RESEARCH ON APPLICATION OF SIX SIGMA MANAGEMENT IN PROJECT MANAGEMENT

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ABSTRACT

Title: Research on Application of Six Sigma Management in Project Management

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Now, it's a time in a customer-centric and big data era, many companies need to meet the needs of their customers while also managing the quantitative management of customers and products and services for the long-term development of the company. This is crucial for most businesses. The Six Sigma management that developed from the 1990s is precisely such a way to determine the company's strategic goals and product development design with the customer as the main body, and pursue the management method of continuous improvement. The Six Sigma management is a statistical assessment method. The core is to pursue zero-defect production, prevent product liability risks, reduce costs, increase productivity and market share, and increase customer satisfaction and loyalty. Six Sigma management tools and procedures for process improvement and is one of the strategies for business management. It was originally founded by Motorola in 1986. Later, due to the promotion of Jack Welch, the eighth CEO of General Electric, Six Sigma became the core management thinking of General Electric in 1995 and is widely used in many industries today.

Nowadays, we will find that the development of a company is inseparable from the composition of large and small projects. The project is a temporary effort by the organization to use pre-determined resources for a predetermined period of time to produce a unique, pre-definable product, service or result. Project management, which

is the project manager, uses the system's viewpoints, methods, and theories under limited resource constraints to effectively manage all the work involved in the project. That is, planning, organizing, directing, coordinating, controlling and evaluating from the project's investment decision-making to the completion of the project to achieve the project's goals. In order to make the Project management smoothly and perfectly performed, it is particularly important to use correct and appropriate methods and theories therein. Among them, the application of Six Sigma management method in project management is a meaningful and guiding reference. In the actual development, many scholars have studied and discussed many of them. At the same time, many companies have applied Six Sigma management methods in the management of certain projects, such as Lenovo Group, which is also the first implementation of Six Sigma in China.

This paper tries to base on the grounded theory and case analysis, and through the collation and analysis of a large amount of data, to further study the application and significance of Six Sigma management in project management. This paper is divided into five chapters. The chapter 1 is an introduction. It mainly elaborates the research background, purpose, method and significance. The chapter 2 is a literature review. It mainly describes the content, core and theory of Six Sigma management, etc., as well as related to process and content of Project management. The chapter 3 is the research method. Through the analysis of a large number of documents and data, the contents, processes, and differences between Six Sigma management and project management are analyzed and studied. The feasibility and difficulties of the combination of the two are further studied. The chapter 4 is a case study. Through the application of Lenovo Group Six Sigma management in project management, the key factors and significance of the process are analyzed。The chapter 5 is conclusions and discussion suggestions. There are some suggestions about how to more effectively combine the two to make analysis and recommendations in the future.

Key words: Six Sigma Management, DMAIC, Project Management

摘 要

标题：六西格玛管理在项目管理应用上的研究

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如今，处于以客户为中心以及大数据时代下发展的企业，既需要满足客户的需求，又要为企业的长期发展做好关于客户和产品服务的量化管理。这对于大多数企业而言是至关重要的。而从 20 世纪九十年代的发展起来的六西格玛管理，正是这样一种以顾客为主体来确定企业战略目标和产品开发设计的标尺，追求持续进步的管理方法。六西格玛管理法是一种统计评估法，核心是追求零缺陷生产，防范产品责任风险，降低成本，提高生产率和市场占有率，提高顾客满意度和忠诚度。六西格玛管理用于流程改善的工具与程序，是商业管理的重要战略之一，最初于 1986 年由摩托罗拉创立。后来由于通用电气第八任执行长杰克·韦尔奇的推广，六西格玛于 1995 年成为通用电气的核心管理思想，今天广泛应用于很多行业中。

现今，我们会发现，一个企业的发展离不开大大小小项目的组成。项目是组织进行的一个暂时性的努力付出，在一段事先确认的时间内，运用事先决定的资源，以生产一个独特且可以事先定义的产品、服务或结果。而项目管理，是项目的管理者，在有限的资源约束下，运用系统的观点、方法和理论，对项目涉及的全部工作进行有效地管理。即从项目的投资决策开始到项目结束的全过程进行计划、组织、指挥、协调、控制和评价，以实现项目的目标。为了使项目管理顺利而完美地进行，在此其中运用正确而合适的方法和理论尤为重要。其中，六西格玛管理方法在项目管理上的应用是一个有意义和指导性的参考。而在实际发展中，有许多学者对此有许多的研究和探讨，同时也有许多企业将六西格玛管理方法应用在某些项目的管理之中，例如联想集团，而联想集团也是中国第一个实行六西格玛管理的企业。

本文试图以扎根理论和案例分析为基础，并通过大量资料的整理和分析，进一步研究六西格玛管理在项目管理上的应用和意义。本文分为五个章节，第一章节为绪论，主要阐述研究背景、目的、方法和意义。第二章为文献综述，主要讲述六西格玛管理的内容、核心和理论等等，以及项目管理的相关流程和内容。第三章为研究方法，通过对文献和资料的分析，分析研究六西格玛管理和项目管理

上的内容、流程和异同等，进一步研究两者结合应用的可行性和困难。第四章为案例分析，通过联想集团六西格玛管理在项目管理上的应用，分析其流程关键因素和意义等。第五章结论与建议，为今后如何更有效地使两者结合应用做出分析和建议。

关键词：六西格玛管理；DIAMC；项目管理

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CHAPTER 1
INTRODUCTION

1.1Research background and motivation

With the successful application of the Six Sigma management method in major companies around the world, more and more companies have introduced this management method one after another. The advantages of reducing production costs, improving product quality and customer satisfaction, and enhancing enterprise competitiveness have gradually emerged. At the end of the 20th century, Japanese companies fully entered the American market, bringing unprecedented challenges to American companies. In order to regain the product market, Motorola Corporation of the United States began to develop a quality improvement strategy. After conducting benchmarking against Japanese companies, the Japanese company's total quality management approach was introduced into the company to determine quality improvement goals. Six Sigma management was born in Motorola in 1987. In ten years, it not only eased the dilemma of the low market share of the enterprise's products, but also increased the profits of the company, becoming a model that has succeeded in using Japan's quality management methods in accordance with its own situation. With the successful application of the Six Sigma management method at Motorola, global companies began to pay attention to this quality management method. Global 500 companies including Microsoft, DuPont and Ford, as well as Japanese and Korean companies such as LG and Samsung, have started full implementation of Six Sigma management. In the early 21st century, Chinese companies also began to implement Six Sigma management within the company. Lenovo Group was the first Chinese company to implement Six Sigma management.

Project management originated from ancient engineering practices such as the Great Wall of China, the Pyramids of Egypt, and the ancient Roman water supply channel. In these large-scale projects, various resources were allocated, various plans were formulated, and the entire project was controlled and managed to achieve the project goals. All reflect the wisdom of the ancients using project management methods. With the advent of the era of knowledge economy and the era of big data in the 21st century, project management has moved from the earliest ancient engineering

practice to the modern project management stage. In addition to traditional industries, almost all industries and organizations such as high-tech, government, and public institutions are project management application practice is carried out. The development of project management is characterized by globalization, diversification, specialization, standardization and professionalism. The heat of project management is as described by the Chairman of the US Project Management Professional Qualification Committee: "Everything is a project, Everything will also become a project." The implementation of large-scale projects is a project, and the holding of small-scale meetings is also a project. The concept of project management continues to deepen and refine in the industry. The academic research on project management is also in full swing. Project management comes from practice. Its methods and technologies have been continuously improved and upgraded, and eventually it has been applied in many fields. Therefore, project management has a good ability to produce, study, and learn. The collaboration of production and research can further promote enterprise openness, innovation, and industrial upgrading.

Since the 1980s, with the development of global economic integration, intensified competition, and the development of information technology, especially network technology, many important management innovation theories and methods have emerged in the field of enterprise management. Project management is a branch of management science. The application of project management methods has attracted the attention of many industries. Six Sigma management is also a highly respected management method in the past three decades. Although different management theories focus on different issues and aspects, but from the development of perspective, various management theories are mutually inclusive and learn from each other. They show obvious convergence and have a basis for integration. At the same time, from the perspective of practice, enterprises need to achieve systemic and integrated management in order to achieve sustainable management innovation solution. Therefore, it is necessary in the analysis of the modern project management theory and method and summarizes the practice on the basis of enterprise success, study keep enterprise sustainable innovation management model, and studies the application of Six Sigma management in project management is a theoretical and practical significance for exploration.

1.2 Research purposes and significance

Six Sigma management is not only a management concept, but also a scientific

method for solving process problems. Different Six Sigma projects use different methods and steps. The DMAIC process improvement process of Six Sigma is through the inspection of the process, based on the data, making the process transformation more accurate and effective, reducing the product defect rate, and improving the market competitiveness of the company. Usually each Six Sigma project is a DMAIC cycle, which is commonly referred to as Six Sigma Improvement Five phases: Define, Measure, Analyze, Improve, and Control. DMAIC is the first letter of these five stages of English words. In accordance with the five steps of this process, we can effectively achieve Six Sigma breakthrough improvements. The team's work ranges from the presentation of a problem to the implementation of a solution. This includes many activities. Through the DAMIC process, team members can play the most effective role in completing the project's mission.

With the rapid development of various industries and the project management concept of enterprises becoming more and more mature, the project management application project management discipline has been diversified. Through the study of the evolution of project management disciplines, it analyzes the guiding significance of project management theory for practical application, combines the macro-policy and the background factors of the times, conducts a synchronic analysis of project management discipline theories, and explores what kind of project management basic theory has practical application. Significant guidance significance, analysis of what methods will follow will become the focus of the application sector, by summing up the basic theories and methods of project management to further promote the application of project management practices to expand into more industries, and promote industrial innovation.

The Six Sigma management method is based on the statistical analysis of data, and the continuous improvement and standardization of the process. The one-time characteristics and term characteristics of the project make it difficult to collecting, analyze and process the data. The lack of quantitative management in project management also deterred the use of Six Sigma methods in project management. However, this is exactly the significance and important line for the study of Six Sigma application in project management.

1.3 Research framework

1.3.1 Basic ideas

Based on the grounded theory and case analysis method, this paper adopts induction analysis method and analyzes and researches relevant literature and data of Six Sigma management and project management on the basis of review. Explain the relevant theories of Six Sigma management and project management and compare the similarities and differences between them. And analyze the feasibility and limitations of Six Sigma management in project management.

1.3.2 Grounded theory and Case study

The grounded theory emphasizes the promotion of theories from the data and believes that only a thorough analysis of the data can gradually form a theoretical framework. This is an inductive process. From the bottom up, information is constantly being condensed. Different from the general grand theory, the grounded theory does not logically deduct the hypotheses that the researchers set in advance, but starts from the data and conducts induction analysis. The theory must be traced back to the original data it produced. It must be based on empirical facts. This is because rooted theorists believe that only theories generated from the data have vitality. If theory and data are consistent, the theory has practical uses and can be used to guide people's specific life practices.

Based on the theoretical basis of the case analysis, this paper mainly discusses the theoretical exploration of Lenovo's Six Sigma management and the application of project management. Through these, we further analyze the feasibility and limitations of Six Sigma management in project management applications in practical applications.

CHAPTER 2
LITERATURE REVIEW

2.1 Six Sigma Management

The concept of Six Sigma (6σ) was proposed by Motorola's Bill Smith in 1986. This concept belongs to the category of quality management. Sigma (Σ, σ) is the Greek letter, which is a unit in statistics and represents the standard deviation from the mean value. The aim is to reduce the number of defects in products and processes during production, prevent product variation, and improve quality.

Six Sigma was started in the mid-nineties by GE to evolve from a Total Quality Management approach to a highly efficient technology for the design, improvement, and optimization of business processes, and to provide a series of technologies equally applicable to design, production, and Service New Product Development Tools. Then it goes hand-in-hand with GE's strategy of globalization, service, and e-commerce, and becomes the most important strategic measure for companies pursuing management excellence throughout the world. Six Sigma has gradually developed into a management philosophy that aims to determine the company’s strategic goals and product development design with customers as its main body, and pursues continuous improvement.

The theoretical core of the Six Sigma management law is the DMAIC process improvement model. DMAIC refers to a process improvement method that consists of defining, measuring, analyzing, improving, and controlling five phases. All activities are carried out around DMAIC. Every stage of DMAIC process improvement is supported by strong data statistics. Scientific methods are used to reduce process defect rate, eliminate deviation and improve process capability. Therefore, only by mastering the DMAIC process and improving the problem solving method can we better implement the six sigma quality improvement project, so as to create more value for the enterprise.

DMAIC is the most important and classic management model in Six Sigma management, focusing on the quality improvement of existing processes. All the professional statistical tools and methods involved in the management of Six Sigma management are in the process of every Six Sigma quality improvement project. The definition is to identify customer requirements and determine the key factors that affect customer satisfaction. Definition is to identify the customer requirements,

determine the key factors that affect customer satisfaction. Measurement makes it possible for quantitative management to make the application of statistical techniques and methods possible. Analysis is the use of a variety of statistical techniques to find out the root cause of the problem. Improvement is the key step to achieve the goal. Control is to control the deviation of major variables within the scope of license. The DMAIC model is a kind of operation method for implementing Six Sigma. It is operation procedure is closely combined with the cycle and working stage of the Six Sigma project. DMAIC model is not a one-time linear process from definition to control, and some techniques and methods are used repeatedly in the application. The application of DMAIC model is a circular process to realize the level of Six Sigma.

The Six Sigma management developed in the 1990s summarizes the successful experience of total quality management, refines the essence of the process management techniques and the most effective methods, and becomes a kind of management that improves the performance and competitiveness of the company. mode. The practice of the management law in Motorola, GM, Dell, Hewlett-Packard, Siemens, Sony, Toshiba and many multinational companies has proved to be effective. The Six Sigma system derived from Motorola has become one of the milestones in the development of quality management. Peter S. Pande., Robert P. Neuman., & Roland R. Cavanaugh (2014) point that Six Sigma is not a business fad tied to a single method or strategy, but rather a flexible system for improved business leadership and performance.

2.2 Project Management

Basically, the project management is not a mystery, organization and team activities to thousands of years of human behavior can be seen as Project management. Human activities can be divided into two categories: one is a repetitive, continuous, and cyclical activity called "operation", such as the mass production of certain products using automated assembly lines; the other is a unique, one-off activity called "project", such as any development activity, renovation activity, construction activity, and so on. OLAF PASSENHEIM (2009) pointed that it was just a few decades ago, in the 1950s, that modern project management was first seen as an individual within the area of economic sciences. Centurise back, so-called "projects" were finished successfully.

In this society, projects can be seen everywhere, from small gatherings to an

outing, a cultural performance, an educational activity, a construction project, and a development activity. Therefore, Project management is closely related to the development of society. HAROLD KERZNER (2009) believes that Project management is designed to make better use of existing resources by getting work to flow horizontally as well as vertically within the company.

The application of Project management methods has attracted the attention of many industries. The Project management discipline has constructed a relatively mature knowledge system and formed a series of methods. These theories and methods are applied in many fields. Since its development, Project management is a method and a tool. Project management provides a management idea and method. In companies that focus on repetitive day-to-day operations, if every job is viewed as a project, the use of project management is appropriate.

The main role of Project management in the organization is reflected in: ①The project manager alliance enhances the economic benefits of the project itself. Mainly through a series of professional project management activities such as controlling project costs, effectively allocating project resources, and enhancing the project team's production efficiency. ②Improve customer satisfaction. Through the successful implementation of the project, the customer's satisfaction with the project and even the company's overall service will be increased, thereby enhancing the company's market reputation and creating more potential business opportunities for the company. ③ Improve project personnel's comprehensive capabilities. In the project implementation process, the project members are effectively managed, and the potential and advantages of the members are fully utilized. In the project implementation process, opportunities are created for the development of the members' skills and the personal professional values of the members are enhanced. By enhancing the overall quality of members, the company’s overall strength and market competitiveness are enhanced.

2.3 Grounded theory

The grounded theory is a research method jointly developed by two scholars, Anselm Strauss and Barney Glaser of Columbia University. It is a qualitative research method that uses a systematic program to develop a guideline for a certain phenomenon and induce it to take root. The grounded theory is a qualitative research method whose main purpose is to establish a theory based on empirical data.

Researchers generally do not have theoretical assumptions before starting the study. They start with actual observations, sum up the experience summary from the original data, and then rise to the theory of the system. This is a method of building substantive theory from the bottom up, that is, to find the core concepts that reflect the essence of the phenomena of things on the basis of systematic collection of data, and then construct related social theories through the links between these concepts. The grounded theory must have the support of empirical evidence, but its main characteristic is not its empirical nature, but that it abstracts new concepts and ideas from empirical facts. In philosophical thinking, the grounded theory approach is based on the post-positivist paradigm, emphasizing falsification of the already constructed theory. The grounded theory emphasizes the promotion of theories from the data and believes that only a thorough analysis of the data can gradually form a theoretical framework. This is an inductive process.

The grounded theory's operating procedures generally include: 1) generating concepts from the data, and logging the data step by step: 2) continuously comparing data and concepts, systematically inquiring about generative theoretical issues related to concepts; 3) Develop theoretical concepts, establish connections between concepts and concepts; 4) theoretically sample and systematically encode data; 5) construct theories to achieve the integration of density, variability, and height of theoretical concepts.

As far as practical application cases are concerned, grounded theory research methods have been widely used in the fields of pedagogy, sociology, and psychology since their appearance. Richer (1975) criticized and questioned the studies on education made by sociologists at the time, and used grounded theory to explain elementary and junior high school students. Sahin T (2012) used procedural rooted theories to explore pupils' learning concepts and how they viewed them. The results of the study showed that students with a slightly worse family economic status thought that learning was a reason for employment, and the study data showed that learning was a passive one.

With the deepening of research, the applicability of grounded theory is continuously expanding. It is used to conceptualize the behavioral models that exist but are not easily noticed when they first appear, and form a difficult and relevant relationship with the research objects themselves. Explaining the theory of behavioral patterns, to dealing with some theoretical concepts whose connotations and extensions are not yet clear or still controversial, the rooting theory developed so far can also be used to deal with structures with very complex factor relationships. The charm of

grounded theoretical research lies in theoretical construction. Compared with quantitative research, it is more suitable to construct a larger scale theory that involves more concepts, more complex relationships between variables, and diverse forms.

2.4 Case Study

Case studies are the most commonly used qualitative research methods. Case studies have been produced and developed so far and have been widely recognized and applied in academia. Different scholars also defined it from different perspectives. Among them, Jennifer Platt (1992) pointed out abstractly that case studies are the logic of research design and must consider the fit of situations and research issues. Subsequently, Stake (1995) pointed out more concretely that the case study is a “boundary system”. The so-called bounded system refers to the time and space of the moving range. She may be an individual, a scenario, an event, an action, or a problem, but also is "an object" rather than "a process." Based on the previous definition, Yin, R.K. (2003) proposed a more operational definition of case studies. That is, when the boundary between the phenomenon and its background is not clear, an empirical study using multiple data sources to investigate the current phenomenon in the real world background.

Case studies generally include the following stages: 1. Preparatory stage; 2. Select the case and write the research plan; 3. Data collection; 4. Data analysis; 5. The formation of hypotheses; 6. Literature analysis; 7. Proposed research conclusions. Case studies help to create new theories, test theories with easier-to-acquire measurement tools and hypotheses that are easy to falsify, and case study conclusions may be more display-effective.

Case study is a very complete research method. It also includes unique design logic, specific data collection and unique data analysis methods. The research it takes is in real life, and phenomena and situations are often not clearly segmented or define. It can be divided into preparation phase, execution phase, and dialogue phase. Different phases have different work to solve different problems in the research process. In addition, the case study has its own unique "environment" for application. Its importance in academic research is no less than that of any other research method, and it shows its unique charm in various researches.

2.5 Lenovo Group

Founded in Beijing in 1984, Lenovo Group is a world-leading PC company engaged in computer development, manufacturing and sales of electronic products, diversification in the information industry, and global leadership. Lenovo is currently a conglomerate of the original Lenovo Group and the original IBM Personal Computer Division. It employs only 25,000 employees worldwide and has users in more than 150 countries around the world.

Currently Lenovo Group has become the world's fourth-largest personal computer manufacturer, and its customers have spread to approximately 150 countries worldwide. It is a company with a turnover of US$39 billion. Lenovo has become the most popular trademark on the global market with its diversified solutions, leading-edge computer products, its personalized design, and easy-to-use features.

Lenovo Group is China's first official company to introduce the Six Sigma Black Belt Training Consulting Project. Lenovo's understanding of Six Sigma management began in 1999 with the book "Jack Welch and General Motors." At that time, Lenovo was attracted by the immense changes that General Electric made in the book by implementing the Six Sigma Quality Program. In 2001, Lenovo introduced the Six Sigma method from Motorola, which was formally adopted as an important part of the continuous improvement system. After receiving the support from the senior management of Lenovo Group, assistant to the President and General Manager of the Quality Management Department, decided to introduce the Six Sigma Black Belt Project from Lenovo's internal agencies. At that time, the local trial of Six Sigma was set in five departments, namely, two factories, administrative logistics department, supply chain management department and customer service department, mainly manufacturing departments, and selected the first batch of black belt plans among the five departments. Train students and carry out a series of training.

CHAPTER 3
RESEARCH METHOD

3.1 Six Sigma Management

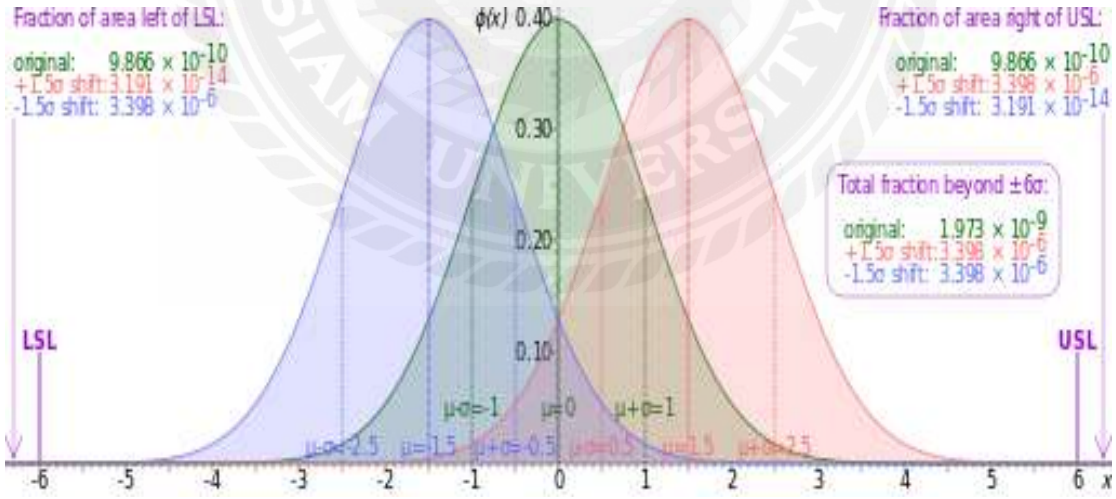
3.1.1 The definition and concept of Six Sigma Management

3.1.1.1 What is Six Sigma

The concept of Six Sigma (6σ) was proposed by Motorola's Bill Smith in 1986. This concept belongs to the category of quality management. Sigma (Σ, σ) is a Greek letter, which is a unit in statistics and represents the standard deviation from the mean value. The production process can be calculated using “Sigma”, which calculates the percentage of non-defective products in the product.

If DPMO is 3/4 million, that is, a 99.99966% pass rate, this is called Six Sigma. DPMO (ie, defect rate per million samples) refers to the chance of a defect within 1 million chances. In other words, Six Sigma means that 99.99966% of the products produced have no quality problems (3.4 defects per million).

Chart 3 - 1



Graph of the normal distribution, which underlies the statistical assumptions of the Six Sigma model. In the centre at 0, the Greek letter μ (mu) marks the mean, with the horizontal axis showing distance from the mean, marked in standard deviations and given the letter σ (sigma). The greater the standard deviation, the greater is the spread of values encountered. For the green curve shown above, μ = 0 and σ = 1. The upper and lower specification limits (marked USL and LSL) are at a distance of 6σ

from the mean. Because of the properties of the normal distribution, values lying that far away from the mean are extremely unlikely: approximately 1 in a billion too low, and the same too high. Even if the mean were to move right or left by 1.5σ at some point in the future (1.5 sigma shift, red and blue), there is still a good safety cushion. This is why Six Sigma aims to have processes where the mean is at least 6σ away from the nearest specification limit.

The table below gives long-term DPMO values corresponding to various short-term sigma levels.

Chart3 – 2

Sigma level	Sigma(with 1.5σ shift)	DPMO	Percentage defective	Percentage yield
1	-0.5	691,462	69%	31%
2	0.5	308,538	31%	69%
3	1.5	66,807	6.7%	93.3%
4	2.5	6,210	0.62%	99.38%
5	3.5	233	0.023%	99.997%
6	4.5	3.4	0.00034%	99.99966%

3.1.1.2 What is Six Sigma Management

The 6σ management method is a statistical assessment method. The core is to pursue zero-defect production, prevent product liability risks, reduce costs, increase productivity and market share, and increase customer satisfaction and loyalty. Six Sigma management focuses on product and service quality as well as process improvement. From the above we can see that "σ" is a Greek letter, used statistically to represent the standard deviation value, to describe the degree of deviation of the individual from the mean, the measured σ represents such as unit defects, 100 The probability of 10,000 defects or errors, the greater the value of σ, the fewer defects or errors. 6σ is a goal. This quality level means that in all the processes and results, 99.99966% is almost flawless, that is to say, doing 1 million things, of which only 3.4 are defective, which almost approaches to the most perfect realm humans can achieve.

In terms of its management implications, it generally includes the following three layers of meaning:

1. It is a quality measure and a goal to pursue.

2. It is a set of scientific tools and management methods that use DMAIC (improvement) or DFSS (design) processes to design and improve processes.
3. It is a business management strategy. Six Sigma management is a process innovation method that reduces the operating cost and cycle while improving customer satisfaction. It is a management method that enhances the profitability of the organization by improving the operating quality of the organization's core processes, and also competes in the new economy. Strength and continuous development ability of business strategy.

Six Sigma management concerns the process, especially the core process that provides value to the market and customers. Because the process capability is measured by σ, the larger σ is, the smaller the fluctuation of the process is, and the stronger the process is with the lowest cost loss, the shortest time period, and the ability to satisfy customer requirements. The 6σ theory believes that most companies operate between 3σ and 4σ, which means that every million operational errors are between 6210 and 66800. These defects require the operator to make up afterwards with sales of 15% to 30% of the funds. Or amend, and if you do 6σ, the funds made up afterwards will be reduced to about 5% of sales. It is worth noting that the 6 level is the ultimate goal of quality. However, for the average organization, it is not easy to achieve 6-level for each Six Sigma project, especially for those companies with low quality or those who have not been operating for Six Sigma. Achieving 3 to 4 quality levels is a very good achievement, which is enough to enable companies to significantly reduce costs, rapidly increase their competitiveness, and obtain satisfactory returns. This is the near- and mid-term goal of Six Sigma management. To achieve the ultimate goal of quality, we should learn to enjoy the results of each stage of project management, and gradually move forward.

3.1.2 Process and implementation procedures of Six Sigma Management

3.1.2.1 Process of Six Sigma Management

The Six Sigma model is a top-down approach to innovation that is led and driven by top corporate executives who propose improvements or innovations in goals, resources, and time frames. The implementation of the Six Sigma mode can use an improved process consisting of DMAIC. The DMAIC process can be used for the following three basic improvement plans:

1. Six Sigma product and service realization process improvement.
2. Six Sigma business process improvement.
3. Six Sigma product design process improvement.

This innovative approach emphasizes the use of quantitative methods and tools, emphasizing the detailed definition and quantification of satisfaction with customer needs. Each stage has clear objectives and is aided by appropriate tools or methods.

3.1.2.2 Implementation procedures of Six Sigma Management

Ⅰ Identifies core processes and key customers

With the expansion of the company's scale, customer segmentation is increasingly intensified, and products and services are more standardized. People's understanding of the actual work process becomes increasingly blurred. Obtaining a clear understanding of existing processes is the first step in implementing Six Sigma management.

1. Identify the core process. The core process is the most important department or operation to create customer value, such as attracting customers, order management, loading, customer service and support, developing new products or services, billing collection processes, etc. They are directly related to customer satisfaction. Correspondingly, processes such as financing, budgeting, human resource management, and information systems are subsidiary processes that support the core processes and are indirectly related to improving customer satisfaction. Different companies have different core processes and answer the following questions to help determine the core process:
(1) What are the main activities of the company to provide products and services to customers?
(2) How exactly are these processes defined or named?
(3) What are the primary outputs used to evaluate the performance or performance of these processes?

2. Define key output and customer objects for business processes. In this process, as much as possible, it is necessary to avoid stacking too many projects and work products under the “export” column so as not to cover up the main content and to lose focus on the work. For a key customer, it is not necessarily an external customer. For

a process, the key customer may be the next process. For example, the key customer of the product development process is the production process.

3. Draw the core flowchart. On the basis of identifying the main activities of the core process, the main activities of the core process are drawn into a flow chart so that the entire process can be seen at a glance.

Ⅱ Defining customer needs

1. Collect customer data and develop customer feedback strategies. Without a clear understanding of customer needs, it is impossible to successfully implement Six Sigma management. Even the internal auxiliary departments, such as the human resources department, must clearly understand the internal customer-company employees' demand conditions. The key to building a customer feedback system is:

(1) Treating the customer feedback system as an ongoing activity is regarded as a matter or center work that should be prioritized for a long period of time.

(2) Hearing different reflections from different customers cannot be viewed in a partial manner due to the special cases that are particularly impressive.

(3) In addition to regular customer feedback methods such as market surveys, interviews, and formalized complaint systems, new customer feedback methods such as customer rating cards, database analysis, and customer audits are actively adopted.

(4) Master the development trend of customer demand.

(5) For customer demand information that has been collected, in-depth summary and analysis should be conducted and communicated to the corresponding senior management.

2. Develop performance indicators and requirements descriptions. Customer needs include product requirements, service requirements, or a combination of the two. For different needs, performance indicators should be separately formulated. For example, in the packaging food ordering process, service requirements mainly include user-friendly ordering procedures, pre-notification services after shipment, and customer satisfaction levels after receiving goods. Product requirements mainly include: According to the time required to ship, use the prescribed transport tools to ensure that the product integrity. A requirement description is a concise and comprehensive description of the product and service performance criteria in a process.

3. Analyze and rank customers' different needs. Confirm what are the basic needs of customers, these needs must be met, otherwise the customer will definitely not produce a sense of satisfaction; what is the customer's variable demand, the better

done in this type of demand, the higher the customer's evaluation rating; which It is the potential demand of the customer. If some characteristic of the product or service exceeds the customer's expectation, the customer will be in an overjoyed state.

Ⅲ Evaluate current behavioral performance against customer needs

If the company has strong resources, it can perform performance evaluation on all core processes. If the company's resources are relatively limited, it should start with one or several core processes to conduct performance evaluation activities. The assessment steps are as follows:

1. Select assessment indicators. There are two criteria: ①These evaluation indicators are available, and data can be obtained. ②These evaluation indicators are valuable and are of concern to customers.

2. The operability of the assessment indicators is defined so as to avoid misunderstandings.

3. Determine the source of the data for the assessment indicator.

4. Prepare to collect information. For a sample survey that requires performance evaluation, a sample selection scheme needs to be developed.

5. Implement a performance evaluation and test the accuracy of the assessment to see if it is worthwhile.

6. Through the analysis of the errors reflected in the evaluation results, such as defective product rate and defective product cost, identify possible improvement opportunities.

Ⅴ Identify priorities and implement process improvements

Differentiate the processes that need improvement, find high-improvement opportunities, and prioritize improvements. If you do not determine the priority, companies can use various aspects to disperse their energies and affect the implementation of Six Sigma management. Business process improvement follows a five-step cycle improvement approach, namely DMAIC mode:

1. Definition. The definition stage is mainly to clarify issues, goals, and processes. The following questions need to be answered: What issues or opportunities should be focused on? What should be achieved? When did you reach this result? What process

is being investigated? It mainly serves and affects which customers?

2. Measure. The evaluation stage is mainly to analyzing the focus of the problem, using key data to narrow the scope of the problem, finding the key reasons leading to the problem, and define the core of the problem.

3. Analyze. Through the use of methods such as logic analysis, observation, and interview methods, the causes of the problems that have been evaluated have been further analyzed to confirm whether there is a causal relationship between them.

4. Improvement. A number of options for improvement are drafted. Through discussion and consultation in various aspects, the most ideal improvement plan can be selected and put into practice. The implementation of Six Sigma improvements can be a partial improvement of the original process; in the case of more existing process problems or greater inertia, it is also possible to re-engineer the process and introduce new business processes.

5. Control. According to the pre-determined control standards in the improvement plan, various problems that arise during the improvement process are solved in a timely manner so that the improvement process does not deviate from the pre-determined track, and a large mistake occurs.

Ⅵ Expanding and Integrating Six Sigma Management System

When a Six Sigma management improvement program achieves the goal of reducing defects, it becomes crucial to consolidate and expand the success of this victory.

1. Provide continuous assessments to support improvement. Widely publicize and promote this improvement program within the company to gain wide recognition of the company's management and employees, to reduce the resistance to further improvement; to implement the improvement plan into easy-to-understand texts for easy implementation; and to implement continuous assessments. Corporate management and employees are encouraged and confident in the results of the assessment; any improvement plan may have areas for further improvement, and strategies for dealing with potential problems should be formulated in advance and ready for further improvement.

2. Define process owners and their corresponding management responsibilities. The adoption of the Six Sigma management method means breaking the obstacles to the

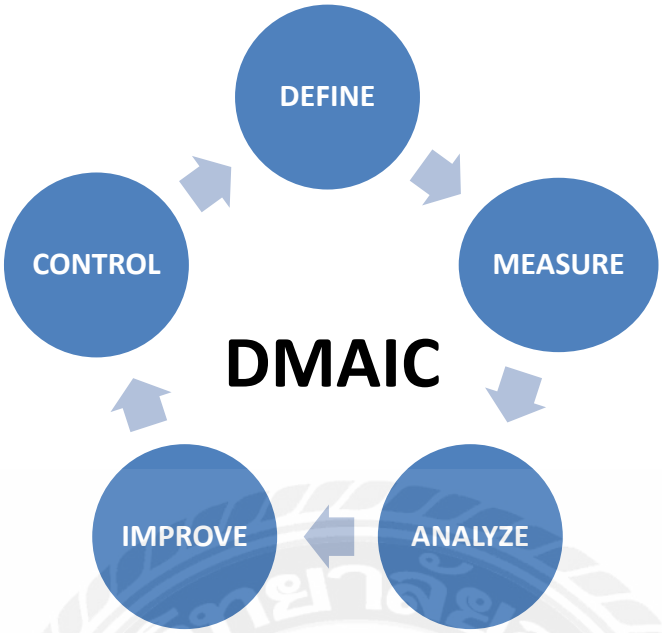
divisional functions of the original department. In order to ensure the efficient and smooth flow of various business processes, it is necessary to designate the person in charge of the process and clarify its management responsibilities, including: maintaining process documentation, evaluating and monitoring process performance, identifying possible problems and opportunities in the process, and starting and supporting new ones.

3. Closed-loop management was implemented and the Group continued to promote Six Sigma performance. Six Sigma management is a process of repeated improvement. The five-step improvement method needs to be used repeatedly in practice to form a closed-loop system with sound development, continuously improve the quality management level and reduce the defect rate. In addition, the management of Six Sigma starting from some core links also has a process of gradually improving the results and expanding the scope of improvement from point to point. According James R. Evans.; &William M. Lindsay. (2005) suggested that Six Sigma relies on the participation and teamwork of employees at all levels-from the lines to top management.

3.1.3 Six Sigma Management Based on DMAIC

The theoretical core of the Six Sigma management method is the DMAIC process improvement model, and all activities are mainly centered on DMAIC. Every stage of DMAIC process improvement is supported by powerful data statistics, using scientific methods and methods to reduce process defect rates, eliminate deviations, and improve process capabilities. The DMAIC project methodology has five phases:

Chart3 - 3



- Define the system, the voice of the customer and their requirements, and the project goals, specifically.
- Measure key aspects of the current process and collect relevant data; calculate the 'as-is' Process Capability.
- Analyze the data to investigate and verify cause-and-effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered. Seek out root cause of the defect under investigation.
- Improve or optimize the current process based upon data analysis using techniques such as design of experiments, mistake proofing, and standard work to create a new, future state process. Set up pilot runs to establish process capability.
- Control the future state process to ensure that any deviations from the target are corrected before they result in defects. Implement control systems such as statistical process control, production boards, visual workplaces, and continuously monitor the process. This process is repeated until the desired quality level is obtained.

The Six Sigma management solution is based on the DMAIC process. It covers the planning, organization, human resources preparation and training, implementation process and evaluation, application and management of related technology methods (including hard tools and soft tools) for Six Sigma management.

3.2 Project Management

3.2.1 Definition and concept of project management

The project is a temporary activity organized by the organization. It uses pre-determined resources within a pre-defined period of time to produce a unique and pre-definable product, service or result.

Project management is the project manager. Under the constraint of limited resources, the system's viewpoints, methods, and theories are used to effectively manage all the tasks involved in the project. That is, planning, organizing, directing, coordinating, controlling and evaluating from the project's investment decision-making to the completion of the project to achieve the project's goals.

According to the traditional practice, when a company sets up a project, at least there will be several departments involved in the project, including the financial department, market department, administrative department, etc., and different departments will inevitably produce during the operation of the project. Friction must be coordinated, and these will undoubtedly increase the cost of the project and affect the efficiency of project implementation.

Project management practices are different. The members of different functional departments form a team because of a certain project, and the project manager is the leader of the project team. Their responsibility is to lead their team to complete all the work on time and in a high-quality way, and to achieve the project without exceeding the budget. The manager of the project is not only the project executor. He participates in the project's needs determination, project selection, planning, and finalization. It also conducts projects on time, cost, quality, risk, contract, procurement, and human resources. All-round management, so project management can help companies deal with complex issues that need to be solved across the board and achieve greater operational efficiency.

3.2.2 Project management content and three elements

3.2.2.1 Project management content

1. Project scope management

It is the management process that controls the work content of the project in order to achieve the goals of the project. It includes the definition of the scope, the planning of the scope, the adjustment of the scope and so on.

2. Project time management

It is a series of management processes to ensure that the project is finally completed on time. It includes the definition of specific activities such as: activity sequencing, time estimation and time control.

3. Project cost management

This is to ensure that the actual cost and cost of completing the project do not exceed the budgetary cost and cost management process. It includes the allocation of resources, the budget for costs, expenses, and the control of costs.

4. Project quality management

It is a series of management processes implemented to ensure that the project meets the quality requirements set by the customer. It includes quality planning, quality control and quality assurance.

5. Project human resources management

It is to ensure that all project stakeholders have the ability and enthusiasm to get the most out of a series of management measures. It includes a series of work such as organization planning, team building, personnel selection and project team building.

6. Project communication management

It is a series of measures that need to be implemented to ensure the reasonable collection and transmission of project information. It includes communication planning, information transmission and progress reports.

7. Project risk management

The project may encounter various uncertainties. It includes risk identification, risk quantification, formulation of countermeasures, and risk control.

8. Project procurement management
It is a series of management measures taken to obtain the necessary resources or services from outside the project implementation organization. It includes project work such as procurement planning, procurement and procurement, resource selection and contract management.

9. Project integration management
It refers to the comprehensive and overall project management work and process that are carried out to ensure that the project work can be organically coordinated and coordinated. It includes the formulation of project integration plans, the implementation of project integration plans, and the overall control of project changes.

3.2.2.2 Project management three elements

In project management, the three most important factors are quality, duration, and cost:
1. Quality is a must and guarantee for project success. Quality management includes quality planning, quality assurance and quality control.

2. Progress management is to ensure that the project can complete the required process on schedule. Under the guidance of a large plan, each participating construction unit prepares its own decomposition plan to ensure the smooth progress of the project.

3. Cost management is the process of ensuring that the project completes the project within the approved budget, including the preparation of resource plans, cost estimates, cost budgets and cost control.

3.2.3 The form and process of project management

3.2.3.1 The form of project management

l. Set up a specialized agency for project management and conduct special

management of the project.

The project is large in size, complex in work, and time-limited; there are many uncertainties in the project, and there are many new technologies, situations, and problems that need to be continuously studied and solved; moreover, there are many departments and units involved in the implementation of the project, and they need to cooperate and coordinate with each other. Therefore, a separate agency should be set up for this purpose, be equipped with a certain number of full-time staff, and conduct special management of the project.

2. Set up full-time project management personnel to perform full-time management of the project.

Some projects are small in scale, work is not complicated, time is not too tight, there are not many uncertainties in the project, and there are not many units and departments involved. However, the outlook is uncertain, and there is still need to strengthen organizational coordination. For such projects, we can appoint full-time personnel: to coordinate management, to assist the relevant leaders of the enterprise to contact, supervise and inspect the tasks of the relevant departments and units, and if necessary, can also be equipped with assistants for full-time staff.

3. Set up the project manager to perform temporary authorization management of the project.

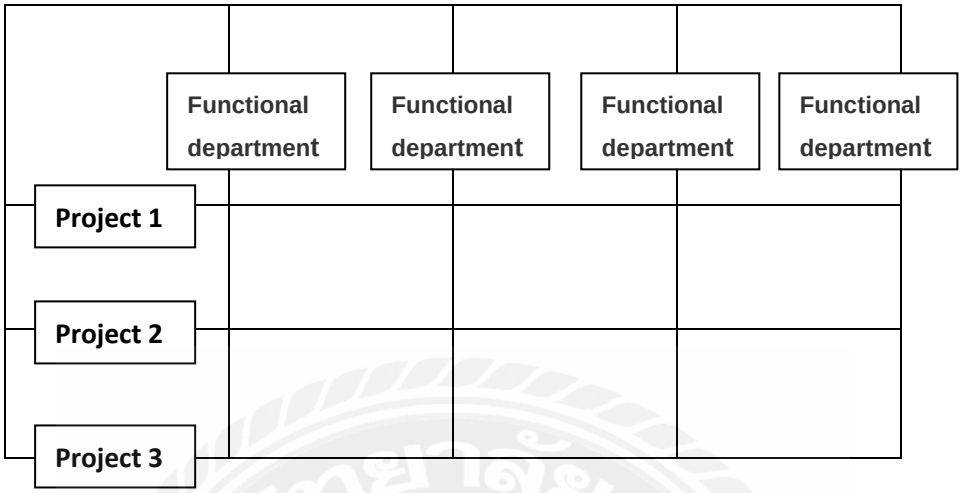
The scale, complexity, involvement, and coordination of some projects fall between the above two situations. For such projects, setting up specialized agencies is not necessary, and full-time personnel in setting up projects are worried about the lack of personnel and their strength is not easy enough. Or it may increase the amount of unnecessary management for the relevant leaders of the enterprise. The first form of special organization may be replaced by the designated competent authority. The second form of full-time coordination personnel may be replaced by the project manager and temporary. Given the corresponding powers, the competent department or person in charge fully assumes the responsibility for the planning, organization and control of the project while giving full play to its original functions or job responsibilities.

4. Set up the organizational structure of the matrix structure and conduct comprehensive management of the project.

The so-called "matrix" is the use of the concept of matrix in mathematics to combine multiple units into rectangles in horizontal rows. The matrix structure is a rectangular organization composed of two vertical and horizontal management systems. The set is a vertical departmental functional system, and the other set is a

horizontal project system made up of projects. Crossovers of the horizontal project system with the vertical departmental functional system in operation will form a matrix. As shown below:

Chart3 - 4



Each member of the matrix structure organization is to accept two aspects of leadership, that is, to accept the vertical leadership of the department in its daily work, and to accept the leadership of the project management department and the project manager when performing project tasks. Once the task of the project is completed, it will no longer accept the leadership of the project management department and the project manager. The organizational structure of the matrix enables an employee to be subordinate to several different leadership departments at a time, so it has duality and multiplicity. At the same time, it integrated the different professionals in the original vertical leadership system to complete the task of a certain project. On the one hand, it strengthened its strength, and on the other hand, it also helped mobilize its enthusiasm and ensure the completion of the project task. The advantages of the matrix structure organization form are: strengthening the horizontal business contacts of various functional departments, facilitating mutual coordination, having greater adaptability; facilitating the concentration of knowledge and skills of various specialized personnel, quickly completing a certain project task, and improving management The effectiveness of the management system has increased the flexibility of the management organization on the premise of maintaining a relatively stable corporate functional system.

3.2.3.2 The process of project management

Project management can be divided into five process groups. The main

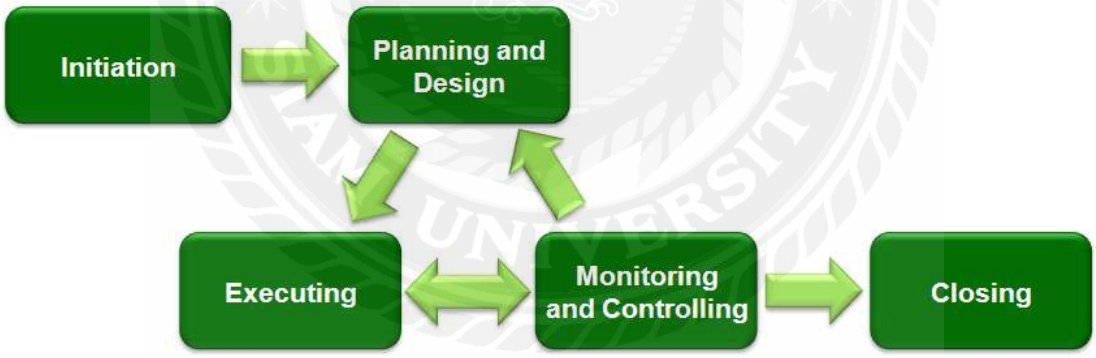
objectives of each process group are:
(1) Start-up process group: Define and approve the project or project stage.

(2) Planning process group: Determine and refine goals, and plan the necessary courses of action for achieving project goals and completing the scope of the issues to be solved by the project.

(3) Implementation process group: Coordinator and other resources to implement the project management plan.

(4) Monitoring process group: Measure and monitor performance regularly, and find out from the project management plan to take corrective measures to achieve the project's objectives.

(5) Closing process group: formally check the product, service or result, and orderly terminate the project or project stage. The project management process group includes project management sub-processes that are linked to each other based on their own evidence and results. That is, the outcome or outcome of a process becomes the basis for another process.
Chart 3 – 5



3.2.4 The advantages and importance of project management

From the above we can see that implementing project management is very necessary. It’s advantages and necessity are summarized as follows:
1. Properly arrange the progress of the project, effectively use the project resources, ensure that the project can be completed on schedule, and reduce project costs. Through the use of a series of project management methods and technologies such as network diagram, key path PDM, resource balance, and resource optimization in

project management, the task composition of the project can be formulated as soon as possible, and the sequence of tasks can be rationally arranged. The use of resources, especially the key resources and key resources in the project, to ensure the smooth implementation of the project, and effectively reduce project costs. If we do not use project management methods, we usually start a project blindly and arrange all resources in the project. There may be many bottlenecks in personnel and tasks, and at the same time, many resources will be left idle. This will inevitably cause Waste of resources and time.

2. Strengthen project teamwork and improve the combat effectiveness of the project team. The project management method provides a series of methods for human resource management and communication management, such as human resource management theory, incentive theory, and team cooperation methods. Through the use of these methods, team spirit can be enhanced, and the morale and efficiency of team members can be improved.

3. Reduce project risks and increase the success rate of project implementation. An important part of project management is risk management. Through risk management, the impact of project uncertainties on the project can be effectively reduced. In fact, these tasks are most easily overlooked in the traditional project implementation process and are also one of the factors that will have devastating consequences for the project.

4. Effectively control the scope of the project and enhance the controllability of the project. During the implementation of the project, changes in requirements often occur. If there is no good way to control, it will inevitably have a lot of bad influence on the project. In the project management, it is emphasized that the scope of control, the establishment of the change control board (CCB) and the change control system can effectively reduce the scope of the project change. The impact of the project ensures the smooth implementation of the project.

3.3 Analyze the feasibility of Six Sigma Management in Project Management

The Six Sigma approach to management is essentially a DMAIC performance improvement model—a customer-centric approach to analyzing problems and solving problems. It forms the basis of Six Sigma management theory, and all processes and activities are closely related to DMAIC. And the process of project management is

also the same. The entire process is customer-centered, and the completion of the project is achieved in the process of consistently satisfying the customer's quest and improvement. This is also the biggest common point between the two, although the management methods, processes, and forms of the two are different. However, based on this common point, Six Sigma management methods and management ideas can be applied to project management. The application of Six Sigma method in Project management also includes these five stages: definition stage; measurement stage; analysis stage; improvement stage; control stage.

Chart 3 – 6

1. Definition stage

The definition phase is the first step in the implementation of the Six Sigma project. The first step in this phase is to make clear: Who are our customers? What are the customer's requirements for completing the project? What are the problems we need to solve? How is the problem expressed? What is our goal? When should this goal be achieved? What are the key factors to solve this problem? What is the process of investigation? Who are the personnel and departments involved in the implementation? By thinking about and answering these questions in order to formulate DMAIC project plans to integrate into the entire project management process.

(1) Identification process and our customers

The key to the Six Sigma management approach is to identify the core processes and key customers. Through this step, you can understand the general structure of the problem and gain a clear understanding of the entire project. If we don't know what the customer really needs, can't truly understand the customer's needs, the customer's evaluation of us, we can hardly give them what they want. When we do not know what the problem is, we cannot solve that problem. The more accurate we define the problem, the clearer our goals will be and the more chances we will hit the bull's eye. If you only say ‘I feel uncomfortable’ to the doctor and the doctor doesn’t ask you

more questions or perform any checks, I'm afraid the doctor will not cure your illness. Therefore, to clarify the problem, we must first clearly define the problem. In the Six Sigma approach, we use all repetitive activities as a process to analyze their inputs and outputs in order to identify the key factors that affect our product and process capabilities. So where are our customers? A customer is a person who receives our products, who may be an external purchaser of our products or services, or may be the operator of the next process in our process. Six Sigma is process-oriented. It takes the product and service quality, cost, efficiency, customer satisfaction, customer loyalty, etc. as the output of the process. To make these results good, it is necessary to analyze the factors that affect the output of the input process. And control, that is, to grasp the "causes", continuously measure, analyze, improve, and control the key input variables in accordance with the characteristics of multiplicity, expansion, and continuity of the process, one by one, and one by one. To solve the problem, step by step to improve the quality characteristics, and continue to strive for perfect flawless direction.

(2) Define and clearly describe the problem

A project is to be supported by different departments and different people. Using a clear definition is a strong guarantee for other people to understand, communicate and support. This is like a manual we drafted for our products to ensure that everyone's understanding is consistent. A good project must be defined in the definition phase should have a complete definition and scope of the project, there must be no ambiguous fuzzy concept.

(3) The establishment of a team

The Six Sigma project was completed through teamwork. The project team is composed of the personnel involved in the project, such as: technology, production, engineering, procurement, sales, finance, management, etc. And the project team is generally composed of 3 to 10 people and should include the person management responsibilities for the improved process.

2. Measurement stage

The purpose of the measurement phase is to identify and record process parameters that have an impact on key process performance and products, measure current process capabilities and quality levels, identify where problems are and where they are, in order to develop improvement goals. There are many factors that affect quality, but usually only 20% are the key factors. Six Sigma management pays close attention to this 20% key factor, which is the key to seize the problem. At this stage, it is necessary to initially find out what are the key factors determining customer demand based on the defined issues. What indicators are used to measure it? According to the

characteristics of the indicators, a corresponding measurement system and collection plan for data and information are established. Through the testing of the current process conditions, the inputs affecting the process output are identified. The determination of the measurement method for project quality management can be divided into two categories, namely estimation and measurement, in terms of pre-management and post-event management. The estimation is based on the actual statistical survey data, and indirectly estimates and predicts the quantitative relationship and the prospect of changes in the matter based on the relationship between the things and their development rules. And metrics measure the differences between current things and standards based on specific criteria. Estimates need to be made when planning a project, and the process of tracking and monitoring during project execution needs to be measured. Good project management is mainly used to track and measure the project elements. By analyzing the measurement data, the problems existing in the progress of the project can be discovered in time, and the solutions can be formulated accordingly.

3. Analysis stage

The purpose of the analysis phase is to identify the key and potential causes of the performance indicators. Due to the complexity of the Six Sigma project, if there is no scientific data analysis, it is difficult to ensure that the true, fundamental causes can be found. Therefore, a variety of statistical methods and management techniques should be comprehensively used in the analysis stage to conduct statistical analysis, comparative testing, defect analysis, variation source analysis, key factor analysis, multiple mutation analysis, correlation analysis and regression analysis, failure mode, and effect analysis of data (FMEA), operation value-added analysis, etc. Discover and prove solutions or implementation solutions that you already know by using reasonable statistical tools from the Six Sigma “toolbox” to discover unknown problems.

(1) Confirm the existing capabilities of the process and define the goals of the process

The main task of the analysis phase is to use the measurement system to conduct status surveys and collection of receipts, make full use of all the information and data collected during the measurement, and determine the key inputs affecting the output through data analysis, that is, determine the key influencing factors of the process. Determine that the actual problem translates into a quantitative and statistical problem, define the problem more accurately once again, and clarify the difference between the status quo and the target.

(2) Determine the key factors to change the process capability

This stage requires the collection and analysis of the data obtained in the measurement phase, and on the basis of the analysis to find the source of the fluctuation, and put forward and verify the hypothesis of the causal relationship between the source of the fluctuation and the quality result. After the causality is clear, determine the determinants that influence the performance of the process. These determinants will become the focus of attention in the next phase of the improvement phase. The main task that should be completed in this stage is to grasp the problems to be improved and find the entry point for improvement, that is, the determinants of performance results. Team members need to analyze past, current performance data and define the direction of future performance. The collected data can be analyzed through various tools such as brainstorming, histograms, and arranging graphs to find an accurate causal relationship. At this stage, the team must
Be cautious, analyze potential problems by piloting on a small scale to determine what will happen and prevent the wrong trend.

(3) Specificity of Influencing Factors in Project Quality Management
The characteristics of the project lead to its easy quality variation. That is, the inconsistency of project quality data. There are two reasons for this variation: accidental factors and system factors. Occasional factors are randomly generated, objectively existed, and system factors are artificially abnormal. The variation caused by accidental factors has a minor impact on the quality of the project. It is a frequent occurrence that is difficult to avoid, difficult to identify, and difficult to eliminate. The variation caused by system factors has a large impact on project quality and is easy to identify. It can be avoided by taking measures. It can also be eliminated. However, in terms of project management, these two types of factors in different projects, because of different levels of personnel, the environment, and product requirements vary, so in the quality control of the project should take appropriate methods and means to identify the quality of variation and The difficulty in control is how to effectively identify and distinguish the above two factors.

4. Improvement phase
The improvement phase is mainly based on the root causes found in the analysis phase, boldly proposes problem solving solutions, and looks for solutions that optimize the process output and eliminate or reduce the impact of key inputs, thereby reducing process defects or variations.

(1) Propose a solution
Based on the analysis phase, we propose solutions to the key issues. The solution approach is to set benchmarks by using other people's good experience or tools

directly, such as the experience of the same industry. In the improvement phase, it is necessary to fully integrate the actual conditions of the company, whether there is a system of data management systems, whether to establish an enterprise resource management information system, whether to establish inter-plant quality assurance systems with suppliers, and so on. It is necessary to grasp the main issues, pay attention to feasibility analysis, employees' attitude towards change, and corporate leaders' support for improvement programs.

(2) Determine the optimal solution

The improvement step should start with the improvement plan that decides whether to remove or reduce the main factors affecting the results. Because not all possible improvements are equally effective, the project team must consider a series of possible improvements and then determine the most effective and appropriate one. The initial task of the team is to identify a variety of possible alternative solutions. Brainstorming is often useful here. The project team identified many possible improvements and they should evaluate the impact of each improvement on the problem and the business. After evaluating alternative options for improvement, breakthrough improvement teams often agree with the most promising solutions. Sometimes, the team will combine some of the features of several improvements to absorb their strengths. The improvement plan should be evaluated and screened, and some comprehensive evaluation techniques can be used to select the plan. For some engineering problems, DOE (Design of Experiments) technology can be used for process parameter optimization or product design improvement. At this stage, some non-traditional creative thinking methods are also very helpful. In order to ensure the success of the implementation of the plan, some local commissioning tests are needed when necessary to verify the improvement plan. In the conventional production of continuity, the periodicity and repetitiveness of its activities make it easy to apply the improvement plan to the next production cycle. However, the one-off features of the project cannot directly apply the improvement plan. This requires the in the selection of the program, full consideration is given to the factors of change applied at the time of different projects.

5. Control stage

The purpose of the control phase is to maintain the effectiveness of the improvement project. In the control phase, the process improvement document or work instructions must be updated in the quality management system, the process control system and the action plan in the absence of control should be established, and the statistical process control should be used. The technology monitors the process in real time. In addition, at this stage, it is an important task to further promote the project results to

other similar business processes. Since the personnel, environment, equipment, and products are changed in different projects, compared with the application in conventional production, it is particularly necessary in the control phase to constantly modify the product requirements standards, equipment parameters, environmental indicators, etc. Train people who influence the process.

3.4 Analyze the limitations of Six Sigma Management in Project Management

Six Sigma management is based on data and stable process control and solves problems that cannot be solved by conventional methods and simple tools. The lack of one-off features and quantitative basis of the project makes it difficult to use the Six Sigma method.

The Six Sigma method is a method that attaches great importance to data collection and analysis. All stages of DAMIC are based on the analysis of data. In the production process, this is not difficult to achieve, the production process has been determined, the customer's requirements for quality are clear and it is easy to measure accurately. However, in project management, project managers must often face sudden problems. Their solutions often have no precedents to follow. Management processes are often affected by many factors. The performance of many jobs is difficult to use clear data. Measured, if you want to clarify the problem more clearly, evaluate performance, and initiate improvement activities, the biggest obstacle is fuzzy data and data.

CHAPTER 4
CASE STUDY OF LENOVO GROUP

4.1 Introduction of Lenovo Group

Lenovo Group Ltd. or Lenovo PC International, often shortened to Lenovo, is a Chinese multinational technology company with headquarters in Beijing, China and Morrisville, North Carolina. It designs, develops, manufactures and sells personal computers, smart phones, workstations, servers, electronic storage devices, IT management software, and smart televisions. Lenovo is the world's largest personal computer vendor by unit sales since 2013. It markets the ThinkPad line of notebook computers, Idea Pad, Yoga and Legion lines of notebook laptops, and the Idea Centre and Think Centre lines of desktops.

Lenovo has operations in more than 60 countries and sells its products in around 160 countries. Lenovo's principal facilities are in Beijing and Morrisville, with research centers in Beijing, Shanghai, Shenzhen, Xiamen, Chengdu, Nanjing, and Wuhan in China, Yamato in Kanagawa Prefecture, Japan and Morrisville in the U.S. It operates a joint venture with EMC called Lenovo EMC, which sells network-attached storage solutions. It also has a joint venture with NEC, Lenovo NEC Holdings, which produces personal computers for the Japanese market.

Lenovo was founded in Beijing in November 1984 as Legend and was incorporated in Hong Kong in 1988. Lenovo acquired IBM's personal computer business in 2005 and agreed to acquire its Intel-based server business in 2014. Lenovo entered the smart phone market in 2012 and as of 2014 was the largest vendor of smart phones in Mainland China.

In 2001, Lenovo introduced the Six Sigma method from Motorola, which was formally adopted as an important part of the continuous improvement system, and became the first Chinese enterprise to officially introduce the Six Sigma Black Belt Training Consulting Project.

Lenovo Group divides Six Sigma management into three levels. The first level: Define the strategic goal of enterprise quality management: The customer-centered quality management concept is reflected in Lenovo's core values: serving customers, accurate and realistic, honest sharing, and entrepreneurial innovation. The second level is to establish a continuous improvement mechanism based on Six Sig's core around the entire process of product realization. The third level: support for strategic

goals, personnel training and development, quality information, quality costs, and cultural awareness. At the implementation process level, the continuous improvement mechanism is placed in a prominent position alongside the quality assurance system. The aim is to continuously improve the quality assurance system through the establishment of a continuous improvement mechanism. At the same time, Six Sigma management will be the core of the continuous improvement mechanism, so that Six Sigma management will be fully integrated with the company. The quality management system is integrated.

At present, Lenovo has established its own Six Sigma green belt, black belt training system and certification system, and has carried out extensive promotion and application within the scope of Lenovo Group Corporation. The specific implementation process of Lenovo Group Six Sigma adopts a combination of theory and practice, and it is very much focused on “doing high school”. After the first phase of training is completed, trainees are required to do the project. In each of the five stages of studying Six Sigma, the students must go back and do the project whenever they complete a course in the course of the course. Only after they have achieved the required degree can they come back to attend classes.

4.2 Application of Six Sigma Management in PM in the Lenovo Group

4.2.1 Theory exploration stage

At the beginning of Lenovo's promotion of Six Sigma management, they were also confused and contradictory. Because the division does its own project, the Six Sigma team has to do its own project. How do we cooperate? How to achieve a balance? This is also a point that Lenovo initially thought about and tried hard to find a breakthrough. In the end, they found that as shown in the figure below, there are strategies, core processes, and corresponding balanced scorecards in the business process. Each division has the ability, foundation, and experience to monitor and operate strategies, core processes, and KPIs. As mentioned earlier, in fact, Six Sigma is also a management method, as long as the core approach and thinking are integrated into the project management process. It can play a role in resource integration.

Chart 4- 1

Project authorization process
Weekly project training
Monthly project review
Reliable instrument panel
Project consolidation model

The following are two examples of examples in the Lenovo Lean Six Sigma Yellow Belt Training manual. It shows how the Lenovo group applied to the Six Sigma management method in a project, mainly the application of DMAIC process in the project process.

Chart 4- 2

Title: Excessive Time for Parts Delivery Area: Warranty Team, RTP Time Frame: 08/01/07-11/30/07 Team: Ima Example	**Define:** **Problem Definition:** Parts ordered are taking an excessive amount of time to be delivered to techs. **Why Selected:** An Authorized Servicer can experience downtime waiting on parts. The repair time takes longer, impacting repair turnaround time and customer satisfaction.

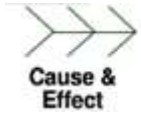
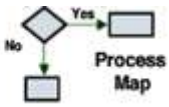
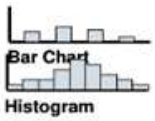
Analyze: **Tools Used:** Fishbone, Excel, Process Map   **Root Cause Findings:** No real time notice of when part will be available; No tracking of parts delivery status in AS database	**Measure:** **Before Measures:** Waiting time for parts can take up to 5 business days. **Objective/Goal:** Reduce wait time by 50%
Improve: **Actions Taken:** 1.created program so AS can track part delivery status; 2.trained parts delivery personnel to update availability status every day or when status changed; 3.ran pilot to test effectiveness and implement metrics for AS's to report average part wait time **Results/Savings:** Average wait time reduced 40%	**Control & Share** **Standardization/Sustaining:** Monthly reporting of average part wait time pulled for top 5% of Authorized Servicer. **Future Plans/Sharing:** Include next 5% AS in reporting in 6 months; share with sister teams in EMEA and LA.

Chart 4- 3

Title: Global Application Inventory Process Area: BT IT Team Time Frame: 06/01/07-10/15/07 Team: M. Overwhelmed	**Define:** **Problem Definition:** 35% of the global application inventory have completed into on all 17 required attributes; 90% of inventory directly affects critical Lenovo business processes **Why Selected:** To enable rapid Disaster Recovery, IT Security Compliance, and BT strategy.
Analyze: **Tools Used:** Fishbone, Excel, Process Map   **Root Cause Findings:** 1.No established metric to measure completeness and data quality; 2.No defined process in AP/J; 3.lack of defined roles/ responsibilities in AG; 4.Required knowledge not transferred or documented.	**Measure:** **Before Measures:** Completeness of required fields varied from 20-100%. Status was inconsistently reported 5-60% of time  Across functions **Objective/Goal:** Maintain 100% completeness on Defined required fields. Have no incremental resource hits to do it.

Improve:	Control & Share
Actions Taken: 1.Review to-be inventory add/ change and decommission, and ongoing review w/stakeholders to business apps; 3.Report metrics at SVP ops calls **Results/Savings:** All apps in scope have met required completeness; future apps apply reqs before approval and release.	**Standardization/Sustaining:** Monthly reporting reporting became standard part of Ops 9/15/07; distributed baseline and reporting to all SVP's 9/30. **Future Plans/Sharing:** Publish requirements on intranet site 11/30/07; distribute requirements to IT focal points in all geo's.

4.2.2 Practical application

The personal computer industry has developed rapidly in recent years. In 2017, global PC shipments totaled 259.5 million units, Lenovo ranked second, PC shipments reached 54.857 million units, and the market share was 21.1%. In addition to the main business of personal computers, Lenovo's products include servers and storage, printing, projection and consumables, digital products and options, service products and mobile phones. Since its acquisition in May 2005 of IBM's personal computer division, overseas expansion has continued to accelerate. Lenovo currently has branches in 66 countries, operates in 166 countries, and has more than 25,000 employees worldwide. Lenovo is divided into four regions: Greater China, Americas, Asia Pacific, Europe, Middle East, and Africa. Each district consists of functional departments, including production, transportation, supply chain, marketing and sales.

Before 2004, multinationals such as Dell and Hewlett-Packard who entered China had not yet adapted to the local market and did not form effective competition with Lenovo. But in 2004, their localization had a big impact on Lenovo's market share, especially in the area of large customers. Lenovo urgently needs to improve execution and core competitiveness to achieve better market performance.

In response to these challenges, Lenovo proposed a change in its original business model when it formulated a strategic plan in 2004, and used the project as the main method to promote the transformation of corporate strategy and business model. The specific measures are as follows:

First, project management is used as a means to implement corporate strategy:
1. After the completion of the strategic plan, some major tasks that need to be resolved across departments will be planned into projects that will be resolved

through strategic projects. Unlike strategic projects and R&D projects, value cannot be measured in terms of time and cost. It may be to open up new areas, solve problems, increase organizational efficiency, integrate strategic resources, and improve employee satisfaction and capabilities. There have been cases where strategic planning did not follow well. The implementation of strategic project management solved this problem. Strategic projects can be effectively implemented and translated into results.

2. Establish a Strategic Project Management Office (PMO) to unify management strategy projects. From 2004 to early 2005, Lenovo PMO established a project management system, including the organizational structure of the process and project management office, and determined the relationship between the strategic tier and the project management office, and the relationship between the strategic tier and the resource budget. The relevant specifications of Lenovo's other departments should comply with the PMO's macro specifications. The more detailed specifications are formulated by the business department. PMO did not interfere with the project administratively, but provided services such as training and established standardized processes. Employees treat PMOs as resources. Some companies have turned the PMO into an administrative agency as one of the reasons for its failure. The work of Lenovo PMO is very effective. The team won a good team award. Lenovo believes that the application of project management in the enterprise must meet certain conditions. First, companies face challenges, that is, external environmental requirements; second, high-level attention; and third, professional teams. The professional team can make a system that meets the corporate environment; fourth, the organizational culture. The organizational culture needs to have knowledge of the project management. Otherwise, it cannot be implemented when implemented.

3. The strategy has special fund budget support. There is no project budget after the completion of the previous strategic plan. But later, the company’s top executives outside the regular budget approved the budget for the project and the project also had bonuses. This guarantees the completion of strategic planning.

Then, attach importance to project management personnel:
1. Select excellent project management personnel to participate in project management professional (PMP) certification exams and application project management standards. The PMP® certification developed and managed by PMI (Project Management Association), the world's largest project management professional association, is the most authoritative and influential project management professional qualification certification in the world. PMP® certification is currently

the only truly globally recognized and universal project management professional qualification certification in the world, and follows PMI's guidelines for project management-project management knowledge system (PMBOK® Guide). The PMBOK® Guide has also been recognized and adopted by relevant authorities in the world. It is a recognized project management standard. After Lenovo acquired IBM, Lenovo's project managers needed a unified communication platform to manage the international team. As a common language in the project management field for people of different cultures, backgrounds, and countries, PMI's project management standards help Lenovo unify project management languages and implement standardized processes. Lenovo selected a group of talents from functional departments such as R&D and supply chain to participate in project management training and PMP certification examinations. After they returned, they became seed members, promoted project management in the functional departments, and trained other employees engaged in project management.

2. Internal implementation of project management advanced sequence. Lenovo's advanced sequence is matched with the overall human resources planning. From 2000 to 2001, the Lenovo Research Institute implemented a sequence, such as an assistant engineer, a deputy chief engineer, a chief engineer, and a chief engineer. Every year, experts are organized to comment on two dimensions. One is the level of knowledge, such as background and comprehension; the other is performance, such as the ability to innovate in research and development. In 2006, Lenovo began to do job grooming in the world. For example, the sales department has a sequence of assistant sales, sales managers, consultants, and so on. The sequence is linked to wages, but a certain percentage is specified. For example, a team's advanced sequence can only have 5%. A dedicated project manager can enter the project management sequence. Lenovo has more than 100 full-time project managers. But almost everyone in the company has done projects. The project management sequence establishes a career ladder for the project manager and provides a rising channel for the career development of the project manager.

Lenovo's practice in project management has effectively promoted the transformation of corporate strategy and the optimization of business models. Through the project approach, it is conducive to the establishment of team work and flat organization. It promoted the formation of team mechanisms and corporate culture, and promoted institutional innovation and international integration. Project management helped Lenovo improve execution and core competitiveness in the external market, thereby improving customer delivery efficiency and customer satisfaction, and ultimately creating excellent performance. In 2006, Lenovo had a 7%

market share in the global PC market, second only to Dell and HP. In 2006, Lenovo’s consolidated revenue reached US$14.6 billion, an increase of 10% over the previous year. In general, through the project team's efforts, the project improvement based on Six Sigma achieved the expected goal. The entire project implements Six Sigma management to reduce waste in the process, improve efficiency, shorten the cycle of computer development projects, and meet the needs of customers and businesses. The previous Six Sigma was mainly used in the manufacturing sector, such as production lines. Through this successful project, it provided a good reference for improving process categories.

CHAPTER5
CONCLUSIONS, SUGGESTIONS AND PROSPECTS

5.1 Conclusion

Enterprise project management is an important part of enterprise management and also an important action for the sustainable development of enterprises. At present most of the enterprises, especially some small and medium-sized enterprises, for the Six Sigma management method in the application of project management has some error, lead to enterprise in the process of implementing Six Sigma project go a lot of detours, can't achieve the target very well, cause a lot of Six Sigma implementation failure. If the enterprise can have a good implementation process and method in the Six Sigma project management, it will help the enterprise to improve the overall project management and operation level to a great extent. In this paper, the Six Sigma project management model is analyzed and discussed to further enrich and improve the Six Sigma project management model and process.

The conclusions of this paper can be summarized as follows:

(1)In introducing the basic concept of Six Sigma management, the DIAMC process of Six Sigma project management and its related implementation process are emphatically analyzed.

(2)On the related concepts of project management, the paper focuses on the evaluation and selection of lean Six Sigma project, as well as the advantages and importance of project management.

(3) After the analysis of Six Sigma management and project management, this paper deeply studies the application of Six Sigma in project management process, through the analysis of DMAIC tools, to achieve Six Sigma project management enterprise provides a good reference.

(4) Based on the background of Lenovo group, the Six Sigma project management and the carrier, application analysis tools and methods, this paper analyzes the Lenovo group in Six Sigma project management theory to explore, and through practical project cases, choose from project evaluation, project implementation process is discussed at the end of the project control of specific tools and methods, with strong practical application value.

All in all, this paper through to the Six Sigma management in project management's assessment of the selection, implementation process, performance management to do the thorough research and the elaboration, for the future may apply Six Sigma management method in the project management of enterprises to provide effective references and good sense.

5.2 Suggestions and thinking

Throughout the entire process of Six Sigma management and project management, the quality, schedule, and investment control in project management are easy and more appropriate applications for Six Sigma management. Quality requirements in these areas are clear, and process data is easy to measure. However, the goal of both is consistent, which is to satisfy the customer.

Six Sigma way is a methodology that derives from customer needs and continues to create value and continuous improvement for customers. Demand, value stream, and continuous improvement are the core concepts of Six Sigma theory. Completion of a good project often involves cross-departmental cooperation. Therefore, not only must each business department pay sufficient attention to it, but also management must give sufficient resources to support it. The implementation of Six Sigma management also requires such conditions. Therefore, the attention and support of the leadership is the key to the success of Six Sigma. Companies that have successfully implemented Six Sigma, when summarizing their experiences, have mentioned without exception: The support of the top leaders is the key to the success of Six Sigma. Of course, implementing Six Sigma management methods in project quality management must also be supported by project managers or higher level leaders. The leadership must assist the team in creating an atmosphere in the company that helps the team work effectively and provide team members with certain professional training to help them have the ability to solve problems.

The project activity itself is a transient process, one by one, that incorporates project management methods into the implementation of Six Sigma management. The project management methodology as a Six Sigma management application tool has enabled many Six Sigma teams to achieve outstanding performance. However, applying the Six Sigma management method to various projects is difficult to break through the constraints of the stability of the process and data requirements. For example, the construction companies and software companies with relatively weak

foundations can only use the data and the lack of standardization. Some tools in Six Sigma management methods fail to achieve significant financial results. Therefore, the application of Six Sigma management methods in project management requires that the company achieve a certain degree of project management maturity.

5.3 Expectation

There is no doubt that Six Sigma project management is a very large system, and many issues still need to be further studied and explored. The following issues are to be further solved and studied:

(1) The DMAIC analysis tool of Six Sigma has certain limitations. How to do some innovative exploration in the case of extension of Six Sigma project management still needs further analysis.

(2) Extensive use of Six Sigma project management, how can it be applied in other areas and its application defects and improvement measures, remains to be further studied.

(3) In the future of the wave of mobilization, how to better use the Internet and mobile applications to innovate the Six Sigma project management model and improve the efficiency of Six Sigma project management remains to be further explored.

Especially on the basis of the development and extension of Six Sigma theory, because of the lean production in recent years, Six Sigma will play an increasingly important role in the future of corporate project management, and the role it plays will become more and more important.

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