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Research on quality management of engineering projects of H Group Co., Ltd

SUN BAO MING

Master in Business Administration

Supervisor :
PhD, Renato Jorge Lopes da Costa, Assistant Professor with Habilitation
Iscte - IUL

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BUSINESS
SCHOOL

Department of Marketing, Strategy and Operations

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Time passes like running water. In the blink of an eye, the completion of my thesis signalled that I was about to finish my studies. A lot of things have happened in these two years of Executive Master in Business Management, especially the arrival of the new crown epidemic has caused changes in life, but life goes on as usual, and my studies have been successfully completed with the help of many people. I would like to give special thanks to those who have given me warmth in my life.

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negative, and then come back is still that is a teenager.

ABSTRACTS

The present dissertation aims on analyzing quality issues in an industrial company. The selected on is Group H Co., Ltd. a state-owned enterprise with strong strength and outstanding project management level. Project H is the key project of the company, which concentrates on the project quality management level of the company.

This thesis comprehensively adopts case study method to describe the quality management objectives, system establishment and operation of the H project, to describe the current status of quality management, to clarify the state of its management, to discover the problems, and to clarify the direction of the analysis of the problems; to extract and analyse the typical problems of the quality management and to determine the ways to deal with the problems and to improve them; and to address the problems from the following four aspects: planning, execution, inspection and disposal.

After in-depth analysis and implementation of a series of management improvement measures, the project quality management performance is greatly improved, which also ensures the intrinsic safety of the project.

Keywords: engineering projects; project management; quality management

RESUMO

A presente dissertação tem como objetivo analisar as questões de qualidade numa empresa industrial. A empresa selecionada é o Grupo H Co., Ltd., uma empresa pública com uma forte força e um excelente nível de gestão de projectos. O Projeto H é o projeto-chave da empresa, que se concentra no nível de gestão da qualidade do projeto da empresa.

Esta tese adopta de forma abrangente o método de estudo de caso para descrever os objectivos de gestão da qualidade, o estabelecimento do sistema e o funcionamento do projeto H, para descrever o estado atual da gestão da qualidade, para clarificar o estado da sua gestão, para descobrir os problemas e para clarificar a direção da análise dos problemas; para extrair e analisar os problemas típicos da gestão da qualidade e para determinar as formas de lidar com os problemas e de os melhorar; e para abordar os problemas nos quatro aspectos seguintes: planeamento, execução, inspeção e eliminação.

Após uma análise aprofundada e a aplicação de uma série de medidas de melhoria da gestão, o desempenho da gestão da qualidade do projeto é consideravelmente melhorado, o que também garante a segurança intrínseca do projeto.

Palavras-chave: projectos de engenharia; gestão de projectos; gestão da qualidade.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Chapter I. Introduction

1.1 Background to the study

H Group Co., Ltd. is a globally operating chemical materials company, dedicated to the research and development, production and sales business of MDI, petrochemicals, speciality chemicals and other new chemical materials. There are three major production bases in Yantai, Ningbo and Zhuhai in China, and Meishan Industrial Park in Sichuan Province and Fuqing Industrial Park in Fujian Province are in the preliminary planning and designing stage. 2011 hosted the Hungarian BC Company, which owns its own overseas production bases, and 400,000 tonnes/year MDI project in the United States is in the process of selecting the site.

H Park is the company's current chemical park with the highest level of automation, the largest scale and the most competitive, the park covers an area of 12 square kilometres, with a planned total investment of 110 billion, divided into one, two and three phases of the project, collectively referred to as the H Project of H Group Co. The construction period is more than 15 years, and such projects are rare at home and abroad. H Group Co., Ltd. adopts E+P+C as the dominant project management mode, relying on its own project management team as the main body, and introduces part of the third-party management company to assist in the management of the mode, and the quality management of the project has been in the process of continuous optimisation and enhancement since the commencement of the construction in 2011, but there were some quality problems and accidents in the course of the project construction. There are some quality problems and accidents, such as: motor stator burning; pumps, fans, compressors and other moving equipment such as overcurrent, bearing lubrication failure, sealing into the water, blade grinding pump shell, broken shafts, etc.; valves leakage of seals, action faults, damage and other problems; static equipment such as furnace tube cracking, heat exchanger, reactor tube plate leakage, pressure vessel flange deformation, misaligned ports, etc.; some of these problems are potentially very serious. The consequences of some problems are also very serious.

The company has done a lot of work on the improvement of engineering quality management, but the current solution to the problem remains at the level of the matter, without in-depth analysis, from the system, procedures, systems to study and analyse and solve the problem, fundamentally, should be the implementation of the process of quality control of the entity quality control, the quality control process of the feedback process to improve, as well as the reasonable optimization of the process of the organisational structure, to build the quality management framework of the H project, in order to create a platform for the sustainable improvement of engineering quality management. Create a platform for sustainable improvement of project quality management. From the position of project manager to the current responsible for the construction quality management of the whole park, I can combine the practical experience of project management with the systematic quality management theory, and continuously optimise the quality management during the continuous construction process of the project, summarise the management lessons learned from the project, which can provide valuable references for the company's petrochemical engineering project quality management.

1.2 Significance of the study

Petrochemical industry is an investment, technology-intensive industry, the project is complex, the investment can easily be tens of billions of dollars, are generally local, national key projects, the success or failure of the project depends on a major; time, quality, cost (time,quality,cost,TQC) is the three major objectives of project management (Hou Xueliang, Hou Ruyi, 2017) quality problems during the construction period of the project will result in reworking, which will prolong the construction cycle and increase project investment; engineering quality is related to the essential safety of the project device operation, quality problems will bury hidden dangers in the project, after commissioning will be frequent maintenance, or even unplanned stopping for maintenance, which will directly affect the quality of the device products and the ability to supply them stably. So do a good job of petrochemical engineering project quality management, can reduce the cost of the whole life cycle, to ensure that the project

commissioned on schedule, and put into use after the "safe, stable, long, full, excellent" operation, to achieve the project's expected goals. Project quality management covers all phases of the project, which is related to the success or failure of the project. Research and good project quality management has the following advantages:

Firstly, the project quality management optimisation study can improve the quality management level and ensure the intrinsic safety of the plant. Since the start of the H Group Limited H project, H Group Limited company set up a project management team, the preparation and introduction of the project management system, H Group Limited chemical project management team's morale is high, the management of the refined, but due to the size of the project is too large, the management of resources is limited, the project management also appeared in a lot of problems, only through the optimization of project quality management research to eliminate the quality of the project construction process Only through the optimisation study of project quality management to eliminate the hidden dangers of the project construction process and continuous improvement can we ensure the intrinsic safety of the plant.

Secondly, it helps to continuously improve the construction of quality management system for petrochemical engineering projects and replicate the management effect. Petrochemical engineering project construction process there are many excellent practices, there are also many quality problems, accidents, project quality and specific project management team's ability is directly related to the project manager, project team management ability, management efforts, resource integration in place on a better performance; and vice versa. Human quality is difficult to copy, but the management model can be inherited. How to make the level of project management does not fluctuate due to changes in people? Through in-depth study of management systems, theories, with systematic tools, methods to solidify the excellent practice of quality management, the formation of management modeling tools, in order to replicate the management effect, to promote the petrochemical engineering and construction industry quality management enhancement, progress.

Thirdly, it helps to improve enterprise management ability. Project management is a branch of management, quality management is the key organisational part of project

management, in-depth project quality management optimisation theory research and practical application, can promote the optimisation of the entire project management, and at the same time can promote the optimisation of the company's quality management system to improve the overall level of corporate management, management capabilities.

Fourthly, it helps to enhance the scientific, practical and intelligent project quality management system in the information age. Engineering project construction of all relevant departments, participating units in the quality management of the existence of information islands, management scope of the blurred, headache, headache, foot problems; through the use of systematic tools, innovative theories, advanced management methods, and constantly develop and optimize the quality of the analysis and control software, and then enhance the quality management system of the scientific, real-world, intelligent level, and ultimately promote the petrochemical engineering and construction industry from excellent to excellence.

1.3 Review of relevant studies

Quality management system is the core of quality management, is the organisational structure, responsibility, authority, procedures and other management capabilities and resource capacity of the complex. Any organisation exists in the role of quality management organisational structure, procedures, processes and resources, that is, there must be a quality management system objectively. Organisations have to do is to make it perfect, scientific and effective. 1990s, China's equivalent to the transformation of the ISO9000 series of standards, released and implemented one after another GB/T19000 series of standards, popularised and applied throughout the country, to promote the level of quality management of the construction site. Yao Yuling et al. believe that ISO9000 creates the most basic quality management structure and external identity effect, while lean management improves internal and external quality performance. The integration of ISO9000 with lean management can form a better quality management model (He Jianzhen, 2011). Later, China began to implement "zero defect" quality management, which advocates that enterprises should play the

subjective initiative of people in business management, and that producers and operators should make joint efforts to eliminate defects in products and work; the core of "zero defect" management is to do the right thing at a time. The core of "Zero Defects" management is to do the right thing at one time, which contains three meanings: the right thing, the right thing to do, and doing the right thing for the first time. Quality is the responsibility of every employee, and everyone should do their best to seek ways to improve quality and eliminate the occurrence of "defects" (Zhang Qingsheng, 2010).

The traditional management mode has been difficult to adapt to the requirements of modern project management due to the drawbacks of low specialisation, slow accumulation of experience, and difficulty in borrowing (Yan Kai, 2018). The introduction of the third party of project management in quality management can reduce the personnel of the construction unit with the help of its specialisation, standardisation, as well as rich experience and efficient working style (Ge Zhihao, 2010). In the process of material acceptance and management, supervision engineers work strictly according to the supervision planning and rules, so that the supervision of material quality is gradually formalised (Xu Ling, Wang Hongbo, 2005). In the process of quality formation of engineering projects, the quality management of the whole engineering products needs the joint cooperation of all participating quality subjects, and the work is interlocked in order to achieve the quality management objectives of the project in a complete way (Liu Litu, 2005).

Quality co-ordination between the units can not be achieved by administrative or compulsory means, but can only be limited by economic means, quality standards and relevant contract terms. From their own interests, the construction unit under reasonable conditions to pursue the optimal quality of the project, the contractor in a certain reasonable quality under the pursuit of the lowest cost. The contractor is the directly responsible party for the quality of the project, and in terms of quality management methods and means, the construction unit is limited to contract management and incentives, and the contractor's management means include contract management and incentives, and administrative management can also be used (Zhao Zikui, 2006). In terms of the responsibility for the quality of the project, the construction unit, as an

investor and a user of the project, is responsible for the overall quality of the project, and the contractor is only responsible for the contractual agreement, regulations require, while the contractor is only responsible for the part of the project that is required by the contract. Although the lifetime system of quality responsibility has been implemented, it is often difficult for the contractor to fulfil the whole quality responsibility of the project and only take responsibility for part of it (Zhang Huaqiang, 2005).

Most of the petrochemical plants operate under high temperature and high pressure conditions, and their operating media are also mostly flammable, explosive, toxic or corrosive. The special nature of the production process, determines the quality of the project must be high standards, strict requirements, that is, the quality of the project must meet the design and the corresponding standards, otherwise it is very easy to occur malicious accidents (Yang Hongbing, 2002). Even if there are no accidents, once the device is put on trial, and then to stop for maintenance, the cost is unacceptably high. Therefore, the quality of the project should meet the high standard of a successful start-up, and after the start-up can be a long-term stable operation. Engaged in the construction of petrochemical engineering projects, the quality of the main responsibility (design, supervision, construction, manufacturing units, etc.) are basically the implementation of ISO9001 quality system. In terms of the various aspects of project quality management, the basis of management is still relatively standardised. However, at this stage of the project quality management research is still stuck in the independent individual, non-systematic research, but also can not be the various stages of engineering quality management of the relevant parties at the same time, systematically into the scope of the study, due to the petrochemical engineering project is a complete system, engineering design, procurement, construction, acceptance is an organic whole, which requires the whole process from the design to acceptance of the systematic, standardised and holistic This requires systematic, standardised and holistic management of the whole process from design to acceptance, which puts forward high requirements on how construction units can carry out quality management of large-scale petrochemical engineering projects (Ge Zhihao, 2010).

The key to ensuring the quality of engineering projects lies in the implementation

of the project implementation process of each link, each part of the implementation of the unit and personnel of its quality responsibility and the establishment of quality organisations, there is no better organisation, then the quality intention can not be reflected in the implementation of the process of each link, part of the embodiment or implementation, the project quality objectives will be difficult to implement. At this stage for each project to form a project management body, implementation management, the need to establish a management system to meet the requirements of the project organisation and implementation management, and network connection called network inter-adaptability balance model (Hou Xueliang, 2017).

How to continuously optimise project quality management? It requires continuous data analysis and information feedback in the management process. In the statistical analysis of data before the identification of project quality management impact factors, identification methods have a lot of methods, the use of each method of the scope of each different, each with its own characteristics, so according to the actual situation of the project to choose the appropriate quality management impact factors identification methods, or a combination of several approaches to use, so that the identification of the project quality management impact factors will be more accurate (permitted by Mao, 2019). Statistics is a science that involves "collecting, organising, analysing, interpreting and presenting data". Statistics provides an important basis for implementing continuous quality improvement. Statistical methods help managers to keep track of trends in quality management and physical quality (James Evans et al., 2016). In order to make quality management and decision-making more scientific, H Group Limited has implemented the project safety and quality monitoring platform (SQP), the project file electronic delivery system, which is still under continuous improvement, and there are still a lot of problems to be solved, but it has set an example for the quality management of large-scale petrochemical projects in China, and the idea of quality management of the H project is currently at the leading level in the industry, and the adopted performance excellence management model (Tang Fen, 2007), has the significance of promotion.

1.4 Content and framework of the study

1.4.1 Content of the study

The main elements of the study include the following:

The first part is a detailed introduction to the domestic and international literature, and sorted out the relevant theoretical knowledge. The research objectives are defined, the research content is framed, the research method is guided out and the technical route of the research is clarified according to the theory.

The second part is an overview of theories related to project quality management, which discusses the theory of quality management from the definition of quality management and the composition of quality management system; and the theory of project quality management from the definition of engineering project quality management, management process, PDCA quality improvement cycle, and the method of analysing the status of engineering project quality management.

The third part is an introduction to the research methodology, which is a combination of literature research, case study, interviews, questionnaires, checklists and histograms.

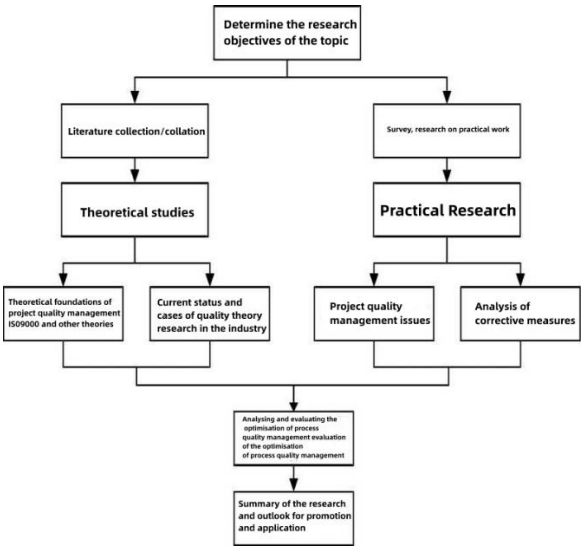
Its fourth part is the empirical research part. Firstly, it is an introduction to the H project of H Group Limited, the overview of the project under construction, the project management objectives, the project quality management organisation, the division of responsibilities for project quality management, and describes the current situation of the quality management of the H project of H Group Limited from the four stages of design, procurement, construction and acceptance. Secondly, it describes in detail the problems of quality management of Project H of H Group Limited and the reasons for the problems from the four stages of design, procurement, construction and acceptance. Thirdly, it describes the optimisation idea of quality management as a whole, and then discusses the specific quality management optimisation measures from the four stages of design, procurement, construction and acceptance. Finally, it describes the safeguard measures and ways to optimise the implementation of the quality management of Project H of H Group Limited from the aspects of organisational safeguard, system

safeguard, technical safeguard, and team capability safeguard.

The fifth part is the conclusion and revelation, from the results of the study on optimisation of quality management in engineering projects, the revelation on management, to how the management effect or the expected goal has been achieved; and also describes the shortcomings of the study and the outlook for the future.

1.4.2 Research framework

This thesis takes the optimisation of quality management of H project of H Group Limited as the research object, through the summary and analysis of the completed project and the investigation and research of the project under construction, the problems existed in the project quality management are deeply analysed, and the problems and the system, organisational structure, and the application of the selection of tools and methodologies are analysed in mutual feedforward, and the theory of PDCA Quality Improvement Cycle is propped up in the organisational mode of the mutually adaptable engineering project, and the The application of analysis tools, based on mathematical and statistical analysis of the basis of continuous improvement, in order to achieve excellent performance of project quality management. The technical route of this thesis is shown in Figure 1-1:



1 Figure 1-1 Research technology line of this thesis

Chapter II. Relevant Concepts and Theoretical Foundations

2.1 quality management theory

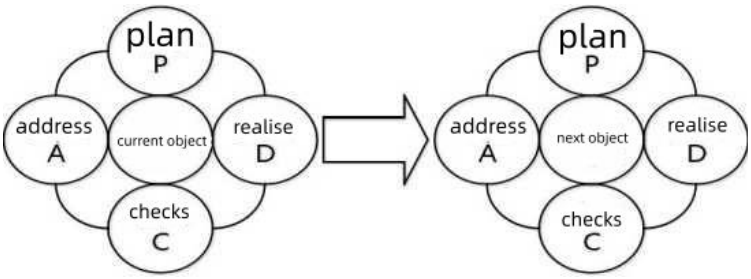
Quality is a generic term with a universal meaning, which has taken on a wide range of meanings due to its extremely broad scope of application. Quality is the adaptability of a product, i.e. the extent to which it meets the needs of the user at the time of use, and is the sum of the abilities and characteristics of an entity that reflect its ability to meet explicit or implicit needs. It can also refer to the quality of work and service of an activity or process.

2.1.1 Definition of quality management

Quality management refers to all the activities that determine the quality policy, objectives and responsibilities and make them realised through quality planning, control, assurance and improvement in the quality system (Su Junsong, 2018). Juran defines quality management as the management of applicability and marketability. Definition of quality management by Feigenbaum: "To be able to carry out research, design, manufacturing and after-sales service at the most economical level of management, with due regard to the conditions of meeting customer requirements, the activities of developing quality, maintaining quality and improving quality within the enterprise constitute an effective system" (Huang Shuping, 2019). Definition of international and national standards: 'coordinated activities organised to direct and control quality management'.

2.1.2 Quality management PDCA cycle

The concept of PDCA cycle was first proposed by Dr Deming, so it is called Deming's loop. The application process confirms that the PDCA cycle (Huang Zhongqiu, 2018) is an effective work procedure that can ensure the smooth progress of quality management activities, and it has been widely used in quality management, the PDCA cycle is shown in Figure 2-1:



2 Figure 2-1 Quality Management PDCA Cycle Chart

Note: The meanings represented by P, D, C and A are as follows:

P (Plan) - Plan;

D(Do)-Execution;

C(Check)-Check;

A(Action)-Processing;

Deming amended Hughart's PDCA cycle (Huang Sheng, 2018) to Plan-Do-Study-Act,which describes this management process more realistically:

(1) Week after week: the four processes of the PDCA cycle is constantly cycling, a cycle to solve part of the problem, the remaining unresolved issues, or emerging issues, and then enter the next PDCA cycle, week after week.

(2) Large ring with small ring: similar to the planetary wheel, is an organisation's overall operating system and the relationship between its various sub-systems, is the large ring to drive the small ring continuous operation of the organic logic of the combination.

(3) Step up: PDCA cycle is not just a cycle of improvement at one level, the process of continuous problem solving is the process of gradual improvement of the management level.

(4) Tools of statistics: The PDCA cycle applies the concepts and methods of scientific statistics. It becomes an efficient tool for advancing work, identifying problems and solving problems, and the typical model is known as four stages, eight steps and eight analyses (Li Jing, 2008).

2.2 Engineering project quality management theory

In the construction process of engineering projects, quality is one of the three major objectives of engineering project management(Hou Xueliang and Hou Ruyi,

2017),In order to achieve the quality objectives of engineering projects, it is necessary to implement effective control of engineering project quality. The quality of engineering projects is complex, dynamic and systematic, and requires systematic management.

2.2.1 Definition of project quality management

Project Quality Management (PQM) is the overall management of the quality of project outputs and the quality of project work to ensure that the project outputs meet the predefined objectives. It involves the process of implementing the organisation's defined quality policies, objectives and responsibilities, as well as the adoption of appropriate systems and procedures, and the adoption of a continuous process to achieve the effective management of the quality of the project.

2.2.2 Processes for quality management of engineering projects

There are two main ways to manage the quality of engineering projects: the first is the immediate management of the quality of engineering projects, and the second is the reprocessing of quality problems after they have formed. The process of immediate management is as follows:

(1) Define the object of management and specify all the categories, attributes and contents of the object of management.

(2) Clarify the standard, the management object in the process or after the completion of the process should meet what conditions, to achieve what requirements specific; if the conditions allow, as far as possible to quantify these requirements, clear quality standards.

(3) The development of quality plans, and to meet: whether the plans and programmes are relevant, when the plans and measures are implemented and completed, by whom the plans are implemented, by what methods, in which process, which link, which process is implemented.

(4) Problem prediction, analysing in advance possible problems and causes of problems, dividing problems into levels according to their importance, and determining priorities for control.

(5) Formulation of countermeasures. After accurately anticipating problems, appropriate countermeasures and measures are formulated and put in place.

(6) Implementing the plan and carrying out quality control work in accordance with the plan.

(7) Tracking observation and inspection, in the implementation process, the process management of specific objects (Liu Huanxin, 2008), the collection of quality data, through the data analysis method to timely grasp the status of the quality of the project.

(8) quality is normal and controllable, then move on to the next job, not controllable, then take appropriate measures to deal with timely. The above process can also be summarised in four steps, that is, PDCA quality improvement cycle. At present, the quality of most projects

(9) Volume management is an ex post facto improvement management style, i.e., problems are dealt with after they occur or are discovered.

Chapter III. Research methodology

This thesis describes in detail the optimization plan of quality management of H project of H Group Co., Ltd. through the summary and analysis of the quality management of the first-phase projects such as MDLPO/AE integration that have been implemented, and continuously optimize the management in the second-phase projects such as ethylene, avoid problems, and continuously improve the quality management of petrochemical projects, and form a model of the summarized experience and replicate it to the management of other projects of the enterprise. We will form a model to replicate the lessons learnt to other projects of the enterprise, and achieve timely feedback and continuous improvement of the quality management effect of the projects through the use of data statistics and intelligent tools.

The main research methods applied in this thesis are as follows:

（1）Literature research method

Literature research method mainly refers to the method of collecting, identifying and organising literature and forming a scientific understanding of the facts through the study of literature. The documentary method is an ancient, yet vital method of scientific research. The general process of bibliographic method consists of five basic parts, which are: proposing a topic or hypothesis, research design, collecting literature, organising literature and conducting a literature review. The proposed topic or hypothesis of the literature method refers to the idea of analysing and collating or reclassifying the relevant literature based on existing theories, facts and needs. Research design begins with the establishment of research objectives, which refers to the use of operational definitions to design the content of the topic or hypothesis as a specific, actionable, and repeatable literature research activity that solves a specialised problem and has a certain significance.

In this thesis, a wide range of Chinese and foreign literature was collected for the study. The Chinese literature was searched from 2006 to 2020 in China Knowledge Network, using keywords such as project quality, engineering project, project quality management, quality, construction management, intelligent, informationisation,

process management, etc. The English literature was searched from https://www.sciencedirect.com/https://link.springer. com, literature from 2006 to 2020 was searched using keywords such as quality, qualitycontrol, projectquality. Through reading and comparing these literatures, we summarize and analyze the application of existing theories in project management practice, think about the possibility of applying quality management tools and methods of manufacturing industry in petrochemical engineering projects, and continuously optimize and innovate the quality management theories of engineering projects.

（2）case study method

Case Analysis Method, also known as the case study method was developed by Harvard University in 1880, and then used by Harvard Business School to cultivate senior managers and management elite education practices, and gradually developed today's case analysis method. Harvard's case study method began as an educational technique for senior managers and business policy related educational practices, and was later borrowed by many companies to become an important method used to train the company's competent employees. Through the use of this method of staff training, it can significantly increase the staff's understanding of the company's various businesses, cultivate good interpersonal relations among employees, improve their problem-solving skills, and increase the cohesion of the company. It refers to the method of analysing a single object in combination with literature to derive a general and universal law of things.

In the course of this thesis, the quality management of the completed Phase I project of Yantai Petrochemical Project of H Group Limited (MDI, PO/AE integration project, etc.) and the Phase II project under construction (including 1 million tonnes/year ethylene, etc.) is analysed as a specific case. It attaches importance to both the theoretical refinement and summary and the analysis of cases, and takes the projects implemented by H Group Chemical as examples to summarise the problems and excellent practices in engineering project management, to enhance the strengths and avoid the shortcomings, and to optimise the quality management of the newly built projects by combining with the new theoretical tools.

（3）interview method

Interview, also known as the interview method, refers to the basic psychological research method of understanding the psychology and behaviour of the interviewee through interviewers and interviewees face-to-face conversation. The interview method takes different forms depending on the nature of the research question, the purpose or the target. According to the degree of standardisation of the interview process, it can be divided into structured and unstructured interviews. The interview method is widely used, highly flexible, obtains more comprehensive and rich information, and through communication with the interviewees, obtains the interviewees' views and opinions on specific issues. This thesis obtains feedback on various aspects of project quality management through face-to-face exchanges with more than 20 people involved in the project of H Group Limited: contractors, supervisors, managers, directors, supervisors, key employees and professional supervision engineers of the Procurement Department and the Design and Management Department. The interviews were conducted on-site, by appointment, and centred on the optimisation of the quality management of Group H's projects.

（4）Questionnaire method

The questionnaire method is one of the more widely used methods in social surveys at home and abroad. A questionnaire is a form used for statistics and surveys that formulates a question in the form of a question. The questionnaire method is a method in which the researcher uses such controlled measurements to gauge the problem under study and thus collect reliable information. Most questionnaires are sent by post, individually or in groups. The respondent fills in the answers according to the questions asked on the form. Generally speaking, questionnaires are more detailed, complete and easier to control than interview forms. The main advantages of the questionnaire method are standardisation and low cost. Because the questionnaire method is conducted with a designed questionnaire instrument, the design of the questionnaire requires standardisation and measurability.

In this thesis, applicable questionnaires are prepared for key aspects involved in quality management improvement or optimisation, questionnaires are administered to

project participants, and statistical analyses of the questionnaires are carried out after the implementation of the survey according to the purpose of the study.

(5) Checklist method

Checklist method is the manager in advance based on many years of practical experience in engineering, each management object may occur within a form of quality issues prepared in the implementation of the project, the form of quality control points within the targeted supervision and management, once there are deviations and problems can be corrected and dealt with in a timely manner. Such as SH / T3503 "petrochemical construction project delivery of technical documents," SH / T3543 "petrochemical construction project construction process technical documents," and petrochemical and other industry standards and norms within the corresponding form, are such a checklist, in the process of engineering and construction, and strictly in accordance with such forms to fill out that you can find the quality of the problem and analyse the status of the quality management.

(6) Histogram method

Histogram, also known as quality frequency distribution chart, is an analytical method to group and organise the collected quality data and describe the quality distribution state with histogram shape. According to the distance between the distribution pattern of the histogram and the tolerance limit, the manager can understand the fluctuation of the project quality, analyse and judge whether the project is in a normal state.

Chapter 4 Empirical Study on Project Quality Management of H Group Ltd.

4.1 Analysis of the current status of quality management in Project H of H Group Ltd.

4.1.1 Overview of Project H at H Group Ltd.

The construction of Project H started in 2011, and the project is divided into three phases. At present, the first phase of the project, namely "Old Plant Relocation and MDI Integration Project" and "PO/AE Integration Project" has been successfully put into production. The second phase includes more than 20 projects including ethylene, polyurethane upstream and downstream product chains and new materials, etc., which are under full construction and will be put into production in batches in the second half of 2020. The third phase of the project is at the stage of preliminary planning and layout.

The key project of the second phase is 1 million tonnes/year ethylene, which is the first 1 million tonnes ethylene project in Shandong Province, with a total investment of about 16.8 billion yuan, covering an area of 2,400 acres, and the project includes a 1 million tonnes/year ethylene combined unit, 400,000 tonnes/year PVC unit, 150,000 tonnes/year EO unit, 450,000 tonnes/year LLDPE unit, 300,000/65,000 tonnes/year propylene oxide / styrene unit and supporting auxiliary and utility facilities. styrene plant, 50,000 tonnes/year butadiene plant and the supporting auxiliary and public engineering facilities. In addition to the ethylene project, the second phase of the project also includes the continuation projects of the first phase of the project, such as gasification phase II and nitrobenzene phase II.

4.1.2 Project H quality management objectives

H Project quality management is centred around four phases: design, procurement, construction and acceptance. The implementation process and entity quality should meet the requirements of laws, norms and systems. Adopting first-class technology, according to first-class standards, selecting first-class design institute, introducing first-class construction team, and constructing first-class project, the H project shall be

constructed into a high-quality project that conforms to the specifications, has 100 per cent coverage of engineering quality control, 100 per cent passing rate of quality acceptance, qualified quality, intrinsic safety, successful commissioning in a single operation, with the capacity indexes meeting the design requirements, and safe, smooth, and long-cycle operation.

1. Design quality management objectives

100 per cent of the survey and design meet the requirements of national norms and standards; 100 per cent of the survey and design documents meet the requirements for procurement, construction and production; 100 per cent of the one-time pass rate for the review of various types of basic design monographs; the change in investment due to design changes is no more than 3 per cent; and there are zero level 3 and above safety accidents caused by the quality of the design;

2. Procurement quality management objectives

The quality of equipment and materials arriving at the site is over 99.8 per cent qualified, and the rate of re-inspection is 100 per cent qualified; The qualification rate of the manufacturer's information is 100 per cent; The rate of timely after-sales service is 99 per cent, and the rate of satisfaction is 100 per cent.

3. Construction quality management objectives

Zero quality accidents above the third level ; the quality of the project is qualified, in line with national and industry specifications for engineering and construction ; B-supplied materials acceptance rate of 100% ; important process verification rate of 100% ; quality inspection and evaluation, the quality of the unit project pass rate of 100% ; radiographic film statistics of welding a film pass rate of 97% or more ; non-destructive testing commissioned by the implementation of the rate of 100%, non-destructive testing of the radiographic film qualification rate of not less than 98.5%, the accuracy rate of film evaluation is not less than 98.5% (hazardous defects shall not be wrongly evaluated and omitted) ; according to the standard specification requirements for re-examination of equipment, materials, re-examination rate of 100%, misuse or use of unqualified equipment, materials for zero ; the implementation rate of the national mandatory regulations related to the quality of construction is 100% ; the timely rate of

rectification of the problems released by the hand-held machine should be 95% or more, the rate of completion of 100% of the acceptance of quality Management objectives ; "three checks and four decisions" work in place 100% ; file rework rate of less than 5%; PSSR and other acceptance procedures with more than 90% satisfaction.

4.1.3 H Project quality management organisation and its responsibilities

1. Project quality management organisation

H project of H Group Co., Ltd. mainly adopts E+P+C+Supervision, IPMT project management mode, and individual treatment unit or small device with proprietary or patented technology adopts EPC or E+PC mode (investment accounted for less than 10%); according to the organisation process of the project, the project is divided into four phases, namely design, procurement, construction and acceptance. The contracting mode of the project adopts the mode of contracting by speciality (civil engineering, installation, anti-corrosion and heat preservation, fire-fighting and other specialities are contracted separately), under which the project management of the construction unit is the core of the whole project management and determines the success or failure of the project.

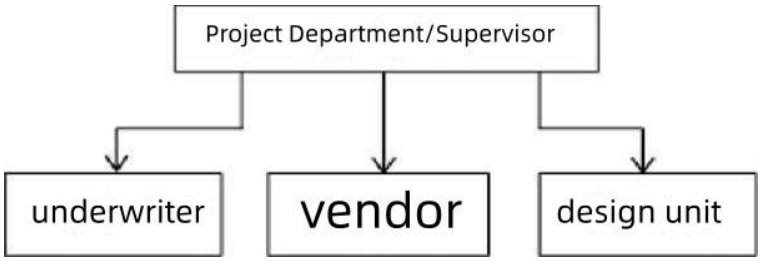
H project of H Group Co., Ltd. is responsible by Chemical Engineering Construction Management Centre of H Group Co., Ltd. which consists of 5 functional management departments, namely Quality Management Department, Design Management Department, Planning Management Department, Cost Control Department, and Safety Management Department (HSE); and 3 departmental branches, namely Information Centre Branch, Procurement Branch, and Finance Branch, as well as Yantai Production Base Office, Production Management Department, Production Preparation Department, and Equipment Management Department, etc., are involved in the project management. The company assigned three divisions, namely Information Centre Division, Purchasing Division and Finance Division, as well as the Yantai Production Base Office, Production Management Division, Production Preparation Division and Equipment Management Division to participate in the project management. Meanwhile, we have set up well-organised project departments, such as Ethylene Project Department, Polyolefin Concentrator Project Department, Polyvinyl

Chloride Project Department and so on.

Manufacturing plant supervision is carried out by professional equipment supervision company for key equipment in the manufacturing plant, and the equipment supervision company is entrusted by the company's Procurement Department and directly managed by it. The Quality Management Department commissions a third-party testing unit to test the quality of on-site welding and incoming special materials. The project departments of ethylene, polyolefin and polyvinyl chloride, which adopt the introduced technology, adopt the joint management team composed of the chemical-based H Group Co. and the related management companies with rich management experience, Jane IPMT (IntegratednProjectnManagementnTeam). The functional departments of the Engineering Construction Management Centre take the professional control of "planning, coordination, guidance and assessment" as their main responsibilities. The Project Department carries out the whole process management of the project, implements the project manager responsibility system, and implements the quality management mode with the contractor as the main body of construction, the Project Department/Supervision as the main body of management, and the Quality Management Department as the supervisory department.

(2) Organisational roles and management functions of the Project Department

The current organisational model is under the full management of contractors and supervisory units by the project department, and the functional departments of the Engineering and Construction Management Centre implement the assessment of the project department in respect of their own professions. Supervision unit in the name of supervision, project management identity, responsible for the construction phase of the project management (supervision), project management personnel to participate in, its main task is cultural leadership and integration, resource coordination, project organisation as shown in Figure 4-1.



3 Figure 4-1 Organisational Chart of Project Department/Supervision

The functions of the project department are summarised as "leadership, communication, coordination, supervision", the implementation of the contractor as the main unit of responsibility for quality management, supervision units for quality management of secondary units of responsibility for quality management, the project department as the main body of quality management management management model, the project department has an absolute assessment of the contractors, supervisors, control of the project construction resources, the overall project quality is responsible for. The project department has the absolute appraisal right to contractors and supervisors, masters the project construction resources and is responsible for the overall quality of the project. The Quality Management Department is mainly responsible for the functions of guidance, supervision and assessment.

2、Project quality management responsibility division of labour

The second phase of the project adopts a strong matrix management mode, where all kinds of resources are directly managed by the project department, and the functional departments provide business support and services, and assess the management results of the project department from the professional aspect. In order to clarify the quality management responsibilities of the Engineering and Construction Management Centre, the quality management responsibilities of relevant units and departments are divided as follows:

(1) Design Management Department Quality Control Responsibilities

Responsible for the quality assessment and selection of contractors for project survey, design and EPC (including EP and EC); Responsible for submitting design conditions to design contractors, organising the review of basic design (preliminary design), the review of detailed design (construction drawings) process compliance,

and organising the technical review of design changes; Responsible for the approval of minor design changes; Responsible for the appraisal of the project document management;

(2) Quality Management Responsibilities of the Purchasing Department

Organise the inspection and selection of material suppliers and establish a list of qualified material suppliers ; Organise the negotiation, bidding and contract management of material procurement for the project ; Organise the feedback of design conditions from suppliers ; Prompt the delivery of the purchased materials and organise the process inspection and factory inspection ; Manage the material outgoing and incoming ; Organise the third-party testing of the materials ; Receive, summarise, issue and file the relevant documents of the purchasing (random documents of the equipments, etc.). Filing.

(3) Quality Management Department Quality Management Responsibilities

Responsible for compiling unified regulations on project quality management, organising professional quality inspections and demonstration project evaluations ; reviewing major construction plans of various professions, guiding key or special process inspections and acceptance ; responsible for evaluating and assessing the quality management work of various project departments ; organising quality meetings of the management centre and planning quality month activities.

(4) Quality management responsibilities of the Programme Management Department

Responsible for the organisation of project bidding, bid evaluation, bid determination, contract negotiation and signing, responsible for the organisation of the contract quality assessment work ； Organisation of the contract submission, for contract changes and supplemental matters, review of contract implementation, from the perspective of contract implementation, assessment of the implementation of the contract quality-related provisions ； Project Department quality management duties ； Overall responsible for the project's design, procurement, construction, acceptance ； To participate in the signing of project design contracts, construction contracts,

procurement contracts and comments on contract quality assessment ； Responsible for signing the project Design contract, construction contract, procurement contract and comment on the contract quality assessment ; responsible for signing the technical annex of material procurement ; organise the approval of the construction contractor's report on the commencement of the unit project, organise the first site meeting ; responsible for the preparation of the project quality management work plan ; organise the acceptance of the A-level quality control points ; organise the transfer of the project completion data and acceptance ; responsible for the confirmation of the construction installation content completeness.

(4) Quality Management Responsibilities of Other Functions

The Department of Cost Control, the Department of Finance, the Comprehensive Office, the Information Centre Division and other departments provide funding, settlement, services, technical support and other guarantees for project quality management within their scope of responsibility. Production base related equipment management department, production preparation department and other engineering related departments in their scope of responsibility for the project design, procurement, construction, acceptance of the project quality related business to provide support and protection, to ensure that the entire project quality objectives of the full realisation.

(5) Contractor quality management responsibilities

Contractor is the main body of construction, the main responsibility for the quality of construction; contractor qualification, contractor personnel qualification, contractor staffing should be in line with national laws and regulations and contractual requirements; contractor should do a good job of drawing review, the preparation of construction organisational design and construction programme, the preparation of quality management plan, the construction of technical delivery of the staff, is responsible for the installation of special equipment to inform the supervisory inspection and inspection, is responsible for the "three checks and four fixes" end item rectification, participate in the intermediate handover, organise the preparation and transfer of the completion data. "Three Checks and Four Decisions" tail correction, participation in intermediate handover, organisation of preparation and handover of as-

built information.

(6) Quality management responsibilities of the supervisory unit

The supervision unit is entrusted by H Group Limited to supervise the construction of the project, and is responsible for the quality of the project construction. The qualification of the unit, the qualification of the personnel, and the staffing should be in accordance with the national laws and regulations and the requirements of the contract, and it should prepare the supervision and management documents, organise the quality inspection activities, and convene the regular site meetings, and supervise the quality of the construction of the project in the whole process.

(7) Quality Management Responsibility Interface

Interface of design and procurement quality management: Before the technical standards of equipment ordering and the delivery status are submitted, it belongs to the scope of design quality management, and after that, it belongs to the scope of procurement quality management. In the stage of procurement quality management, quality management is mainly managed by the Procurement Department, with professional support from the Design Management Department, Equipment Department and other design and quality related departments.

Procurement and construction quality management interface: Before the unpacking inspection and handover from the construction unit, it belongs to the scope of procurement quality management, after that, it belongs to the scope of construction quality management. In the construction quality management stage, the quality management is dominated by the project department and quality management department, with professional support from the procurement department, equipment department and other units related to procurement quality.

Design, Procurement, Construction and Acceptance Quality Management (DPCAQM) interface: DPCAQM is the domain of Design, Procurement and Construction Quality Management (DPCAQM) until the intermediate handover, and Acceptance Quality Management (AQM) thereafter. During the acceptance phase, the design, procurement and construction quality management departments provide professional support to the acceptance quality management.

Whether it is daily quality supervision or special organisation of various types of quality inspection, its ultimate goal is to regulate the quality behaviour of the main body of each participant in the construction, so as to ensure that the project entity meets the requirements of the norms and standards.

4.1.4 Status of quality management in Project H

1. Status of project design quality management

Design quality management is an important part of project quality management. The Design Management Department is the competent authority for Project H. Under the strong matrix project management model, design management specialists are assigned to the project department to manage the whole cycle of project design quality.

The Design Management Department takes the lead in design quality management, the Design Management Specialist assigned to the project department organises and implements the design quality management, and the project department and other functional departments cooperate with the design quality management. Design Management Department is responsible for formulating and maintaining a series of design quality control procedures, and clarifying the management responsibilities of each participant and each department within the enterprise. With the co-operation of the Design Master Institute and various professions within the enterprise, the Design Management Department has taken the lead in formulating the design basis of the park in order to clarify the requirements of the organisational structure and coding of the park project, the hydrogeological conditions of the design, the specifications of utilities, and the sequence of norms and standards to be implemented. On the basis of each design standard of GB, SH, HG and DB, the design unified requirements of each speciality were gradually improved by combining the best engineering practices at home and abroad. The unified design regulations and requirements started to be promoted in the first phase of the project, and there were some flaws in the implementation due to the understanding deviation of individual design units during the implementation process. The external review identified a number of risks of design irregularities, and the design programme was corrected in a timely manner. The overestimation of completed projects is relatively low, and losses due to design changes and rework in park projects are now

basically kept within 3 per cent of the project investment.

From the project design preparation stage to the project completion and acceptance, the Design Management Specialist takes the lead in formulating the quality control plan of the project according to the contract signed with the design institutes, builds up the communication bridge between the design institutes and the project department, and organises the quality control work of the project such as design scheme review and drawing review at various stages. Organise the design institute and related professionals to participate in the basic design review. Organise construction, supervision and other participating units to review all kinds of special parts and drawings, and hire industry experts to set up a consulting team.

The design basis and various professional design regulations were prepared based on the accumulated project practice of the General Research Institute and Group H Co., Ltd. without fully considering the design habits of each design unit, and subject to the cognitive level of the authors, some of the contents had ambiguities or ambiguities, and encountered the doubts and resistance of some design units in the early stage of the implementation of Phase I of the project, especially from the foreign patentees. The ethylene project was joined by new patentees and design units, the progress of the external review was uncontrolled, there were schedule conflicts caused by the review of the basic design programme, and the duration of the drawing review was longer than expected.

2. Status of project procurement quality management

Project procurement is the material foundation of engineering project construction, H Group Limited Procurement Department Engineering Procurement set up four professional procurement module, and set up procurement management, warehousing management, internal control and supplier management of three management and supportive modules, most of the staff for the graduation of undergraduates or postgraduates within eight years, a total of 93 people; is responsible for the whole company (mainly in Yantai) engineering and construction equipment, material procurement, warehousing management of the entire work of the company. At present, there are more than 20 projects under construction in the second phase of the project,

and the annual purchasing amount is about 10 billion RMB, and the purchasing volume is huge, and the purchasing quality management is under great pressure, as there are thousands of equipments, nearly 70,000 sets of electrical and instrumental equipments, 125,000 tonnes of steel, 2,187 kilometres of pipelines, 1,070,000 pieces of fittings, 170,000 sets of valves, 342 kilometres of bridges, and 8912 kilometres of cables in the second phase of the project.

After the commencement of the project, the construction unit submits the material and equipment demand plan, the procurement department receives the demand plan, classifies and summarises the demand plan, and allocates the purchasing tasks to the professional purchasers, who organise the bidding, framework or direct purchasing according to the degree of urgency of each material. Equipment engineers are involved in technical work such as negotiation of equipment technical agreements and return conditions with design institutes. Coordination and organisation of the arrival progress of equipment and materials is done by the procurement coordination of the procurement management module. Currently, there are few procurement coordinators, and some people even manage the procurement coordination of three projects on a part-time basis.

Petrochemical equipment is complex, and manufacturing involves many norms and standards with high technical content. The Purchasing Department has sorted out and issued a series of technical standards for the procurement of H Group Limited, such as "Brand Library of Raw Materials for the Procurement of Electromechanical Instrumentation" and "Uniform Specification for the Purchase and Ordering of Centrifugal Pumps", "Uniform Specification for the Purchase and Ordering of Heat Exchangers", "Technical Requirements for the Purchase of General Purpose Valves" and so on, in order to clarify the technical requirements for the procurement of material orders. Important equipments and materials sign special technical agreements at the same time of signing procurement contracts.

In the manufacturing stage, according to the manufacturer's manufacturing plan, the professional purchaser puts forward the demand plan for supervision of manufacturing supervision, and the equipment management department dispatches the supervisor to supervise the manufacturing in the factory (Wang Suying et al., 2019),

who submits a weekly report on the supervision of manufacturing. Based on the weekly report, the Procurement Department reviews, evaluates, and assesses the quality of the manufacturing supervision. Every year, there are more than 100 supervision supervisors providing supervision services to H Group Limited, and several supervision units are now experiencing difficulties in allocating resources. The Purchasing Department randomly organises quality assurance system audits of manufacturing plants, audits the implementation of quality control procedures and records of all parties involved in the manufacturing process, and puts forward corrective action requirements. Generally speaking, "whoever purchases, whoever is responsible for", the professional purchasers are responsible for the quality of the materials purchased by them, but the process also reveals that some of the purchasers are lacking in professional knowledge and skills; When encountering major quality problems, the quality management personnel are still mainly responsible for tracking and judging the supplier's corrective actions (review of corrective measures, implementation process, results, etc.). The current resources of the Purchasing Department are overstretched to cope with the complex quality management of procurement.

Material warehousing by the storage module custodian is responsible for, according to the "warehousing materials inspection regulations" for the inspection inventory work, directly shipped to the site of the equipment and materials by the procurement co-ordination organisation equipment engineers, supervision, construction units, etc. to carry out unpacking and inspection of the equipment, the quality of equipment, the existence of the equipment, the equipment in the "unpacking and inspection records" on the list of clear in order to deal with and claims.

3. Status of project construction quality management

After the issuance of the project design documents, the Planning Management Department of the Engineering and Construction Management Centre organises tendering or direct commissioning, determines the construction contractor and signs the construction contract. Each unit establishes a project department, sets up a special quality management department in its organisational structure, and carries out quality management by speciality; before commencing construction, the contractor carries out

project construction quality management planning and prepares a project construction quality plan. group H Ltd. conducts an audit of the personal qualifications and abilities of key personnel for quality management, such as quality assurance engineers.

Configuration of the construction unit: the project manager, professional engineers, etc. are responsible for the organisation and coordination of the project, and the supervisory unit is admitted according to the personnel dispatch plan, which is approved by the project department and the quality management department of Group H Co. The chief supervision engineer, chief representative, professional supervision engineers and supervisors are required to be licensed, the number of personnel according to the project needs and contractual agreements, the current quality of supervision personnel, licensing situation fails to meet the contract and specification requirements.

At present, the contractor's technical and quality personnel are mostly undergraduates and specialists within five years of graduation, and their qualifications and abilities do not meet the contract requirements. According to Article 3.1 of Welding Quality Control Management Regulations (M-WHYTP-D04-015), the ratio of the number of welding quality inspectors to the number of welders shall meet the configuration requirement of 1:25. Welding quality inspectors should have high school or technical secondary education, engaged in welding operations for more than 15 years; or college education, engaged in petrochemical welding management for more than 3 years.H Group Co., Ltd. quality management department issued a notice one month in advance, to carry out welding quality management personnel due diligence special inspection, after the inspection, the number of welding quality inspector configuration in some units still can not meet the requirements of the management regulations.

Contractor and supervisory unit formulate quality control points (ABC three-level quality control plan) for different disciplines based on design documents, relevant standards and relevant management regulations of the owner, and organise inspection and acceptance work according to the control points. The project department/supervisor organise weekly joint quality inspection, generally do not form inspection report, reflected in the form of weekly meeting quality assessment, the more serious problems supervision unit to the contractor to send supervision notification form and supervision

contact list, the project supervisor with the quality of the monthly report in the form of a monthly report of the quality management of the project to the Quality Management Department. The project departments and supervisors rewarded and punished the construction units according to the "Quality Assessment, Reward and Punishment Management Procedures" prepared by the Quality Management Department.

The Quality Management Department carries out special quality inspections twice a week for each speciality, and comprehensive quality inspections and audits once a fortnight with the Equipment Department and other departments, and carries out vertical and horizontal full-coverage inspections of each installation one by one, and forms the Quality Problems Inspection Report to be sent to the relevant project departments/supervisors. According to the problems found in the special inspection and comprehensive inspection of the department, the relevant contractors and supervisors will be assessed, and the project departments will be assessed and scored monthly and annually.

4. Status of project acceptance quality management

Phase I project in the pipeline pressure test package preparation process, there is always a welded joint test report and other information constraints on the preparation of pressure test package documents, to find a third-party testing, supervision of temporary surprise signing of the report. The process of collecting random information and quality certification documents from manufacturers is time-consuming.

The acceptance of the completion of the Phase I project was delayed by about one year, with delays in the preparation of the completion report and the collection of process information. The project acceptance system implemented for the Yantai Petrochemical Engineering Phase II project follows the acceptance organisation model of the Petrochemical Phase I project, by setting up a mid-delivery acceptance team and checking the acceptance process after three checks and four determinations. A joint inspection team is formed by the Project Department and Quality Management Department of the Engineering Management Centre and the Production Preparation Department, Equipment Department and Production Unit of the production base to carry out the inspection in accordance with the regulations on the management of

completion and acceptance. For the problems found in the inspection item by item records, the preparation of tail item rectification table, rectification plan, for the class A and affect the driving of the class B tail items, must be completed before the handover of rectification; for the other tail items do not affect the driving of the other tail items, need to clarify the rectification programme and time of rectification, and tracking rectification, to achieve the tail item closure management.

The Engineering Construction Management Centre and the production base upgraded the systematic documents such as the procedure of project intermediate handover management of Phase I project and the management regulations of three inspections and four determinations; after the commencement of the Phase II project, the joint production base convened the supervisory unit and the construction unit to organise an experience exchange meeting on project intermediate handover management, so as to let all the parties concerned to understand and be familiar with the process of engineering acceptance by means of experience sharing and technical exchanges and to make preparations for the acceptance of petrochemical projects in advance.

4.2 Analysis of Quality Management Problems and Reasons for Project H of H Group Ltd.

4.2.1 Analysis of the main problems and causes of design quality management

The Engineering and Construction Management Centre (ECMC), which consists of two levels of design management organisations, namely the Design Management Department and the Project Department, has carried out a series of design quality management work in accordance with the project design quality management plan. However, due to the fact that there are too many projects starting at the same time, the complexity of the project system structure, the first-time use of process packages, and the lack of process management, it is inevitable that problems will arise in the quality of project design.

1. Main problems in design quality management

Projects adopting mature or self-developed process packages have design quality

problems to varying degrees. According to the overall analysis and statistics, a large number of design changes occurred in MDI integration and PO/AE integration in the first phase of the project, causing the overall project schedule to lag behind; among them, the proportion of design changes in MDI integration reached 3-5% according to the converted No.1 drawing, and that in PO/AE integration even reached more than 7%.

2. Reasons for design quality management problems

In the process of transforming external information into construction drawings, the design institute did not integrate the conditions of feedback from manufacturers and craftsmen, reverse simulation, and did not design according to the terms and conditions agreed in the contract, and did not design according to the unified regulations on the design issued by H Group Limited, and some of the unified regulations of H Group Limited were lagging behind in updating and there was a failure of constraints on some of the design institutes. The design institute did not fully consider the reasonableness of the process, the cheapness of the construction, and the convenience of the operation and maintenance before the official drawings were issued, and the review of professional drawings within the design institute and the comprehensive drawings between the professions were not in place, and the optimisation of the design scheme was not carried out and the design scheme was not optimal. Design quality needs to be improved, frequent "errors, omissions, touch" and other conventional design quality problems. In the design submission, drawing review work, construction, supervision and other units did not carry out detailed review of the design drawings, did not find problems in time, so that the work is a formality, in the "one step at a time" state. The design units paid attention to the contractual target of keeping the floating proportion of investment in design changes within 3 per cent of the total investment, ignoring the hidden impact of design changes on the project.

4.2.2 Analysis of the main problems and causes of procurement quality management

In recent years, safety accidents have occurred in the field of engineering and construction because of the quality of purchased materials. Without strict quality management and supervision of the material procurement process, even the highest

price cannot guarantee the quality. Therefore, throughout the procurement process, we should focus on quality management as the centre, implement measures and strengthen responsibilities, so that quality management is put into practice.

1. Major problems in procurement quality management

For chemical plants, the equipment is the top priority. In the first phase of the project of Group H Ltd. with 1,820 static equipments, there were 72 leakages, out of which, 34 leakages were due to manufacturing reasons. Problems in purchasing quality management, as shown below:

(1) Problem improvement relies on the actual production capacity of suppliers, the level and responsibility of personnel, and the competence and responsibility of supervisory personnel, etc., with few means of autonomous control and insufficient capacity.

(2) From time to time, there are unfavourable supervisory and manufacturing management, and the manufacturing process and factory inspection are not strictly controlled, such as the arrival of the motor voltage does not match the technical agreement, the bolts in the tower are not firmly fastened, the weld seams in the tower disc are large, and some of the weld meat is insufficient, the coil collector is frozen and cracked, as well as the quality of the anti-corrosion surface of the equipment, and so on.

(3) equipment unpacking inspection exists in the form of a problem, or even do not carry out the unpacking inspection, the late emergence of fewer pieces, quality problems, often occur "tug of war" phenomenon.

2. Causes of procurement quality management problems

The management of Group H Ltd's procurement technical standards should be done by a specialised organisation in order to optimise access to information and keep up to date with relevant requirements.

(1) Purchasing technicians have insufficient business skills, do not understand the manufacturing standards and acceptance standards, and have insufficient communication and cooperation with other related departments in the purchasing process, failing to pre-empt problems and causing economic losses. The design unit feedback to the manufacturer's requirements is not comprehensive, resulting in the

completion of the equipment manufacturing or after entering the field does not meet the requirements for use.

(2) Insufficient attention is paid to the supervision and construction work in the factory, insufficient management and assessment, and the personnel stationed there are not responsible enough to do a good job in supervision and construction; at the same time, the opening and inspection work after the arrival of the materials is just a formality. Warehousing is managed by non-professionals, who are not clear about the inspection and storage requirements for materials of different categories and materials, resulting in the admission of unqualified materials, and the confusion of materials in warehouse management, which can easily cause quality problems.

4.2.3 Analysis of major problems and causes of construction quality management

1, the main problems of construction quality management

The inspection process of the key, key issues, can not be in-depth diagnosis, in the inspection of the problems found, generally on the matter of rectification, the solution can be. There is no in-depth analysis of the problems, and the root causes, direct causes and triggering factors of the problems have not been clarified one by one, so that it is not possible to formulate measures fundamentally to avoid the recurrence of these problems.

2. Reasons for construction quality management problems

Contractors are constrained by the high mobility of technical and quality management personnel, the long training cycle of technical and quality management personnel, and the lack of accumulation of technical and quality experience. Sometimes they lack understanding of the design drawings and are not clear about the design ideas and intentions. Most contractors stick to the old rules and regulations, use less new materials, technologies and methods, and have a low willingness to use advanced work tools and monitoring and measuring instruments due to cost reasons. They always try to remedy or cover up problems after they have occurred, but are rarely able to reduce and prevent risks beforehand.

The project department/supervision of some professional engineers with poor technical quality, the quality control points of the inspection in form, do not have the

ability to control beforehand, mostly to make up for the aftermath. Responding to quality problems is also mostly based on rectification and punishment, and seldom analyses the problems in depth. Certain supervision engineers only sign the documents and information without checking the practice, contributing to the quality control points in the form of a problem.

4.2.4 Analysis of major problems and causes of project acceptance quality management

1. Major problems in project acceptance quality management

Project acceptance is divided into process acceptance and completion acceptance, process acceptance, including hidden works acceptance, quality control point acceptance, division, sub-projects, unit project acceptance, etc., the quality of the entity and the documentation to meet the quality requirements before acceptance. Completion acceptance is the last procedure of project quality, but also the last work of project management. At present, there are problems in the quality management of project acceptance in terms of entity and documents, as follows:

(1) The process of acceptance documents and information planning is not in place, there are control points set up unreasonably, the acceptance of divisions, sub-projects, unit works are not carried out in accordance with the procedures, or omit the acceptance procedures. Can not be prepared on time, signed documents and information, for the acceptance of the signing of information is more common, part of the supervision is not clear about the technical standards, signatures do not gatekeeper problems occur from time to time.

(2) After the four special acceptance processes of fire protection, environment, safety and occupational health have been passed, it is necessary to wait for the completion information and settlement to be completed before the completion acceptance can be carried out. After the completion of the project, a large number of personnel will withdraw from the project, resulting in the preparation of project completion information and the completion acceptance of the cooperation process, the lack of a plan, the slow collation of the completion information, the falsification of the information, and the delayed progress of the problem.

(3) process quality acceptance is to achieve the overall quality control of the construction project is indispensable important steps, but at present there is a widespread process quality acceptance is not rigorous problem. Acceptance of the stage results, there is a lax gatekeeper, the problem of formality, it is difficult to find quality defects, leaving the quality of the hidden danger, affecting the essential safety of the project.

2. Reasons for project acceptance quality management issues

Payment, assessment and other indicators agreed in the contract with the contractor did not include acceptance as a key assessment indicators, as a construction unit, it is bound to follow the baton of the interests of the configuration of resources and the provision of services. In the H Group Limited contractors generally a project department to undertake a number of projects, new and old projects synchronised cross, technicians are generally young, frequent replacement, inadequate skills. Resource allocation determines the inability to implement the project acceptance quality plan, so that the acceptance of work in a form.

(1) Completion acceptance is more complicated, need to fire, occupational health, safety, environmental four government departments involved in the special acceptance are passed before proceeding, because of the pre-design of the safety, environmental approval documents, the part of the acceptance is often inaccurate plans, constraints, can not be accurately planned, can only be a passive emergency organisation.

(2) The contractor project manager exists the idea of focusing on the progress but not the quality, focusing on the entity but not the information; the contract between H Group Co., Ltd. and the supervisory unit is a commissioning contract with per-person billing, and the supervisory unit's management is a passive management, with insufficient initiative and low quality personnel. Often belittle the quality management of the acceptance stage, resulting in poor acceptance quality management.

4.3 Optimisation Measures for Quality Management in Project H of H Group Ltd.

4.3.1 Ideas for optimising quality management in engineering projects

Quality management of engineering projects is the management activities carried out to meet the quality requirements of projects in the process of achieving the quality management objectives of engineering projects. In order to ensure that the construction of engineering projects is carried out in an efficient, high-quality and safe manner, Group H Ltd. has upgraded and continuously optimised the four phases of design, procurement, construction and acceptance on the basis of the conventional quality management of engineering projects. In the past, all aspects of project quality management operated independently, and the quality management problems in each aspect were also closed for improvement. Through the PDCA quality management improvement cycle of planning, implementing, checking, processing (improvement) and feedback in a downward direction, the company continuously improves in the construction of projects, improves constantly, and continuously puts into operation petrochemical projects with high quality .

4.3.2 Optimised programme design for project quality management

How to achieve quality management optimisation in the four phases of design, procurement, construction and acceptance according to the PDCA idea of quality management optimisation? The quality management optimisation scheme is designed as follows:

1、Project design quality management optimisation programme design

Project design quality management based on the standards, the level should be high; the quality management of the design process should be implemented in place, through the process of checking, the implementation of corrective measures to achieve the goal of optimising the quality management of project design.

2. Project procurement quality management optimisation programme design

In addition to PDCA quality control, the technical and quality level of management personnel should be improved continuously, and external resources should be

introduced continuously; the quality management of key and special materials should be improved by planning, and the implementation of supervision and inspection should be strengthened, and the quality management of project procurement should be optimised by strict assessment.

3. Optimised programme design for project construction quality management

By simplifying construction quality management documents, it transitions from having many laws to having laws and strict enforcement; by collecting quality management data through handheld devices, it analyses quality data and problems in depth, identifies the crux of the problem, controls the key, and eliminates the problems and hidden dangers in a timely manner, so as to achieve the optimization of construction quality management.

4. Project acceptance quality management optimisation programme design

How to use the project acceptance quality management link with the end as the beginning? The acceptance programme for key parts and major links should be formulated separately, the acceptance plan should be prepared according to professional characteristics, the awareness of quality management should be improved, and the problems and deviations related to the acceptance process and acceptance at all stages of the project should be dealt with in a timely manner, so as to achieve the optimization of the quality management of the acceptance of the project.

4.3.3 Optimisation measures for project design quality management

H Group Limited design quality control objectives: design scheme advanced, reasonable, economic, practical, the depth of design documents to meet the order and construction requirements, in line with the requirements of the petrochemical design specifications, the design of single-line diagrams in line with the requirements of the process piping and test pressure package inspection, the overall quality of the design to achieve the level of the national excellent design. From the summary analysis of previous projects of H Group Limited, the specific optimisation is as follows:

1、Optimise the design quality management plan, prepare and publish the design uniform regulations

From the pre-design of the return conditions, design scheme determination,

blueprint design based on the standard, to the design of the drawing review, the design of the final design and other design quality management links, design management plan in the design of the more important part of the standard based on the design of the design of the standard based on the standard determines the quality of the design of the product, how to make the standard is at a high level? After absorbing, introducing and integrating, the Design Management Department has revised and issued 8 uniform regulations on design, see Table 4-1 for details; together with the Standard Committee of Electromechanical Instrumentation and the Production Operation Centre, it has issued 13 enterprise standards and 23 best practices; and it has upgraded the version of 7 uniform regulations such as Uniform Provisions for Structural Specialties and Uniform Provisions for Pipes.

For the parts not covered by the current standards, the company organises professionals to prepare enterprise standards and best practices. On the basis of the industry and national standards, the company further refines the requirements of the relevant quality standards, so as to ensure the correctness of the source.

Table 1 Table 4-1 Summary of Changes to the Uniform Design Provisions for FY 2020

professions	**Main amendments to the harmonised provisions**
arts and crafts	Revision of backflow protection design principles for utility media, compressor and centrifugal pump outlets in conjunction with the company's published Best Practices for Preventing Backflow Pollution in Utility Systems Summary and Application Guidelines for the Setting of Chemical Check Valves for Group H Ltd.
tubing	Revision of bolting corrosion protection, insulation materials and insulation thickness, corrosion protection painting, preparation of American Standard material standards and grades, etc.
drainage	Supplementary water conservation requirements, wastewater caching requirements, wastewater line consolidation principles, etc.
circulating water	Revision of circulating water fouling thermal resistance coefficient, design requirements for circulating water cooling unit and dosing unit, etc.

constructions	Revised and supplemented the requirements for thermal insulation materials, drainage requirements, external window design requirements, external wall decorative materials and colour requirements.
framework	Revision of the requirements for anticorrosive painting of steel structures, fire protection zones according to smoke, non-conflagration fire zones and fire-resistant coating requirements adopted, etc.
estimates	Requirements for the revision of the fee schedule.
techno-economic	Revised tax rates and updated utility prices.

The Company constantly updates the uniform regulations on engineering design and focuses on promoting the application of H Group Limited's corporate standards and best practices in engineering design, encouraging the application of new technologies, techniques and materials, and enhancing the advanced nature of design solutions.

2. Measures to ensure the implementation of the design quality management plan

In conjunction with all relevant departments, the company has continued to optimise the design in accordance with the principles of "certainty, balance, unity, coordination and certainty" for the overall design, and has adhered to the principles of safe and reliable system operation, high level of management automation, simple and easy operation, guaranteeing progress and facilitating construction. Before the design enters the implementation stage, the Project Department of Group H Co., Ltd. organises various professionals to review the design documents and put forward design problems in time. Strictly manage the depth of feasibility study, process package and foundation design to ensure that the design has sufficient time. H Group Limited issued management regulations, requiring the participating design institutes to strengthen the communication between various professions, and the project department of the design institute is required to organise the drawing review of various professions before each main item and unit is drawn.

3、Strictly check the implementation of improving the quality of design drawings

According to the objective reality to carry out the comparison and improvement of multiple programmes, to determine the optimal design scheme. Raise the importance of the design submission, drawing review, not only the project department, construction

unit, supervision to review the drawings, the company's process technicians should also review the drawings, in advance to find out the problems of the drawings, to reduce the design changes.

4. Timely handling of deviations in design quality management

The Design Management Department of Group H Co., Ltd. further strengthened the management of design contracts, and the Project Department, together with the Design Management Department, compiled a design site service management system to standardise the management of design representatives' on-site work, and to do a good job in construction site service. Emphasising that design change is an important embodiment of testing the level of detailed design, the design unit will be assessed and the last elimination system will be adopted to motivate the design unit to grasp the essential work and better serve the project.

4.3.4 Optimisation measures for project procurement quality management

Purchasing quality is the main component of project quality and has a decisive role in project quality. To ensure the stability and improvement of purchasing quality, H Group Co., Ltd. mainly controls from optimising the purchasing quality plan, increasing the implementation of purchasing process quality management, strengthening the acceptance of materials and equipment supervision and manufacturing.

1. Optimising procurement quality management plans

In addition to the unified standard requirements for regular materials, the procurement quality management plan is prepared separately for critical and specific materials and equipment. On the basis of regular categories, there are special requirements for special materials to ensure that the purchased materials meet the quality standards and design requirements in terms of technical and technological performance, and so on. The quality management of critical and specific materials determines the time axis of the whole project, which is the critical path of procurement management and the focus of optimisation. Other optimisations are as follows:

Organise the inspection and selection of material suppliers, and establish the qualified material suppliers list ; Classify the purchased materials according to the

design drawings, and treat the key important materials differently ; Organise the personnel to prepare the purchasing quality plan, and review and approve the plan according to the regulations ; Organise the related professionals to discuss the technical descriptions of the key important materials, and ensure that all the performances satisfy the requirements of the standards and drawings ; Prepare and publish the purchasing quality management documents, and continuously improve the purchasing quality management standards by constantly revising and updating the purchasing quality management documents. The quality management documents of purchasing are constantly revised and updated to improve the quality management standards of purchasing.

2. Increase the implementation of the procurement quality management plan

After the signing of the procurement contract, the organization design, supervision, construction and manufacturers of technical exchanges and design briefings, product characteristics of the development of a more complete control measures and acceptance of the programme ; to strengthen the management of equipment supervision and manufacturing equipment acceptance and supervision and manufacturing is an important means of ensuring the quality of the equipment, the H Group Ltd. project purchases a large number of large, diverse, key equipment, such as propylene filling tower, ethylene compressor unit, special materials and complex working conditions of ethylene cracker tube (Incoloy800H), etc., determines the supervision and manufacturing program must be targeted to different manufacturers in many countries. Special materials, complex working conditions of the ethylene cracker furnace tube (Incoloy800H), etc., the procurement of a variety of forms, involving different manufacturers in many countries, determines the supervision of the manufacturing programme and acceptance of the programme must be targeted, the staff of the high professional competence. H Group Co., Ltd. is mainly in the following areas to strengthen the management:

First, the development of joint quality inspection programme. In view of the characteristics of the product to develop a more complete supervision and acceptance programme, the key, special equipment, organisations sellers, design, construction,

supervision and other organisations joint inspection, to ensure product quality.

The second is to send permanent representatives to suppliers. The final inspection and test before leaving the factory should be supervised, and the quality certification materials issued by the supplier should be verified and confirmed, so that the quality of the products can be checked before leaving the factory.

Thirdly, the Procurement Department sends technicians or experts to carry out regular or irregular supervision and inspection of suppliers according to the actual situation. Through supervision and inspection, we can fully grasp the comprehensive ability of suppliers, discover their weaknesses in a timely manner and urge them to make improvements.

Fourthly, materials are effectively inspected and accepted. Strictly in accordance with the system, regulations, standards and procedures, carefully carry out inspections and take full responsibility for the materials inspected. The acceptance of the variety, specification, quantity and quality of the incoming materials must be accurate.

Fifthly, the equipment monitoring and reporting system is combined with the regular inspection system for key and critical equipment, combining the advantages of both to provide better supervision and control of key quality points of the equipment throughout the manufacturing process.

3. Strictly check and review the effectiveness of the implementation of the procurement quality plan

During the implementation of the procurement quality management plan, check and review the effectiveness of the third party's implementation according to the quality plan. Develop countermeasures for capacity bottlenecks in manufacturing plants, such as alternate suppliers, without sacrificing quality or passive acceptance.

Acceptance is carried out in strict accordance with the process and specifications. The Purchasing Department organises purchasing quality control engineers, the Quality Management Department, the Project Department, the Supervision Unit, the Contractor, the Supplier, the Commodity Inspection and other corresponding personnel to carry out the unpacking and inspection of the equipment, to form the acceptance report (with a list of problems), and to be dealt with by the purchasing quality control engineers, and

to be allowed to enter into the warehouse after passing the inspection.

4. Timely handling of deviations in procurement quality management

When the field implementation situation deviates from the quality plan, the person who finds out the deviation items and organises the relevant personnel to analyse the reasons for the deviation items, puts forward the improvement or rectification plan, and completes the plan in a fixed number of persons and at regular intervals; if the pro-quality management plan is not formulated reasonably, it should be fed back to the person who formulates the quality plan, so as to revise and improve the level of the quality plan.

Rectification notices are issued in response to problems, and the implementation of the problems is strengthened. Regular assessment of suppliers, assessment ranking, for more than two consecutive times ranked last supplier, to take orders, terminate the strategic cooperation and other punitive measures. It is strictly prohibited to conceal and privately deal with supply quality problems, and suppliers are severely held accountable.

4.3.5 Optimisation measures for project construction quality management

Construction quality management is the main battlefield of petrochemical engineering project quality management, involving a large volume of works, many personnel and equipment, complex operating environment, and is the most complex and most prone to quality problems in the whole life cycle of engineering projects. Therefore, the management of construction quality is the core of project quality management, plays a role in the whole project quality management, is the largest investment, configuration resources of the most quality control links(Xia Dan, 2019),The following optimisation measures are taken for the construction quality management problems.

1. Optimising the construction quality management plan

(1) Continuously revise and simplify the quality management documents, simplify and revise 54 quality management regulations into 38, through simplifying the documents, highlighting the core, landing the system, and strictly enforcing it, so as to realise the change from having many laws to having laws to follow.

(2) According to the current contractors, supervisors generally exist technology, quality management skills, self-study standard willingness and ability to insufficient problems, the preparation of illustrated, simple and easy to understand technical briefing documents, "H Group Limited Industrial Park Typical Specialty Construction Procedures and Quality Control Documents Compendium" includes 25 petrochemical specialties / processes typical of the construction work, the document a total of 932 PPT, 92000 The document contains 932 PPTs and 92,000 words, which can be used by the contractor's management directly to give instructions to the operating personnel. Prepared "Compilation of Construction Detail Management Requirements for Project H", which contains 17 construction detail guidance documents with more than 21,000 words, which can be directly used by contractors to reduce their time and energy for learning in the complicated standards.

(3) use the quality of the monthly meeting to share the opportunity to share in the form of PPT quality typical accident cases and typical problems 22 times, almost covering all the typical construction operations of petrochemical industry, the units involved in the construction of a few PPT as long as simple to learn the key contents of such typical operations, basically, can be mastered.

(4) Accelerating the revision of the system based on feedback, adopting mutual feedback to collect the opinions of contractors and supervisors through various channels, such as the exchange meeting, and adjusting and revising the quality management plan and related systems. For example, the annual quality management exchange meeting in 2019 was attended by a total of 22 units, including 8 supervisory units and 14 contractors; superintendents, project chief engineers, technical leaders, etc.; a total of 116 opinions and suggestions were collected, of which more than 10 have been implemented on the ground.

2, through the process of testing software systems, SQP platform to achieve the application of quality data analysis

(1) Adoption of a process testing software system for quality management and enhancement of the level of implementation

In 2020, the total welding equivalent of H Group Limited Park 3,702,340,000 inch

diameter, the total number of 678,372,000 sheets of film, inspection of welded joints 160,840,000, film a pass rate of 98.37%, welded joints a pass rate of 97.87%, the qualification rate is stable, the quality of control. However, there are still: unfused, round defects, bar defects accounted for a large proportion of the overall proportion of unfused defects showed a downward trend, round defects with environmental changes fluctuations and other important issues. The main reasons for defects are not clean bevel cleaning, low temperature rain and snow, windy environment protection measures are not in place. In this regard, the unfused should strengthen the inspection and control of the wrong side of the mouth, especially the inspection of the wrong side of the group of large diameter welded joints; by strictly limiting the positive and negative deviation of the pipe and fittings to solve the problem of the wrong side of the group of pipelines; round defects, strip defects should be strengthened to clean the bevel of the inspection efforts, especially for the shackle alloy, aluminium and magnesium alloy bevels should be cleaned with an organic solvent, to ensure the cleanliness of the bevel. Strengthen protection measures in winter and rainy seasons to ensure a good environment. Formulate a general process for defect rectification and treatment, and clarify the responsibilities of related parties.

(2) Enabling data analysis of quality issues on the SQP platform

The use of SQP platform, using a variety of quality analysis methods, to provide support for the quality control of the project, through the data analysis of quality issues for research and judgement, it will be able to derive the trend or probability of fluctuations in quality issues, in order to manage personnel to better quality management, 2020, the site welder turnover rate is higher than 10%, and the same industry in the country with the large-scale construction, the welder demand for the environment is positively correlated to the welding, resulting in welders The turnover of welders is more frequent. Annual total assessment of welders 5169 people, qualified 3151 people, qualified rate of less than 70%, the number of welders increased, the quality is declining, the need to strengthen the welder, welding management.

3. Improvement of quality problem prediction and diagnostic capability with evidence-based scientific thinking

Evidence-BasedPractise (Evidence-BasedPractise), also known as Evidence-Based.H Group Ltd. engineering and construction application of evidence-based theory and practice is still in its early stages, this study in the welding qualification rate of evidence-based exploration, the main applications are as follows:

(1) to capture the essence of welding, proposed welders to take the initiative to find out their own identification of welding defects, still according to all qualified to give incentives, welders are clear that there are no defects in the welding process, welders want to be rewarded and recognised.

(2) Search relevant practical experience, databases, and find all the evidence possible to solve this problem, and formulate the welder's reward system "Pipeline Welding Quality Assurance Measures and Rewards and Punishments Implementation Rules".

(3) Through the questionnaire of 53 welders, let the welders evaluate the fairness and reasonableness of the system before the implementation of the system, and analyse and summarize the best methods and approaches that can improve the welding pass rate.

(4) After fully communicating with the welders, balance the progress and benefits, and propose the most operational programme for practice; and based on the analysis and research of the evidence-based theory on welding quality problems, summarize and evaluate the effect of the theory's practice.

This study has been thinking, due to the welded joints detection is not 100%, generally 10% or 20% sampling, even if a pass rate of 98%, according to the probability of 2% of the welded joints are unqualified, from the pursuit of a high pass rate, to want to find more unqualified welded joints and to make it into qualified, to reduce the number of unqualified joints in the untested welded joints, the development of the welder's own point of non-destructive testing of the mouth of the "pipeline welding quality assurance Measures and rewards and penalties for the implementation of the rules", their own point of mouth found themselves welded unqualified welded joints not only do not punish, but also according to the 100% qualified reward, through the practice of 2020, initially achieved the desired results, so that the untested part of the welded joints of the sampling of the qualified rate gradually increased.

4. Allocate resources to address construction quality management deviations in a timely manner

Group H Ltd. deals with deviations from the construction quality programme in a timely manner by carrying out effective monitoring and measurement before, during and after the construction of projects.

Prior to the establishment of a quality management system, not through the Engineering Management Centre system of the initial assessment of the unit, will not be allowed to start work. If unauthorised work is found, the construction unit will be deducted A yuan. At the same time on the general contracting unit deductions B yuan; not in accordance with the requirements of the establishment of quality management organisations, units are not allowed to start. Found unauthorised start of work, the construction unit deduction B yuan. At the same time, the general contractor shall be deducted C yuan.

In the matter of the full-time quality management personnel can not meet the needs of the site work, the lack of a deduction D yuan; did not collect or prepare the release of the relevant quality management system documents, each deduction E yuan; did not set up or fill out the relevant records, each deduction F yuan; testing equipment can not meet the needs of the site, each deduction G yuan.

Continuously optimise the quality management of projects under construction after the fact, and solidify and implement good practices. When deviations from the quality plan are detected, corrections are made in a timely manner to maintain the implementation of the quality plan. Corrections are made in the following areas to optimise quality management methods:

（1）According to the economic loss, the quality accident level is divided, the investigation team is formed according to the accident level, the investigation report is formed, and the responsibility is pursued according to the system to ensure the implementation of the problem handling. Accident level is shown in Table 4-2.

Table 2 Table 4-2 Quality Accident Classification Table

hierarchy	Basis for grading quality incidents
Level 1 quality incident	Quality accidents with direct economic losses > 10 million yuan
Level 2 quality incidents	5 million yuan (direct economic loss of W10 million yuan)
Level 3 quality incident	500,000 V direct economic loss W5 million quality incidents
Level 4 quality incident	50,000 V direct economic loss W500,000 quality incidents
Level 5 quality incident	5,000 W direct economic loss W $50,000 quality incident

(2) Configure full-time quality management personnel for key and special processes, ensure due diligence and fulfilment of responsibilities by presetting fines, and implement the problems found in the major inspections, such as configuring qualified welding quality inspectors according to the ratio of 25:1 for the number of welders.

(3) the establishment of a variety of resources to ensure that a variety of tests, inspections and timely processing, such as cooperation with the China National Weapons Industry Institute of 52, in the fastest possible time for a variety of welding specimens for mechanical properties test, to ensure that the implementation of monitoring and measurement of the work of promoting

4.3.6 Optimisation measures for quality management of project project acceptance

1. Optimise the project acceptance quality management plan

Acceptance is not only a routine part of the project, or the end point of data preparation and archiving, but also a means of control with the end as the beginning, which needs to be set in the beginning stage of the project to set control objectives, and then implement them one by one and step by step in each stage of the project implementation. First of all, according to professional characteristics, the development of professional acceptance of quality plans, the preparation of practical and meet the mandatory provisions of the construction project inspection and test plan; secondly, the

device according to their respective engineering characteristics or priorities, to develop a focused, targeted special quality acceptance plan; project acceptance of quality management is through the whole process of project implementation, according to the different professions, the progress of the work process, do a good job in the training of technicians, the implementation of a good inspection and test plan. The implementation of a good inspection and testing programme. Unit project division should consider the acceptance, completion of the rationality of the group volume, the development of materials testing plan, strict implementation of the quality control point acceptance plan and sub-parts of the acceptance plan. Different projects, according to the project quality management focus, individually formulate the acceptance plan for key parts, for example:

(1) In the hot and cold zones of ethylene cracking, acceptance management should be strengthened by focusing on the processes of disassembling, installing and coiling of large multi-stage compressors, and the control points can be adjusted to level A or AA if necessary (the Quality Management Department of level AA is involved in acceptance).

(2) For the cracking furnace area, the focus of acceptance quality management should be on the prefabricated installation, welding and heat treatment of the furnace tubes.

(3) ball tank construction, quality acceptance should focus on the welding of special materials, heat treatment.

(4) In the construction of vertical storage tanks, the quality acceptance focuses on the impermeable construction of the tank foundation. Each device in the preparation of acceptance quality plan, should refer to different professional, process construction plan preparation acceptance plan, should fully consider the site construction on the acceptance of the impact of the work, and do a good job to dispose of the plan to avoid contradictions, for example:

(5) For prefabrication of steel structure and pipeline, implement the process of prefabrication and then anticorrosion to reduce the workload of on-site patching and avoid acceptance of a large number of on-site anticorrosion processes.

(6) Strengthen the work of the installation unit and the detection unit to communicate, improve the efficiency of the use of construction scaffolding, and strive to achieve the speciality of specialised work, reduce the need for additional scaffolding of the detection unit, and improve the efficiency of the detection operation.

2. Increase the implementation of project quality acceptance

(1) The quality of acceptance is the last link of project quality management, and all relevant parties of the project should pay attention to the control of acceptance. In the quality management system, it should be clear that the acceptance of the responsibility of the main body, clear acceptance of the work of the staff, to avoid acceptance of the work in form.

(2) Regular organisation of quality inspection, inspection should pay attention to the inspection of construction data, first check the data and then check the site; at the same time in the acceptance of branch projects, pipeline pressure testing, equipment testing before the requirements of the required quality assurance information must be complete.

(3) Introducing information management software, scanning and uploading contractor and supervisory information to the platform after signing is completed, and supervisors and the project department will strengthen the process of checking to ensure the implementation.

3. Strengthening compliance monitoring of quality acceptance procedures

(1) construction units and supervision units to strictly implement the acceptance system, the construction in order to timely, true and correct completion of the acceptance process. Especially need to conceal the process and later difficult to rectify the parts, should be 100% complete inspection, the formation of a complete acceptance record.

(2) Make use of the platform's resources to implement online graphic records of quality acceptance, fill in acceptance reports through hand-held devices, upload photographs of on-site records, form acceptance quality data, and simplify the preparation and collation of acceptance records.

4. Timely handling of deviations from acceptance results

(1) Weave professional exchange meetings, standardise technical briefings, carry out acceptance professional and technical training for on-site construction personnel and quality management personnel, improve personnel management level, and strengthen the three inspection system of construction units. Clarify the relationship and role of self-inspection, flat inspection and final inspection in the project, and improve the project quality acceptance rate.

(2) If the process information is not accepted, it shall not be allowed to enter the subsequent work, so as to ensure that the information is timely and complete. To synchronise the information with the construction of the project, effectively shorten the finishing time of the handover information after the handover, and ensure that the handover information will be reported to the owner's archive room three months after the handover after the completion of the supervisory review.

(3) in the contract will be the project process acceptance quality, the delivery of the quality of acceptance, completion of the quality of acceptance as the focus of the assessment, the main divisions of the project, the unit project progress payment should be attached to the acceptance of the information of the signing of the document, or not pay, strict assessment efforts to ensure that the acceptance of the deviation from the problem of the handling of the efforts

4.4 Guarantees for the implementation of quality management optimisation measures for projects of Group H Ltd.

How to ensure that the quality management of the project of Group H is optimised? In addition to quality management optimisation in the five areas of "man, machine, material, method and environment", Group H Limited has formulated various quality management optimisation safeguards, mainly including: organisational safeguards, institutional safeguards, technical safeguards and team competence safeguards, which are described in the following paragraphs.

4.4.1 Organisational safeguards

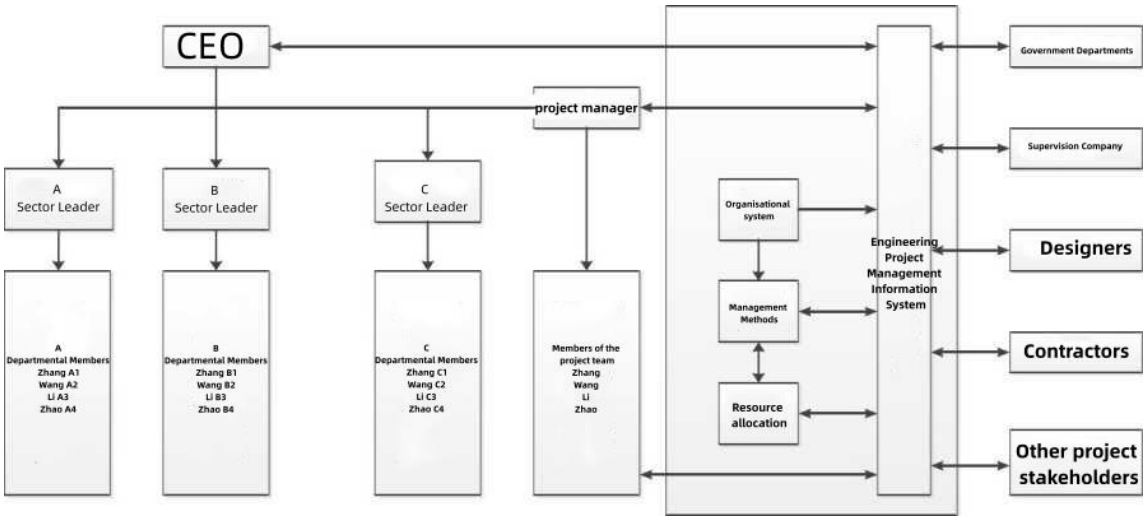
Setting up a suitable project management organisation is the basis for optimising quality management, and an efficient organisation is the guarantee for the success of

the project. The existing quality management organisational structure is often aimed at quality control in the design, procurement, construction and acceptance stages of petrochemical engineering projects, and lacks a corresponding overall coordinated management system. This has led to the fact that quality problems in the design stage are often found only in the procurement stage or construction stage, and some quality problems have been temporarily suppressed and covered up, and cannot be solved in a timely manner (Li Qingfeng,2018). The basis of organisational guarantee is the establishment of an efficient quality organisation, without a good organisation, the quality intention can not be carried out to each link and each part of the implementation process, and it is difficult to achieve the quality objectives of the project, while a good organisational structure can effectively complete the objectives of engineering project management, effectively respond to a variety of changes, so that the quality management system operates normally to ensure that the quality objectives are achieved.

Project H takes the Engineering and Construction Management Centre as the highest management body to coordinate resource allocation. Due to the large volume of engineering and construction, with an annual investment of nearly 20 billion yuan in the ongoing construction works, involving more than 20 sets of installation works, and more than 20,000 participants in the construction works during the peak period, the appropriate organisational structure is the basic guarantee for the operation of promoting this huge construction system.

The engineering construction organisation of Group H Limited takes the project as the operation unit, establishes an independent project department for each project, takes the project manager as the organisation core, combines the resources of all parties, and realises the all-round and all-process smooth transmission of the project management information, which is connected to the Internet and is called the Network Adaptive Balance Mode. This new adaptive balance model to overcome the current project matrix type organisational model deficiencies, the project manager was awarded by the higher leadership than the other functional leaders high "half level" of priority, from the depth of the co-ordination of resource allocation, while the general manager and the functional departments from the horizontal better for the coordination of

resources for the project, this can ensure that the resources required for the project to be coordinated, the project manager is the core of the organisation, combining all the resources. This can ensure the deployment of resources needed for the project and solve the project conflict, based on this idea, the engineering construction management centre in the organisational restructuring, not only will the project department from the balance of the matrix adjusted to a strong matrix, and the use of the company's information technology construction advantages, the project department and the functional departments through the software, the Internet, the use of mobile phones or handhelds as mobile terminals management tools to set up the new Project organisation and management model as in Figure 4-2 (except for the project manager's authority and information technology other organisational structures are the same as the original construction management centre organisational structure)



4 Figure 4-2 Project management organisational model with interoperability

4.4.2 Institutional safeguards

The establishment of a system, need to take into account a variety of factors to ensure that it can be truly applied to the actual process of management to ensure the rationality of the system, the establishment of the relevant units involved in the quality management system approval committee.

In order to better achieve the project quality objectives and promote the implementation of the project quality management system, Project H has implemented a two-tier management system model from the owner's level: Tier 1 system: quality-

related management and technical documents prepared by each functional department of the company covering each project department; and Tier 2 system: quality-related management and technical documents prepared by the owner's project department for a specific project. In the preparation of the above systems, they are divided into different categories according to the management level of the documents, e.g., the first-level system is mainly divided into management manuals, procedure documents and management regulations according to the structure of the quality system documents.

4.4.3 Technical safeguards

Technical assurance, as the key support for the process management of engineering projects, plays an indispensable role in the realisation of project quality objectives. In the process of realising the quality objectives, Project H of H Group Co Ltd, by focusing on the grassroots technical assurance and introducing advanced intelligent tools, stood at the top to implement technical leadership for the project construction, promoted the technical upgrading of the supervisory management team and the contractors, and pushed forward the smooth implementation of the project to ensure the Stability and continuous improvement of project quality.

1. Basic technical security

(1) Harmonisation and improvement of the system for obtaining certificates of admission for welders

In order to control the welding quality from the source, H Group Co., Ltd. invested more than 1 million yuan in the construction of the welder's examination place, terminated the previous non-standard, non-uniform, by the contractor's respective organisation of the welder's examination, all the entry welders for a unified examination, selecting a professional welding supervisor to form the examiner resource pool, randomly selected examiners to organise the welder's entry examination. Ensure that the examination process is open, fair and transparent, which provides an important guarantee for the welding quality of H project.

(2) Realisation of a unified examination and certification system for post-weld heat treatment operators

Heat treatment, as a special control process to eliminate post-weld stress, stabilise

post-weld dimensions and improve mechanical properties of welded joints, plays an extremely important role in the quality of welded joints. For the current post-weld heat treatment operators do not have the national level of examination and certification requirements, heat treatment operators low entry threshold, in order to put an end to the operation of personnel who do not have the ability, H Group Co., Ltd. formulated a unified assessment of post-weld heat treatment operators to obtain a certificate system must be carried out to obtain a unified assessment of the certificate must be licensed in the process of operation, to ensure that the ability of the heat treatment operators to provide an important safeguard for the quality of heat treatment. This ensures the competence of heat treatment operators and provides an important guarantee for the quality of heat treatment.

(3) Centralised third-party film evaluation system for non-destructive testing

H Group Limited petrochemical engineering NDT tasks are undertaken by seven units, in order to ensure the timeliness and uniformity of the feedback of the evaluation results, the department set up a special evaluation room, under the organisation of the H Group Limited NDT engineers, seven NDT

The unit focuses on evaluating the film, evaluating it on the same day and issuing a report by 2 p.m. every day, and through this resource integration and effective supervision, the work of non-destructive testing has taken good results.

(4) Introduction of a fourth party for non-destructive testing

In order to standardise the operational behaviour of the NDT third party and ensure that the NDT one-time pass rate can effectively support the welding quality improvement and eliminate welding hazards to the greatest extent possible, the H Group Limited H project has introduced a fourth party for NDT, which is not responsible for the specific NDT tasks, but only randomly carries out random checking, rechecking and reset according to a certain proportion and the importance level of the pipeline, by which the supervision of NDT is carried out. The third party, found that the difference between the third-party testing pass rate and the sampling pass rate, not only verifies the authenticity of the testing unit's on-site testing and the accuracy of the evaluation of the film, but also, more importantly, enhances the quality awareness of the testing unit

and standardises the operational behaviour. Warning and deterring NDT third party, consolidating the last line of defence of welding quality.

(5) Adoption of industry-advanced work tools and processes to enhance construction quality

The excavation of the pump pit of the cave depot adopts a telescopic boom excavator, which greatly improves the excavation efficiency, increases the slagging efficiency by about four times, shortens the construction period by 50%, and significantly improves the construction quality.

In-service pipeline using hydraulic sand blasting process, water sand blasting machine is easy to operate, removal of higher efficiency, does not hurt the surface, can clean up a variety of shapes, large area cleaning, but also surface polishing treatment, rust removal of high quality, surface roughness is good, for large pieces of equipment rust removal operations with high efficiency, and good quality results.

2. Application of advanced intelligent tools

Constructing an information-based quality monitoring platform based on all parties of the project, adapting to the quality management of large and complex projects.

(1) Introduction of the Nobita Pipeline Welding Information Management System

Through the introduction of "Nobita Pipeline Welding Information Management System" of Nobita Information Technology Co., Ltd, we can carry out all-round and whole-process progress and quality management of pipeline welding in the whole life cycle of engineering construction:

Analysed statistical information from design institutes and construction contracts to assist in pre-quality planning for pipeline welding.

Welding quality management is assisted by welders' qualification management, face recognition issuance of welding consumables and other methods.

Welding progress management is supported by modules such as "Statistics" and "Dispensing Management".

Pipeline pressure testing management is assisted by the "Pressure Test Kit Audit" module.

Digital delivery is achieved to facilitate data traceability and operation and

maintenance of the construction unit after the project is completed.

Collaborate the construction, general contracting, construction, testing, supervision of various units to a platform for data sharing, flexible data exchange among units, timely and accurate information communication.

Reduce workload through direct import from design data into the system, customised reports, automatic generation of handover information, and electronic delivery.

Using mobile phone APP to achieve welding information pre-entry, face recognition collaterals, on-site inspection, inspection management, quality control point management.

Through big data analysis, the welding quality and progress of the next period (or project) is predicted and warned. Owners create specialised information platforms in project management, requiring that documents, drawings or changes, forms and data generated in the implementation of the project are uploaded to these information platforms and management software, in order to facilitate the integrated management and sharing of project information (Zhou Xiongjie, 2016).

(2) Introducing welding robots to improve welding efficiency and ensure welding quality.

According to the welding characteristics of vertical storage tanks, the introduction of a high degree of automation and good welding quality of Beijing Boqing Technology Co., Ltd. developed trackless automatic welding robot (HAT10-3B), in the H Group Limited for the introduction of the new pilot.

The welding robot adopts melting electrode mixed gas shielding welding (GMAW), using 80% gas and 20% carbon dioxide gas mixture, ceramic pad protection welding, welding bevel 30 degrees, compared with arc welding, welding deformation is small. Welding plate thickness of 10mm, horizontal welding efficiency of 36m/8 hours, vertical welding efficiency of 20m/8 hours, its welding torch comes with a wind shield, weld formation is better, the torch can be automatically adjusted within the range of 2mm, high welding efficiency, good welding quality. The use of automatic welding robots is the direction of development of tank welding, with the continuous progress of

technology to ensure high quality welding.

(3) Adopt SQP platform for data analysis and timely feedback to promote quality management improvement

With the development of the IT industry, more and more engineering software used in project management, engineering information management gradually from electronic to digital, intelligent direction, to provide a digital means of support for the management of the construction process of the project data is no longer limited to the progress, cost and other intuitive data, data style diversity, data records to obtain ease of access for the construction of quality management provides more data analysis, Management possibilities, in quality management, how to effectively use these data is also a project management to face a problem.

Taking the ethylene cracker of Project H as a real case study, it introduces how to use quality data with QC analysis method to find out the key factors affecting the site quality, promotes the optimisation of the site quality management method through the analysis of quality factors, and analyses the site quality situation by classifying and counting the sample data - the quality data of the ethylene cracker - and by using the methods of stratification method, Pareto chart, and Fishbone diagram.

By analysing the quality data and decomposing the quality problems, we can intuitively find the weak points of on-site quality and the key factors of quality problems. Aiming at the key factors, applying systematic thinking, formulating improvement measures and correcting management problems is an effective way to avoid the recurrence of similar problems.H Group Co., Ltd. identified the key factors of on-site problems through the analysis of welding quality management data and made corresponding adjustments to the management measures, which provided data support for on-site quality management. Subsequently, by improving the intelligent operation of quality data, it will continue to upgrade the intelligent analysis system and leave the complicated data analysis work to the software system to achieve real-time analysis and real-time control. Xiong Ying et al. analysed the current common problems based on ISO9004, and concluded that the effective integration of processes and management into the current intelligent management is the key to improving the quality management

level.

4.4.4 Team capacity assurance

Team ability is the ability to achieve the maximum efficiency of the team by giving full play to the team spirit, complementing and helping each other on the basis of team integration.The quality management team of H Group Co., Ltd. is rooted in the good corporate culture of H Group Co., Ltd. which not only needs to have strong individual ability, but also needs to have the ability to do their best in different positions and co-operate with other members. In the quality management of Yantai Petrochemical Project, while trying to improve its own ability and quality, the quality management team of H Group Co., Ltd. is doing its best to promote the team building of the supervisory units and contractors, carry out all kinds of quality and technical trainings, and form a good teamwork and co-operation with the departments, so as to escort the smooth progress of the project.

1. Team training and learning

(1) The Quality Management Department of Group H Limited organises various technical and quality training according to specialties.

Organize various professional supervision engineers, various contractors professionals, quality inspection personnel to carry out a variety of professional training, 30 training throughout the year, the organization of welder skills test 5,169 items, the organization of various units of management personnel, skilled workers into the factory exam 2,000 times, to enhance the awareness of the construction personnel, the level of consolidation of the foundation of quality management; organization of non-destructive testing of the fourth party to the third-party unit of non-destructive testing training, and its Negative reassessment of 25%, the number of sampling 80 times, sampling 20,000 negatives, to carry out third-party testing organisations review 12 times, to ensure that the testing unit standardised operation.

(2) Interdepartmental training and exchanges

The Quality Management Department of Group H Co., Ltd. conducts mutual-feedback training and exchanges with the Production Management Department, the Equipment Management Department, the Project Department and other departments in

view of the characteristics of each project under construction, so as to let the professionals speak out and gain a deeper understanding of the key points, weak links, etc. of the installations in a macro- and professional sense and work together as a gatekeeper for the quality of the installations.

(3) Invite famous experts and scholars in the country and industry to give lectures in the park.

In order to focus on the quality control of the park, the Quality Management Department invites experts and scholars in the petrochemical engineering and construction industry to come to the park to take the pulse of the quality, to find out the major and key quality problems that exist or may exist in the park through the professional ability and perspective of the experts and scholars, and at the same time to improve the skills and knowledge of the relevant professionals in the park through the training and lectures to better serve the quality of the engineering and construction. Professor XXX, a member of Boiler and Pressure Vessel Standardisation Technical Committee, Ms. XX, an expert in welding technology of petrochemical industry, and Mr. XXX, a senior technician enjoying the State Council's Special Skill Allowance, to come to Yantai to give lectures and guidance and take the pulse of the quality of engineering construction, which has achieved good results.

2. Information and communication safeguards

In the complex project information, effective information communication is crucial for project construction. petrochemical engineering projects have the characteristics of involving a large number of people, team temporary, etc., which puts forward high requirements for the correct and smooth communication of information, such as the lack of good information communication channels, will greatly hinder the realisation of the objectives of the project management. the management team of H Group Ltd. innovates information communication channels in the construction of projects. The management team of H Group Co., Ltd. innovates the information communication channels in the project construction, in addition to the conventional channels such as telephone and email, it improves the efficiency of communication by adopting new information communication channels such as handheld machine,

company manpower map and Wechat exchange group, and has achieved good results.

The following are the main channels to ensure information communication in the engineering and construction of Group H Ltd:

(1) Information is communicated by telephone and in writing. Daily work is communicated by telephone, and important matters or documents are communicated through written documents.

(2) Sharing of information through handhelds The handhelds based on the SQP platform independently developed by H Group Co., Ltd. use the 4G network to realise real-time checking of special types of work such as welders, launching of quality audits, and online rewards and penalties through editing, storing, photographing, calling, sharing, etc., which have greatly improved the organisation of on-site inspections and the feedback efficiency, and facilitated the efficient implementation of quality management.

(3) Independent WeChat group interaction. The establishment of independent WeChat groups for key and special quality processes on site to achieve resource sharing, instant arrangement and feedback of problems, such as the establishment of WeChat groups for heat treatment of special pipelines, WeChat groups for welding of ethylene cracking furnace tubes, and groups for welders' exams, etc., which greatly facilitates the relevant personnel's quality control of key and critical processes, and ensures the communication of information in a better way.

(4) Self-service mailbox system of the company's manpower map information. H Group Limited's manpower map information system registers and stores all kinds of information of all employees, supervisors and contractors of H Group Limited's main and key personnel, including information on the personnel's affiliation, position, profession and so on, so that the user can conveniently select through the manpower map to carry out the functions such as sending emails to each other or to a group of people with the relevant personnel, applying for and reviewing things, training or checking information release and event announcements. The user can easily choose to send emails or group emails, apply for and review things, publish training or inspection information, and announce events through the manpower map, which is out of the

simple mode of the original address book, and ensures smooth communication between various roles in project management.

3, teamwork and communication . H Group Limited Quality Management Department by professional division of civil construction, installation (including anti-corrosion), electrical instrumentation, three professional modules, three modules are both independent and unified, according to the mode of twice-weekly professional inspections and fortnightly joint inspections of different installations of vertical and horizontal full-coverage carpet inspection, induction and refinement of the root causes of a variety of quality problems and laws, and to guide the contractors to actively avoid quality issues It guides contractors to take the initiative to avoid quality problems and rectify and review to eliminate quality problems and hidden dangers, so as to better improve the quality of engineering entities.

Conduct joint site quality inspections between departments every fortnight to ensure that all departments from different angles to find and put forward a variety of issues affecting the quality of the site, to prevent the visual dead-end of the single professional, all-round to the quality of the construction process in advance to find and solve the quality of problems and hidden dangers

Chapter 5 Conclusions and Implications

5.1 Conclusions of the study

Quality management, as one of the important goals and tasks of project management, plays a decisive role in the success or failure of the project, and is also the focus and difficulty of project management research. This thesis carries out theoretical research and discussion on the optimisation of quality management of H project, and on the basis of the summary of practical experience and lessons learned in the first phase of the project, it implements the cyclic research of planning, execution, checking and improvement on the optimisation of quality management of the second phase of the project. The main results are as follows:

Through goal setting, establish a quality management system, define the responsibilities of all parties, and find the deficiencies after running in the actual engineering projects. Further in-depth optimisation, under the general principles, to establish a more suitable for specific projects to implement the guarantee of the management system. The project's organisational structure, resource allocation is the basis of the project organisation, which determines the strengths and weaknesses of the project's quality management. From the slightly more balanced matrix organisational model of the Phase I project, changing to the organisational model of the Phase II project with the project department as a strong matrix, and then to the exploration of the organisational model of the inter-adaptive project, the optimisation of the organisational structure has always been placed in an important position in the optimisation of the quality management of the project. The right to allocate project-related resources and resource quality has always been paid attention to in the project management optimisation study, which resulted in the strong allocation of resources by the project department and the second phase of the project operation mode in which the functional departments carry out resource gate-keeping in respect of their specialties and training and guidance to improve the quality of resources.

By sorting out and summarising the situation of the project implementation

process, identifying typical problems through various technical means, benchmarking the PDCA quality improvement cycle, benchmarking the problematic links, targeted analysis, uncovering the root causes of the problems, formulating optimisation measures, and further improving the improved management system. After the big framework is determined, strong implementation is the guarantee of the effect. In order to make quality management more predictable and turn the original passive management after the fact into active management before the fact, in the optimisation of quality management, checklists, histograms, Pareto charts, fishbone diagrams (cause and effect diagrams), and other quality analysis methods are used to analyse the data relying on the SQP (quality and safety monitoring platform), and to provide predictive judgments on the management of the quality based on the systematic thinking of the data statistics.

Through the four stages of design, procurement, construction, acceptance, the whole process of the project quality management optimization research, the H Group Limited Yantai Petrochemical Engineering Phase I project to summarize, systematic analysis and research, to avoid from a single professional, theoretical research of one-sidedness, not only can be very good for the specific problem of the right medicine, but also make the optimization program is systematic, complete, and comprehensively covers the project organization of the various processes, the whole All departments involved in the project reflect on their respective roles and efficacy in the system, and on the shortcomings, based on their own responsibilities, formulate optimisation measures for continuous improvement.

The specific implementation measures of organisational safeguard, system safeguard, technical safeguard and team capability safeguard are applied in the optimisation study of project quality management, and the correctness, advantages and disadvantages of the safeguard measures are verified, which provide a reference basis for the quality management of similar projects in the future.

5.2 Management Insights

Through the operation of PDCA theory in the quality management of H project,

combined with its specific implementation status in the four phases of design, procurement, construction and acceptance, as well as the expected results, it is believed that the key to solving the quality management problems is the systematic and perfect establishment of the system construction, the implementation of the measures, as well as the optimisation and improvement of the problem disposal and methods.

Doing a good job of planning, implementing, checking and disposing requires a variety of mature theories and methods for basic support, fusion of personnel management, skills and responsibility. The establishment of the system, the formulation of plans, and the clear responsibilities of personnel start from the root. For specific problems arising in the specific operation process to take different measures, absorbing advanced theories, methods, and clear problems in which part of the process, quickly make a judgement, strong implementation of the principle of disposal. Refinement of the quality management process to enhance the effectiveness of the quality of the entity details.

Quality management personnel need to keep optimising and improving all the time, both to guarantee the essential safety of petrochemical engineering projects and to achieve other management objectives of petrochemical engineering projects. If the systematic theory is combined with practical work in the daily work of the enterprise, it can play an innovative role in the workflow, efficiency, effectiveness, etc., improve the overall management level, and achieve high efficiency and excellence in project management and enterprise operation. Not only can it improve the management level of the enterprise, but also in the industry for other units to learn and improve the management level of the industry.

5.3 Shortcomings and prospects of the study

5.3.1 Shortcomings of the study

This thesis is mainly to H project as a research blueprint, through the system establishment and improvement, and its operational status description, through specific problems reflection, targeted optimisation of ideas and measures to ensure that this is inevitably too one-sided, there are limitations in all parties.

This thesis proposes a network of inter-adaptability of the project management organisational model, iterative improvement theory in the process, although there are applications, but due to the core by the nature of the elements of the limitations, such as in the "human" factor, the interests of all parties entangled under the pattern of the operation of the quality plan process will still appear some unforeseen problems, the relevant measures are still to be strengthened and improved. Improvement of relevant measures still need to be strengthened and perfected.

This thesis focuses on the theoretical research and problem analysis of the project implementation stage, such as the project decision-making stage, the design preparation stage on the impact of quality management work did not carry out in-depth thinking and research, and failed to go deeper from the source, the analysis of quality management work is inevitably disconnected, so the research results of the whole process, the whole lifecycle, the whole element of the quality of the research point of view is insufficient, and should be further improved and optimised.

5.3.2 Vision for the future

Through an in-depth understanding of the international advanced project management model, as well as the overall trend of mainstream engineering project management, we will make a brief outlook and planning for the future project management work from the following aspects, hoping that the project quality management can get a qualitative leap:

1. Operational aspects of the project: industrialisation

The EPC (Entire Process Contracting) model has become more and more suitable for China's national conditions, and the trend of single design/cost/construction/audit professionals becoming blue collar is becoming more and more obvious. And the requirements for the whole process management personnel, such as engineering management personnel, are getting higher and higher. The trend of eliminating a number of people and enhancing industrialisation is obvious. It is necessary to speed up the degree of resource integration, as well as the absorption and reserve of excellent talents, to ensure the optimisation of the quality system from the organisational point of view.

2. Information technology aspects: information technology

Expanded application of BIM model from single modelling and calculation to whole process management mode. Penetration from high-precision projects to ordinary engineering projects. Provide more excellent safeguards for quality management through the absorption and application of new technologies.

3. Engineering and technical aspects: industrial integration

The proportion of actual application of assembled buildings in China's construction sector will increasingly penetrate into the traditional building construction model. The proportion of the number of migrant workers will drop dramatically. The proportion of construction industry-type workers will rise dramatically. The construction technology means and the rapid climb of industrial type workers will bring new opportunities to the quality management of the project, and there will be a great improvement from the quality assurance.

With China's social and economic development, people pay more and more attention to product quality and project quality, the company needs to innovate project management, adopt excellent management mode, strengthen the training and absorption of personnel, the application of new tools, methods, optimise the project process management of information interaction mode. Management, quality management, quality management optimisation, managers will always be on the road, constantly growing, constantly improving, constantly improving, constantly moving forward, in the petrochemical engineering project quality management will certainly get a qualitative leap!

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