It takes the production stage as a node and extends forward and backward.

It extends forward to the supplier and product planning and design stage and backward to the product sales and after-sales service stage. The whole process includes the cost of the supplier, product design, purchase, production, sales, and consumer, etc. (Yan & Li, 2003).

In this approach, cost control becomes strategic, systematic, comprehensive, and proactive. It is not only a cost control approach but also a cost control approach that is combined with enterprise development.

Past research
John Shank & Govindarajan introduced value chain analysis to the field of strategic cost management.
They proposed a three-pronged framework for conducting strategic cost management, which includes value chain analysis, strategic positioning, and cost driver analysis (Shank, 1992).

Jeffery F. Rayport and John J. Sviokla suggested the concept of a virtual value chain, where they argued that value-added material activities make up the traditional value chain, while value-added information activities form the virtual value chain (Shank & Govindarajan, 1993).

The physical and virtual value chains differ in terms of economic principles, management content, and value-added processes. The physical value chain consists of a series of continuous activities, whereas the virtual value chain is a non-linear matrix with inputs and outputs accessible through various channels. Information is seen as a source of value in the virtual economy, and activities such as collecting, organizing, selecting, synthesizing, and distributing information contribute to value creation.

In his book "Value Chain Management," Zhang (2001) explains that the value chain is the integration of production, marketing, finance, human resources, and other aspects of an enterprise. It coordinates the work of each link to form an interconnected whole, which includes capital, material, and information flows.

Sun (2002) divides the enterprise value chain into three categories: internal value chain, vertical value chain, and horizontal value chain. He uses value chain analysis as the main approach to reconstruct the discipline of management accounting.

Yin & Wang (2010), based on partnership and information sharing, analyze the application of two value engines (relational rent and cross-organizational learning) in supply chain cost control. The increase in customer value through supply chain cost control is referred to as a value engine. Relational rent and cross-organizational learning are seen as important ways to increase customer value in modern enterprises. The supply chain is different from traditional enterprises, and partnership and information sharing portray its characteristics from static attributes and dynamic mechanisms.

The study found that SZEC's value chain cost management differs from Western theories and practices. SZEC's innovations in value chain structure, flexible organization, and customer value guidance have enriched China's management accounting practice and are of great significance to the development of cost management accounting in China (Chu, 2009).

Research methodology

This paper is a case study type paper; the main research method is a case study, and the main content is to analyze the cost control of Chang’an Construction Company.

First, this paper uses literature reading and data collection methods to collect relevant literature about value chain theory and cost control theory. Firstly, this paper uses literature reading and data collection methods to collect relevant literature on value chain theory, cost control theory, and value chain cost control theory, then carefully reads and categorizes them to form the current status of domestic research and foreign research, and then reviews them in chronological order.

Secondly, this paper studies the development and evolution of value chain theory, cost control theory, and value chain cost control theory from the perspective of vertical development and explores the development laws of theories in related fields.
Finally, the case study method is used to combine the value chain theory and cost control theory, apply the theory to practice, analyze and study the actual situation of cost control in enterprises, and draw case insights.

Chang’an Construction Company was founded in 1989, later approved by the Beijing Municipal People’s Government, and restructured into a wholly state-owned company with a registered capital of 550 million yuan, corporate governance, and the organizational structure of the general manager under the leadership of the board of directors.

Company belongs to the construction enterprise, subordinate to more than 20 secondary subsidiaries, with a workforce of more than 7,000 people. It was founded more than 30 years ago, gradually growing into a large-scale comprehensive construction enterprise group integrating construction, real estate development, municipal administration, metro, and garden protection.

Over the past 30 years since its establishment, Chang’an Construction Company has gradually grown into a large-scale comprehensive construction enterprise group integrating engineering construction, real estate development, municipal government, subway, and garden protection.

The group has the special grade qualification for general contracting of building construction, the first-grade qualification for real estate development, and the first-grade qualification for general contracting of municipal services, and has undertaken many major construction projects such as the Central Plaza, the Hao Yang Building, the Xiao Jia He Road Bridge, the Beijing Tong Ren Tang Pharmacy, and the Jiao Men Subway Station. By the end of 2014, Chang’an Construction Company had completed more than 180 Great Wall Cup projects and more than 20 Luban Prize and National Excellent Projects. Since its establishment, in the spirit of being people-oriented, adhering to the basic line of the Party, constantly reforming and innovating, and leading the overall development with a scientific outlook on development, the overall advantages and comprehensive strength of the enterprise have been continuously enhanced.

Finding

Value chain analyses

The internal value chain of a construction company consists of two types of activities: basic activities and auxiliary activities, which is the same as the value chain model proposed by Prof. Porter. The basic activities of a construction company include five main activities: project contracting, construction preparation, project construction, completion and inspection, and warranty service, while the auxiliary activities include four: procurement management, technology development, human resource management, and enterprise infrastructure.

Project contracting refers to the bidding process of an enterprise, in which the enterprise needs to follow the market, understand the information of competitors, collect information to prepare bidding documents, organize bidding activities, and sign project contracts.

Project contracting is the key link in a construction enterprise. Only by contracting new projects can an enterprise have business activities, carry out production and operation, and generate profits.
Construction preparation refers to the intermediate preparation between project contracting and project construction, in which the enterprise has to conduct field investigation on the project site and determine the construction plan. During the construction process, the enterprise should consider the materials and labor and reasonably utilize the market resources and enterprise resources to reduce the cost.

Project construction is the central part of the construction enterprise, and the enterprise should organize the construction according to the requirements of the construction contract. The costs incurred in the construction process mainly include material costs, labor costs, equipment costs, overhead costs, temporary facility costs, etc. In this process, the enterprise should synthesize the enterprise resources of the value chain, integrate upstream and downstream enterprises, and improve the level of project management.

Completion and acceptance are the links between project completion, acceptance, and settlement, and warranty service belongs to the link after project delivery. A good warranty service can win a good reputation and image for the enterprise in the industry, which is conducive to the enterprise maintaining market competitiveness.

Procurement refers to the purchase of inputs used in the value chain. Costs in the procurement management process mainly include material costs, purchasing costs, transportation costs, and inventory costs. Technology development refers to activities that can widely improve products and processes, and advanced technology can enable enterprises to maintain long-term competitiveness and cost advantages.

Human Resource Management (HRM) is the management of personnel in an organization, including hiring, evaluation, training, termination, and compensation systems. Infrastructure consists of a large number of activities, including financial services, security services, legal services, governmental services, organizational management, etc.

Cost control analysis

Tendering first arose in the United Kingdom as a method used by the government in the procurement of materials. With the improvement and soundness of the laws and regulations relating to tendering, tendering has been widely used in the construction industry and has gradually become a common method of contracting. Tendering can prevent backroom operations and is a relatively fair and impartial method.

The cost of project contracting is mainly the bidding cost, which mainly includes the preliminary public relations fee, the winning service fee, the bidding deposit, the additional terms and conditions after winning the bidding, and others. Project contracting stage to prepare bids, the preparation of bids to go through professional training, not because of the quality of personnel problems caused by the existence of problems in the bidding process to the enterprise in the bidding process to cause unnecessary cost losses.

When preparing bids, the preparers should study and analyze the project quality requirements and list quotations carefully. In the process of development, the enterprise divides the business development zone by region, and the project department and the office in charge of the region are responsible for the business development work in the region.

Each project department sets up a group of experts to study and analyze the owner's tender and the market situation of labor, raw materials, and machinery and equipment in the region, and prepare reasonable bidding materials to ensure that the cost of the project can be controlled at an acceptable level at the contracting stage, to increase the profit of the project.
Cost control in the project implementation stage can be divided into two parts: cost control in the project preparation stage and cost control in the project construction stage. The cost control in the project implementation stage mainly includes professional training for relevant employees to improve their professional quality and competence, to ensure that the project construction process is not due to personnel negligence and practice ability problems resulting in cost losses, the development of a reasonable and comprehensive construction program, the raw materials, machinery and equipment, labor costs, and other direct costs to carry out strict control, real-time supervision, to prevent waste, to do a good job in the safety and protection measures, standardize personnel operations, regular maintenance, and so on.

The project preparation stage is mainly to investigate the project, including topography, above-ground facilities, underground pipelines, geology and hydrology, land acquisition and relocation, a three-way situation, etc. In this stage, the enterprise has to formulate a cost plan. At this stage, the enterprise should formulate a cost plan, which is the basis of cost control in the construction stage. The cost plan should be specific and reasonable, with an operable system, laying a good foundation for the subsequent cost control of the project. Before project implementation, assign an experienced team to conduct a site visit to the construction project and set up a cost target and plan based on the bidding price and the actual situation in the area.

During the construction phase of the project, the cost plan formulated in the preparation phase was strictly implemented, and cost variances were summarized at regular intervals to find out the reasons for the variances and make corrections promptly.

Chang’an Construction Company and its subsidiaries required the project departments to summarize the cost variances every week, prepare cost analysis reports every month, find out the reasons for cost overruns promptly, and carry out cost control during the construction process in the following years. The leaders of the group will select projects every month to listen to the cost analysis report of the projects, put forward opinions and suggestions on the problems in cost control of the subordinate enterprises, and encourage the subordinate enterprises to actively implement cost control.

After the project is completed and accepted, many enterprises will put their energy into other projects, resulting in the finalization of the work of the front being long, machinery and equipment not being transferred, the cost still incurred, and the construction phase of the gain being gradually broken down and disappeared.

Therefore, enterprises must carefully arrange the final closing work to ensure that machinery, equipment, and personnel are orderly withdrawn from the site. When the project is nearing its end and enters the stage of completion and settlement, the financial personnel should calculate the cost of each stage in time and make a comparison and analysis with the planned cost, and the project management should reasonably allocate the site personnel and clean up the site materials, machinery, and equipment in time to prevent unnecessary costs and expenses. In the closing work, the staff should synchronize the preparation of acceptance data to ensure the authenticity and accuracy of the data and, at the same time, start to arrange for the relevant departments to enter the site for acceptance and inspection, which can shorten the acceptance phase and save costs for the enterprise.

After the completion of the project, Chang’an Construction Company integrates on-site resources promptly, conducts project cost analysis, and summarizes the experience of the project. After delivering the project, Chang’an Construction Company will contact the property company and the owner regularly to learn about the problems that exist in the
subsequent use process, solve them promptly, and at the same time provide reference experience for future projects to avoid unnecessary cost losses caused by the same problems. This will not only enable the enterprise to maintain a good cost advantage but also win a good reputation among customers, which is conducive to the maintenance of the enterprise's competitive advantage in the industry.

**Conclusion**

Through an in-depth examination of Chang’an Construction Company's value chain cost control, several key findings have emerged. Tendering, when executed with expertise, sets the foundation for cost efficiency and project profitability. Region-specific strategies, as adopted by Chang’an, enable tailored, effective bid preparations.

Cost management, split between the preparation and construction phases, is crucial. A well-crafted cost plan, grounded in thorough site analysis, guides construction-phase expenses. Continuous monitoring and timely adjustments are essential for alignment with this plan.

Post-completion isn't just an endpoint but a phase of reflection and strategy optimization. Efficient resource allocation post-project and regular stakeholder engagement not only curb future costs but also enhance the company's reputation.

In essence, strategic tendering, meticulous planning, rigorous cost oversight during execution and post-project evaluations are pivotal in ensuring cost-effectiveness in the construction sector. This study, centered on Chang’an Construction Company, offers valuable insights for broader industry applications.

**Recommendation**

Considering the specific conditions of China, environmental protection and Internet finance are the hot issues that people are concerned about, so cost control based on value chain theory will gradually approach these two aspects in future development.

With the deepening research on the theory and practice of environmental accounting and Internet finance, the development trend of value chain cost control is mainly manifested in the following two aspects: firstly, the environmental cost control and management of green value chains in the context of low-carbon economies; secondly, the research on the cost control of capital flow in value chains in combination with Internet finance, e-commerce, and financial shared services.

Due to the weak theoretical foundation and various constraints, there are still many deficiencies in the writing of this paper, and we hope that we can systematically study the issue of value chain cost control in our future studies and work.

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