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Proposing solutions to improve the customer service level - a case of a Chemical Enterprise in China

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Master in Applied Management

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BUSINESS
SCHOOL

Department of Marketing, Operations and General Management

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Abstract

Companies focused on increasing their processes' efficiency often follow small scale improvements or radical improvements. Shanxi Jinyu Kelin Technology Co., Ltd., a high-tech manufacturer of ultra-fine calcined kaolin, is currently dealing with difficulties that are negatively affecting the customer service levels, recognizing the need to make some changes in the way current processes are being performed. In particular, the company acknowledges that the decreased service levels are primarily attributed to the untimely delivery of final products, which is caused by delays in receiving raw materials from suppliers. These delays are consequence of various decisions made throughout the company's procurement process, starting from the evaluation and selection of suppliers to the subsequent delivery and of raw materials.

This thesis is thus focused on proposing solutions to improve the procurement process at the company and the Action Research methodology is used for that purpose.

The diagnosis of the processes have shown that late delivery and low customer service are consequence of multiple root causes, including a lack of centralized procedures, problems with the information systems, fragmented information, low orders placed to suppliers and low quality of supplier delivery. Three different solutions are proposed to deal with these causes, focused on the improvement of the procurement plan submission, supplier selection and order placement. A future implementation of these proposals is expected to result in significant efficiency gains for the company, either in terms of the time it takes to complete these processes as well as on the quality of suppliers and their service.

Keywords: Chemical enterprises, procurement, business process improvement, service level

JEL Classification:

L65 Chemicals

Y4 Dissertations

Resumo

Empresas focadas em aumentar a eficiência de seus processos geralmente seguem melhorias de pequena escala ou melhorias mais radicais. A Shanxi Jinyu Kelin Technology Co., Ltd., fabricante de caulim calcinado ultrafino, enfrenta atualmente dificuldades que afetam negativamente os níveis de serviço ao cliente, reconhecendo a necessidade de fazer algumas mudanças nos processos da empresa. Em particular, a empresa reconhece que a diminuição nos níveis de serviço se deve principalmente a atrasos nas entregas dos produtos finais, atrasos estes causados por atrasos no recebimento de matérias-primas dos fornecedores. Estes atrasos são consequência de diversas decisões tomadas ao longo do processo de procurement da empresa, desde a avaliação e seleção de fornecedores até a posterior entrega das matérias-primas.

Neste contexto, esta tese tem como objetivo propor soluções para melhorar o processo de procurement na empresa, recorrendo-se à metodologia Action Research para esse fim.

O diagnóstico dos processos mostrou que os atrasos na entrega e o reduzido nível de serviço ao cliente são consequência de múltiplas causas raiz, incluindo falta de procedimentos centralizados, problemas com os sistemas de informação, informações fragmentadas, encomendas de baixo volume feitos aos fornecedores e baixa qualidade na entrega dos fornecedores. São propostas três soluções para lidar com essas causas, com foco na melhoria do envio do plano de compras, seleção de fornecedores e colocação de pedidos. Espera-se que a futura implementação destas propostas resulte em ganhos de eficiência significativos para a empresa, quer ao nível do tempo de conclusão destes processos, quer ao nível da qualidade dos fornecedores e do seu serviço.

Palavras-Chave: Empresas na Indústria Química, Procurement, melhoria de processos, nível de serviço

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Glossary

VSM: Value-stream mapping

SAP: System, Application, and Products in Data Processing

ERP: Enterprise Resource Planning

S4 HANA: Digital core business platform for enterprises

MDG: Master Data Governance

SRM: Supplier relationship management

BPI: Business Process Improvement

BPM: Business Process Management

BPR: Business Process Reengineering

COP: Collaborative operation platform

1. Introduction

This chapter presents the research background and challenges faced by Shanxi Jinyu kelin Technology Co., Ltd., a chemical enterprise in which the project is developed. The research problem and objectives are afterwards presented, along with the proposed methodology.

1.1. Problem statement

When companies are aimed at exploring alternative strategies that might promote a higher efficiency of their processes, two main options arise (Dumas, 2018; Harmon, 2019): their processes might need to be improved at a smaller scale; or large-scale and radical improvements might be required. Radical changes are in fact the purpose of process reengineering as put forward by Hammer (1990), which mainly refers to the holistic and subversive redesign of existing business processes by enterprises with the help of information technology, while aiming at redesigning a business process that can significantly improve the operating conditions of the enterprise. On the other hand, small scale improvements are useful when aiming at smaller and incremental process improvements. In any case, improving the efficiency of processes is a key concern of companies struggling to survive in a highly competitive environment (Harmon, 2019), which is the case of Shanxi Jinyu Kelin Technology Co., Ltd. – a high-tech company that develops and produces ultra-fine calcined kaolin using gangue.

In the past, due to the support of national policies, monopoly operation and other conditions, Shanxi Jinyu Kelin Technology Co., Ltd. managed to achieve good returns. Under these circumstances, taking advantage of the knowledge and resources accumulated for many years, reducing costs, improving efficiency and enhancing competitiveness, has become an important topic for Shanxi Jinyu Kelin Technology Co., Ltd.

Within this setting, since the company recognizes that it is currently undergoing some difficulties that are negatively affecting the customer service levels, this project arises in order to explore and better understand those difficulties and propose solutions to overcome it. Particularly, the company recognizes that these lower service levels are mainly related to the fact that the final product is not being delivered on time due to delays in the delivery of raw materials from suppliers. This late raw material delivery is recognized to be the result of

several decisions made in the procurement cycle followed by the company, from the moment the suppliers are evaluated and selected until the raw materials are delivered and evaluated.

Accordingly, the research problem addressed in this thesis is focused on exploring on how to improve the procurement process so as to improve the service level delivered to the final customers.

1.2. Objectives

Following the context presented above, this project aims at proposing solutions to improve the procurement process at the Shanxi Jinyu Kelin Technology Co., Ltd., so as to improve the service level delivered to the final customers.

In order to achieve this aim, several partial objectives should be achieved:

i. Understanding how the current process is currently performed;
ii. Identifying the root causes of the problems identified in the process;
iii. Proposing alternative solutions with potential to deal with the beforementioned problems and causes;
iv. Assess the impact of the proposed solutions.

1.3. Methodology

The Action Research methodology is used in this project, since it is the methodology that better fits the nature of the proposed project, which is developed in close collaboration with a company towards the resolution of a real problem and with the close involvement of all the collaborators working in the process under study (Coghlan and Brannick, 2005; Coughlan and Coghlan, 2009). And under this context, an adapted version of the Business Process Management (BPM) lifecycle is followed to guide the project through the following stages: Stage I: Process Identification, Stage II: Process Discovery, Stage III: Process Analysis, Stage IV: Process Redesign; Stage V: Process evaluation (replacing the well-stablished implementation and monitoring stages) (Dumas, 2018).

1.4 Project scope

This project is applied to a chemical enterprise located in China, focusing on the improvement of the procurement process in particular. The disadvantages of the extensive management

style and system developed by the enterprise for many years have become increasingly prominent, thus further weakening its ability to participate in market competition. As a manager, how to make full use of the superior resources accumulated by the enterprise for many years, overcome and transform the disadvantages of enterprise procurement management, reduce costs, improve efficiency and enhance competitiveness has become an important topic for the company to operate and participate in international competition.

1.5 Project structure

This project is organised and structured into five major chapters.

The first chapter corresponds to an introduction to put forward the main research points of the project.

The second chapter presents the literature review related to BPM, Business Process Improvement and lean production theory, searching for evidence and facts, exploring good development trends, thus providing rich theoretical support and effective analysis tools for this project.

The third chapter details the methodology followed in the thesis, explains the different methods and internal logic adopted in different stages of the project promotion process.

The fourth chapter is focused on presenting the case study and the results.

And finally, the fifth chapter presents the main conclusions, limitations and lines of further research.

2. Literature Review

This chapter aims at presenting previous studies that can be used to support the development of the proposed project. Considering the objective of the project, this literature review is focused on the following topics: business process management; Business Process Improvement (BPI); BPI tools, techniques and methodologies; and recognizing the key role of Lean within BPI studies, a review is also presented on the use of the Lean philosophy in the manufacturing context in general, and in the chemical manufacturing sector in particular.

2.1 Business process management

Harmon (2014) gave a classic explanation to the definition of business process: he defines a group of activities as a business process with one or more inputs and one or more outputs, with these outputs representing an added value to customers. In short, business process is a combination of a series of activities that create value in an enterprise and which are designed and implemented carefully to provide specific products or services for specific customers or market needs. This process focuses on how to successfully complete tasks in the organization. Then two important characteristics of the process are extracted: one is customer-oriented, including customers outside and inside the organization; the second is to cross the boundary of existing functional departments, branches or subsidiaries. Business process is a series of logically related tasks that are performed to achieve a specific business goal.Harmon (2014) found that although some enterprises have a strong desire for reform, they are still unable to make progress. They seem to know what to do, but they just cannot act. Under the new economic model, the customer economy dominates, and today's market is a buyer's market. What flows in the business process is data, including structured data and unstructured data, and data is the output of the activities in the business process. Roles are mainly defined in the business process, and there is no department that has no direct contact with the organization. The business process determines the organization, and the organization performs the responsibilities of each role defined in the business process, and ultimately realizes the value-added of the company.

According to Hammer (1990), Business Process Management involves continuous improvement of business processes, the strategy of improving the company's operating efficiency and maintaining the company's competitive advantage. Hammer (1990) also put forward the concept of Business Process Reengineering (BPR). At that time, he studied the reengineering of organizational function structure, hoping to improve the operation of

enterprises through the improvement of organizational function structure. With the change of organizational structure, business processes also need to change according to the change of functions, and the change of business processes can promote the smooth operation of enterprises and save enterprise resources. This author made clear the concept of business process reengineering through a series of exploratory studies. According to him, BPR means that every process in the company's production and operation is user-centered and the company's business is reorganized according to this principle; check each production activity, judge their nature, and divide it into the company's mandatory business activities and non-core business activities, and combine and simplify the latter to improve the company's entire process.

On the other hand, Davenport (1993) put forward the concept of Business Process Improvement (BPI), distinguishing it from BPR as defined by Hammer (1990). He first studied the concept of business process reengineering, and afterwards recognized that BPI was a preventive enterprise management method. According to the same author, BPI is on the basis of combing and analyzing the existing process, and then proposing an improved design scheme by using a series of methods, and then begins to implement the improved business process, and evaluates it. In view of the problems found in the evaluation, it analyzes and improves again and circulates continuously to achieve the best management effect.

Hammer & Champy (1993) state that that BPI theory was developed based on BPR theory, and they have a certain inheritance and development relations. BPR theory is a redesign of business process, which makes the business process of the enterprise subversive, a thorough transformation of the enterprise, and a reorganization of productivity and production relations within the enterprise. On the other hand, BPI is the improvement of business processes. Combining with the shortcomings of some links in business processes, the improvements is put forward. BPI is a method of step-by-step improvement, which will not cause great changes to the original business process. Generally speaking, BPI relies on small scale and incremental improvements of processes, while BPR relies on more radical changes (Harmon, 2019).

Harmon (2019) pointed out that the risk of BPR is very high. Although the expected return is high, there will be many problems encountered in the reform process. Under the pressure of the internal and external environment, it will make it difficult for the process to achieve the expected results, leading to a high risk of reform failure. On the contrary, the risk of BPI is very low, because this improvement will not involve too many departments, but only coordinate and improve a few problems, with much less risk. The scope of BPI design

and transformation is small, which enables enterprises to make scientific analysis, have an intuitive understanding of the transformed business, carefully analyse the transformation process, and improve all the factors that are not conducive to the business process. Compared with BPR, the external environment and internal environment to be analysed are relatively simple, which is beneficial to the implementation of scientific transformation. When a business process has problems, BPI transformation can be quickly implemented, and the transformation methods can be flexible and diverse to ensure the efficiency of process operation. In that case, it does not need a lot of analysis, but only good communication between departments, and managers can quickly make judgments.

Salas,E. et al. (2012) also summarized four core ideas of process improvement. Firstly, the object of process improvement is the business process of the enterprise, and everything should be carried out around the process in order to achieve the goal of creating excellent processes. In the process of improvement, people should try to ensure that every operational link in the business process can create value, thus ensuring the scientific and reasonable business process. Secondly, the customer's needs are always the focus of process improvement. In the practice of enterprise business process improvement, we should take customer demand as the guide and combine the strategic planning of enterprise development to standardize and improve enterprise business processes. Thirdly, process improvement also includes the corresponding organizational structure design and the determination of post responsibilities, which is not only the change of process steps, but also the establishment of a matching organizational structure after redesign, and the clarification of responsibilities of each department and the post setting of personnel. Fourthly, process improvement is continuous. After the improvement, the enterprise continuously monitors and evaluates the process, and through the continuous improvement of the process performance, the enterprise process improvement becomes the norm and the overall improvement is realized.

Considering the low risk and flexibility of BPI, and considering that the purpose of this thesis is not to redesign and change processes at a global scale, it can be concluded that it is the most appropriate method to be applied in the improvement of the procurement process improvement of Shanxi Jinyukelin Technology Co. Ltd – it should be highlighted that this project intends to improve the existing process without completely subverting or reshaping it into a new process. As such, the next section will explore previous studies about BPI.

2.2 Improving and reengineering processes in the manufacturing and service sector

Different approaches have been used aiming at improving processes both in the manufacturing and service sector. Lean philosophy has been widely used (e.g., Ciancio, 2018), and methodologies such as Six Sigma (e.g., Ciancio, 2018), optimization (e.g., Mehdouani et al., 2019) and simulation (e.g., Vergidis et al., 2012).

Lean production pursues to streamline unnecessary and redundant steps and processes in the production process, avoid all unnecessary waste, and strictly manage product quality Harmon (2019). Supported by improving the organizational efficiency of personnel, improving the organizational structure and improving the company's operation mode, it constantly improves the flexibility and flexibility of the production system, meets the diversity of customers' needs, realizes high flexibility, zero inventory and zero defects in enterprise production, and finally improves the company's economic benefits and realizes its strategic objectives.

Six Sigma is generally based on scientific statistical theory, and mainly adopts project management technology for process analysis, often following the DMAIC cycle (Blackburn J, 2012). The process includes definition, measurement, analysis, improvement and control. Finally, the continuous improvement of product quality or service quality can be realized.

Simulation is also widely used for process improvement purposes, enabling the identification of errors, bottlenecks and existing problems, following then with the proposal of specific changes promoting the elimination of those bottlenecks and errors (Mehdouani et al., 2019). These proposals of improvements can first be tested through the analysis of multiple scenarios, with the implementation of solutions taking place only after such scenario testing.

Finally, another commonly used approach for improving business processes is optimization. It aims at identifying the optimal solution to a specific problem – it is thus focused on finding the best solution, and not only a good solution (Vergidis et al., 2012).

Several recent studies have been developed focused on the use of process improvement using each one of these methods, or a combination of it. According to Gupta, S. et al. (2016), encompasses several management practices that, under the philosophy of continuous improvement, aim to eliminate waste and provide more value to the customer with less costs involved, which means doing more with less. In this regard, this methodology relies on the reduction or elimination of all types of waste involved in the processes, enabling organizations to focus on the activities that really add value to the customer (Régis et al., 2019). According to Gupta, S. et al. (2016), this philosophy is globally recognized and is

often adopted in the culture of organizations in both manufacturing and service sectors. Indeed, the following two studies for each one of the mentioned industries support the importance of the lean philosophy in process improvement, which, by eliminating waste, inefficiencies and non-value activities, enhances process performance. Paolo and Emrah (2019) introduced the use of a genetic algorithm with the aim of improving business processes, combining it with discrete event simulation, and put forward a business process improvement scheme suitable for manufacturing companies with many varieties and small batches. Nemanja and Milovan (2018) conducted in-depth research on the theory of business process improvement, holding that all aspects of business process improvement should be considered, and proposed an algorithm to verify the feasibility of business process improvement. Ahmed et al. (2021) studied the methods that should be adopted when the business process improvement theory was applied to the medical field, and conducted an empirical study with a hospital, providing methods and measures for the hospital to apply business process improvement. Jones et al. (2019) studied the business process improvement of a student management office, which provided a theoretical perspective for establishing process optimization and improvement in the organizational field. Chountalas et al. (2019) studied the process optimization design in the software development process of a technical service company, and applied the business process improvement theory to reduce the time and cost of the company's development process.

Comprehensive experts and scholars have analyzed and studied the process improvement to different degrees. Generally speaking, the implementation of business process improvement can effectively improve the operational efficiency and performance of enterprises. The improvement of business process is mainly to investigate and analyze the existing work and follow the original path of business process. Through continuous and gradual process improvement, we can improve operational efficiency and continuously and steadily improve process performance, thus ensuring the elimination or reduction of waste in the process while promoting the competitive advantage of enterprises. And as mentioned above, Lean philosophy has been in fact widely used for this purpose, being key when the aim is to reduce process waste.

2.3 Lean philosophy

Caldera et al.(2017) intended to eliminate waste and pursue perfection in the face of the whole production system by optimizing and continuously improving the production process of

products. The five principles of lean thinking are as follows: make clear the value of products to customers; clarify the product value stream and organize production and business activities; the continuous flow of value; demand pull; keep the consciousness of continuous improvement and pursue the perfect production mode.

Womack (1990) named the Toyota mode of production as lean production for the first time. Toyota people summarized the contents wasted in the long-term operation and improvement process, and there are seven kinds of wastes, which are called seven wastes, in order to avoid market fluctuation or maximize the use of production equipment: waste of inventory due to excessive production, excessive materials, receipt of raw materials, etc.; the waste of waiting time caused by unbalanced operation and incorrect production plan, which is manifested in the waste of space, time and human tools caused by placing, stacking and moving; waste of processing due to excessive precision, excessive use of manpower, financial resources and time; the waste of actions caused by unbalanced hands, idle hands, one-handed work, taking materials and tools, etc. In the production site, the purpose of management is to keep man-machine materials in the best control state, and to deal with and solve problems quickly and effectively, which can effectively improve efficiency, maintain high quality level, low cost level, fast logistics speed and timely and accurate delivery date, thus improving the company's market competitiveness. However, many enterprises still have misunderstandings in management. They just pay too much attention to the formulation of certain systems or simply increase management personnel, which eventually leads to poor improvement results and greater waste, which is called management waste.

2.3.1 Lean philosophy: applications in the manufacturing sector

Melton (2005) applied the principle of lean production to improve a large comprehensive steel plant, and compared and analysed the improvement effect through the value flow chart. Bittencourt et al.(2019) proposed a Six Sigma management and improvement model based on lean concept, which was successfully applied in a telecom company in Portugal and achieved good results. Vishnu et al. (2016) proposed a solution to the problem of line body balance in the assembly line of mixed-line production through parallel workstations, which improved the production efficiency of the assembly line. Chiarini and Brunetti (2019) provides an essential framework for the successful implementation of lean production in manufacturing industry, absorbs many internal factors in lean production operation, and establishes a verification model according to the framework.

Gleeson et al. (2019) can combine the influence of employees' subjective consciousness with "Lean Six Sigma" to create an operating platform with good productivity under chaotic production conditions, and at the same time, identify the staff who control the inspection checkpoints. Maware and Adetunji (2019) established two sets of evaluation models, which were set for the operation efficiency of integrated circuit industry and the actual operation efficiency of lean production, and found the role of lean regulation through the relationship between them, in which the regulation of clock rate was the key factor affecting the actual operation of lean production. Yadav et al. (2020) developed a lean manufacturing framework to strengthen its application in developing economies. Roth et al. (2020) proposed a production system framework, which integrated lean production and factory physics. The framework draws lessons from the most advanced understanding, including performance measurement system, which supports the realization of target conditions based on variability and shortening delivery time, as well as the method of continuous improvement.

2.3.2 Lean philosophy: applications in the chemical manufacturing sector

Chauhan and Singh (2011) pointed out that the two main areas to realize lean production are labor, machinery and equipment. The research focuses on the two crucial flexibilities of lean production, and focuses on the work of lean manufacturing and what it can achieve by managing the flexibility of labour and machines. Basán, N.P. (2019) pointed out that in order to overcome the problems of low production efficiency, high cost and long time to supply new products to the market, leading companies are committed to new models, such as lean production, digitalization and Industry 4.0. That can simplify the production line and help the lean production line to achieve a more efficient and high-quality production system by dealing with all the waste, delays and failures in the workplace.

Yudhatama and Hakim (2020) aim to minimize the production time and cost through the optimal number of workstations, thus improving the output level of Indonesian truck assembly lines. The unprovoked consumption in the production process is analysed by lean production, and the time unit is set up to summarize the man-hour consumption of placing all processed products, and the inductive module is assembled into the digital programming model that has been built.

2.4 Conclusions

The main methods to improve the business process in manufacturing industry are Six Sigma, dashboard management, visual management, ESIA, KPI system, IT and so on. From the perspective of improving work efficiency, management scientists began to study business processes, and put forward ideas such as business process optimization and business process reengineering. Through the study of business process adaptability, it was gradually extended to various fields, and business process optimization of chemical enterprises began to increase in recent years, developing towards the information field.

Scholars have made a lot of achievements in the study of business process improvement, and put forward that when improving and optimizing business process, we should proceed from the overall situation of the company's business process and make full preparations for the company's development, including the application of information platform, the coordination of management organization and the management of business personnel. Most research also show that introducing business process improvement can improve the management efficiency and promote the development of the company. In the field of chemical enterprises, lean production theory can effectively improve organizational efficiency and save resources.

In early factory management, business process was an important part of management. From the perspective of improving work efficiency, management scientists began to study business process, and put forward ideas such as business process improvement and business process reengineering, which were gradually extended to various fields through the study of business process adaptability. Business process transformation is a complex process, and decision makers need to make overall analysis in order to make good decisions. According to the development strategic objectives of the enterprise, combined with the internal and external environment analysis, formulate business process improvement strategies that are in line with their own development, promote business process improvement can continuously adjust and optimize until the system is satisfactory.

3. Methodology

3.1. Action Research Methodology

The Action Research methodology is followed in this thesis (Coghlan and Brannick, 2005). This methodology is considered a good fit for this project since it is developed in a company context with the aim to solve a real problem, where company's collaborators are actively collaborating for the development of the project (Coghlan and Brannick, 2005; Saunders et al., 2016). Such an active collaboration is key for the success of the project since it allows taking into account the different perspectives of the different people involved, and based on those perspectives, the solutions proposed to improve the process are expected to be more efficient and effective, translating the real needs of the company (Coughlan and Coghlan, 2009).

3.2. Adapted BPM Lifecycle

The proposed project will be guided following an adapted version of the BPM lifecycle (Dumas, 2018), in which the following stages will be followed (see Figure 3.1): process identification, process discovery, process analysis, process redesign, process implementation and process evaluation (replacing the execution and monitoring stages, since the duration of the project does not allow for the monitoring stage to be completed). Using the adapted BPM lifecycle as a framework of reference allows us to discuss many incremental changes that might be required in order to improve process under study.

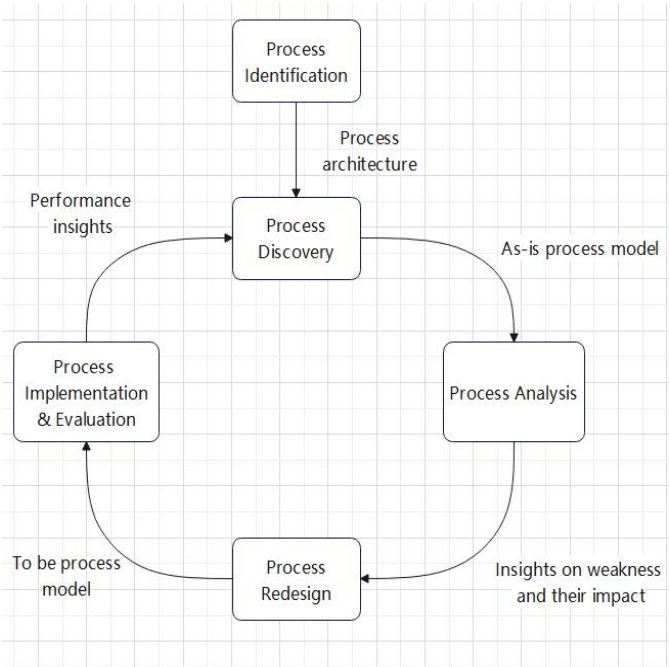

FIgure 3.1 Adapted BPM Lifecycle adopted for this thesis

Source: (Adapted from Dumas et al. (2018)).

Process identification is concerned with the high-level description and evaluation of a company from a process-oriented perspective, thus connecting strategic alignment with process improvement. Currently, identification is mostly approached from an inward-looking perspective (Dumas et al. 2018). Process discovery refers to the collection of information about the current way a process operates and its representation as an as-is process model. Currently, methods for process discovery are largely based on interviews, walkthroughs and documentation analysis, complemented with automated process discovery techniques over non-encrypted event logs generated by process-aware information systems (van der Aalst, 2016). Process analysis refers to obtaining insights into issues and problems relating to the way a business process currently operates. Currently, the analysis of processes mostly builds on data that is available inside of organizations or from perceptions shared by internal and external process stakeholders (Dumas et al. 2018). There is also a need for new approaches for quality assurance, correctness, and verification, as well as for new corresponding correctness criteria. These can build on existing notions of compliance (Vinodh, S, 2012), reliability (J, Furman. et al. 2018), quality of services (Halse, L. et al. 2016) or data-aware workflow verification (Beifert, A. et al. 2017), but will have to go further in terms of consistency and consideration of potential payments. Evaluation refers to the instantiation of a case and its information technology processing. At present, this kind of evaluation is promoted by the main index value or business process management system (Dumas et al. 2018).

3.2.1. Stage I: Process Identification

Stage performed to understand the business status and existing problems of Shanxi Jinyu kelin Technology Co., Ltd, focusing on the procurement process currently followed in the company. Semi-structured interviews with the experts and senior management of Shanxi Jinyu kelin Technology Co., Ltd. were performed. Among them, there were 20 respondents in the leading position, covering high-level, middle-level and grass-roots managers, and 30 business experts. The following protocol of questions was used as a basis for these interviews:

- ✓ How do you evaluate the current performance of the procurement process as a whole?
- ✓ Is there any particular task, set of tasks, or sub-processes in the procurement process having a negative impact on customer service? If yes, which are those tasks or sub-processes?

- ✓ At present, how does our company carry out supplier performance, evaluation and elimination? For suppliers shared by many companies in the group, how to share information such as supplier performance and bad behaviour punishment?

These interviews are aimed at analysing all aspects of the procurement process, from supplier evaluation and selection until the reception and evaluation of raw materials on site, and identify the particular process stage (or stages) in which the problems and difficulties might be arising. These interviews are carried out through on-the-spot interviews, and the interview time of each interviewee is set at half an hour to one hour. The interview is carried out gradually based on the interview outline, and other related questions will be added depending on how the conversation evolves (the same applies to all the semi-structured interviews proposed in the following stages of the methodology).

3.2.2. Stage II: Process Discovery

In order to understand the process selected for analysis in detail, a process map is designed using a swim-lane diagram built in Visio – this allows to build the as-is process map. For that purpose, primary data is gathered through direct observation and semi-structured interviews, and secondary data is gathered using official documents of the company. Semi-structured interviews were done with leaders or business backbones who have been engaged in procurement business for a long time, with a total of 50 interviews, and were used to ask questions focused in understanding the sequence of steps and tasks performed throughout the process.

Once a first draft of the swim-lane diagram is built, it is validated within a focus group composed by 15 middle managers.

3.2.3. Stage III: Process Analysis

This stage is devoted to identify the problems and underlying causes associated with the as-is process.

First of all, the most prominent problems and potential reasons in the procurement business process are excavated through observation and semi-structured interviews. The semi-structured interviewees are mainly the leaders of procurement business and the main contributors familiar with procurement work, with a total of 50 interviewees. In this interviews the following questions are asked*: What are the problems faced in the process? And why are these problems arising?*

Once identified, these causes and root causes are organized and visually represented using an Ishikawa diagram (also called fishbone diagram) and 5 whys. According to Murugaiah et al. (2010), repeatedly asking the *why* of a non-conformity allows to obtain a deeper cause, i.e., the root cause of the problem. Accordingly, the use of both these tools provides a more accurate representation of the real causes behind the problems, using as a basis information gathered through observation and interviews, as mentioned before. Then, the final root cause list will be verified through individual interviews with 50 people covering leaders and business backbones.

Finally, the key performance indicators (KPI) that can be useful to measure the impact of the solutions that will be proposed to deal with the previously selected causes are defined and measured in the as-is process.

3.2.4. Stage IV: Process Redesign

This stage is focused in the proposal of solutions to deal with the causes of the problem identified under Stage III.

Firstly, based on literature review and online search, some possible ideas were identified, and then a brainstorming meeting was held with the partners in the process. The brainstorming was performed with a group of 15 people, mainly employees with more than ten years' experience in Shanxi Jinyu Kelin Co., Ltd, and it was aimed at discussing possible solution ideas. Afterwards, a focus group was conducted with 50-person group composed of leaders and business experts to further explore the previously identified ideas and ask for any other ideas on the solution to the problem. In this interview, the following questions were raised: *From the proposed solutions, which solutions should be applied and why? Do you have any other suggestions that should be considered?*.

Then, the proposed solution set is presented for validation purposes within the scope of a semi-structured interview with 15 people, mainly employees with more than ten years' experience in Shanxi Jinyu Kelin Co., Ltd. So as to discuss possible solution ideas. According to the selected solution, the future flow chart is designed using the swim lane diagram built in Visio (similar to the procedure suggested in the second stage). The target map should highlight the changes compared with the existing process.

3.2.5. Stage V: Process Implementation

This is the stage in which the measures presented in the previous phase are indeed applied to improve the company's problems (Coughlan & Coghlan, 2002; Coghlan and Brannick, 2005). Since the time-frame for this project does not allow for implementation, an implementation plan should be prepared for guiding the future implementation of the proposed solutions.

3.2.6. Stage VI: Process Evaluation

Once all the solutions are proposed, it is essential to analyze its impact in the process and to what extent the proposed solutions allow to solve the original problem, which in this project is to improve customer service levels (Coghlan & Brannick, 2005).

The evaluation proposed within the scope of this project relies on the feedback (in the form of questionnaire) from the company's partners, who evaluate the process and also rely on the comparison between the current process and the target process.

4. Case study

4.1. Company presentation

Shanxi Jinyu Kelin Technology Co., Ltd. was established in 2007, which is the largest high-tech enterprise in Asia and leading in China to develop and produce ultrafine calcined kaolin by using coal gangue. The company has a number of technical patents, strong technical strength and reliable product quality. It is a provincial demonstration enterprise for comprehensive utilization of resources, a provincial enterprise technology center, a provincial engineering technology research center, a provincial brand-name product enterprise, a provincial private science and technology enterprise, a provincial "specialized and innovative" enterprise, and a provincial pilot enterprise for integration of industrialization and modernization. Won the honors of Shanxi Science and Technology Progress Award, Municipal Standardization Outstanding Contribution Award and Municipal Science and Technology Innovation Outstanding Enterprise.

The enterprise covers an area of more than 200 kilometers and employs 280 people. Now it has the capacity of digesting 600,000 tons of coal gangue and producing 500,000 tons of calcined kaolin annually. At present, the fourth production line under construction is expected to be put into production before the end of 2023, when the total production capacity will reach more than 120 tons. The company's products are mainly used in heat-sensitive project, decorative project, water-based coatings, electrophoretic paint, rubber plastics and other industries, and also have broad application prospects in petroleum catalysis, printing ink, polyester chemical fiber, high-performance concrete, medical rubber plugs and other industries.

Product layout standards are two major markets at home and abroad, and the domestic market share will reach 51.2% in 2022. Foreign markets are distributed in Southeast Asia, Japan, South Korea, Europe, Australia, Central Asia, Africa and South America. The export of calcined kaolin accounts for 70% in China, and it is the leader of calcined kaolin industry.

In 2023, Shanxi Jinyu Kelin Technology Co., Ltd. will adhere to the guidance of innovation, comprehensively consolidate basic management, continuously strengthen the construction of technical talents, and promote the company's high-quality development. Make the enterprise become a modern high-quality development enterprise with value creation, responsibility and green development.

4.2 Stage I: Process Identification

Based on the interviews performed with key stakeholders in the company and with knowledge concerning the procurement process (as detailed in the methodology), it was possible to conclude that several key challenges are currently being dealt with at three phases of the procurement cycle: when submitting the procurement plan, when select suppliers and when placing orders. Particularly, it is a common agreement between many of the interviewees that the fact that several suppliers end up by delivering their raw materials with large delays when compared to the contracted lead times, which might be partly motivated by the fact that Shanxi Jinyu Kelin Technology Co., Ltd. follows a policy of placing more frequent orders in lower volumes, and this might be justified by a poor selection of suppliers in the first place. This was something mentioned by several collaborators: *the procurement cycle is long, and the unstable quality of suppliers has become a current problem*. It is also mentioned that several inefficiencies are found in the order placement stage, which might also delay the reception of the raw materials required for the production of the final product. This can be in fact confirmed by some of the statements from the interviews: *Whether it is a material application or a procurement application, it needs to go through multiple processes for approval and repeated verification and confirmation, which is inefficient*; *There are many overlapping approval links in the approval process for material application submitted by the grassroots units and procurement application summarized by the material department.*

This thus justifies the relevance to explore in more detail the procurement plan submission, the supplier selection and the order placement stages of the procurement process as it is currently performed at Shanxi Jinyu Kelin Technology Co., Ltd.

4.3 Stage II: Process Discovery

Figures 4.1, 4.2 and 4.3 show the process followed to submit the procurement plan (Figure 4.1), to select suppliers (Figure 4.2) and to place orders (Figure 4.3), respectively.

4.3.1. Procurement plan submission

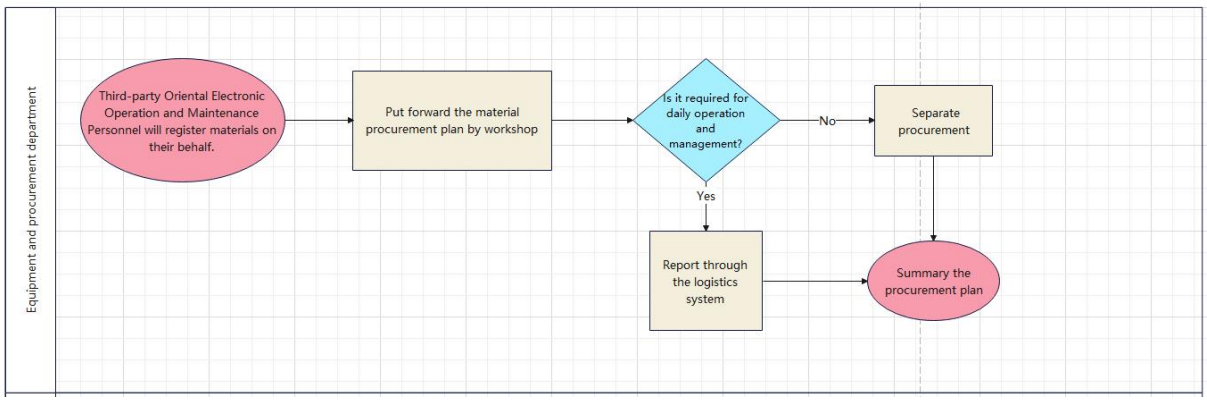

Figure4.1 Procurement plan submission process

Source: author

The enterprise management department of the group, the material and equipment department of the division and the material and equipment department of the third-level unit all participate in the procurement submission process. The division will lead the centralized procurement of its subordinate units, and will set up a bidding office. However, some third-level units with large purchases also set up their own bidding offices, which are responsible for the bidding of materials purchased independently.

The Equipment & Procurement Department shall submit the procurement plan of materials, spare parts and equipment to the Division before 18th of each month, and the Division shall distribute the ownership of procurement subjects.

The monthly material purchasing plan is put forward by the material staff of the sub-workshop using department. Then, put forward the material procurement plan by workshop. If it is required for daily operation and management, to report through the logistics system. If not, to take separate procurement. Finally, summery the procurement plan. For the material requirements (equipment, cables, chemicals, steel, etc.) suitable for centralized procurement, the Division is responsible for organizing all procurement work from the follow-up sourcing to the issuance of the supplier's bid-winning notice. The rest of the procurement plan will be entrusted to the Material & Equipment Department of the third-level unit, which will carry

out the procurement work by itself, and the procurement results collected by itself need to be summarized to the Division regularly.

Specifically, the submission of the purchase plan consists of two parts: first, the demand for materials/equipment/equipment maintenance services of various business units is collected. There are generally two sources of demand: one is from the daily production and operation management, and the other is from the procurement of engineering project types included in the investment plan. The second is to balance the demand plan accordingly, that is, to balance the demand for some materials/equipment that are safe and can be shared in the region, and at the same time, consider the arrival of goods in transit to make the final purchase plan.

4.3.2. Supplier selection

The process of supplier selection itself involves all aspects of strategic procurement and procurement execution. As a separate function, general supplier management mainly includes supplier development and access, supplier assessment and withdrawal, supplier quality improvement and comprehensive coordination functions.

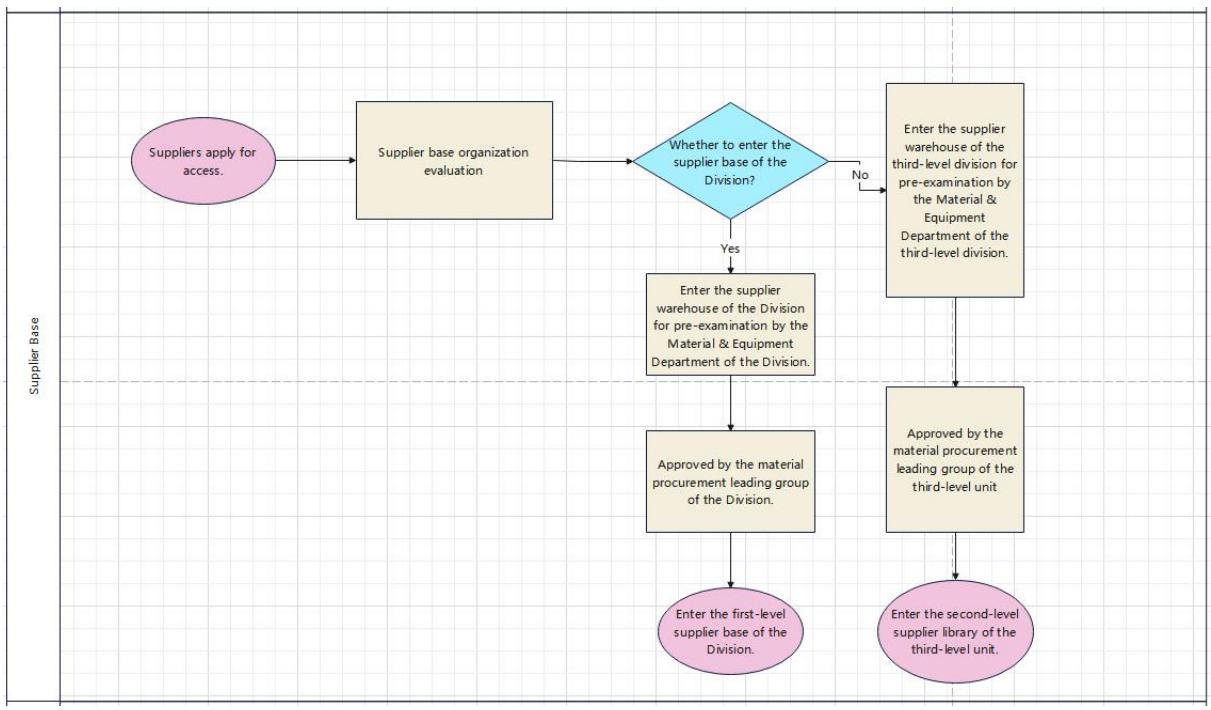

Figure 4.2 Supplier selection process

Source: author

For the procurement method of inviting suppliers, a supplier library is established, which is established at the level of the division and at the level of the third-level unit. The supplier

library of the Division is called the first-level supplier library, and the supplier library of the third-level unit is called the second-level supplier library. All third-level units give priority to suppliers in the first-level, and establish a second-level supplier library for suppliers involved in independent procurement by all third-level units.

Suppliers apply for access, there is the supplier base organization to evaluate. If allowed to enter the supplier base of the division, enter the supplier warehouse of the Division for the pre-examination by the Material& Equipment Department of the Division and enter the first-level supplier base of the Division. If not, enter the supplier warehouse of the third-level division for the pre-examination by the Material & Equipment Department of the third-level division and enter the first-level supplier base of the third-level unit.

For the suppliers managed by the third-level unit, the same process is followed, but for the second-level supplier library. The supplier evaluation Committee is also composed of members of various departments of the third-level unit. The leader of the final audit team is also the leader of the third-level unit. After passing the examination, it is finally entered into the secondary supplier library of the third-level unit.

The supplier assessment of Shanxi Jinyu Kelin Technology Co., Ltd. is conducted annually, and at the beginning of the first quarter of each year, all suppliers that traded in the previous year are assessed annually. The evaluation is also carried out at two levels: the division and the third-level unit. The process is basically the same, but the main body of execution is different. Suppliers are evaluated according to three levels: A, B and C. The supplier with the best evaluation results is the A-level supplier, accounting for 5% of the suppliers, followed by B-level suppliers, accounting for 15%. The remaining 80% are C-level suppliers.

After the Division of the secondary unit or the Equipment & Procurement Department of the subordinate unit starts the supplier evaluation, the evaluation committee will first conduct the evaluation, and the evaluation committee will conduct a comprehensive evaluation according to the Annual Evaluation Score Table. The key criteria used for this evaluation is punctuality. Suppliers whose assessment score is less than 75 points are considered as unqualified suppliers, and their information is deleted from the supplier database. For qualified suppliers with a score of 75 or above, the evaluation committee will put forward grading opinions. After that, it will be reviewed by the material management leading group, and the supplier registration is updated in the system (Oriental Vertical and Horizontal System).

4.3.3. Order placement

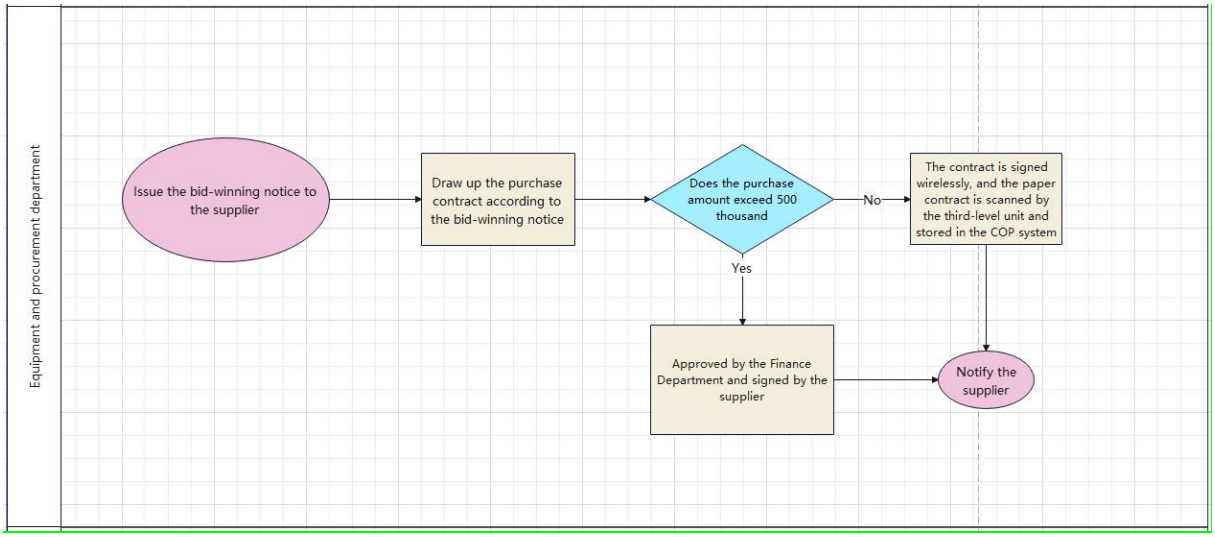

Figure4.3 Order placement process

Source: author

Generally, the ordering process is based on the price, quantity and key terms of the subject matter determined in the sourcing stage. According to the contract template, the purchasing details are confirmed with the winning supplier in the contract text, and finally the contract terms are implemented and the contract approval and seal are followed up.

Issue the bid-winning notice to the supplier, then, draw up the procurement contract according to the bid-winning notice. If the procurement amount exceeds 500 thousand, approved by the finance department and signed by the supplier, if not, the contract is signed wirelessly, after the contract is signed, the planning supervisor of the Equipment & Procurement Department of the Division will push the purchase order to the logistics system of the third-level unit in the Oriental Vertical and Horizontal Logistics System according to the contract results. And the paper contract is scanned by the third-level unit and stored in the COP system. Finally, notify the supplier. For the part centrally purchased by the Division, after receiving the bid-winning notice, the Equipment & Procurement Department of the third-level unit will carry out the subsequent contract signing process. A single purchase of more than 500,000 yuan (including 500,000 yuan) requires signing a contract with the supplier. The signing of the procurement contract is signed by the third-level unit and the supplier.

The part of independent procurement usually does not exceed 500 thousand yuan, and there is no need to sign a contract. It needs to be approved by the comprehensive planning department and the finance department, and finally the planning supervisor and the supplier

sign a specific contract. At present, Shanxi Jinyu Kelin Technology Co., Ltd. has no online procurement contract, but all of them sign project contracts offline, and then manually scan them into electronic documents and save them in COP system.

At the end of each month, the material supply center makes unified settlement according to the receipt and delivery of materials in each branch, summarizes and classify the materials to be settled through the material procurement system, and then send the settlement amount, details and bills to the settlement center, which sends the funds and details to the financial departments of each branch after review, and then transfers them to the material department through the financial departments of each branch, and the material department carefully check each sum to be settled. After confirmation, the monthly income and expenditure statements, the details of all kinds of materials in and out of the warehouse, and all kinds of statements and payment applications can be issued to the financial department, and payment can be made only after the financial department has verified them.

4.4 Stage III: Process Analysis

4.4.1 Identifying the causes of the problem

After understanding in detail each of the above processes, it is now possible to highlight the causes for the late delivery of final products to customers and the consequent low customer service level (see Figure 4.4).

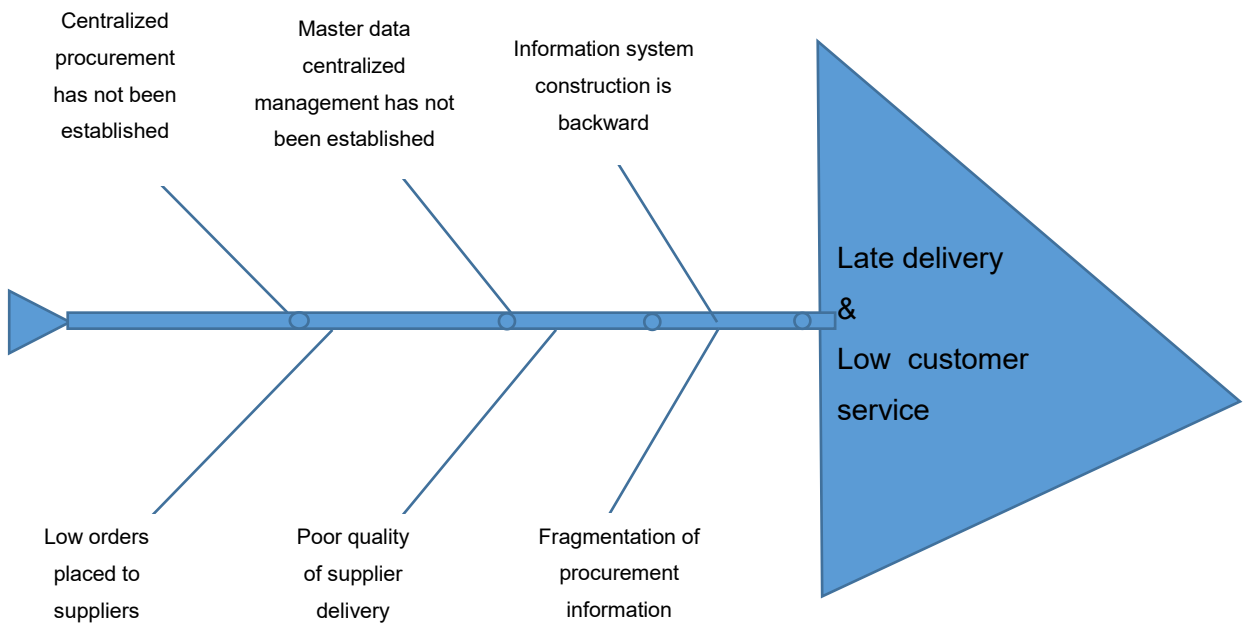

Figure 4. 4 Fishbone diagram of procurement process issues

Source: author

Cause 1: Centralized procurement has not been established

Centralized procurement was first used in government procurement, which concentrated time, manpower and resources to carry out procurement tasks (Azizi, 2015). Afterwards, it was gradually adopted by large companies and then extended to small and medium-sized enterprises. The content of centralized purchasing includes collecting all the purchasing needs in the company in the early stage, summarizing the demand quantity of similar products, forming an overall purchasing plan, and conducting unified supplier sourcing and price management during purchasing.

Usually there are three levels of centralized procurement (Azizi, 2015):

- ✓ The centralization of purchasing functions means that all purchasing tasks required for the whole company are completed by the purchasing department or company.
- ✓ The centralization of procurement resources on excellent suppliers, so as to achieve lower prices, better quality and better after-sales service.
- ✓ Different products are concentrated in a single supplier, and suppliers with high quality manufacturing ability and supply ability are selected. On the basis of the second level, suppliers are further reduced, which greatly reduces the management content and complexity of suppliers, thus greatly optimizing the procurement management.

Judging from the current situation of Shanxi Jinyu Kelin Technology Co., Ltd, the first level of centralized procurement is not achieved. Shanxi Jinyu Kelin Technology Co., Ltd. adopts a regional procurement method, which relies on a centralized procurement at the second-level unit, with some purchases being delegated to third-level units, which greatly disperses the procurement volume and fails to taking advantage of economies of scale and bargaining power. It is even more impossible to talk about the measures to centralize material suppliers at the second and third levels. On the contrary, the second-level unit, usually the business department, has a supplier library, and the third-level unit also has its own supplier library for the self-purchasing part, which increases the number of potential suppliers and, consequently, makes it more difficult to centralize purchases in a small group of suppliers, reducing the company’s control over suppliers and resulting in poor delivery quality of suppliers' materials or services. For self-collected materials in particular, they need to be reported to the Division every time, and then pushed back to the third-level unit after being approved and judged by the Division to be self-collected. This process design greatly prolongs the procurement cycle of self-collected materials.

Cause 2: Master data centralized management has not been established

Because of the redundancy and error need afterwards to be corrected, which takes time; and this might delay the delivery of raw materials, and consequently, the delivery of final products. Master data is the basis of all business processes, and errors in master data will cause problems in all aspects of business processes. In the enterprise with good master data management, the master data standardization project will be passed by the passing city. Establish master data standards. Design company-level processes and organizations. Because if there is no company-level master data management. It is built in secondary or tertiary units. Problems such as data redundancy, multiple codes of the same object and different data information will occur. When the company merges information or trades between internal units. You must adjust the master data. In order to proceed with the transaction.

At present, the main purchasing master data of Shanxi Jinyu Kelin Technology Co., Ltd. are material master data and supplier master data. No group-level master data standard has been established. It is managed by each secondary unit level and tertiary unit. The division of the second-level unit establishes the rules for material creation, and each third-level unit establishes its own master data. Material master data. At present, there are a total of 210,000 materials used by the Division, and the number of materials commonly used by all third-level units is basically 20,000 to 30,000. There are a large number of problems of one object with multiple yards, and outdated and untreated materials. There is no number management for supplier master data at present. But there is also data redundancy. In addition, the supplier master data is set up in the division and the third-level units, which also has the problem of repeated management.

Cause 3: Information system construction is backward

Many links of Shanxi Jinyu Kelin Technology Co., ltd.' s procurement still adopt backward offline management mode. If it is convenient to report the purchase demand, the advanced enterprise's practice is to generate the demand plan of material purchase by running MRP according to the production demand. The production plan of Shanxi Jinyu Kelin Technology Co., ltd. is out of line with the purchase plan, and the purchase plan is mainly calculated based on the forecast line of the generation plan, without accurate system demand management and corresponding purchase plan. Similarly, the whole process of purchasing and sourcing is carried out offline, only the final bid-winning result is entered into the Oriental Vertical and Horizontal System.

The main materials of the Division are purchased by bidding, but a small amount of materials are entrusted to the third-level units for independent bidding, which lacks supervision and information system support, and all of them are completed offline. The management and collaboration of suppliers, also without a unified information platform, is completely offline. In terms of warehouse management, advanced management enterprises have enabled RFID scanning guns to receive and deliver goods in warehouses. Or add more advanced robot operations. Then Shanxi Jinyu Kelin Technology Co., ltd still adopts the mode of manually inputting the results into the information system. Not only is it time-consuming and laborious, but there will also be many human errors.

Cause 4: Fragmentation of procurement information

At present, there is a high diversity of information systems used at Shanxi jinyu kelin technology co., Ltd.: The information systems commonly used in the materials department are Dongfang Zongheng System, JD.COM Huicai Purchasing Platform, Group COP System and Nailing Platform. Some units use UFIDA NC system and equipment management system (website); Individual business divisions use Kingdee system; At present, a branch is developing a material intelligent management system, which integrates logistics management system, planned acquisition control system and equipment management system, and organically combines equipment management and warehousing management to transfer and gather data. Generally speaking, the use of information systems in various units of the Group is not uniform.

COP system is a unified office system used by Shanxi jinyu kelin technology co., ltd., and the main functions used by the purchasing department in this system are: information release, payment planning and approval of materials and spare parts, and contract approval. Because the systems used by each unit are different, the data in each unit forms an information island. Within each unit, the procurement and financial systems are also independent systems, which leads to the disconnection between the procurement warehousing and payment processes, and a lot of information needs to be supplemented by the procurement personnel and the financial personnel into their own department systems.

Cause 5: Low orders placed to suppliers

Due to the different situation of Shanxi Jinyu Kelin Technology Co., Ltd., some units have small warehouse capacity, and the purchased materials need to be delivered in batches. The delivery date is arranged by the warehouse staff. Sometimes, the quantity of delivery required at a time is small, some mining enterprises are located in remote areas, and the delivery cost is high. Some suppliers refuse to deliver the goods under such circumstances.

Cause 6: Poor quality of supplier delivery

Shanxi Jinyu Kelin Technology Co., Ltd. opts to select as the winning bid the one with the lowest price, meaning that the suppliers who won the bid were often not the head enterprises in the industry, and the quality of the products delivered was of great hidden dangers. According to some company's experts, some suppliers who had been shortlisted had excellent products - the quality of those products left an excellent impression on the frontline workers, but they failed to win the bid because of the high price. In fact, the service life of the products of the newly successful suppliers, especially some accessories, has been showing to be greatly reduced when compared with that of excellent products, which affected the production progress, thus increasing the procurement frequency, leading to higher procurement costs and also impacting in the customer service level (either due to low quality products being delivered and due to delays in the delivery caused by the need for additional procurement cycles).

4.4.2 Selecting the causes to be improved

Under the background that technologies such as digital factory, big data analysis, mobile internet and cloud platform are becoming more and more mature, Shanxi Jinyu Kelin Technology Co., Ltd. must adopt international leading IT platform, realize business process reengineering and digital transformation through the progress of information technology, and enhance corporate brand image.

Drawing lessons from the best practices of mining industry and the development trend of informatization, taking the world-leading informatization management system as the technical platform, and combining with the development needs of S mining company, the construction objectives of this process reengineering project are as follows:

To sort out and optimize the management process of the main business under centralized control of the group company. Build an advanced procurement management platform with the popular advanced procurement management information system in the market as the core,

which meets the requirements of the Group's business reality and the times. The procurement business scope includes material procurement, supplier relationship, intelligent warehousing, master data platform and so on.

Carry out the implementation of related businesses based on the Group's data standards and standardized management system. Change the current situation that the procurement master data is not standardized and the data quality is not high, and realize high-quality data management based on the unified data management mode within the group and corresponding management requirements.

Carry out the project construction according to the concept of promoting the management reform of the Group on the basis of combing and optimizing the management process, improve the swimming lane diagram of the core procurement business of the Group headquarters, the business department and its subordinate enterprises, and establish an information system platform to support the corresponding core business.

4.4.3 Key performance indicators (KPI)

Key performance indicators are reflected by the time required for different stages of the procurement process.

TABLE 4.1 KPIs used to evaluate future processes' improvements Source: author

Procurement process	Problems	KPI	As-is measurement
Procurement plan submission	Long submission cycle time (related to late delivery)	Time for the third-level unit to report the purchase demand	7-9 days
Supplier selection	Poor delivery quality of suppliers (related to low customer service)	Supplier assessment score results	80-100 points
Order placement	Late delivery	Time to receive materials after a return	Imported parts: 3 months - 1 year Equipment: 1-3 months Others: 7-20 days

4.5 Stages IV and V:Process Redesign and Implementation

The solutions proposed to solve each of the causes selected for improvement are detailed below.

4.5.1. Proposed solutions

Solution 1: Improvement method of procurement plan submission

Because the procurement before improvement is managed by the group, the division and the third-level units at three levels, it has caused the overstaffed procurement organization and extended the procurement time. The same planned multi-level manual balance is also the main reason for slowing down the business process and amplifying the purchasing demand. Although the current procurement plan has a multi-level balanced profit pool, there is no balanced profit pool across three levels of companies to use the redundant inventory of brother companies to meet their own procurement needs, causing great waste and inventory backlog.

Based on the reengineering of procurement organization, the management level of the division has been cancelled, and a group-level centralized procurement center is proposed. The submission of procurement plan will be reported from the third-level unit to the centralized procurement center. Unify the permission setting of purchasing plan submission and clarify the division of work. Avoid the confusion caused by the authority, realize the balance of the library by the system automatically running MRP, and automatically generate the safety inventory by the system. Use the system to automatically decide whether centralized mining or self-mining.

In order to ensure the smooth progress of production, Shanxi Jinyukelin Technology Co., Ltd. has maintained a high inventory for a long time. Based on the lean production theory, high inventory covers many management problems. It is absolutely necessary to put an end to the wrong practices of enlarging the purchase demand layer by layer because of fear of insufficient inventory, and enlarging the inventory by taking the lead instead of consuming it.

Based on the elimination and automation method in value chain reengineering, the multi-level approval, multi-level balance and off-line inventory management in the procurement plan submission process need to be reduced or removed by elimination, while the backward method of manual balance and inventory utilization, the automation method based on value chain management, through technical means, through system operation MRP and scientific

safety inventory setting. To accurately calculate the purchase demand. Greatly reduce the manual processing time. Shorten the submission process that originally took 1-2 weeks to a few minutes. At the same time, inter-company procurement across companies can be realized. Supply one party's idle materials to the other party through inter-company procurement and delete the self-purchasing approval and push it back to the procurement process of the third-level company. Through the procurement catalog preset by the system, it is automatically decided whether to purchase centrally or independently.

Solution 2: Improvement method of Supplier selection

The same planned multi-level manual balance is also the main reason for slowing down the business process and amplifying the purchasing demand. First of all, with the establishment of the group's centralized procurement center. Supplier master data is established at the group level. Manage in MDG system. A supplier has only one record in the whole group. Shared by all companies in the group. MDG is the abbreviation of Master Data Governance, which mainly manages the company's materials, suppliers, customers, financial data and other information. The material master data and supplier master data of purchasing department of Shanxi Jinyu Kelin Technology Co., Ltd. are mainly managed in this system. And maintain the interface with other systems to synchronize the master data to other related systems. SRM is the abbreviation of Supplier relationship management, which mainly includes three parts: supplier management, demand management, contract management and procurement collaboration. Supplier management includes supplier registration, review, submission, information change, supplier performance evaluation and exit from the whole life cycle management. Procurement sourcing includes inquiry, public bidding, invitation to bid, competitive negotiation, competitive negotiation, single source and other sourcing methods. The purchaser initiates online sourcing, and the supplier offers online bidding, bid opening and bid selection. Purchase collaboration includes order collaboration and receipt and delivery collaboration.

According to the theory of supplier management. Establish the whole life cycle management of supplier registration, supplier development certification, supplier evaluation and supplier withdrawal. All supplier management related processes are established on the supplier collaboration platform SRM. Through SRM platform, the whole procurement process of sourcing, contract signing and warehousing can be coordinated. Strengthen management while strengthening contact with suppliers. In view of the lack of binding force on suppliers, the main assessment unit is in the division, and the demands of the third-level units cannot be

conveyed unless there are major problems. With the support of the new SRM system, supplier evaluation can be initiated according to the quality of a single delivery.

Solution 3: Improvement method of Order placement

The biggest problem in the order placing process is that the purchase contract is not related to the purchase order of the logistics information system. Through additional conditions, enter into cooperation with the general business department to improve the reluctance of suppliers to cooperate under the condition of low orders. By establishing a supplier withdrawal mechanism, the situation of low-quality suppliers can be effectively improved. After the improved process, firstly, the SRM contract will be transmitted to ERP to generate purchase orders. Then the scanned information of the project contract will be stored in the COP system. For the first time, we will maintain the project contract number in the ERP system and bind it with the purchase order. Changes to subsequent contracts can be found and updated according to the previously maintained contract relationship.

Through the reengineering theory of supplier value chain, and at the same time through SRM system to achieve collaboration with suppliers. Suppliers can see the contents of purchase orders through SRM platform at the first time. Sharing order information can speed up the drafting and signing of contracts.

Each of these solutions allow to deal and overcome some of the causes identified in Figure 4.4, as shown in Table 4.2.:

- ✓ Solution 1 deals with the causes' centralized procurement has not been established' and 'master data centralized management has not been established'. Shanxi jinyu kelin technology co., ltd. canceled the management level of the division and proposed a group-level centralized procurement center. The third-level unit reports the procurement plan to the centralized procurement center. Unify the authority setting of purchasing plan submission and clarify the division of labor. Avoid the confusion caused by permissions, realize the balance of the library through the system automatically running MRP, and automatically generate the safety inventory through the system. Use the system to automatically decide whether to concentrate mining or self-mining. Through systematic operation MRP and scientific safety stock setting. To accurately calculate the purchase demand. Greatly reduce the manual processing time. Shorten the

submission process that originally took 1-2 weeks to a few minutes. At the same time, cross-company cross-company procurement can be realized.

- ✓ Solution 2 deals with the causes' fragmentation of procurement information' and' poor quality of supplier delivery' . Coordinate the whole procurement process of sourcing, signing and warehousing through SRM platform. The withdrawal mechanism of suppliers is established to strengthen management and strengthen contact with suppliers. In view of the lack of binding force on suppliers, the main assessment unit is the division, and the demands of the third-level units cannot be conveyed unless there are major problems. With the support of the new SRM system, supplier evaluation can be started according to the quality of a single delivery.
- ✓ Solution 3 deals with the causes' Information system construction is backward' and ' low orders placed to suppliers'. Shanxi jinyu kelin technology co., ltd. chose ERP, MDG and SRM products from SAP company to replace a large number of procurement management related systems. Such as Kingdee, UFIDA and Dongfang Zongheng. SAP is the abbreviation of "system, application, and products in data processing". It is the name of a product and also the name of a company. It was established in waldorf in 1972. ERP is the abbreviation of Enterprise Resource Planning, which refers to a management platform built on the basis of information and combined with many management ideas. Manage the company's procurement, sales, production, finance, human resources and other aspects of business.

TABLE4.2 Causes targeted by each solution Source: author

	Solution 1	**Solution 2**	**Solution3**
Cause 1	X		
Cause 2	X		
Cause 3			X
Cause 4		X	
Cause 5			X
Cause 6		X	

4.5.2. To-Be Swim Lane Diagrams

Figures 4.5, 4.6 and 4.7 present the swim lane diagrams for the three processes considering that all the solutions proposed above are implemented.

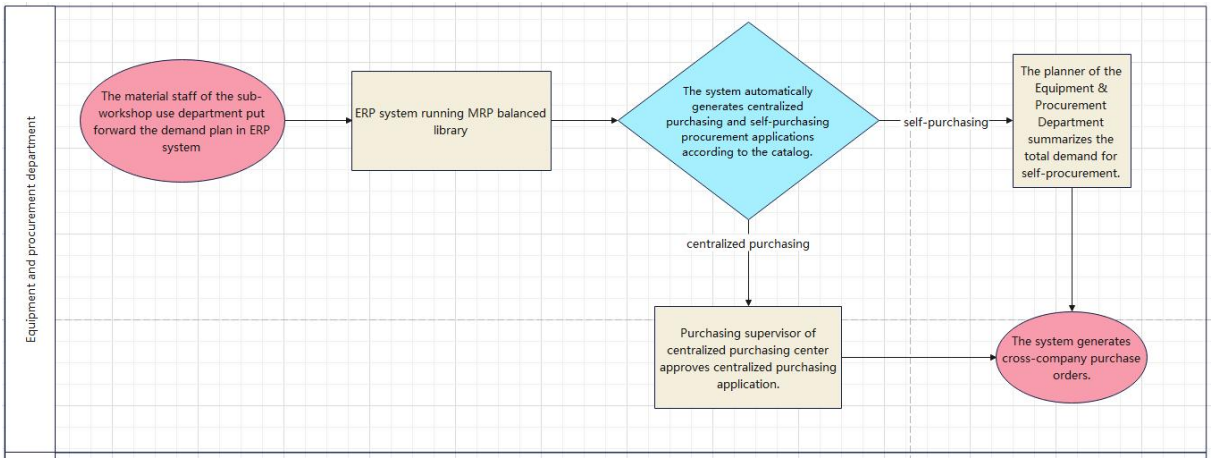

Figure 4.5 Improved swimming lane diagram of procurement plan submission

Source: author

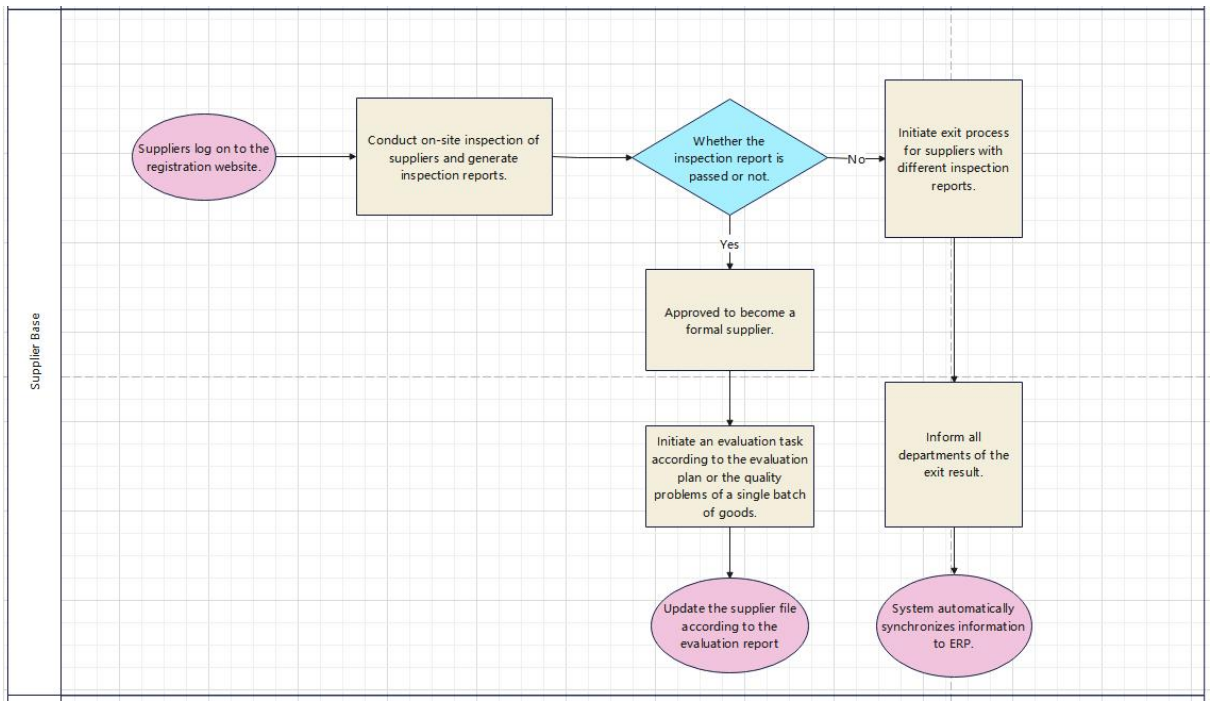

Figure 4.6 Improved swimming lane diagram of supplier selection

Source: author

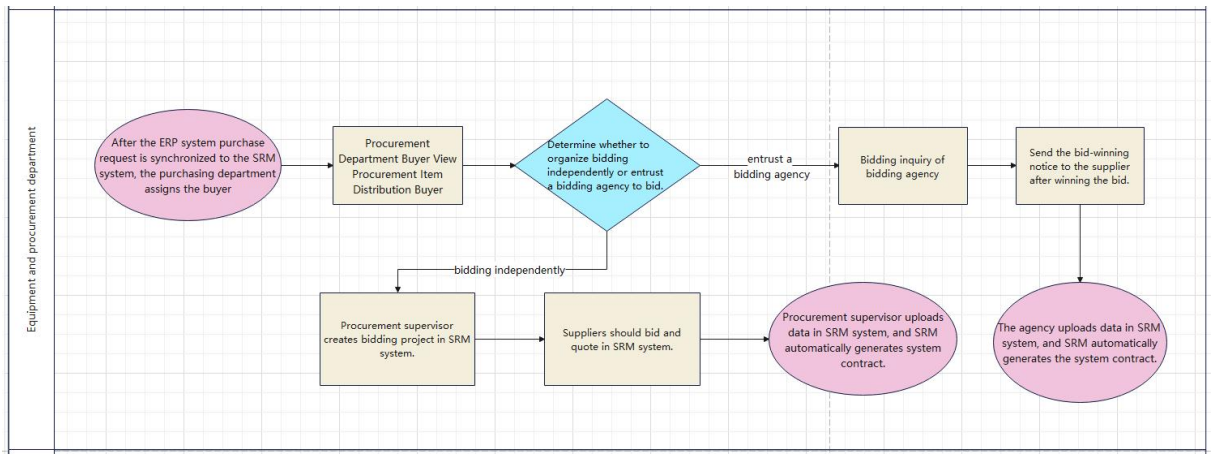

Figure 4.7 Improved swimming lane diagram of order placement

Source: author

4.5.3. Implementation plan

Procurement plan submission

The material staff of the sub-workshop use department put forward the demand plan in ERP system. Then, ERP system running MRP balanced library. The system automatically generates centralized purchasing and self-purchasing procurement applications according to the catalog. If centralized purchasing, Purchasing supervisor of centralized purchasing center approves centralized purchasing application. If self-purchasing, The planner of the Equipment & Procurement Department summarizes the total demand for self-procurement. Finally, the system generates cross-company purchase orders.

Supplier selection

Suppliers log on to the registration website. Conduct on-site inspection of suppliers and generate inspection reports. Determine whether the inspection report is passed or not. If the inspection report is passed, approved to become a formal supplier. Initiate an evaluation task according to the evaluation plan or the quality problems of a single batch of goods. Finally, Update the supplier file according to the evaluation report. If the inspection report is not passed, initiate exit process for suppliers with different inspection reports and inform all departments of the exit result. Finally, System automatically synchronizes information to ERP.

Order placement

After the ERP system purchase request is synchronized to the SRM system, the purchasing department assigns the buyer, procurement Department Buyer View Procurement Item Distribution Buyer. Determine whether to organize bidding independently or entrust a bidding agency to bid. If bidding independently, procurement supervisor creates bidding project in SRM system. Suppliers should bid and quote in SRM system. Finally, procurement supervisor uploads data in SRM system, and SRM automatically generates system contract. If entrust a bidding agency to bid, bidding inquiry of bidding agency and Then send the bid-winning notice to the supplier after winning the bid. Finally, the agency uploads data in SRM system, and SRM automatically generates the system contract.

4.6 Stage VI:Process Evaluation

Table 4.3 shows the comparison of KPIs evaluated before and after the implementation of solutions, showing the potential to reach significant improvements with the proposed solutions.

After a series of re-engineering, such as running MRP in the system instead of manual balance warehouse, we added the balance warehouse between companies. The system calculates safety stock, etc. The backlog of inventory is gradually decreasing by 20%.

After a series of reengineering, the submission time of procurement plan was shortened from 21 days to 7 days. The procurement demand-seeking time has been shortened from the previous 10-30 days to 7-20 days. In terms of supplier delivery, except for imported parts and equipment, the delivery time is longer. The improvement is not obvious. The daily delivery evaluation of common materials is shortened by 2-5 days.

TABLE 4.3 KPI target value evaluation index Source: author

Procurement process	KPI	As-is measurement	To-be value measurement
Procurement plan submission	Time for the third-level unit to report the purchase demand	7-9 days	3-4 days
Supplier selection	Supplier assessment score results	80-100 points	90-100 points
Order placement	Time to receive materials after a return	Imported parts: 3 months - 1 year Equipment: 1-3 months Others: 7-20 days	Imported parts: 2 months - 6 months Equipment:20days- 1 months Others: 7-14 days

Before business process reengineering, the Division centralized procurement, and the procurement plans of each unit were submitted to the Division for summary and approval after being approved by the unit. The centralized procurement plan will remain in the Division for procurement, and those that are not centralized will be diverted back to the original demand unit. After the process reengineering, the level of centralized procurement is raised to the group level, and the third-level unit still retains the function of self-procurement after deducting the redundant level of the division. However, different from the previous backflow, the re-engineered process sets up centralized purchasing catalogue in the information system, realizes the business requirements of two-level procurement and hierarchical authorization, strengthens the strategic procurement function, and optimizes the supplier level and grade through category analysis and procurement scale; You can sign a framework agreement with suppliers to shorten the procurement time. A series of adjustments straighten out the process, effectively support the two-level procurement system, give play to the benefits of large-scale procurement, and improve the quality of suppliers. It is expected to greatly reduce the procurement cost of enterprises.

In the process of business process reengineering, Shanxi Jinyukelin Technology Co., Ltd. has also established rules and regulations and assessment standards to adapt to the new business process. All departments have changed from functional management to process management. Clear process and flexible system speed up the implementation of the process, and the use of information system under the background of new technology further simplifies the implementation of the process. Many steps that need to be approved and operated offline can be completed online. Finally, the management cost of Shanxi Jinyukelin Technology Co., Ltd. was reduced.

Seamless integration of SRM management sourcing process and ERP system. The horizontal connection between ERP and SRM can be realized. Buyers can initiate online sourcing, suppliers can quote online, online pricing, and the results of sourcing can be automatically transmitted back to ERP, which is seamless, transparent, compliant and efficient, and provides support for subsequent data analysis and decision-making.

At present, the main suppliers are managed by various business divisions, and a few suppliers are managed by enterprises themselves, so there is no centralized and unified supplier management platform; Take the invitation to be shortlisted, manage the supplier shortlisting process offline, approve offline, and jointly review offline, and only record the supplier shortlisting results online; The supplier evaluation adopts offline annual evaluation, and the evaluation results are not connected with the supplier files. In the future, multiple sets

of procurement management systems will be launched. The Group will manage suppliers in a unified way, and the suppliers will be managed by a unified platform. Supplier self-registration, development certification, access, approval, information change, freezing, thawing, withdrawal and other life cycle management are all carried out online, leaving traces in the process and being efficient; Supplier evaluation is conducted online, and different evaluation periods can be set according to categories. The results of supplier evaluation are connected with supplier files, which provides a basis for supplier improvement. Unified supplier management platform, supplier management from decentralized to centralized; Optimize the supplier resource pool.

At present, the procurement department of Shanxi Jinyukelin Technology Co., Ltd. cooperates with suppliers in sourcing and execution, and cooperates with suppliers by telephone, SMS, WeChat and QQ. With the process reengineering and the launch of multiple procurement management systems, online sourcing is realized, suppliers confirm orders online, and feed back the delivery date and quantity; Create delivery notice online; The purchaser of Shanxi Jinyukelin Technology Co., Ltd. transmits the receiving information to the supplier after receiving the goods; Online reconciliation of suppliers provides a basis for invoicing. Open up the cooperation of upstream suppliers in the supply chain; Open up internal and external cooperation to improve procurement efficiency; Order collaboration, receipt and delivery collaboration and invoice collaboration are all conducted online, providing data support for future data analysis.

With the implementation of business process improvement, Shanxi Jinyukelin Technology Co., Ltd. has also set up a brand-new information management system. These brand-new management systems constitute a brand-new information management platform of Shanxi Jinyukelin Technology Co., Ltd.. The master data management platform MDG manages the supplier master data at the group level. Purchase demand and supplier collaboration information are unified in SRM system. The management of demand plan and the execution of procurement are unified in ERP system. Compared with the offline project data query work that used to take several hours. On-line information system can make staff quickly query the required purchasing data in a few minutes, which greatly speeds up the daily work efficiency.

5. Conclusion

Based on BPM and process improvement, this project finds out the current challenges and reasons of enterprises through semi-structured interview and fishbone diagram analysis, and puts forward improvement methods with the concentrated results of semi-structured interview as the main line.

At present, the business process improvement group of enterprises is carried out under the background of digital transformation of enterprises, and the business process reengineering of most enterprises is also digital transformation. The improvement of the procurement business process of Shanxi Jinyukelin Technology Co., Ltd. is also the digital transformation of its procurement business. Based on the principle of centralized procurement in Shanxi Jinyukelin Technology Co., Ltd., we upgraded it to unified procurement at the group level, and set up a centralized procurement center at the group level, which reduced the procurement staffing of each secondary unit and strengthened the purchasing control ability of the group.

The application of SRM system of Shanxijinyu Kelin Technology Co., Ltd. has realized the coordination of the whole procurement process. Including order collaboration, delivery collaboration, invoice collaboration, etc. It has further accelerated the procurement process and strengthened the relationship with suppliers. Based on the systematic analysis of purchasing historical data, we have established a brand-new supplier assessment and evaluation system for Shanxijinyu Kelin Technology Co., Ltd. By applying the most standard business practices of informatization and digitalization, we have established an informatization and digitalization platform for Shanxi Jinyukelin Technology Co., Ltd.. Change all kinds of business delays and errors caused by backward information system construction in the past. Optimize the office environment.

As a professional chemical enterprise, Shanxi Jinyu Kelin Technology Co., Ltd. has its unique enterprise characteristics after years of development. According to the enterprise situation of Shanxi Jinyu Kelin Technology Co., Ltd. and the problems existing in the procurement process, the author can only selectively apply some theories of business process improvement to analyze and solve some problems, but can't comprehensively use all theories to analyze and elaborate.

Secondly, because the internal trade secrets of Shanxi Jinyu Kelin Technology Co., Ltd. are involved, the data obtained from Shanxi Jinyu Kelin Technology Co., Ltd. are limited, so it is impossible to use detailed data to analyze, and perhaps it cannot fully reflect the detailed

situation of Shanxi Jinyu Kelin Technology Co., Ltd.' s procurement business, which affects the depth of research.

Thirdly, the standardization of master data and the design of corresponding parameters and weights such as supplier assessment and evaluation. With the continuous change of enterprise situation, the corresponding factors and weights may need to be readjusted.

With the development of the times, new technologies such as blockchain, big data, cloud computing and artificial intelligence have shined in all walks of life, bringing revolutionary changes to many enterprises. Although this kind of technology is still necessary for Shanxi Jinyu Kelin Technology Co., Ltd., because Shanxi Jinyu Kelin Technology Co., Ltd. was backward in information system construction before, it could not leap into the era of new technologies such as cloud computing. The application practice of these new technologies in Shanxi Jinyu Kelin Technology Co., Ltd. is the key and direction of subsequent process improvement.

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Appendix A –Material supplier access application form

Basic information of material suppliers

Name of supplier:	
Supplier type:□manufacturer □Agent □merchant	Name of manufacturer represented:
Industrial and commercial registration number:	
Country:	Region:
Address:No. Road (Street), province (city) and city (district) Zip code:	
Scope:	
Quality management system certification and certification bodies:	
Product quality certification and certification bodies:	
Production/manufacturing license obtained and number:	
Awards:	
Company type:	Company phone number:

Appendix B –Annual supplier assessment score sheet

Name of supplier:

serial number	Assessment items	Examination sub-item	Score range	Actual score	Remarks
1	Quality level (30 points)	Quality management system	0-2		
		Product certification	0-3		
		Arrival quality	0-10		
		Quality of use	0-10		
		Quality evaluation	0-5		
		Subtotal			
2	Contract deed (20 points)	Contract performance rate	0-8		
		Timeliness of delivery	0-7		
		Accuracy of delivery	0-5		
		Subtotal			
3	Delivery capacity (15 points)	Delivered quantity	0-5		
		Lead-time	0-3		
		Response ability to increase/decrease orders	0-3		
		Guarantee ability of sporadic or urgent orders	0-4		
		Subtotal			
4	After-sales service and honest management (20 points)	Good faith management	0-5		
		Timely response rate	0-4		
		Troubleshooting	0-4		
		After-sales service	0-4		
		Jointly improve and participate in development.	0-3		

		Subtotal			
		Preferential degree	0-10		
		Ability to digest price increases	0-5		
		Subtotal			
			0-100		
Comments of the review panel (Signature) Month Day Year					