



**THE INFLUENCING FACTORS OF COMPETENCY OF
CONSTRUCTION ENGINEERING MANAGEMENT
GRADUATES**



**LI CHUANHONG
6417195444**

**AN INDEPENDENT STUDY SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF BUSINESS
ADMINISTRATION
GRADUATE SCHOOL OF BUSINESS
SIAM UNIVERSITY**

2024



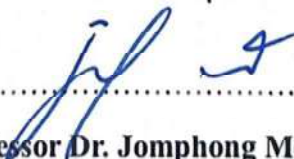
**THE INFLUENCING FACTORS OF COMPETENCY OF
CONSTRUCTION ENGINEERING MANAGEMENT
GRADUATES**

LI CHUANHONG

This Independent Study has been Approved as a Partial Fulfillment of the Requirements
for the Degree of Master of Business Administration

Advisor: .....
(Dr. Jidapa Chollathanrattanapong)

Date:3...../.....Sep...../.....2024


.....
(Associate Professor Dr. Jomphong Mongkhonvanit)

Graduate School of Business

Date:20...../.....Sept...../.....2024

Title: The Influencing Factors of Competency of Construction Engineering Management Graduates

By: Li Chuanhong

Degree: Master of Business Administration

Major: Educational Management

Advisor:



(Dr. Jidapa Chollathanrattanapong)

3 / Sep / 2024

ABSTRACT

The employment positions of graduates majoring in construction engineering management are the basic management positions of construction engineering. However, in recent years, graduates are unable to adapt to specific positions. This study analyzed the influencing factors of competency of construction engineering management graduates, and put forward suggestions for improvement. The objective of the study was to explore the influence of professional theoretical knowledge, professional skills, work ability, and personal qualities on the competency of construction engineering management graduates.

This study adopted the quantitative research method and applied the iceberg theory. The questionnaires were distributed during the survey period and 136 valid questionnaires were recovered. This study found that professional theoretical knowledge, professional skills, work ability, and personal qualities have a significant positive influence on the competency of construction engineering management graduates. For recommendations, the improvement strategy should focus on the following aspects: 1) Reconstruct the talent training system, appropriately increase the class time of professional theoretical courses, and update the course teaching content in a timely manner; 2) Develop in-depth cooperation between schools and enterprises to jointly compile talent training programs and innovate talent training models; 3) Encourage students to participate in various skill competitions at all levels and strengthen the intensity of technical services; 4) Use case analysis, role playing, etc., to strengthen the sense of responsibility, hard-working and pressure-resistant education.

Keywords: iceberg theory, construction engineering management graduates, competency

ACKNOWLEDGEMENT

The independent study stays in the thanks, the study career in the university is about to draw a successful end. Looking back on the way to study, all the way through trials and hardships to hone the will, after countless spring, summer, autumn and winter to present this study to this point. Life is always saying goodbye to different people and things, here, to say "goodbye" to everything here.

First of all, I would like to thank my tutor. This independent study is completed under the guidance of my tutor, who has devoted a lot of sweat and blood, from the independent study topic selection, theoretical knowledge analysis, research methodology, independent study writing to the final draft of the whole process, have been carefully guided, put forward a lot of good suggestions, to help me successfully complete the whole independent study. My supervisor also gave me every care and help in my life. I deeply feel the charisma of my supervisor's easy-going and selfless dedication, her scientific and rigorous attitude, and her agile and meticulous thinking ability, which will benefit me for the rest of my life. I would like to express my heartfelt gratitude and deep respect to my tutor!

Secondly, I would like to thank my classmates who have shared my joys and sorrows with me. I would like to express my sincere gratitude to all the students who have cared and helped me! Thank you for their company, the campus life with them was full of laughter, which I will never forget!

Finally, I would like to thank my family. Thank you to my family for their great support, selflessness and dedication to my family in terms of academics! I will work harder in my future work and study to live up to my family's expectations!

Declaration

I, Li Chuanhong, hereby certify that the work embodied in this independent study entitled “The Influencing Factors of Competency of Construction Engineering Management Graduates” is result of original research and has not been submitted for a higher degree to any other university or institution.

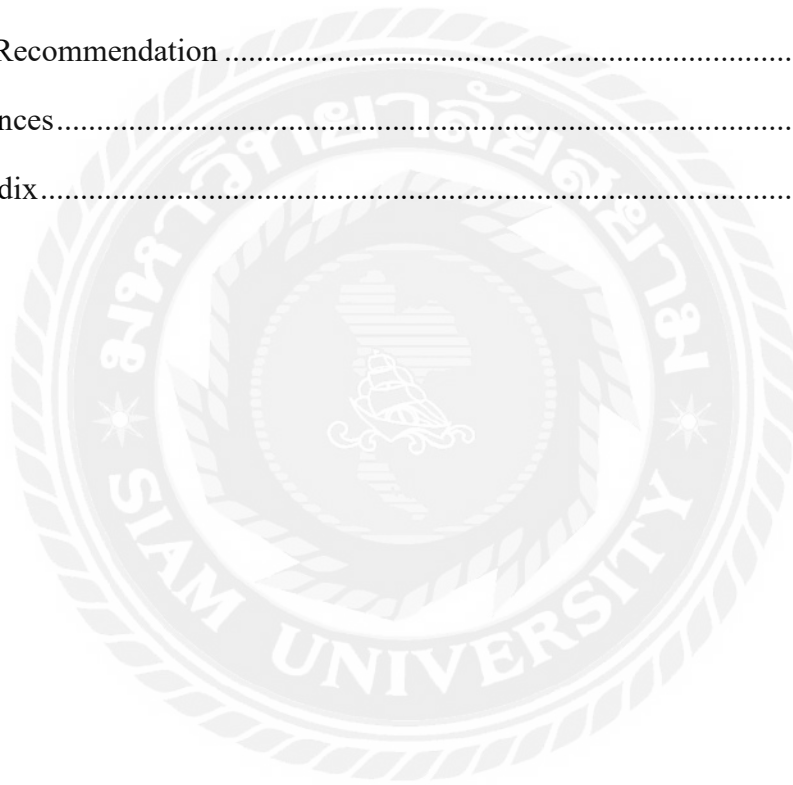


(Li Chuanhong)
June 4, 2024

CONTENTS

| | |
|-------------------------------------|-----|
| ABSTRACT..... | I |
| ACKNOWLEDGEMENT | II |
| DECLARATION | III |
| CONTENTS..... | IV |
| LIST OF TABLES | VI |
| LIST OF FIGURES | VII |
| Chapter 1 Introduction | 1 |
| 1.1 Research Background | 1 |
| 1.2 Research Questions..... | 2 |
| 1.3 Research Objectives..... | 3 |
| 1.4 Research Scope | 3 |
| 1.5 Research Significance..... | 4 |
| 1.6 Definition of Key Terms..... | 4 |
| 1.7 Research Limitations | 5 |
| Chapter 2 Literature Review | 6 |
| 2.1 Introduction..... | 6 |
| 2.2 Literature Review..... | 6 |
| 2.3 Related Research..... | 11 |
| 2.4 Conceptual Framework..... | 13 |
| Chapter 3 Research Methodology..... | 14 |
| 3.1 Introduction..... | 14 |
| 3.2 Research Design..... | 14 |
| 3.3 Hypothesis..... | 16 |
| 3.4 Population and Sample | 17 |
| 3.5 Data Collection | 18 |

| | |
|--|----|
| 3.6 Data Analysis | 18 |
| Chapter 4 Findings | 25 |
| 4.1 Introduction..... | 25 |
| 4.2 Demographic Characteristics of Respondents | 25 |
| 4.3 Descriptive Statistics of Variables | 26 |
| 4.4 Correlation Analysis of Variables..... | 33 |
| Chapter 5 Conclusion and Recommendation..... | 36 |
| 5.1 Conclusion | 36 |
| 5.2 Recommendation | 37 |
| References..... | 42 |
| Appendix..... | 45 |



LIST OF TABLES

| | |
|--|----|
| Table 3.1 Questionnaire Design..... | 15 |
| Table 3.2 Cronbach's Reliability Analysis of Professional Theoretical Knowledge . | 18 |
| Table 3.3 KMO and Bartlett's Test of Professional Theoretical Knowledge | 19 |
| Table 3.4 Cronbach's Reliability Analysis of Professional Skills | 19 |
| Table 3.5 KMO and Bartlett's Test of Professional Skills..... | 19 |
| Table 3.6 Cronbach's Reliability Analysis of Work Ability | 20 |
| Table 3.7 KMO and Bartlett's Test of Work Ability | 20 |
| Table 3.8 Cronbach's Reliability Analysis of Personal Qualities | 20 |
| Table 3.9 KMO and Bartlett's Test of Personal Qualities | 21 |
| Table 3.10 Cronbach's Reliability Analysis of Competency of Construction Engineering Management Graduates | 21 |
| Table 3.11 KMO and Bartlett's Test of Competency of Construction Engineering Management Graduates | 21 |
| Table 3.12 Confirmatory Factor Analysis (CFA)..... | 22 |
| Table 3.13 Rotated Component Matrix | 23 |
| Table 4.1 Demographic Characteristics of Respondents | 25 |
| Table 4.2 Correlation Between Variables (Pearson Correlation Matrix) | 34 |
| Table 5.1 School-Enterprise Construction of Vocational Literacy Curriculum System | 39 |

LIST OF FIGURES

| | |
|---|----|
| Figure 2.1 Conceptual Framework | 13 |
| Figure 3.1 Hypotheses | 17 |
| Figure 4.1 Satisfaction with the Level of Professional Theoretical Knowledge | 26 |
| Figure 4.2 Satisfaction with the Level of Rigor..... | 26 |
| Figure 4.3 How to Improve the Level of Professional Theoretical Knowledge..... | 27 |
| Figure 4.4 Satisfaction with the Level of Professional Skills..... | 27 |
| Figure 4.5 Satisfaction with the Level of Communication Skills..... | 28 |
| Figure 4.6 Satisfaction with the Level of Coordination Skills | 28 |
| Figure 4.7 Satisfaction with the Level of Service Consciousness | 29 |
| Figure 4.8 How to Improve the Professional Skills of Construction Engineering Management Graduates | 29 |
| Figure 4.9 Satisfaction with the Level of Problem-Solving Skills | 30 |
| Figure 4.10 Satisfaction with the Level of Analytical Skills..... | 30 |
| Figure 4.11 Satisfaction with the Level of Resilience..... | 31 |
| Figure 4.12 How to Improve the Work Ability of Construction Engineering Management Graduates | 31 |
| Figure 4.13 Satisfaction with the Level of Sense of Responsibility | 32 |
| Figure 4.14 Satisfaction with the Level of Hard Work..... | 32 |
| Figure 4.15 Satisfaction with the Level of Ability to Resist Stress..... | 33 |
| Figure 4.16 How to Improve the Personal Qualities of Construction Engineering Management Graduates | 33 |

Chapter 1 Introduction

1.1 Research Background

In the environment of rapid development of vocational education (Guo,2021), scientific and technological progress must rely on talent, talent training cannot be separated from education, as colleges and universities, cultivate excellent talents who can be qualified for the position, is the urgent need to solve the problem of schools, for the comprehensive construction of socialist modernization of the country, and the realization of national rejuvenation of China's dream to make a positive contribution. China's higher vocational education is the cultivation of highly skilled professionals for production, construction, management, and service needs of the front line, which started and developed with the reform and opening up. Although it has only experienced a short period of more than ten years, due to the situation and policies have given the green light to higher vocational education, and the advanced concepts and practice of international higher vocational education have been spread to China with the Internet and other ways, so China's higher vocational education has shown unprecedented development momentum, and higher vocational colleges and universities in China have been growing up like a rainbow (Guo, 2021). Moreover, the number of higher vocational and technical colleges and universities, enrollment and graduates have exceeded the number of ordinary colleges and universities in China.

In the process of professional development, problems such as insufficient job competence of graduates and inability of trained students to adapt to their positions quickly have gradually emerged (Nie, 2020). It is worthwhile for schools to consider how to train students to be competent for the corresponding positions, taking into account the needs of the society. Construction engineering management for the civil engineering field of building construction, real estate development, consulting and other related enterprises and institutions, training to master the basic theoretical knowledge of construction engineering, master building construction technology skills, with the ability to be able to manage the field of civil engineering management capacity of high-quality technical skills, that is, the initial employment position is generally the grass-roots level of the construction engineering management posts.

Since the 1970s, scholars at home and abroad have conducted relevant research on competency, because of the differences in research fields, perspectives and specialties, many different views have emerged, and different conceptual definitions and interpretations of competency have been formed. Some of the definitions focus on the

focus of individual behavioral factors, while some focus on the focus of the individual characteristics of the factors, but the results of the research have formed some commonalities: the need to examine competency in a particular situation (Tan, 2010). However, there are some similarities among the research results: the need to examine the state of competence in a specific situation, such as working conditions, environment, and job requirements. For example, if leadership becomes a critical competency in one position, it can become a limiting factor for high performance in another position. The competencies necessary for an employee to achieve high performance in a particular position are called competencies, which are influenced by individual knowledge, skills, personality, cognition and other characteristics, but the ultimate goal of competency is the achievement of higher performance, which suggests that competency can be an effective measure of the level of training in schools (Tan, 2010). On the basis of the application of competency model, it can be divided into excellent performance group and general performance group, which means that enterprises can be based on the competency model to assess the work ability of the incumbent. From the above discussion can be found, competence is mainly for a specific position, the incumbent needs to have in this position can play out the professional knowledge and skills, at the same time, their own personality characteristics and job requirements fit, but also involves with the position of the incumbent of the relevant personality traits, personality traits, including individual character, attitudes, and values and other content.

As colleges and universities, in-depth study of the problems in the process of professional construction, take measures to improve the ability of students to adapt to their positions, grasp the key links, and make positive contributions to the comprehensive construction of a modernized socialist country and the realization of the Chinese dream of national rejuvenation (Sun, 2019).

In view of the above background, this study selects the construction engineering management graduates of eight vocational colleges in Shandong Province as the research subjects, analyzed the students' professional theoretical knowledge, professional skills, work ability and personal qualities, and put forward suggestions to improve the competence of construction engineering management graduates, so as to promote the healthy development of construction majors.

1.2 Research Questions

In the process of professional construction, there are a series of problems such as students' weak professional theoretical knowledge, insufficient level of professional

skills, poor work ability, and personal qualities need to be improved, which have become the main problems affecting the development of the profession. Only by changing the concept, increasing the hours of professional theory courses, innovating the talent training mode, and strengthening the technical service, can the graduates be better adapted to the specific positions, and then improve the competence of the graduates. In this study, the situation of construction engineering management graduates in eight vocational colleges and universities in Shandong Province is analyzed to provide more scientific suggestions for the development of the profession.

(1) What are the influencing factors of competency of construction engineering management graduates?

(2) Do professional theoretical knowledge, professional skills, work ability, and personal qualities affect the competency of construction engineering management graduates?

1.3 Research Objectives

This study analyzes the competency of construction engineering management graduates of eight vocational colleges and universities in Shandong Province by studying the existing literature such as the study of grass-roots managers' competency and the study of job competency, and using the relevant tools and knowledge systems learned to elucidate the current situation and problems of their graduates' competency. Suitable strategies are proposed, so as to promote the healthy development of the construction engineering management graduates.

(1) To analyze factors affecting the competency of construction engineering management graduates.

(2) To analyze the influence of professional theoretical knowledge, professional skills, work ability, and personal qualities on the competency of construction engineering management graduates.

1.4 Research Scope

This study took the construction engineering management graduates of eight vocational colleges in Shandong Province as the research subjects, adopted the quantitative research method, and centered on the competence of graduates of

construction engineering management. A questionnaire was designed according to the iceberg theory. A total of 145 questionnaires were distributed from September 2023 to January 2024 to professional leaders, directors of teaching and research departments, key teachers and business managers in 8 vocational colleges and 20 cooperative enterprises, and 136 valid questionnaires were recovered.

1.5 Research Significance

From the theoretical point of view, this study fully utilizes the iceberg theory, and puts forward practical suggestions from different aspects, such as professional theoretical knowledge, professional skills, work ability, and personal qualities, which fully reflects the research perspective and practicality of the iceberg theory. The study also provides corresponding practical value to the application of the iceberg theory, so that it can further deepen the theoretical research and better apply it to practice.

From the practical point of view, this study deeply analyzes the construction engineering management graduates, analyzes the problems and reasons, and puts forward the solution strategies for the four aspects of professional theoretical knowledge, professional skills, work ability, and personal qualities, so as to maximize the job competence. This study has strong practical value for the development of construction engineering management major, and also provides new methods and ideas for the development of other specialties to further promote the healthy development of institutions.

1.6 Definition of Key Terms

Professional theoretical knowledge refers to the fundamental and advanced theoretical knowledge that graduates should possess in construction engineering management. This encompasses a comprehensive understanding and mastery of related disciplines such as architecture, engineering management, construction technology, project management, and engineering economics.

Professional skills refer to the practical abilities that graduates should have in construction engineering management, encompassing skills in design, planning, construction, supervision, budgeting, and project management.

Work ability denotes the competencies demonstrated by graduates in actual work

settings, including problem-solving, teamwork, communication skills, decision-making abilities, and leadership qualities.

Personal qualities refer to the individual character traits and dispositions of graduates, such as responsibility, patience, integrity, self-discipline, learning capacity, creativity, and stress management.

Competency in construction engineering management signifies the graduates' capability to integrate their professional knowledge, professional skills, work ability, and personal qualities in managing construction engineering projects comprehensively.

1.7 Research Limitations

When investigating the factors influencing the competency of construction engineering management graduates, several limitations arise. Firstly, sample representativeness is a crucial consideration. If the selected samples are confined to a specific region or institution, they may fail to comprehensively reflect the situation of all construction engineering management graduates, impacting the universality and applicability of the research findings.

The issue of subjective assessment also merits attention. Assessments of aspects such as personal qualities and work ability often rely on feedback from supervisors, colleagues, or self-evaluations, which may be influenced by subjective biases, affecting the accuracy of the results. Furthermore, the measurement standards for work ability and professional skills according to the specific needs of different industries and enterprises, make it difficult to evaluate all graduates. Challenges in data acquisition may also be encountered. Many influencing factors require long-term follow-up investigations and extensive data collection to draw accurate conclusions. Rapidly evolving industry demands constitute another significant limitation. The techniques and management methods in construction engineering management are constantly updated, meaning that the evaluation criteria and competency requirements used in research may soon become outdated, leading to insufficient timeliness of the research findings.

Chapter 2 Literature Review

2.1 Introduction

This chapter analyzes and summarizes domestic and foreign scholars' research on construction engineering management, including management post competence, professional theoretical knowledge, professional skills, work ability, personal qualities and other research content, using the iceberg theory.

2.2 Literature Review

2.2.1 Competency of Construction Engineering Management Graduates

Through the search of Zhi.com and Wan fang databases, a total of 1,276 articles were found with the keyword of "job competence", among which 324 articles were related to the basic level managers, which provides a rich theoretical foundation for the study of job competence in China. Taylor first researched competence, and after him, John Flanagan proposed the method of key event interview, which laid an important foundation for continuous research on competence. In subsequent studies, researchers have studied competency at the level of individual differences, thus providing a strong impetus for the study of competency modeling. In the process of research, Akgerman & Sonmez (2020) incorporated the motivation factor into it, redefined the concept of performance appraisal, conducted research on performance, and continuously enriched the competency model. Berit (2020) redefined the concept of performance appraisal by incorporating incentive factors into the research process.

According to Chang et al. (2021), different competency models must be used for the human resource management department. Differentiated competency models are needed for junior managers and general employees. Fredrik et al. (2020) pointed out that based on a questionnaire survey of 7100 people from 267 companies, a new generation of managerial competency model was found by analyzing and studying the outstanding and average performers.

Bai (2015) studied the post-competency of young doctors in Henan Province through the questionnaire and believed that the clinical ability of doctors should be improved through institutional education and continuing education. He & Dai (2017) analyzed the influencing factors affecting the post-competence of master tutors in colleges and universities, put forward the strategy to improve the construction of master

tutors in colleges and universities, and considered that team building, mechanism, and business ability should be strengthened. He (2015) started from three theoretical perspectives of strategic management, corporate governance, and human resource management, constructed a competency index element library, including personnel communication, organizational leadership, general planning, and other elements, but at the same time admitted that the index library does not apply to special enterprises, and acknowledges the influence of corporate culture and value orientation on the characteristics of employee competency. Li et al. (2019) found the development of competency models for executives in different strategy stages based on the three stages. For example, in the strategy formulation stage, mastery of conceptual, decision-making, and information-processing skills is favored.

The strategy implementation phase usually includes organizational and coordination, interpersonal communication, and motivational skills. In addition, in the strategy management phase, there is a tendency to generalize reflection, rapid response, analyzing data, and stress tolerance. Wang (2021) explored the competency model construction of top managers in large private joint-stock enterprises, the study focuses on top managers in large private joint-stock enterprises and emphasizes the degree of fit between competency models and enterprise management practices. Ye (2022) concluded that competency modeling helps to improve the overall management and control level and implement performance evaluation, thus helping enterprises to realize the coordinated development of the three dimensions from individual employees to the whole company as a whole (Liu, et al. 2021). According to the survey of executives, the competency model for this group should include three main competency characteristics: self-management, interpersonal communication, and career integration. The level of interpersonal communication competence has the most significant positive correlation with job performance, while the corresponding correlation between the other two is somewhat weaker. At present, the competency modeling of junior managers has become the focus of many scholars' research. There is a big difference between different junior managers in industries, and there is a big difference between the training, recruitment, and selection of junior managers.

2.2.2 The Iceberg Theory

(1) Concept of the Iceberg Theory

The iceberg theory is an important theory in Satya's family therapy, which is actually a metaphor. It refers to a person's "self" like an iceberg, we can see only a small

part of the surface - behavior, while a larger part of the inner world is hidden in the deeper layers, not visible, just like an iceberg. The larger part of the inner world is hidden in the deeper layers, not visible to people, just like an iceberg. The part that can be seen floating on the water is called external competency characteristics, including professional knowledge and skills, etc.; and the part that is not easy to see and hidden under the water is called internal characteristics, including values, personality, motivation, and execution ability.

Drucker's "Quality Iceberg Theory" questioned the validity of traditional oral and written assessment to a certain extent, and its consideration of competency has obvious stratification and definition. In the subsequent research, the academic community on the difference between competence and ability had a more heated debate (Wang, 2021). The current academic community basically agreed that competence (competency) refers to people-oriented, focusing on individual behavioral performance (people-oriented, performance-focusing) of the ability, while the ability (competence) is the ability of the individual to perform.

Competence refers to the task-oriented, result-focusing ability. By focusing on the behavioral characteristics of individuals based on their own developmental needs, such as a positive attitude towards participation and an effort to learn from practical experience of individual competence for their own development, these implicit traits are partly responsible for the development of individuals. To a certain extent, these implicit traits can influence competency. Therefore, by constructing the iceberg model of accounting literacy, understanding the layers of competence and the hierarchical structure of accounting literacy, we can optimize the competence of construction engineering management graduates by providing targeted training for the explicit part of the layer according to the needs and the layer, and by subtly influencing and catalyzing the implicit part of the layer.

(2) Professional Theoretical Knowledge

Professional theoretical knowledge is a foundational aspect of the competency model for construction engineering management graduates, emphasizing the necessity of acquiring and rigorously applying relevant knowledge. Qin (2011) explored the competency model of junior managers, identifying professional theoretical knowledge as a key component, alongside professional and technical ability, work direction ability, problem-solving ability, and employee motivation ability. This understanding is deeply rooted in the iceberg theory, which suggests that competencies can be divided into visible and hidden components, where the visible tip represents skills and knowledge,

and the submerged portion includes traits, self-concept, and motives.

In the context of professional theoretical knowledge, the iceberg theory posits that while explicit knowledge forms the observable tip, a deep and comprehensive understanding forms the larger, concealed part beneath the surface. This theoretical framework emphasizes that acquiring surface-level knowledge is insufficient; graduates must integrate and apply this knowledge effectively in real-world scenarios, indicating a deep-seated understanding (Wang, 2021). The iceberg theory further suggests that true competency in professional theoretical knowledge encompasses not just cognitive knowledge but also the ability to apply this knowledge in practical settings. This involves a blend of analytical thinking, problem-solving skills, and the capacity to synthesize new information effectively (He & Dai, 2017). Therefore, graduates must develop a robust theoretical foundation and the ability to translate this foundation into actionable insights and solutions in their professional practice.

(3) Professional Skills

Professional skills are critical for construction engineering management graduates, encompassing communication skills, coordination ability, and service consciousness. These skills are essential for effectively managing projects, teams, and client relationships. Communication skills refer to the ability to convey information clearly and effectively to others, which is vital for coordinating with team members, clients, and stakeholders. Effective communication ensures that project goals, timelines, and expectations are understood by all parties, minimizing misunderstandings and fostering a collaborative work environment. Coordination ability involves mobilizing, organizing, and fully utilizing the enthusiasm and capabilities of team members. It is essential for synchronizing various aspects of a construction project, ensuring that resources are efficiently allocated, and tasks are completed in a timely manner. Coordination ability also includes conflict resolution skills, as managing a diverse team often requires addressing and resolving disputes. Service consciousness is the sense of providing customers with enthusiastic, attentive, and proactive services. In construction engineering management, this means understanding and anticipating client needs, maintaining a high level of customer satisfaction, and fostering long-term relationships. It involves a client-focused approach that prioritizes delivering quality service and value.

Liu et al. (2016) constructed a model of nurse manager job competency that highlighted the importance of professional skills and management quality. This model, though focused on nursing, offers valuable insights into the significance of professional

skills in performance appraisal and competency development. The researchers emphasized that professional skills, including communication, coordination, and service consciousness, are fundamental for effective management and leadership. Effective communication ensures clear and precise information exchange, which is crucial for project success (Fredrik et al.,2020). Coordination ability facilitates the smooth functioning of project activities and resource management. Service consciousness enhances client satisfaction and loyalty, contributing to a company's reputation and success. These skills are integral to successful project management, team leadership, and client relationship management. The competency model by Liu et al. (2016) reinforces the importance of these skills, providing a framework for assessing and developing the competencies required for effective performance in managerial roles.

(4) Work Ability

Work ability in construction engineering management is a crucial factor that encompasses several competencies, such as problem-solving ability, analytical ability, and strain ability. These competencies enable graduates to effectively handle various challenges and dynamic situations in their professional roles. Problem-solving ability involves using scientific methods to swiftly and efficiently complete tasks assigned by leadership. This competency reflects a graduate's capability to identify issues, evaluate potential solutions, and implement effective strategies to resolve problems. Li (2016) highlights the importance of problem-solving ability in the competency model of grassroots managers, indicating its critical role in successful management and project completion. Li (2016) also emphasizes the role of coordination and responsibility in the competency model of grassroots managers. Coordination involves harmonizing different aspects of a project, ensuring that all components work together seamlessly. Responsibility reflects a manager's commitment to their role, accountability for their actions, and dedication to achieving project goals.

In the context of workability, these competencies are interrelated and collectively contribute to a manager's effectiveness. Problem-solving ability enables quick and efficient task completion, analytical ability ensures thoughtful and informed decision-making and strain ability allows for flexibility and adaptability in the face of change. Together, they form a comprehensive skill set that is essential for managing construction projects successfully. This method involves detailed interviews that explore past behaviors and experiences, providing insights into a candidate's work ability and potential performance in managerial roles. Work ability in construction engineering management is a multifaceted competency that includes problem-solving

ability, analytical ability, and strain ability. These skills are critical for navigating the complexities and uncertainties of construction projects. The competency model established by Li (2016) underscores the importance of these abilities, along with coordination and responsibility, ineffective management, and leadership.

(5) Personal Qualities

Personal qualities are pivotal in shaping the competency of construction engineering management graduates. These qualities include a sense of responsibility, hard-working nature, and stress resistance. Each plays a crucial role in determining a graduate's effectiveness and performance in their professional environment. The sense of responsibility involves taking the initiative to perform all useful tasks within and beyond the work. This quality signifies a proactive approach to responsibilities, ensuring that tasks are completed diligently and efficiently. Graduates who have a strong sense of responsibility are more likely to take ownership of their projects, leading to higher accountability and reliability. Hard-working nature refers to the ability to endure laborious and demanding tasks. It reflects a graduate's dedication and perseverance in the face of challenging work conditions. This quality is essential in construction engineering, where projects often require long hours and intensive physical and mental effort. A hard-working attitude ensures that graduates remain committed to their tasks, contributing to the overall success and timely completion of projects. Zhang (2019) utilized the partial least squares method to demonstrate that personal qualities have a significant positive influence and promotion effect on competence. This analysis highlights the integral role plays in enhancing a graduate's overall competency. The study indicates that personal qualities are not only beneficial for individual performance but also contribute to broader organizational success by promoting a culture of responsibility, hard work, and resilience.

2.3 Related Research

In the United States, engineering management is generally known as "construction engineering management", and by the American Board of Engineering and Technology (ABET) assessment of this program is generally affiliated with the College of Engineering, there are a small number of colleges and universities set in the School of Business (School of Management) and the School of Design and the Environment and so on. Education in this program focuses on the entire life cycle of building project-specific facilities, including design, budgeting, purchasing, construction, operation, and maintenance, and is typically awarded a bachelor's degree in construction engineering

management (B.E.M.) (Ning & Liu, 2011). The United Kingdom, the earliest country to carry out engineering management education, is one of the birthplaces of the contemporary construction contract management system, engineering project management model based on the general contractor, in the United Kingdom has been about 200 years of history. Many countries and regions, including Singapore and Hong Kong, have their construction contract management systems originated from the United Kingdom. The Chartered Institute of Building (CIOB) and the Royal Institution of Chartered Surveyors (RICS) have jointly promoted the continuous development of the construction management profession at home and abroad through assessment and accreditation. The original version of FIDIC's civil engineering construction contract clauses was based on the contract clauses of the British Civil Engineering Institute. Depending on their own conditions, the engineering management programs of British universities have undergraduate programs ranging from two to four years.

According to the research of Huang et al.(2009), many colleges and universities do not have a unified major direction, and the major settings of each college and university are relatively diversified and have their own characteristics. For example, the University of California, Berkeley (UC Berkeley) with project management, site management and business management and other directions; Florida State University (FSU) with residential construction, land development, public buildings and industrial buildings and other directions; University of Reading (Reading) with construction management, building surveying, quantity surveying, and other directions; Salford University (Salford) with project management, real estate management and investment, real estate management and investment, construction surveying, quantity surveying, and other directions; Salford University (Salford) with Project management, real estate management and investment, quantity surveying and other directions. In the engineering management courses of foreign universities, engineering and technology courses account for more than half of the courses, practice and internship also account for a larger proportion, and the curriculum system is more focused on the connection with the future work qualification.

The cultivation process of engineering management majors in domestic colleges and universities is guided by the Education Instruction Committee of the Ministry of Education (Feng, 2005), aiming at cultivating senior compound talents who have basic knowledge in the fields of management, economics, civil engineering technology and law, and who can engage in the whole process management in the field of construction of domestic and international engineering projects. In terms of curriculum and cultivation plan, engineering management major should contain four platforms of management, economics, technology and law, and the teaching is carried out according

to the three sections of public basic courses (Huang & Zhu, 2009), professional basic courses and professional direction courses, interspersed with course design, practical teaching and internships inside and outside the school, and the final semester to complete the graduation design (or thesis).

2.4 Conceptual Framework

In order to fully analyze the influencing factors of competency of construction engineering management graduates, this study takes the iceberg theory as the theoretical basis, and constructs a job competence model with four indicators, namely, professional theoretical knowledge, professional skills, work ability and personal qualities, as the independent variables, and the conceptual framework of this study is shown in Figure 2.1.

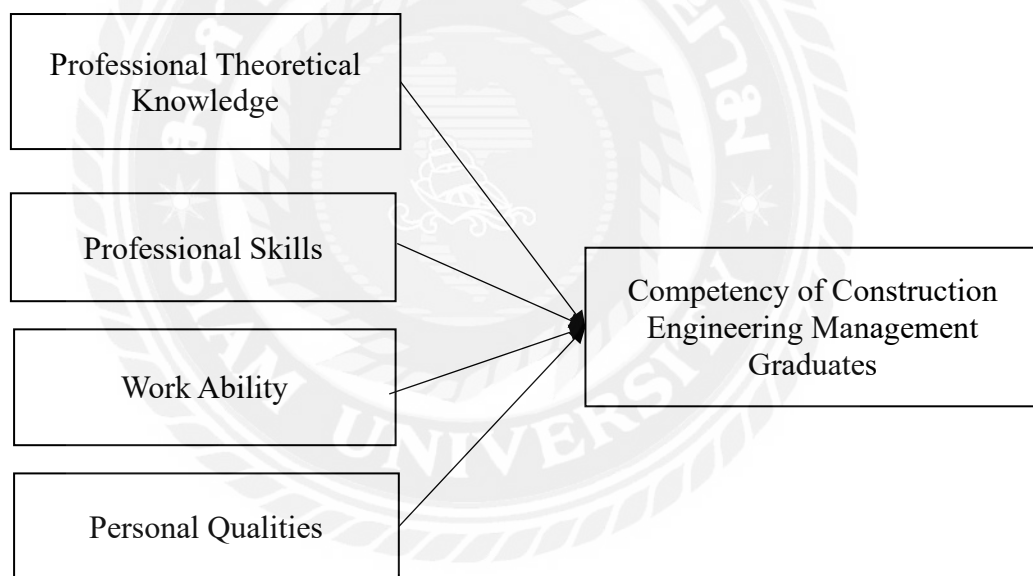


Figure 2.1 Conceptual Framework

Chapter 3 Research Methodology

3.1 Introduction

This study adopted the quantitative method by reviewing the iceberg theory, collecting, organizing, and analyzing related research literature, and designing an online questionnaire based on the iceberg theory. According to the iceberg theory, we analyze and study the current situation of construction engineering management graduates' competence in management positions, clarify the existing problems, put forward from different perspectives, and put forward suggestions and guidance for the development of the construction engineering management profession, which in turn realizes the research purpose of this study.

3.2 Research Design

Referring to CNKI China Knowledge Network, Wipro, Wan fang, Google Scholar and other well-known academic resources at home and abroad, this study collected, organized and analyzed the similar research literature and practice reports, and searches for keywords such as "Iceberg Theory", "Construction Engineering Management Profession", "competence of basic management positions", etc., sorted out the literature resources related to the topic of the thesis, read more than 80 pieces of literature, and finally identified 39 core articles for academic analysis.

A questionnaire was designed according to the "Iceberg Theory" and the characteristics of construction engineering management competence, and the QR code was generated through the Questionnaire Star platform and distributed through the Questionnaire Star network. In the questionnaire design, "professional theoretical knowledge" includes three aspects, which are concretely reflected in three measurement items: satisfaction with professional theoretical knowledge, satisfaction with the degree of rigor, and satisfaction with the way to improve professional theoretical knowledge. "Professional skills" includes five aspects: professional skills, communication skills, coordination skills, service awareness and ways to enhance professional skills. "Work ability" includes four aspects: problem solving ability, analytical ability, adaptive ability and overall work proficiency. "Personal qualities" includes four aspects: responsibility, diligence, ability to withstand pressure and comprehensive personal quality. "Competency of construction engineering management graduates" includes four aspects: project management ability, technical knowledge application ability, continuous learning ability, and teamwork ability.

Table 3.1 Questionnaire Design

| Factors | Question |
|------------------------------------|--|
| Professional Theoretical Knowledge | <ol style="list-style-type: none"> 1. How satisfied are you with the level of professional theoretical knowledge of construction engineering management graduates (which means that they have the basic theoretical knowledge of the profession required for study and the knowledge of professional skills required for work)? 2. To what extent are you satisfied with the rigor (ability to work calmly and rationally, pay attention to key details, think thoroughly, act rigorously, and pursue precision) of graduates of the Construction Engineering Management program? 3. How to improve the professional theoretical knowledge of construction engineering management graduates? |
| Professional Skills | <ol style="list-style-type: none"> 4. How satisfied are you with the level of professional skills of graduates of the construction project management program (meaning that they have mastered the skills of the program and are able to use the professional skills they have learned to complete specific tasks quickly)? 5. To what extent are you satisfied with the communication skills (defined as a person's ability to communicate information effectively with others) of graduates of the Construction Engineering Management program? 6. How satisfied are you with the coordination skills (which are the ability to mobilize, organize, and fully motivate people) of construction project management graduates? 7. Your degree of satisfaction with the construction engineering management graduates of the service consciousness (refers to the customer to provide warm, attentive, proactive service consciousness, that is, consciously take the initiative to do a good job of service work a concept)? 8. How to improve the level of professional skills of construction project management graduates (professional skills, communication skills, coordination skills, service consciousness)? |
| Work Ability | <ol style="list-style-type: none"> 9. How satisfied are you with the problem-solving ability of graduates of the Construction Engineering Management program (ability to use scientific methods, to quickly complete work assigned by leaders, and good problem-solving ability)? |

| Factors | Question |
|---|---|
| | <p>10. How satisfied are you with the analytical skills (ability to think positively and then quickly analyze problems) of construction engineering management graduates?</p> <p>11. How satisfied are you with the resilience (the ability to change quickly and adapt to changes in the outside world) of graduates of the Construction Engineering Management program?</p> <p>12. How to improve the work ability (problem solving ability, analytical ability, adaptability) of construction engineering management graduates?</p> |
| Personal Qualities | <p>13. To what extent are you satisfied with the sense of responsibility (which is a spirit of consciously taking the initiative to do all useful things within and outside of one's job) of the graduates of the construction project management program?</p> <p>14. How satisfied are you with the level of hard work (ability to withstand hard work and labor) of construction project management graduates?</p> <p>15. To what extent are you satisfied with the stress tolerance (the ability to adapt to high-intensity work and to accept and relieve stress effectively) of graduates of the construction engineering management program?</p> <p>16. Based on your experience, how can you improve the personal qualities (sense of responsibility, hard work, stress tolerance) of construction management graduates?</p> |
| Competency of Construction Engineering Management Graduates | <p>17. I can effectively organize, plan and monitor the progress, cost and quality of construction projects.</p> <p>18. I can proficiently apply technical specifications and standards related to construction projects to solve technical problems in construction.</p> <p>19. I can keep up with the latest development in the field of architectural engineering, and constantly learn new knowledge and new technologies to improve my professional ability.</p> <p>20. I can actively participate in team work, support and cooperate with team members to complete project objectives.</p> |

3.3 Hypothesis

H1: Professional theoretical knowledge has a positive influence on the competency of construction engineering management graduates.

H2: Professional skills have a positive influence on the competency of construction engineering management graduates.

H3: Work ability has a positive influence on the competency of construction engineering management graduates.

H4: Personal qualities have a positive influence on the competency of construction engineering management graduates.

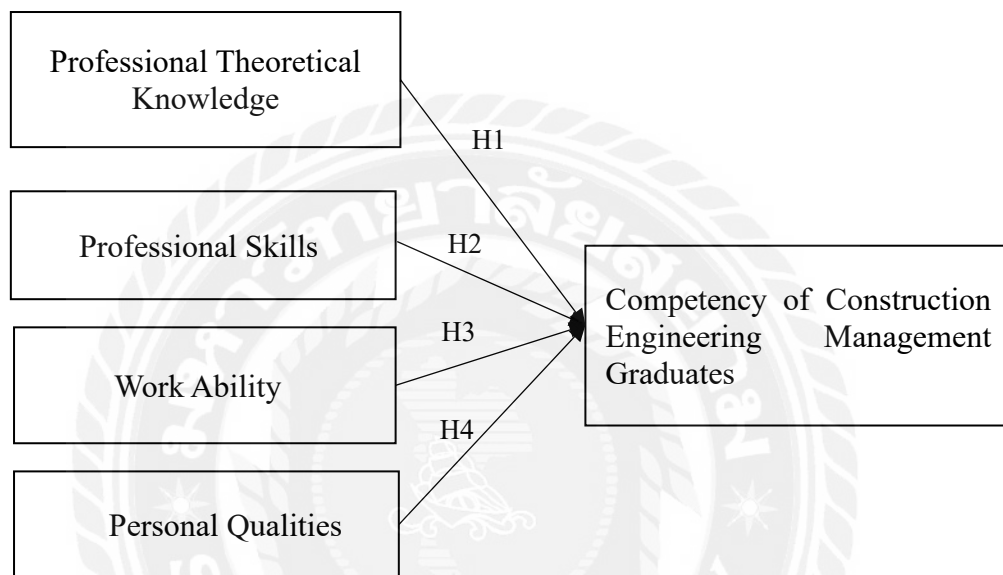


Figure 3.1 Hypotheses

3.4 Population and Sample

In this study, we investigated 8 representative higher vocational colleges and 20 closely cooperating enterprises in Shandong Province. The selection of samples followed the principle of scientific rationality to ensure the validity of the survey data. At the university level, 8 representative higher vocational colleges were selected. At the enterprise level, 20 companies that have long-term relationships with these institutions and have some influence in the industry were selected. Such sample selection helps us to more accurately understand the perceptions and expectations of schools and enterprises on the competency of construction engineering management graduates. The sampling method adopted in this study was the simple random sampling. The sample size was eventually determined to be 150.

3.5 Data Collection

From September 2023 to January 2024, 150 electronic questionnaires were distributed online, and 136 valid questionnaires were recovered, with a validity of 90.67%. The questionnaire is divided into two parts, the first part is the demographic information of the respondents, such as gender, age, years of work and so on. The second part carries out the design according to the competency characteristics contained in the "Iceberg theory", and analyzes the interviewees' different views and opinions on the competency of construction engineering management positions from the aspects of professional theoretical knowledge, professional skills, work ability and personal qualities.

3.6 Data Analysis

3.6.1 Reliability of the Questionnaire

The Cronbach's coefficient was used for the reliability test using SPSS 20.0 software. Since the value of Cronbach's Alpha ≤ 0.5 means that the data are "slightly reliable", the value of Cronbach's Alpha ≤ 0.7 means that the data are "relatively reliable", the value of Cronbach's Alpha ≤ 0.9 means that the data are "very reliable", and the value of Cronbach's Alpha > 0.9 means that the data are "very reliable". "very plausible", Cronbach Alpha > 0.9 means "very plausible".

The questionnaire on "professional theoretical knowledge" was analyzed for reliability using SPSS software, and the Cronbach's reliability coefficient was used for the reliability test, resulting in a Cronbach's coefficient value for the questionnaire of 0.732, which is greater than 0.7, thus indicating that the data of the study are of high quality in terms of reliability.

Table 3.2 Cronbach's Reliability Analysis of Professional Theoretical Knowledge

| Number of items | Sample size | Cronbach's alpha coefficient |
|-----------------|-------------|------------------------------|
| 3 | 136 | 0.732 |

In terms of validity, this study uses KMO and Bartlett's test to verify the validity, as can be seen from the following table: the KMO value is 0.745, between 0.7 ~ 0.8, and the research data is suitable for extracting information.

Table 3.3 KMO and Bartlett's Test of Professional Theoretical Knowledge

| KMO and Bartlett's test | | |
|--------------------------|-------------------------|--------|
| KMO values | | 0.745 |
| Bartlett sphericity test | Approximate cardinality | 20.376 |
| | <i>df</i> | 15 |
| | <i>p-value</i> | 0.020 |

The questionnaire on "professional skills" was analyzed for reliability and validity using SPSS software, and the Cronbach's reliability coefficient was used to test the reliability of the questionnaire, and the value of the Cronbach's coefficient for the questionnaire was 0.708, which is greater than 0.7, and thus indicates that the data of the study are of high quality in terms of reliability.

Table 3.4 Cronbach's Reliability Analysis of Professional Skills

| Cronbach's Reliability Analysis-Simplified Format | | |
|---|-------------|---------------------------------------|
| Number of items | Sample size | Cronbach's alpha coefficient α |
| 5 | 136 | 0.708 |

In terms of validity, this study uses KMO and Bartlett's test to verify the validity, as can be seen from the following table: the KMO value is 0.738, between 0.7 ~ 0.8, and the research data is suitable for extracting information.

Table 3.5 KMO and Bartlett's Test of Professional Skills

| KMO and Bartlett's test | | |
|--------------------------|-------------------------|--------|
| KMO values | | 0.738 |
| Bartlett Sphericity Test | Approximate cardinality | 12.458 |
| | <i>df</i> | 6 |
| | <i>p-value</i> | 0.021 |

The questionnaire on "work ability" was analyzed for reliability and validity using SPSS software, and the Cronbach's reliability coefficient was used to test the reliability of the questionnaire, and the Cronbach's coefficient value for the questionnaire was 0.712, which is greater than 0.7, thus indicating that the data from the study are of high quality in terms of reliability and can be used for further analysis.

Table 3.6 Cronbach's Reliability Analysis of Work Ability

| Cronbach's Reliability Analysis - Simplified Format | | |
|---|-------------|------------------------------|
| Number of items | Sample size | Cronbach's alpha coefficient |
| 4 | 136 | 0.712 |

In terms of validity, this study uses KMO and Bartlett's test to verify the validity, as can be seen from the following table: the KMO value is 0.735, between 0.7 ~ 0.8, and the research data is suitable for extracting information.

Table 3.7 KMO and Bartlett's Test of Work Ability

| KMO and Bartlett's test | | |
|--------------------------|-------------------------|--------|
| KMO values | | 0.735 |
| Bartlett sphericity test | Approximate cardinality | 25.256 |
| | <i>df</i> | 6 |
| | <i>p-value</i> | 0.000 |

The questionnaire on "personal qualities" was analyzed for reliability and validity using SPSS software, and the Cronbach's reliability coefficient was used to test the reliability of the questionnaire, and the Cronbach's coefficient value for the questionnaire was 0.770, which is greater than 0.7, thus indicating that the data of the study are of high quality in terms of reliability and can be used for further analyses.

Table 3.8 Cronbach's Reliability Analysis of Personal Qualities

| Cronbach's Reliability Analysis - Simplified Format | | |
|---|-------------|------------------------------|
| Number of items | Sample size | Cronbach's alpha coefficient |
| 4 | 136 | 0.770 |

In terms of validity, this study uses KMO and Bartlett's test to verify the validity, as can be seen from the following table: the KMO value is 0.747, between 0.7 ~ 0.8, the research data is suitable for extracting the information, and the validity is very good from the side.

Table 3.9 KMO and Bartlett's Test of Personal Qualities

| KMO and Bartlett's test | | |
|--------------------------|-------------------------|--------|
| KMO values | | 0.747 |
| Bartlett sphericity test | Approximate cardinality | 27.307 |
| | df | 6 |
| | p-value | 0.000 |

The questionnaire on "competency of construction engineering management graduates" was analyzed for reliability and validity using SPSS software, and the Cronbach's reliability coefficient was used to test the reliability of the questionnaire, and the Cronbach's coefficient value for the questionnaire was 0.821, which is greater than 0.7, thus indicating that the data of the study are of high quality in terms of reliability and can be used for further analyses.

Table 3.10 Cronbach's Reliability Analysis of Competency of Construction Engineering Management Graduates

| Cronbach's Reliability Analysis - Simplified Format | | |
|---|-------------|------------------------------|
| Number of items | Sample size | Cronbach's alpha coefficient |
| 4 | 136 | 0.821 |

In terms of validity, this study uses KMO and Bartlett's test to verify the validity, as can be seen from the following table: the KMO value is 0.854, between 0.7 ~ 0.8, the research data is suitable for extracting the information, and the validity is very good from the side.

Table 3.11 KMO and Bartlett's Test of Competency of Construction Engineering Management Graduates

| KMO and Bartlett's test | | |
|--------------------------|-------------------------|--------|
| KMO values | | 0.854 |
| Bartlett sphericity test | Approximate cardinality | 19.241 |
| | df | 7 |
| | p-value | 0.000 |

3.6.2 Validity of the Questionnaire

The data collected from the questionnaire needs to have reliability in addition to validity. In this study, the standard was met after the reliability analysis and then the questionnaire validity was analyzed. The validity analysis is usually based on the obtained KMO value and Bartlett's Sphericity Test to confirm whether the validity is feasible or not. If the KMO value obtained is greater than 0.8, this indicates that the questionnaire is well suited for the research data. If the KMO value obtained is between 0.6 and 0.8, this indicates that the research data of the questionnaire is generally suitable. If the KMO value obtained is less than 0.6, this indicates that the research data of the questionnaire is not suitable. For Bartlett's spherical test, if it is less than 0.05, the sig is significant, indicating a strong correlation. According to the results of the analysis of the research data, the variables were analyzed for validity, the KMO value is greater than 0.7, which indicates that the research data of the questionnaire is very suitable. Sig is significant in Bartlett's Test of Sphericity. After analyzing, it can be known that the constructed variable model can be subjected to Confirmatory factor analysis (CFA). Therefore, CFA was performed on the data.

Table 3.12 Confirmatory Factor Analysis (CFA)

| Total Variance Explained | | | | | | | | |
|--------------------------|---------------------|--------------|-------------------------------------|---------------|--------------|-----------------------------------|---------------|--------------|
| Component | Initial Eigenvalues | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
| | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 11.003 | 78.590 | 78.59 | 78.590 | 78.590 | 5.508 | 39.346 | 39.346 |
| 2 | 0.862 | 6.158 | 84.74 | 6.158 | 84.748 | 3.007 | 21.481 | 60.827 |
| 3 | 0.467 | 3.333 | 88.08 | 3.333 | 88.081 | 2.842 | 20.301 | 81.128 |
| 4 | 0.423 | 3.021 | 91.10 | 3.021 | 91.102 | 1.396 | 9.974 | 91.102 |
| 5 | 0.339 | 2.420 | 93.52 | - | - | - | - | - |
| 6 | 0.222 | 1.586 | 95.10 | - | - | - | - | - |
| 7 | 0.178 | 1.274 | 96.38 | - | - | - | - | - |
| 8 | 0.141 | 1.009 | 97.39 | - | - | - | - | - |
| 9 | 0.116 | 0.825 | 98.21 | - | - | - | - | - |
| 10 | 0.089 | 0.508 | 98.72 | - | - | - | - | - |
| 11 | 0.084 | 0.507 | 98.73 | | | | | |
| 12 | 0.080 | 0.505 | 98.74 | | | | | |
| 13 | 0.070 | 0.503 | 98.76 | - | - | - | - | - |
| 14 | 0.071 | 0.501 | 98.79 | - | - | - | - | - |
| 15 | 0.068 | 0.498 | 98.80 | - | - | - | - | - |
| 16 | 0.067 | 0.483 | 99.00 | - | - | - | - | - |
| 17 | 0.066 | 0.478 | 99.20 | | | | | |

| | | | | | | | | |
|----|-------|-------|-------|--|--|--|--|--|
| 18 | 0.049 | 0.352 | 99.55 | | | | | |
| 19 | 0.041 | 0.290 | 99.84 | | | | | |
| 20 | 0.022 | 0.156 | 100.0 | | | | | |

Generally, the total variance contribution rate is greater than 60%, which indicates that the factor's ability to explain the original variable is acceptable, and greater than 80%, which indicates that the factor's ability to explain the variable is good. The result of factor analysis of the variables shows that the cumulative explanatory rate of each variable is 91.102%, which is greater than 0.5. This indicates that the overall validity of the questionnaire is good.

The results of the factor analysis need to be practically meaningful for each factor. Rotating the factor loading matrix makes the relationship between the original variables and the factors more salient, i.e., each variable has a larger loading on only one common factor and a smaller loading on the other common factors. Also, the factors were rotated to be able to better categorize each raw variable. The rotated formation matrix was performed by the maximum variance method to verify that there is no covariance in the question items measured by each variable and analyzed based on the maximum eigenvalue. From Table 3.13, it can be seen that a total of five factors were extracted, and each variable has a large loading on only one common factor, while the loadings on the other common factors are small, which indicates that each variable has a better but differentiated validity.

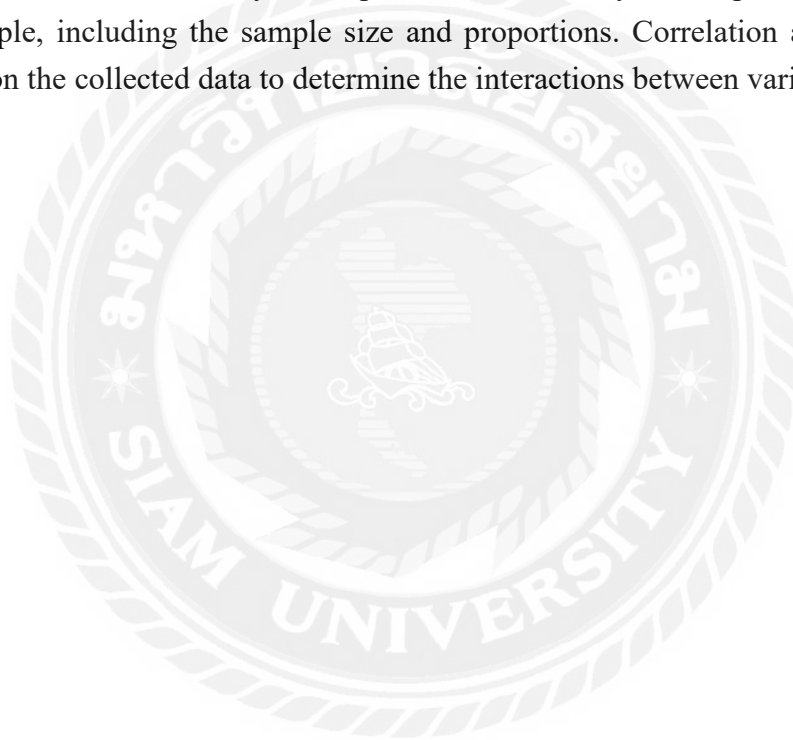
Table 3.13 Rotated Component Matrix

| | Component | | | | |
|-----|-----------|-------|-------|---|-------|
| | 1 | 2 | 3 | 4 | 5 |
| Q1 | | | | | 0.768 |
| Q2 | | | | | 0.771 |
| Q3 | | | | | 0.737 |
| Q4 | | | 0.781 | | |
| Q5 | | | 0.829 | | |
| Q6 | | | 0.777 | | |
| Q7 | | | 0.782 | | |
| Q8 | | | 0.765 | | |
| Q9 | 0.809 | | | | |
| Q10 | 0.807 | | | | |
| Q11 | 0.822 | | | | |
| Q12 | 0.839 | | | | |
| Q13 | | 0.664 | | | |
| Q14 | | 0.758 | | | |
| Q15 | | 0.776 | | | |

| | | | | | |
|-----|--|-------|--|-------|--|
| Q16 | | 0.761 | | | |
| Q17 | | | | 0.774 | |
| Q18 | | | | 0.756 | |
| Q19 | | | | 0.723 | |
| Q20 | | | | 0.801 | |

3.6.3 Questionnaire Data Analysis

After data collection, analysis was required, and the specific process was as follows: Firstly, the collected data were cleaned and inspected, including checking for missing data, outliers, and abnormal values. If there were issues, the data were processed or excluded. Secondly, descriptive statistical analysis was performed on the survey sample, including the sample size and proportions. Correlation analysis was conducted on the collected data to determine the interactions between variables.



Chapter 4 Findings

4.1 Introduction

This chapter mainly analyzes the collected data, makes a quantitative analysis of the 136 valid questionnaires collected, digs deeply into the factors affecting the competency of construction engineering management graduates, and uses SPSS method to make a statistical analysis of the data and draw a conclusion.

4.2 Demographic Characteristics of Respondents

Of the 136 valid questionnaires, 90 were from males, accounting for 66% of all respondents. Forty-six were females, or 34 percent of all respondents. With regard to age, 80 persons, or 59 per cent of all surveyed, were under 25 years of age; 12 persons, or 9 percent of all surveyed, were between 26 and 30 years of age; 10 persons, or 7 percent of all surveyed, were between 31 and 35 years of age; and 34 persons, or 25 percent of all surveyed, were 36 years of age or older. With regard to the number of years of practice in the field, 102 persons, or 75 percent of the total number of respondents, have been in the field for 3-5 years; 8 persons, or 6 per cent of the total number of respondents, have been in the field for 6-10 years; and 26 persons, or 19 per cent of the total number of respondents, have been in the field for 11 years or more. For details of the specific data, as shown in Table 4.1.

Table 4.1 Demographic Characteristics of Respondents

| Attributes | Classification | Number of Persons | Percent% |
|-----------------------------|-----------------------|--------------------------|-----------------|
| Gender | Male | 90 | 66.18 |
| | Female | 46 | 33.82 |
| Age | Under 25 years of age | 80 | 58.82 |
| | 26-30 years old | 12 | 8.82 |
| | 31-35 years old | 10 | 7.35 |
| | Over 35 years of age | 34 | 25.00 |
| Number of years of practice | 3-5 years | 102 | 75.00 |
| | 6-10 years | 8 | 5.88 |
| | 10 or more | 26 | 19.12 |

4.3 Descriptive Statistics of Variables

(1) Professional Theoretical Knowledge

On the question "How satisfied are you with the level of professional theoretical knowledge?" 0% chose "very satisfied", 18.38% chose "satisfied", 14.71% chose "average", 55.15% chose "dissatisfied", and 11.76% chose "very dissatisfied".

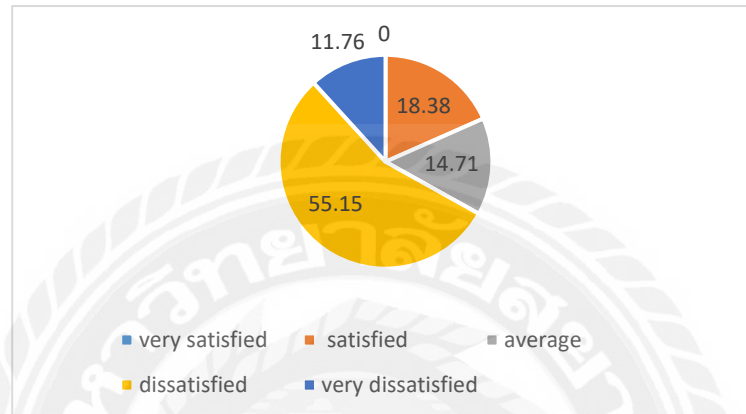


Figure 4.1 Satisfaction with the Level of Professional Theoretical Knowledge

On the question "Satisfaction with rigor?" 3.68% chose "very satisfied", 33.09% chose "satisfied", 25.0% chose "average", 27.94% chose "dissatisfied", and 10.29% chose "very dissatisfied".

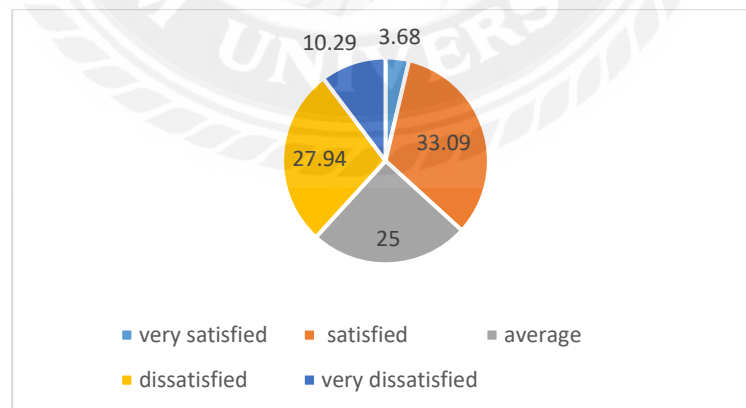


Figure 4.2 Satisfaction with the Level of Rigor

On the question, "How to improve the level of professional theoretical knowledge of construction engineering management graduates?" 47.79% chose "increasing the hours of specialized theory courses", 30.88% chose "innovating the teaching content of

courses", 14.71% chose "deepening the teaching reform", and 6.62% chose "others".

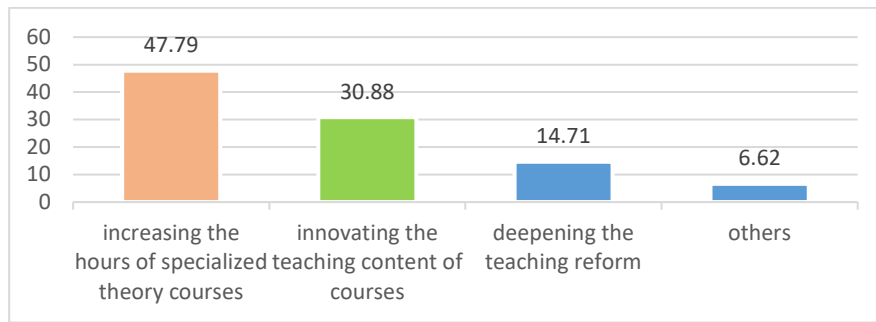


Figure 4.3 How to Improve the Level of Professional Theoretical Knowledge

(2) Professional Skills

In the question "Satisfaction with the level of professional skills?" 3.68% chose "very satisfied", 7.35% chose "satisfied", 17.65% chose "average", 66.18% chose "dissatisfied", and 5.15% chose "very dissatisfied".

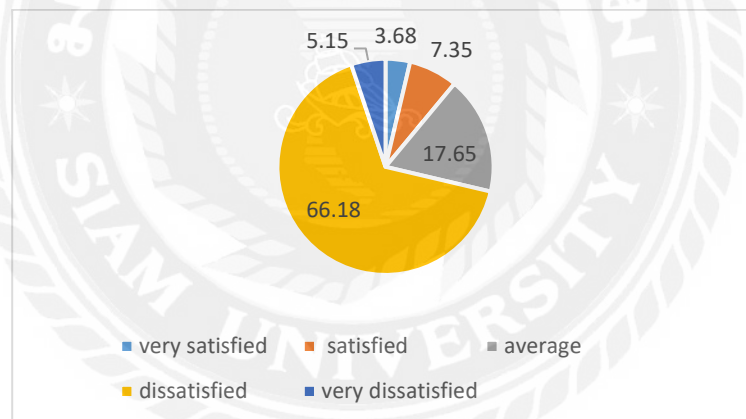


Figure 4.4 Satisfaction with the Level of Professional Skills

In the question "How satisfied are you with your communication skills?" 0% chose "very satisfied", 13.24% chose "satisfied", 22.06% chose "average", 60.29% chose "dissatisfied", and 4.41% chose "very dissatisfied".

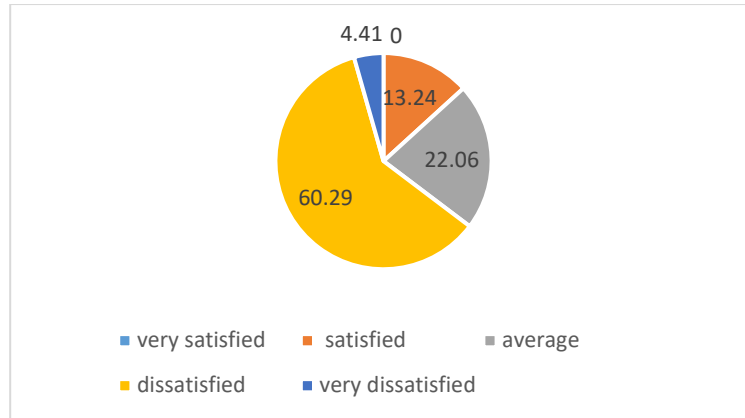


Figure 4.5 Satisfaction with the Level of Communication Skills

On the question "How satisfied are you with your coordination skills?" 3.68% chose "very satisfied", 14.71% "satisfied", 22.79% "average", 47.79% "dissatisfied" and 11.03% "very dissatisfied".

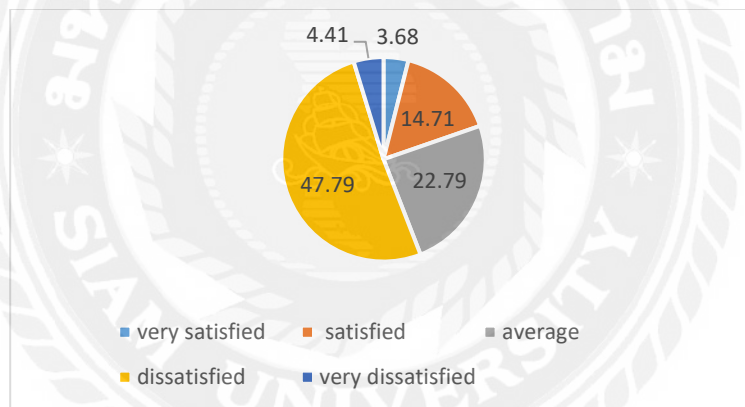


Figure 4.6 Satisfaction with the Level of Coordination Skills

On the question of "Satisfaction level of service consciousness?" the percentage of those who chose "very satisfied" was 14.71%, "satisfied" 11.03%, "average" 70.59%, "dissatisfied" 3.68% and "very dissatisfied" 0%.

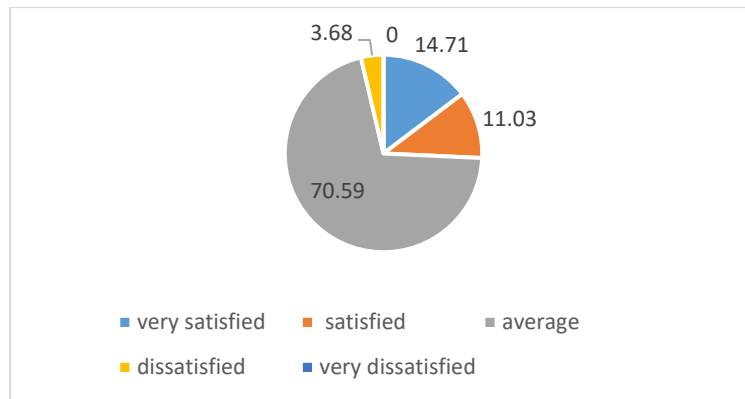


Figure 4.7 Satisfaction with the Level of Service Consciousness

On the question of "How to improve the professional skills level of construction engineering management graduates?" 52.94% chose "in-depth cooperation between schools and enterprises, jointly develop talent training programs", 28.68% chose "innovative talent training mode", 16.91% chose "in-depth cooperation with enterprises, more skill training", and 1.47% chose "others".

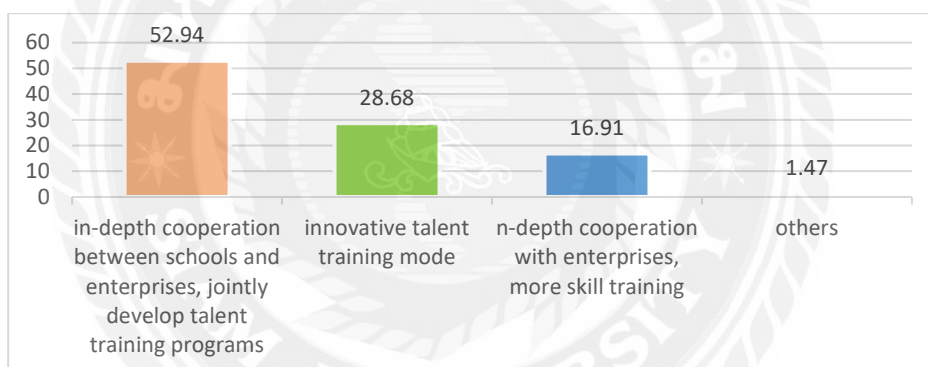


Figure 4.8 How to Improve the Professional Skills of Construction Engineering Management Graduates

(3) Work Ability

In the question "How satisfied are you with your problem-solving skills?" 1.47% chose "very satisfied", 18.38% "satisfied", 23.53% "average", 25.74% "dissatisfied" and 30.88% "very dissatisfied".

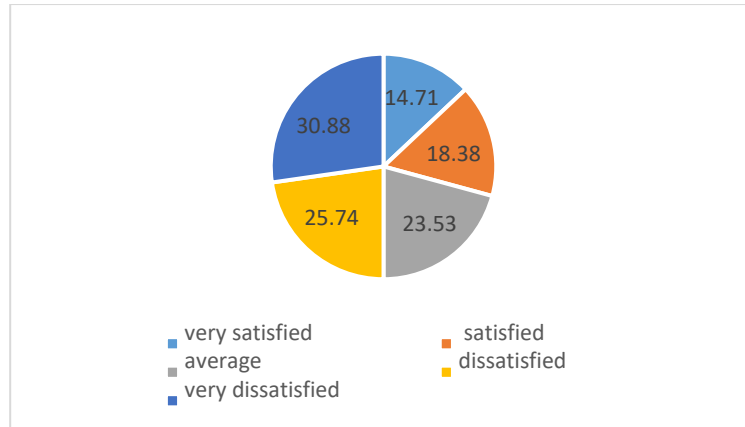


Figure 4.9 Satisfaction with the Level of Problem-Solving Skills

On the question "How satisfied are you with your analytical skills?" 7.35% chose "very satisfied", 22.06% chose "satisfied", 0% chose "average", 50.74% chose "dissatisfied", and 19.85% chose "very dissatisfied".

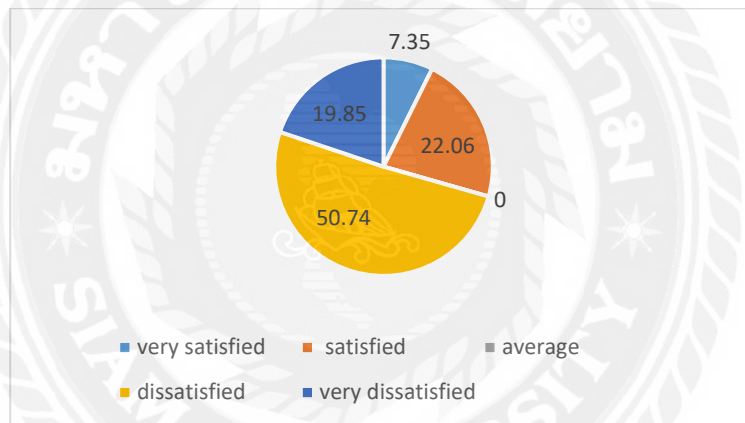


Figure 4.10 Satisfaction with the Level of Analytical Skills

On the question "How satisfied are you with your resilience?" 5.88% chose "very satisfied", 14.71% "satisfied", 62.50% "average", 14.71% "dissatisfied" and 2.21% "very dissatisfied".

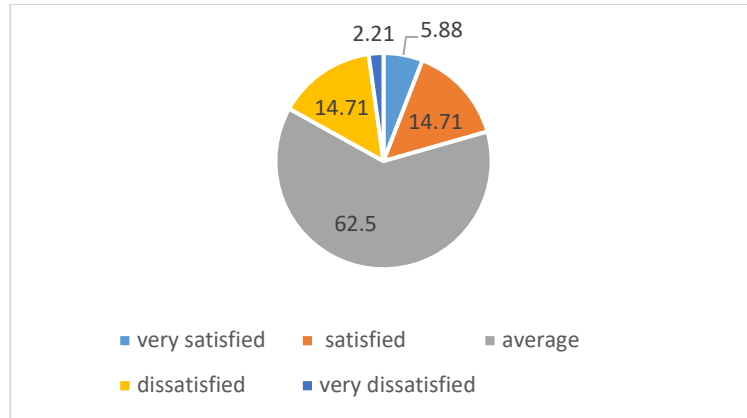


Figure 4.11 Satisfaction with the Level of Resilience

On the question of "How to improve the work ability of construction engineering management graduates?" 69.85% chose "emphasize the role of skills competition", 14.71% chose "strengthen the technical service", 13.24% chose "improve the comprehensive ability of teacher team", and 2.21% chose "others".

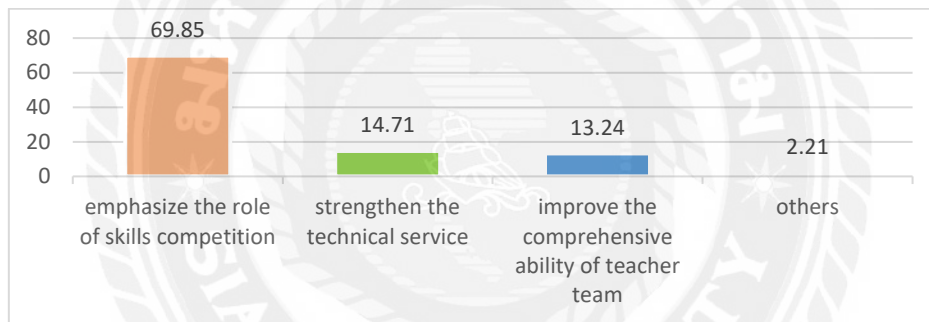


Figure 4.12 How to Improve the Work Ability of Construction Engineering Management Graduates

(4) Personal Qualities

In the question "How satisfied are you with your sense of responsibility?" 2.94% chose "very satisfied", 0% chose "satisfied", 30.88% chose "average", 65.44% chose "dissatisfied", and 0.74% chose "very dissatisfied".

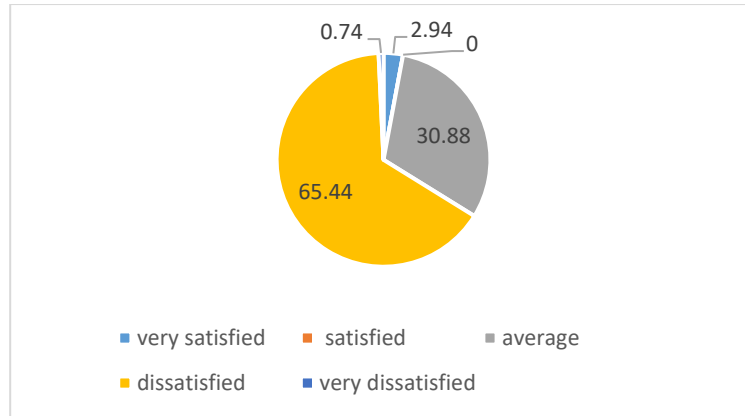


Figure 4.13 Satisfaction with the Level of Sense of Responsibility

In the question "How satisfied are you with hard work?" 0% chose "very satisfied", 0% chose "satisfied", 22.06% chose "average", 77.21% chose "dissatisfied", and 0.74% chose "very dissatisfied".

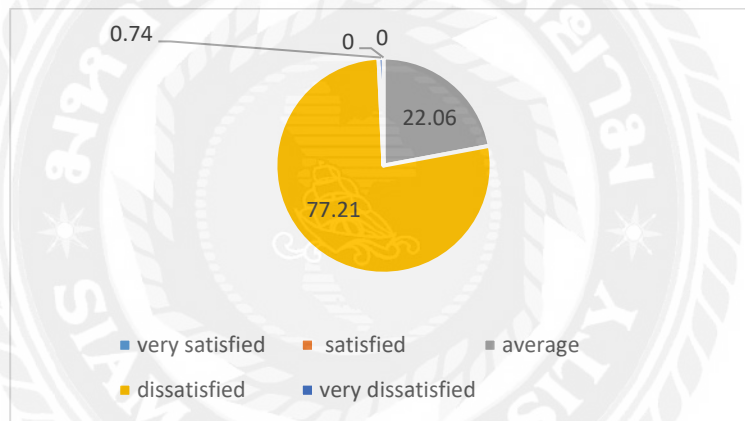


Figure 4.14 Satisfaction with the Level of Hard Work

In the question "How satisfied are you with your ability to resist stress?" 0% chose "very satisfied", 0% chose "satisfied", 19.12% chose "average", 72.06% chose "dissatisfied", and 8.82% chose "very dissatisfied".

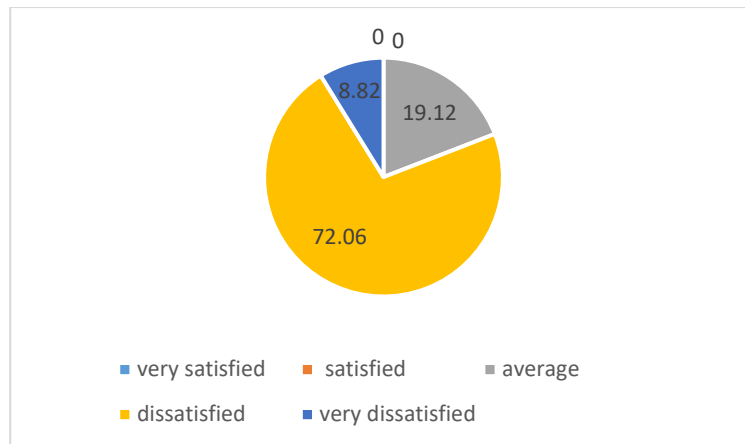


Figure 4.15 Satisfaction with the Level of Ability to Resist Stress

In the question "Based on your experience, how to improve the personal qualities of construction engineering management graduates?", 79.41% chose "Increase case studies", 15.44% chose "Organize field trips and simulation projects", 1.47% chose "increase psychological lectures", and the percentage of those who chose "others" was 3.68%.

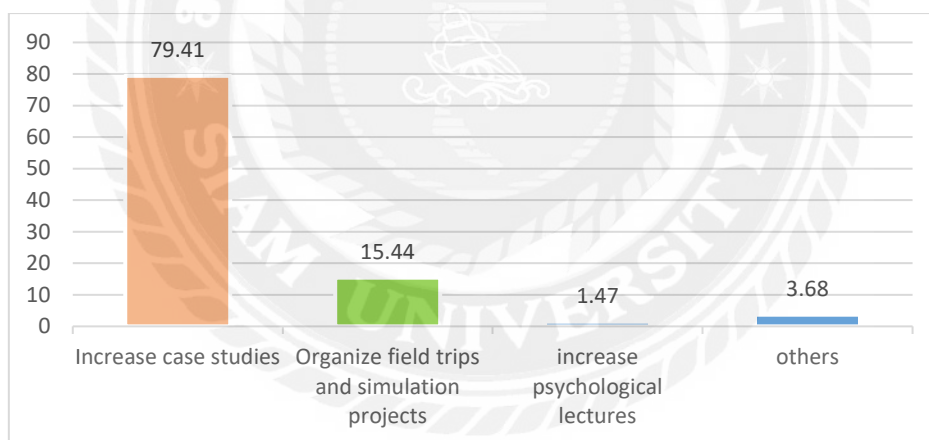


Figure 4.16 How to Improve the Personal Qualities of Construction Engineering Management Graduates

4.4 Correlation Analysis of Variables

Correlation analysis is a method of analysis that examines the relationship between different variables to measure how closely two variables are related. A distinctive feature of correlation analysis is that the variables are independent of each other, but it is only suitable for variables with binary normal distribution. Both variables are ending

variables, co-varying and interdependent. The correlation coefficient ranges from -1 to 1, with 1 representing a perfect positive correlation and -1 representing a perfect negative correlation, and the correlation coefficient is likewise subject to hypothesis testing. The correlation coefficient is usually used in the study to indicate r . When the correlation is less than $r \leq 0.3$, it means that there is no linear correlation between the two variables; when the correlation coefficient is $0.3 < r \leq 0.5$, it means that there is a low linear correlation between the variables; when $0.5 < r \leq 0.8$, it means that there is a significant correlation between the two variables; when $0.8 < r$, it means that there is a high degree of linear correlation between the two variables.

Table 4.2 Correlation Between Variables (Pearson Correlation Matrix)

| Variables | Professional Theoretical Knowledge | Professional Skills | Work Ability | Personal Qualities | Competency of Construction Engineering Management Graduates |
|---|------------------------------------|---------------------|--------------|--------------------|---|
| Professional Theoretical Knowledge | 1 | | | | |
| Professional Skills | .599** | 1 | | | |
| Work Ability | .615** | .658** | 1 | | |
| Personal Qualities | .606** | .628** | .644** | 1 | |
| Competency of Construction Engineering Management Graduates | .674** | .697** | .687** | 0.665** | 1 |

NOTE: *. Correlation is significant at the 0.05 level (2-tailed). **. Correlation is significant at the 0.01 level (2-tailed).

The data indicates a significant correlation among the five variables of professional theoretical knowledge, professional skills, work ability, personal qualities, and competency of construction engineering management graduates, with correlation coefficients significant at the 0.01 level. The results reveal correlation coefficients of 0.599, 0.615, and 0.606 between professional theoretical knowledge and professional skills, work ability, and personal qualities, respectively, indicating a moderate positive correlation. Notably, the correlation coefficient between professional theoretical knowledge and competency of construction engineering management graduates stands at 0.674, suggesting a strong positive relationship and a substantial influence of the former on the latter.

Furthermore, the correlation coefficients between professional skills and work

ability, personal qualities, and competency of construction engineering management graduates are 0.658, 0.628, and 0.697, respectively, indicating a moderate to strong influence of professional skills on work ability and personal qualities, with the strongest correlation observed with competency of construction engineering management graduates, the highest among all variables. The correlation coefficient between work ability and personal qualities is 0.644, demonstrating a strong correlation, while that between work ability and competency of construction engineering management graduates is 0.687, highlighting the crucial role of work ability in influencing competency of construction engineering management graduates. Lastly, the correlation coefficient between personal qualities and competency of construction engineering management graduates is 0.665, signifying a notable impact of personal qualities on competency of construction engineering management graduates.

In summary, the data underscores a significant positive correlation between competency of construction engineering management graduates and professional theoretical knowledge, professional skills, work ability, and personal qualities of construction engineering management graduates. Notably, the strongest correlation is observed between professional skills and competency of construction engineering management graduates, emphasizing the pivotal role of professional skills in enhancing competency of construction engineering management graduates. Work ability and professional theoretical knowledge follow closely, exerting notable influences on competency of construction engineering management graduates. Consequently, enhancing the competency of construction engineering management graduates necessitates a holistic approach that emphasizes professional skills training, theoretical knowledge acquisition, and personal qualities cultivation. These factors are interconnected and collectively contribute to graduates' competency of construction engineering management graduates, underscoring the importance of comprehensive quality improvement.

Therefore, according to the results of data analysis, professional theoretical knowledge has a positive influence on the competency of construction engineering management graduates. Hypothesis H1 is established. Professional skills have a positive influence on the competency of construction engineering management graduates. Hypothesis H2 is established. Work ability has a positive influence on the competency of construction engineering management graduates. Hypothesis H3 is established. Personal qualities have a positive influence on the competency of construction engineering management graduates. Hypothesis H4 is established.

Chapter 5 Conclusion and Recommendation

5.1 Conclusion

This chapter mainly summarizes the results of data analysis and puts forward reasonable suggestions. Professional theoretical knowledge, professional skills, working ability and personal qualities have a significant positive influence on the competency of construction management graduates. According to each influencing factor, the study puts forward some suggestions for the development of construction project management.

5.1.1 Factors Influencing Competency of Construction Engineering Management Graduates

The correlation coefficient between professional theoretical knowledge and the competency of construction engineering management graduates is 0.674, greater than 0.5, and less than 0.9, with a P-value of less than 0.01, indicating a positive relationship between professional theoretical knowledge and the competency of construction engineering management graduates. The correlation coefficient between professional skills and the competency of construction engineering management graduates is 0.697, greater than 0.5, and less than 0.9, with a P-value of less than 0.01, indicating a positive relationship between professional skills and the competency of construction engineering management graduates. The correlation coefficient between work ability and the competency of construction engineering management graduates is 0.687, greater than 0.5, and less than 0.9, with a P-value of less than 0.01, indicating a positive relationship between work ability and the competency of construction engineering management graduates. The correlation coefficient between personal qualities and the competency of construction engineering management graduates is 0.665, greater than 0.5, and less than 0.9, with a P-value of less than 0.01, indicating a positive relationship between personal qualities and the competency of construction engineering management graduates.

Therefore, the correlation analysis leads to the conclusion that there is a strong positive relationship between these factors and the competency of construction engineering management graduates, and the P value of less than 0.01 emphasizes the statistical significance of this relationship. Specifically, professional theoretical knowledge, professional skills, work ability, and personal qualities all positively influence the competency of construction engineering management graduates.

5.1.2 Professional Theoretical Knowledge, Professional Skills, Work Ability, Personal Qualities Have a Positive Influence on the Competency of Construction Engineering Management Graduates.

According to the correlation analysis, professional theoretical knowledge, professional skills, work ability, personal qualities and the competency of construction engineering management graduates have correlation. The research data concluded that professional theoretical knowledge ($\beta=0.674$, $P<0.01$), professional skills ($\beta=0.697$, $P<0.01$), work ability ($\beta=0.687$, $P<0.01$), and personal qualities ($\beta=0.665$, $P<0.01$) have significantly and positively influence on the competency of construction engineering management graduates. The variables together explain the competency of construction engineering management graduates weight of 91.102%, which is in line with the requirement. Professional theoretical knowledge has a positive influence on the competency of construction engineering management graduates. Professional skills have a positive influence on the competency of construction engineering management graduates. Work ability has a positive influence on the competency of construction engineering management graduates. Personal qualities have a positive influence on the competency of construction engineering management graduates.

5.2 Recommendation

5.2.1 Professional Theoretical Knowledge

(1) Reconstructing the talent training system and increasing the hours of specialized theoretical courses appropriately

Through the research and analysis of the demand for construction engineering management professional talents, we extracted the ability quality index, based on the quality index, mapped the talent training objectives, pushed back the courses that should be offered, constructed the "school quality education platform courses + school-enterprise co-construction" course professionalism course body, optimized the curriculum system. The curriculum includes compulsory courses and elective courses, of which the compulsory courses include ideological quality series courses, physical quality series courses, humanistic quality series courses, and the elective courses include cultural literacy, natural sciences, humanities and social sciences, arts and aesthetics and related courses. Following the laws of vocational education, the growth of skilled personnel and the physical and mental development of students, handling the relationship between basic public courses and specialized courses, theoretical teaching and practical teaching, academic certificates and various types of vocational training

certificates, integrating the content, standards and evaluation of skills competitions into the curriculum system, and appropriately increasing the number of hours of specialized theoretical courses.

(2) Updating the course teaching content in a timely manner

First of all, keep up with the development of the times, improve the course content in a timely manner, to ensure the effectiveness of the professional teaching improvement, so as to ensure that you can correctly select the new teaching content; Secondly, with the construction engineering related BIM technology, CAD software applications, site inspection management and other skills teaching is very critical, as far as possible to synthesize the various aspects of the teaching of advanced technology, so as to be able to promote the innovation of personnel training mode, relatively more We are confident that we can meet the demand of the society.

(3) Deepening pedagogical reforms

Adhere to the traditional advantages and promote the integration of books and certificates. Program development should adhere to the traditional advantages of the college "dual certificate", combined with the "academic certificate + a number of vocational skills certificate" (1 + X) system of the latest requirements, according to the vocational skills level standards and professional teaching standards, the certificate training content organically into the professional talent training program, optimize the curriculum and teaching content, coordinate the organization and implementation of teaching, deepen the reform of teaching methods and methods, improve the flexibility of talent training, and promote the integration of books and certificates. According to the requirements of vocational skill level standards and professional teaching standards, the certificate training content will be organically integrated into the professional talent cultivation program, the curriculum and teaching content will be optimized, the teaching organization and implementation will be coordinated, and the reform of teaching methods and approaches will be deepened, so as to improve the flexibility, adaptability and relevance of talent cultivation.

5.2.2 Professional Skills

(1) In-depth cooperation between schools and enterprises and joint preparation of talent training programs

Invite enterprise technical backbone to participate in the joint preparation of personnel training programs, change the current school as the main body of the development of professional personnel training program status quo, from the enterprise "recruitment" of the interests of enterprises to attract enterprises to join the development of personnel training programs in the school before the start of the development of personnel training programs should take the initiative to contact the construction enterprises, and regularly with the Enterprises to communicate, exchange, ask the views of the enterprise and the job content of the relevant positions, and enterprises to sign a cooperation agreement with the enterprise should clearly indicate that the enterprise needs to work with the school to develop professional personnel training program obligations, the implementation of building and construction enterprises to participate in the development of professional personnel training program.

(2) Innovative talent training models

The school-enterprise vocational skills program is divided into three phases, covering two years of students' schooling, as shown in Table 5.1.

Table 5.1 School-Enterprise Construction of Vocational Literacy Curriculum System

| First semester | First, second, third and fourth semesters | Fifth semester |
|--|--|--|
| Delivered at the stage of new student enrollment, the program is designed to enable students to experience Lenovo's corporate culture, implant a correct view of growth in new students, eliminate negative emotions, stimulate interest in learning, and improve learning initiative. | The content is embedded in daily teaching activities and student work through lectures, forums, online classes, video viewing, virtual classrooms, and scenario simulations. | Specific career guidance is given to graduates to assist them in their first steps into the job market, such as career/job analysis, interviewing skills, and preparation. |

5.2.3 Work Ability

(1) Emphasizing the role of skills competitions

Encourage students to participate in all kinds of skill competitions at all levels and obtain vocational skill level certificates or vocational qualification certificates. Students who participate in national first-class, provincial first-class competitions or the World Skills Competition and win prizes during their school years can exchange credits for specialized courses in accordance with the provisions of "Management

Measures for Vocational Skills Competitions" (Vocational College [2022] No. 20). If you have obtained all kinds of grade certificates or qualification certificates, you can replace the corresponding credits according to the credit replacement schedule of the certificates.

(2) Strengthening technical services.

Provide construction cost, supervision, surveying and mapping services for the community to give full play to the advantages of the profession, through the combination of industry and education to expand the space for running the school, and apply for the establishment of "technical services" based on the "supervision, cost consulting" company, which can provide students with a long-term, stable and reliable It can provide students with long-term, stable and reliable internship and training bases and enhance their work ability.

(3) Improving the overall capacity of teacher teams

Teachers are the forerunner and practitioner of education and teaching, and the cultivation of talents in higher vocational colleges and universities also needs teachers to be guides, so it is very crucial to improve the comprehensive strength of the teacher team for the construction engineering management professional talents cultivation mode of higher vocational colleges and universities. On the one hand, when recruiting professional teachers, higher vocational colleges and universities should not lower the requirements of talent introduction in order to meet the teaching needs, and ensure the high level of education from the very beginning to ensure the reliability of professional course teaching. On the other hand, the institutions of in-service teachers can be appropriate to carry out the ability to improve training, provide more opportunities for teachers to participate in relevant forums, lectures, research, etc., so that teachers can continue to improve their own educational concepts, thereby promoting effective innovation and improve the talent training model to ensure that the quality of training and increase efficiency. In addition, higher vocational colleges and universities to carry out ideological and political education for teachers is also very important, which can promote the teachers to establish a correct education and teaching concepts, and maintain a positive attitude towards education and teaching, help to avoid teachers to produce education slack.

5.2.4 Personal Qualities

The personal qualities of graduates are enhanced mainly in terms of improving their sense of responsibility, hard-working and stress-resistant abilities. Students' ability to shoulder personal and social responsibilities is enhanced, their spirit of hard work and endurance in the face of challenges and difficulties is strengthened, and their ability to resist pressure is enhanced so that they can maintain a stable state of mind and work efficiently under stressful circumstances.

(1) Education for a sense of responsibility: Through case studies and role-playing, students understand the importance of a sense of responsibility and learn how to assume and fulfill responsibility in practical work, so that they can clarify the importance of personal and social responsibility and take the initiative to assume responsibility in their studies and lives.

(2) Hard-work and endurance training: field trips, simulated engineering projects and other activities are organized to enable students to experience and exercise their hard-working and endurance abilities in practice. Students' ability to endure hardship and stress is significantly improved, so that they can better adapt to the challenges of future work and life.

(3) Development of stress resistance: Students are taught strategies for recognizing and coping with stress through psychology lectures and stress management workshops.

References

- Akgerman, A., & Sonmez, B. (2020). The relationship between trust in first-line nurse managers and organizational commitment. *International Nursing Review*, 67(2), 167-169.
- Berit, M.S., Trude, A.H., & Terese, B. (2020). “Navigation to prioritizing the patient” – first-line nurse managers’ experiences of participating in a quality improvement collaborative. *BMC Health Services Research*, 20(1), 39-40.
- Bai, G.Q. (2015). Analysis of the current situation of young doctors' job competence in Henan Province - based on the practice of Xinxiang Medical College. *China Health Career Management*, (12), 904-906.
- Chang, Y.C., Yeh, T.F., Lai, I., & Yang, C.C. (2021). Job competency and intention to stay among nursing assistants: The mediating effects of intrinsic and extrinsic job satisfaction. *International Journal of Environmental Research and Public Health*, 18(12), 69-70.
- Cao, W. J. (2017). Research on education and training management based on job competency model. *Science and Technology Innovation Herald*, (29), 177+179.
- Chen, J. W. & Gu, L. Y. (2016). Competency research and training course design for basic managers in elderly care organizations. *Social Welfare (Theoretical Edition)*, (10), 23-27.
- Chen, Z.B., Liu, J., & Cui, Y.P. (2018). The construction of three-dimensional structural model of job competency. *Guangdong Vocational and Technical Education and Research*, (01), 201-203.
- Cui, L.L. (2020). Construction and application of competency-based training system for basic production managers. *Modern Enterprise*, (02), 25-26.
- Deng, H.Y., & Ge, X.Q. (2016). Research on competency measurement model of basic supervisors in high-tech enterprises. *Beijing Social Science*, (03), 77-83.
- Fredrik, M., Therese, H., & Magnus, S. (2020). First-line managers experiences of working with a structured support model for systematic work environment management. *International Journal of Environmental Research and Public Health*, 17(11), 17-18.
- Feng, X.D. (2005). Deepening teaching reform and building a research-based undergraduate teaching system. *China Higher Education*, (Z1), 36-38.
- Feng, M., & Pi, W. H. (2013). An empirical study of multilevel dynamic competence of corporate managers - An analytical model based on DEMATEL. *East China Economic Management*, (06), 129-137.
- Gao, Q. (2014). Basic qualities and abilities that grassroots managers should have. *Enterprise reform and Management*, (11), 19.

- Guo, Z.X. (2021). Counselors in higher vocational colleges should pay attention to students' mental health education. *Health Career Education*, (08), 26-27.
- Huang, C.Y. & Zhu, Y.H. (2009). Construction of engineering management professional curriculum system and concentration of professional characteristics. *Journal of Chongqing Institute of Science and Technology (Social Science Edition)*, (05), 205-206
- He, Q.Z., & Dai, C.G. (2017). Investigation and reflection on the competence of Master's degree supervisors' positions in higher education. *Research on Higher Education*, (08), 51-59.
- He, Z.C. (2015). Deconstruction of comprehensive vocational competence of grassroots managers and its implication for talent cultivation: A survey and analysis based on grassroots management position holders in Pearl River Delta enterprises. *Journal of Mudanjiang University*, (05), 27-33.
- Hua, X.H., Ren, D., Li, Y., & Bi, S.L. (2017). Exploring the competency modeling of middle managers in higher vocational colleges and universities--An empirical study on the selection and management of middle cadres in a higher vocational college and university as an example. *Journal of Chengdu Aviation Vocational and Technical College*, (04), 72-74.
- Harmoinen, M., &Suominen, T. (2020). Realizing appreciative management from the viewpoint of first-line managers in social and health care. *Scandinavian Journal of Caring Sciences*, 34(1), 44-46.
- Li, R. (2016). Competency modeling of junior managers in manufacturing companies -- A study based on behavioral event interviews. *Journal of Suzhou Institute of Science and Technology (Social Science Edition)*, (02), 79-83.
- Li, W. H., Peng, L. M., & Zhang, D. H. (2019). Research on job competency of construction team leaders in engineering projects. *Journal of Railway Science and Engineering*, (10), 2636-2642.
- Li, Y. M., Meng, X. L., Liu, R. X., & Wei, X. H. (2019). Research on the construction of competency model for equity fund managers' investment ability of equity fund managers. *Management Review*, (10), 200-211.
- Liu, J., Zhao, B., Li, Y.L., Wang, H.X., Tian, S.N., & Zhang, X.X. (2016). Current status of research on competency modeling for nurse leader positions. *Chinese Journal of Nursing*, (05), 609-613.
- Liu, X.Y., Zhao, X. Y., Xue, E.C., Nie, L., Meng, L. L., & Pang, X.H. (2021) Construction of professional competency model of center for disease prevention and control. *Zhonghua yu fang yi xue za zhi [Chinese journal of preventive medicine]*, 55(7), 72-75.
- Mo, Z.Y., Chen, X. Z., &Hua, J.J. (2012). Research on the current situation and basic framework of China's higher education reform--Based on the perspective of

- comprehensively improving the quality of higher education. *Research on Higher Education of Southwest University of Science and Technology*, 22-26.
- Monica, S.P., Anne, L., Merete, M., & Lars, L. (2019). First-line managers' experience of the use of audit and feedback cycle in specialist mental health care: A qualitative case study. *Archives of Psychiatric Nursing*, 33(6),41-43.
- Ning, X. & Liu, W.H. (2011). Comparison and insights of the curriculum of engineering management programs in mainland and Hong Kong universities. *Journal of Shenyang University of Architecture (Social Science Edition)*, (04), 495-499.
- Nie, L.Q. (2020). *Research on professional construction and management of higher vocational colleges in Shenzhen*. Tianjin University, Tianjin University, Tianjin.
- Qin, K. (2011). Competency modeling of grassroots managers. *Journal of Wuxi Institute of Vocational Technology*, (06), 69-72.
- Sun, F. (2019). *Research on the construction of curriculum system of higher vocational education*. Northwest Agriculture and Forestry University, Xianyang.
- Stromberg, A., Engstrom, M., Hagerman, H., & Skytt, B. (2019). First-line managers dealing with different management approaches. *Leadership in health services (Bradford, England)*, 32(4), 38-41.
- Tan, X. D. (2010). *Development and construction of curriculum system of higher vocational architectural engineering*. Shandong University, Jinan.
- Wang, Q. (2021). Discussion on the authorized certification of skilled personnel's job competency. *China Electric Power Education*, (07), 34-35.
- Wang, J. P., & Chen, W. M (2020). Southern power grid UHV transmission company: Innovative implementation of training evaluation based on job competency. *China Power Education*, (02), 14-15.
- Xin, B.Y. (2013). Innovative thoughts on writing teaching materials for the course of fundamentals of management in higher vocational colleges and universities - - Based on the Perspective of Cultivating Competent Qualities of Grassroots Managers. *Labor Union Forum (Journal of Shandong Province Labor Union Management Cadre College)*, (02), 138-140.
- Yang, L.L. (2017). Study on competency trait modeling of junior managers in logistics enterprises. *Logistics Engineering and Management*, 39(05),52-53.
- Ye, P. (2022). Reform of higher vocational "Fundamentals of Management" course based on the competency training of grassroots managers. *Journal of Anhui Institute of Vocational Technology*, (01), 61-63.
- Zuo, R. (2022). A study on the training needs of junior managers in state-owned enterprises based on competency modeling. *China Small and Medium Enterprises*, (11), 149-150.

Appendix

Appendix 1 Questionnaire on Competency Enhancement Strategies for Grassroots Management Positions in Construction Engineering

The initial position of construction engineering management graduates is usually the grassroots management post, the purpose of this questionnaire survey is to investigate whether the ability of the graduates to adapt to the position, in order to facilitate the mastery of the graduates of the post competence. The results of the survey are only for academic research, the questionnaire is anonymous, please answer objectively according to your own true thoughts, thank you for your support and cooperation! The multiple-choice questions are all single-choice questions.

Part I.

1. Age [fill in the blank]

2. Gender [fill in the blank]

3. Years of practice [fill in the blank]

Part II.

1. How satisfied are you with the level of professional theoretical knowledge of construction engineering management graduates (which means that they have the basic theoretical knowledge of the profession required for study and the knowledge of the professional skills required for work)?

- Very satisfied
- Satisfied
- General
- Dissatisfied
- Very dissatisfied

2. To what extent are you satisfied with the rigor (ability to work calmly and rationally, pay attention to key details, think thoroughly, act rigorously, and pursue precision) of graduates of the construction engineering management program?

- Very satisfied
- Satisfied
- General
- Dissatisfied
- Very dissatisfied

3. How to improve the professional theoretical knowledge of construction engineering management graduates? The

- Increase the number of hours of specialized theory courses
- Innovation of course content

- Deepening pedagogical reform
- No other

4. How satisfied are you with the level of professional skills of graduates of the construction project management program (meaning that they have mastered the skills of their profession and are able to use the professional skills they have learned to complete specific tasks quickly)?

- Very satisfied
- Satisfied
- General
- Dissatisfied
- Very dissatisfied

5. To what extent are you satisfied with the communication skills (defined as a person's ability to communicate information effectively with others) of graduates of the Construction Engineering Management program?

- Very satisfied
- Satisfied
- General
- Dissatisfied
- Very dissatisfied

6. To what extent are you satisfied with the coordination skills (the ability to mobilize, organize and fully motivate people) of construction engineering management graduates?

- Very satisfied
- Satisfied
- General
- Dissatisfied
- Very dissatisfied

7. your degree of satisfaction with the construction engineering management graduates of the service consciousness (refers to the customer to provide warm, attentive, proactive service consciousness, that is, consciously take the initiative to do a good job of service work a concept)?

- Very satisfied
- Satisfied
- General
- Dissatisfied
- Very dissatisfied

8. How to improve the level of professional skills of construction project management graduates (professional skills, communication skills, coordination skills, service awareness)? The

- In-depth cooperation between schools and enterprises, joint preparation of talent training programs
- Innovation of talent training model
- Deeper penetration into enterprises and more skill training
- No other

9. To what extent are you satisfied with the problem-solving ability of graduates of the construction engineering management program (ability to apply scientific methods, to complete the work assigned by the leadership quickly, and to have good problem-solving ability)?

- Very satisfied
- Satisfied
- General
- Dissatisfied
- Very dissatisfied

10. To what extent are you satisfied with the analytical ability (the ability to think positively and then quickly analyze problems) of graduates of the construction engineering management program?

- Very satisfied
- Satisfied
- General
- Dissatisfied
- Very dissatisfied

11. To what extent are you satisfied with the adaptability (the ability to change quickly and adapt to changes in the outside world) of graduates of the construction engineering management program?

- Very satisfied
- Satisfied
- General
- Dissatisfied
- Very dissatisfied

12. How to improve the work ability (problem-solving ability, analytical ability, adaptability) of construction engineering management graduates? The following are some examples

- Emphasize the role of skills competitions
- Strengthening of technical services
- Improve the comprehensive capacity of the teacher team
- No other

13. To what extent are you satisfied with the sense of responsibility (a spirit of consciously taking the initiative to do all useful things within and outside of the program) of the graduates of the construction engineering management program?

- Very satisfied
- Satisfied
- General
- Dissatisfied
- Very dissatisfied

14. To what extent are you satisfied with the degree of hard work (ability to withstand hard and tiring work) of graduates of the construction project management program?

- Very satisfied

- Satisfied
- General
- Dissatisfied
- Very dissatisfied

15. To what extent are you satisfied with the ability of graduates of the construction engineering management program to cope with stress (the ability to cope with high-intensity work, to make positive self-adjustments, and to accept and relieve stress effectively)?

- Very satisfied
- Satisfied
- General
- Dissatisfied
- Very dissatisfied

16. Based on your experience, how can you improve the personal qualities (sense of responsibility, hard work, stress tolerance) of graduates in construction project management?

- Increase case studies
- Organize field trips and simulated engineering projects
- Increase the number of psychological lectures, etc
- No other

17. I can effectively organize, plan and monitor the progress, cost and quality of construction projects.

- Strongly disagree
- Disagree
- Normal
- Agree
- Agree very much

18. I can proficiently apply technical specifications and standards related to construction projects to solve technical problems in construction.

- Strongly disagree
- Disagree
- Normal
- Agree
- Agree very much

19. I can keep up with the latest development in the field of architectural engineering, and constantly learn new knowledge and new technologies to improve my professional ability.

- Strongly disagree
- Disagree
- Normal
- Agree
- Agree very much

20. I can actively participate in team work, support and cooperate with team members to complete project objectives.

- Strongly disagree
- Disagree
- Normal
- Agree
- Agree very much

