ISCTE Business School
Instituto Universitário de Lisboa

Supply Chain Operation Strategies and Risk Management with Working Capital Consideration: A Case Study of the Supply Chain of Lightning Protection Products in China

CHEN Jianxiong

Thesis submitted as partial requirement for the conferral of the degree of

Doctor of Management

Supervisor:

Professor Álvaro Rosa, Associate Professor, ISCTE University Institute of Lisbon

January 2016

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January 2016

Declaration

I declare that this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university and that to the best of my knowledge it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed  Date: 18, January, 2016

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作者申明

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Abstract

With the advent of economic globalization, competition is increasingly hinged on supply chain. Meanwhile, working capital becomes a key element of a successful supply chain. This thesis researches the supply chain of a typical lightning protection products manufacturer in China, *i.e.* Company Z. The thesis starts with the working capital issues in the supply chain of Company Z; then, with the help of questionnaires and a sensible indicator system and weight assignments; analyzes and summarizes the status quo of the working capital and related key issues in the supply chain consisting of Company Z and its suppliers and customers. Building on such analysis, a two-dimensional classification matrix is created to divide suppliers and customers into four groups (namely, strategic-type, partner-type, general-type, and bottleneck-type) and supply chain operation strategies are devised for each group. Furthermore, based on such supply chain operations strategies of Company Z, a working capital risk management mechanism with an early warning system is developed, and a supply chain-based financing platform is designed to help the supply chain participants seek financing and share the risks with working capital.

Key words: Working Capital; Supply Chain; Operation Strategy; Risk Management

JEL: G32; D21

Resumo

Com o advento da era da globalização económica, a cadeia de suprimentos tornou-se cada vez mais importante para a concorrência empresarial, e ao mesmo tempo, o fundo de maneio tornou-se num elemento chave para o sucesso da gestão da cadeia de suprimentos. Neste trabalho, a cadeia de suprimentos de uma empresa chinesa de fabricação de produtos típicos de proteção contra relâmpagos, a empresa Z, é o objeto de estudo. Tomando como ponto de partida os problemas de fundo de maneio existentes na cadeia de suprimentos da empresa Z, por meio de questionários combinados com o estabelecimento de um sistema de indexação e de ponderação, foram realizadas análises precisas sobre problemas-chaves existentes e da situação atual da gestão do fundo de maneio da cadeia de suprimentos a montante e a jusante da empresa Z. Estabeleceram-se matrizes bidimensionais de classificação para respectivamente subdividir os fornecedores e clientes em quatro categorias, a saber, categoria de fornecedores/clientes estratégicos, categoria de fornecedores/clientes parceiros, categoria de fornecedores/clientes comuns e categoria de fornecedores/clientes críticos (“engarrafamentos”) e propor estratégias diferentes na cadeia de suprimentos para diferentes categorias.

Por fim, o nosso estudo indica que segundo a estratégia de operação da cadeia de suprimentos da empresa Z, deve ser estabelecido um mecanismo de controle e gestão de risco de fundo de maneio, um sistema de alerta de risco e, ainda, projetar uma plataforma de financiamento a fim de prover o financiamento emergente da cadeia de suprimentos da empresa Z e a partilha dos riscos de gestão do fundo de maneio.

Palavras chave: Fundo de maneio; Cadeia de suprimentos; Estratégia de operação;
Gestão e controle de riscos

JEL: G32; D21.

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Chapter 1: Introduction

1.1 Research Background and Significance

1.1.1 Research Background

In the era of economic globalization, business competition is growing increasingly intense. And the competition has no longer been limited to companies but extended to the supply chain. Supply chain management is the methodology that seeks to manage manufacturing, transportation, distribution and sale at the lowest cost of the supply chain system while maintaining customer service at a certain level, by an organic planning and arrangement of the activities of suppliers, manufacturers, distributors, retailers and their warehousing and distribution centers. It also includes the logistics, information flow and capital flow management during such a process. As an important means of modern management, supply chain management targets at faster speed, higher certainty and the maximum net value added in the process of supply chain operations, helping improve the overall operational efficiency and benefits in an organization; emphasizes on the integrated management and optimization of the supply chain, coordinating intercompany as well as cross-departmental flows of products, information, capital and services and thereby achieving the overall goal of the supply chain system as well as creating value for players at each node of the supply chain. Supply chain management helps lower costs, improve flexibility and enhance responsiveness, contributing to better competitiveness of the supply chain. It has become a driving force for a company to gain competitive advantages and improve profitability. Particularly, working capital carries a growing weight in supply chain management.

Working capital, known as the ‘blood’ of the supply chain, is the money that is closely related to supply chain operations. As smooth flows of working capital provide for the sound operating mechanism of the supply chain, the management of working capital is critical to the

supply chain. At many high-performing companies at home and abroad (Wang et al., 2007), CFOs or financial managers devote 60% and more of their working time to managing supply chain-related working capital. Therefore, It is necessary to include such management in the decision making process of supply chain operations.

This thesis investigates the supply chain of Company Z – a leading lightning protection products manufacturer in China. In service to the development, manufacturing and distribution of lightning arresters and other lightning protection products, the supply chain engages suppliers like manufacturers of electronic components, hardware, rubber/plastic fabrications, and serves customers in many fundamental industries like telecommunications, electric power, petroleum and petrochemicals, new energy, aerospace, defense, construction, rail transit, and information technology. With competitive lightning protection products, Company Z attracts upscale customers in the communications industry and is a core supplier for Ericsson, ZTE, Huawei and Nokia Siemens Networks. The investigation discovers that Company Z, whose supply chain plays a crucial role, faces increasing cost pressure and is in desperate need to find ways to reduce costs and enhance efficiency. The usual approaches for cost reduction adopted by Company Z include reducing cost reduction targets for suppliers and negotiating with customers for better prices. The former approach works on suppliers to squeeze supply prices and may lead to undesired outcome: there is not so much room suppliers can maneuver their cost and too much squeezing may result in desperate moves such as employment of materials of inferior quality or unproven alternatives (which may create defective, low-performance, unreliable products and cause quality-related problems and damage to the business and reputation) or forced quitting in a loss-making circumstance or at the slight chance of profit (which may result in a broken supply chain). Similarly, the latter approach that works on customers for a higher sales price may also lead to undesired outcome: customers may find a new supplier or simply abandon the procurement if they find the price unbearable (which may also result in a broken supply chain). Moreover, Company Z has a sufficient working capital but also faces the risk of a broken supply chain: on the one hand, the Company often delays payment to and constantly demands lower prices against suppliers, which affect their operations and increase their financial pressure; on the other hand, the

Company does not take into account business and financial situations of customers. Furthermore, in addition to such problems with suppliers and customers, Company Z also has to spend in identifying or developing resources, which also raises the overall cost. This turns out to be a common case with the supply chain among manufacturing companies as investigation with other companies or industries shows. Related theoretic research has hence ensued.

This thesis considers the entire supply chain around Company Z and delves into, with empirical validation, working capital-conscious supply chain operations strategies and risk management mechanism. During the research involved in the thesis, a working capital assessment is firstly conducted on Company Z along with a sensible indicator system and weight assignments; then a survey is conducted via questionnaires and interviews (face-to-face, telephone and email) with 220 suppliers and 104 customers of Company Z to collect the data for analysis.

In summary, this thesis starts with the working capital issues in Company Z's supply chain and analyzes from the supply chain management as perspective the management problems in the Company, before proposing a package of indicators, strategies and approaches in an attempt to lower operating costs, improve capital efficiency, and reduce risks.

1.1.2 Research Significance

The research involved in this thesis has important theoretical value and practical significance, which are mainly embodied in the following two aspects:

1. Theoretical Significance

After doing some literature review, I find that most scholars give no consideration to working capital in researching supply chain management and that more scholars conduct research of working capital from the perspective of finance and corporate internal management without considering the supply chain. The research involved in this thesis just makes up the existing insufficiency and gap in these two aspects. It means combining supply chain management and working capital management, and considering corporate operation

strategy and risk management from the perspective of upstream and downstream supply chain as the beneficial supplement and improvement of working capital management theory and supply chain management theory. The research involved in this thesis is exploratory and innovative at the leading edge. Therefore, the research has very important theoretical significance.

2. Practical Significance

In the present enterprise management, most analyses and treatments of enterprise issues are in relation to enterprise's internal considerations. Enterprises only consider internal issues with working capital without giving consideration to the collaboration of working capital from the perspectives of upstream and downstream supply chains, thus it is prone to cause supply chain capture. To explore supply chain based decision making method and model, it is required to consider the working capital of upstream and downstream supply chains, which has important guiding significance and value for the development of modern enterprises. The research involved in thesis not only accommodates the demands for development of supply chain's management theory and management theory of working capital, but also provides scientific decision making means for enterprise's practical operation. Therefore, it has a broad application space and important practical significance.

1.2 Research Framework and Main Contents

1.2.1 Research Framework

The purpose of thesis is to build a system for assessment of risks with working capital in the supply chain of enterprise and early warning management with the supply chain of Company Z as the research object on the basis of existing supply chain management and research of working capital management theory. The competitive advantages of enterprises in the supply chain will be supported through management of risks with the working capital of supply chain.

The dissertation is organized under the following framework: Chapter 1 brings up the issues to be tackled: why the thesis focuses on supply chain operation strategies and risk

management mechanism giving consideration to working capital – the background and significance of the thesis; Chapter 2 summarizes and reviews existing literature on supply chain management and working capital management theories; Chapter 3 builds an indicator system and assesses the working capital risks in Company Z's supply chain; Chapter 4 builds a two-dimensional classification matrix for suppliers and customers respectively and devises appropriate operation strategies for each type; Chapter 5 develops an early warning indicator system, defines the upper and lower warning limits, and conducts an early warning analysis of Company Z and its suppliers and customers on the supply chain for risk control purposes; Chapter 6 sum ups and gives an outlook on future research. The specific idea is as shown in Figure 1-1:

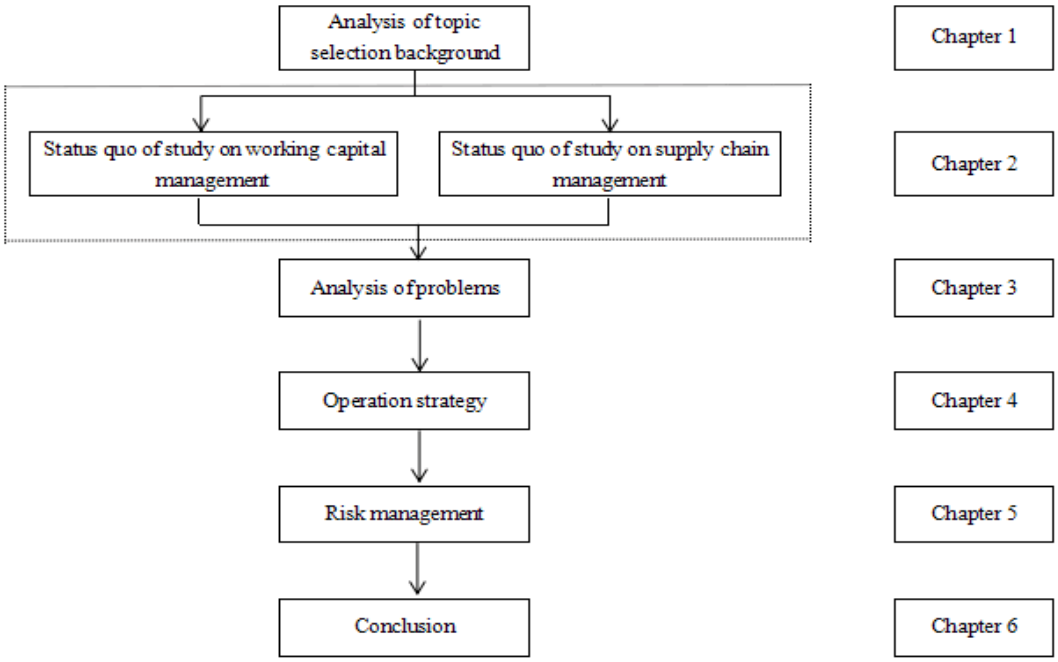

Figure 1-1 Basic Framework of the Thesis

Source: Author finishing

1.2.2 Main Contents

Thesis consists of six chapters.

Chapter 1: Introduction. It mainly elaborates the topic selection background, theoretical and practical significance of research, research framework and main contents of thesis, as well as research methods, main innovation points, etc.

Chapter 2: Literature Overview. Relevant literatures are sorted out and summarized in two monographic researches, *i.e.* management theory of supply chain and management theory of working capital, laying a foundation for the supply chain operation strategy and risk management mechanism giving consideration to working capital as set out below.

Chapters 3 to 6 are the focus and core of thesis and also the part of innovation in this thesis.

Chapter 3: Assessment of risks with working capital of the supply chain of Company Z. Firstly, we will select assessment indicators, and use Delphi method and hierarchy analysis to determine the weight; secondly, build risk assessment model and determine the standards for assessment of risks with working capital in the industry; an analysis will be subsequently made as to the status quo of working capital of Company Z before an analysis of the supply chains at the upstream and downstream of Company Z. Then, efforts will be made to design supplier questionnaire and customer questionnaire, sort out data in relation to the questions in questionnaires, and judge the risks with working capital of suppliers and customers respectively with assessment model and judgment conditions for risks with working capital; in the end, the problems with the working capital of Company Z's and upstream and downstream supply chains.

Chapter 4: Supply chain operation strategy giving consideration to working capital. Company Z's suppliers are classified by the level of risk with suppliers' capital and the value of suppliers, and a two-dimensional matrix is built for analysis. Appropriate strategies are put forward for four types of suppliers; similarly, Company Z's customers are classified by the level of risk with customers' capital and the value of customers, and a two-dimensional matrix is built for analysis. Appropriate strategies are put forward for four types of customers. A two-dimensional matrix is built for suppliers and customers respectively for classification analysis and proposing appropriate strategies, which is the core of thesis.

Chapter 5: Supply chain risk management mechanism giving consideration to working capital. Firstly, determine warning upper and lower limits for risks with working capital. Secondly, manage the warning of risks with the working capital of Company Z's and upstream and downstream supply chains, and build a supply chain based financing platform.

Chapter 6: Conclusion and outlook. It mainly concludes the main contents of this thesis and indicates the shortcomings and future research direction of this thesis.

1.3 Research Methods and Main Innovations

1.3.1 Research Methods

Selection of research methods depends on the nature and characteristics of research object and needs of research purpose. The supply chain operation strategy and risk management mechanism giving consideration to working capital can be carried out from the perspectives of management, economics, accounting, etc. The research involved in thesis is on typical cases in combination of fund-movement theory, information economics, risk return and other theories in economics theory as well as the comprehensive knowledge of multiple disciplines including management, financial management and supply chain management. It adopts literature research, theoretical modeling, case research and other methods, and focuses on linking theory with practice. The research methods show a diversity of characteristics.

(1) Literature research. Accessing to relevant documents to grasp the latest cutting-edge development and research results of supply chain management theory and working capital management theory and normative analysis of supply chain management theory and working capital management theory lay a foundation of theoretical basis for thesis.

(2) Theoretical modeling. On the premise of basic perspective of supply chain management and working capital management objectives, select working capital risk assessment indicators, determine weights with Delphi method and analytic hierarchy process, calculate assessed value of working capital based on industry data and build the general theoretical models for working capital risk assessment and working capital risk warning respectively.

(3) Case Research. Link theory with practice, as corporate working capital management is an issue with strong reality. The research involved in thesis selects cases as much as possible, trying to fully confirm the reasonableness of theoretical perspectives to increase persuasion with typical cases and apply the same in the practical work of working capital

management of supply chain.

1.3.2 Main Innovations

This thesis focuses on supply chain operation strategies and risk management mechanism giving consideration to working capital, which is mainly reflected in the following aspects:

(1) Build a working capital risk assessment system: firstly, the thesis proposes an evaluation indicator system for assessment of risks with working capital based on existing theoretical research and extensive expert opinions, and builds the working capital risks assessment model with weights determined by the Delphi method and the Analytic Hierarchy Process.

(2) Conduct categorical analysis of upstream and downstream enterprises and propose different operation strategies: based on the level of their exposure to working capital risks and their value to Company Z, Company Z's suppliers are divided into four groups and are analyzed with a two-dimensional matrix before appropriate strategies are developed; similarly, based on the level of their exposure to working capital risks and the degree of customization at Company Z, Company Z's customers are also divided into four groups and are analyzed with a two-dimensional matrix before appropriate strategies are developed.

(3) Build an early warning system for working capital risks and corresponding risk management mechanism:

An early warning system for working capital risks of supply chain is developed to determine the upper and lower limits assigned for monitoring working capital risks on the supply chain. Then early warning analysis and management are conducted for the working capital in Company Z's supply chain. An analysis is also conducted as to the early warning of working capital risks in different sections at the upstream and downstream and of Company Z, and different strategies are adopted. In addition, a supply chain-based financing platform is devised.

Chapter 2: Literature Review

There are mainly two aspects of management research that are closely related to this thesis: namely, supply chain management and working capital management.

2.1 Review of Literature on Supply Chain Management

The review of literature on supply chain management in relation to the research involved in thesis is mainly in three aspects, i.e. research on selection of suppliers, research on channel building and research on supply chain coordination:

1. Research on Selection of Suppliers

Supplier selection is now an important part of corporate procurement decision. In the supply chain, procurement cost of most companies accounts for more than 70% of the total cost of product. Supplier selection will directly affect the cost reduction of enterprises, increase their flexibility, and enhance their competitive advantage. A lot of researches have been conducted on supplier selection in the academic circles, mainly on the supplier selection indicator system and supplier selection method.

Related scholars have researched the supplier selection indicator system. American scholar Dickson (1966) was the first to begin a systematic research on supplier evaluation. He summed up 23 supplier selection standards and their rank and weights through statistical survey of 273 procurement managers and representatives of the American National Association of Purchasing Managers. Ellram (1990) suggested that, when making the supplier selection decision, it's required to consider the cost, delivery period, quality and other quantitative indicators as well as qualitative indicators including object consistency, management compatibility and strategic similarity. Weber et al. (1991) reviewed 74 literatures on supplier evaluation and selection published in the period from 1967 to 1990, and drew the conclusion that price, delivery, quality and equipment capacity were the most important

evaluation criteria. Willis et al. (1993) proposed the supplier selection using the evaluation and production model composed of price, quality, delivery performance, inventory planning, financial situation, speed of reaction to special order, speed of processing customers' problems, and convenience of ordering. Smytka and Clemens (1993) suggested using corporate demand factors, measurable cost factors and risk factors as supplier selection criteria. Min (1994) indicated in his research the selection of 7 indicators, *i.e.* supply-demand relationship, quality assurance, service performance, financial conditions, risk perceived, cultural exchange barriers and trade restrictions, to evaluate international suppliers. Patton (1996) pointed out that the most important factors and sequence of supplier selection and evaluation decision were product quality, price, delivery, sales support, facilities and technology, order procedures and financial situation. Choi and Hart1ey (1996) concluded through analysis that the purchasing managers in the US auto industry believed that the price, quality and delivery consistency, technical ability, customer service, reliability, long-term relationship and close degree, flexibility, and financial situation were the most important indicators for evaluation of supplier selection. Mummalaneni et al. (1996) pointed out that Chinese purchasing managers preferred to use price, cost, quality, delivery, professional level of sales personnel, response capability of customer demand, etc. as evaluation indicators when selecting suppliers. Noci (1997) suggested using 13 indicators as the selection and evaluation system for evaluating "green" suppliers. Menon et al. (1998) proposed 7 indicators, *i.e.* price, on-time delivery, financial situation, management, corporate reputation, performance capabilities and response to unforeseen incident as evaluation indicators for selection of third party logistics. Yahya and Kingsman (1999) investigated 16 experienced managers and supervisors through the use of analytic hierarchy process in order to determine the supplier selection evaluation system and the corresponding weights.

With the rapid development of business activity in the 21st century, a large number of scholars further conducted an extensive, in-depth research on the selection indicator system for evaluating suppliers. Petroni and Braglia (2000) proposed to form the indicator system for evaluation and selection of suppliers with price, quality, on-time delivery, technical capabilities, management capabilities, production facilities and capabilities. Handfield and

WaIton (2002) put forward an indicator system for selection of suppliers and performance evaluation compoased of 10 most important indicators. Yahya and Kingsman (2002) proposed to form the indicator system for selection and evaluation of suppliers with on-time delivery, quality, response speed, technical capabilities, financial situation, management, equipment and facilities as well as observing regulations and discipline. Shahadat (2003) indicated that 9 indicators, *i.e*. price, quality, on-time delivery, assurance conditions, technical capacities, prompt and effective treatment of substandard products, reputation, financial capacity and maintenance technical services were often used in developing countries to evaluate and select suppliers. Mininno (2003) put forward an evaluation system for selection of suppliers consisting of product prototype manufacturing time, product structure design time, design modification time, cooperative design, quality system and technical level. Bharadwaj (2004) pointed out that the evaluation indicators for supplier selection decision in the order of priority were product quality, product arrival, timely delivery performance, replenishment accuracy, ability to complete urgent orders, accuracy of loans and payment, product price and service, after-sales help and support, and ability and desire to assist product design. Pi and Low (2005) used price, quality, on-time delivery and service as selection indicators for evaluation of suppliers. Wang et al. (2007) designed an indicator system for evaluation and selection of suppliers with supply chain response time, production flexibility, value-added productivity, total logistics management cost, delivery performance, replenishment rate, order realization lead time, perfect order realization, ensuring cost or returns processing cost, realization period time, asset turnover, and inventory days.

Relevant scholars have also conducted a detailed research on supplier selection methods, which include linear weighting method, cost method, mathematical programming method, artificial intelligence method, combination method and other method.

Some scholars have researched linear weighting method. Saaty and Alexander (1981) proposed the analytic hierarchy process (AHP), which give full play to people's initiative and expressed some qualitative factors in a quantitative form based on people’s experience, intuition and insight in an uncertain environment. Therefore, AHP has been widely applied in supplier evaluation and selection. Byun (2000) adopted AHP to analyze the procurement

process of Korean cars and select suppliers. Chena et al. (2006) designed a supplier evaluation and selection decision method for fuzzy multiple indicator groups based on TOPSIS method in an uncertain environment. Cevriye and Didem (2007) built an ANP model for preferred suppliers, and validate the effectiveness of this model through cases. Chou and Chang (2008) designed a fuzzy group decision method for preferred suppliers. Lee (2009) proposed the supplier selection FAHP model giving consideration to the opportunity, costs, benefits and risks.

Some scholars researched cost method. For example, Timmerman (1986) suggested selecting suppliers with the cost ratio method; Monczka and Trecha (1988) select suppliers through researching on the direct and indirect costs of corporate procurement activities; Filip and Jozef (1996) proposed the activity-based costing (ABC) method for supplier selection, and then the ABC method was applied to a certain degree; Benton and Park (1996) summed up the procurement batch model based on the full quantity discount and excess quantity discount of cost model; Degraeve et al. (1998) drew with the Total Cost of Ownership (TCO) method that mathematical programming model was superior to the evaluation model and multi-project model was superior to single project model; Kawtummachai and Hop (2005) designed a supplier selection and procurement distribution model with cost minimization as the objective and service level as the constraint.

There are also many scholars having researched mathematical programming method, which can be divided into single objective programming and multi-objective programming. Among relevant scholars engaged in research on single objective programming, Gaballa (1974) used linear programming method to deal with the issues of supplier selection and procurement amount optimization for the first time and built a mixed integer programming model. Then, lots of scholars focused on research in the field. Chaudhry et al. (1993) designed a mixed integer programming model to solve the problems with supplier selection and procurement amount distribution under the conditions of multi-resource network. Narasimhan and Stoynoff (1986) established a non-linear single objective mixed integer programming model, and arrived at a conclusion that the total cost was inversely proportional to the procurement amount and lead time. Turner (1988) proposed a linear programming model for

the British coal procurement plan. Pan (1989) selected suppliers and increase supply stability with the strategy of order decomposition and built a single objective linear programming model with price, quality and service as constraints. Benton (1992) proposed a single-objective nonlinear programming model for supplier selection and procurement amount distribution optimization involving multiple products, suppliers and buyers on the conditions of limited supply resources and price discount. Jayaraman et al. (1998) devised a single-objective mixed integer nonlinear programming model used to solve the problems with supplier selection and procurement amount distribution decision on the conditions of multiple products and supply sources and no price discount. Ghodsypour and Brien (2001) established a single-objective mixed integer nonlinear programming model for solving the problems with multi-stage supplier selection and procurement amount distribution optimization decision on the conditions of single product, multiple supply sources and no price discount. Andi et al. (2002) devised a single-objective linear programming model for supplier selection and procurement amount distribution optimization decision. Crama et al. (2004) established a single-objective mixed integer nonlinear programming model used for supplier selection and procurement amount distribution and production scheme optimization decision in case of single-enterprise and multi-enterprise procurement. Chuda et al. (2005) developed a single-objective mixed integer programming model in accordance with the characteristics of joint decision-making for multi-period and multi-product supplier selection and procurement amount distribution. Kheljani et al. (2009) built a single-objective mixed integer nonlinear programming model targeting at minimizing the total cost of supply chain for the issues with supply selection and procurement amount distribution of multi-cycle, multi-supply source and single-product procurement in case of no price discount.

Among relevant scholars engaged in multi-objective programming researches, Buffa and Jackson (1983) proposed a multi-objective linear programming model, and gave comprehensive consideration to quality, price, service and delivery. Weber and Current (1993) built a multi-criteria linear programming model to solve the problems with supplier selection and procurement amount distribution optimization decision under the conditions of single product, multi-supply source and no price discount. Multi-objective linear programming

model is more in line with actual procurement situation, therefore this model has been widely used. Birsen et al. (2001) also designed a multi-criteria linear programming model for supplier selection and procurement amount distribution optimization with multi-product, multi-supply source and no price discount. Gao and Tang (2003) built a multi-objective linear programming model giving consideration to procurement budget, production demand, inventory capacity, ratio of different products and other constraints. Amid et al. (2006) constructed a fuzzy multi-objective linear programming model without discount and fuzzy demand for single-cycle and single-product procurement. Kumar et al. (2006) designed a fuzzy multi-objective linear programming model of single-cycle, multi-supply source and single product. Wadhwa and Ravi (2007) devised a multi-objective mixed integer linear programming model based on the conditions of incremental price discount. Wu et al. (2009) designed a fuzzy multi-objective linear programming model for solving the issues with joint decision-making for supplier selection and procurement amount distribution in an uncertainty environment. Diaz et al. (2010) designed a fuzzy multi-objective linear programming model and an interactive algorithm for solving the issues with optimized segmentation of purchase order.

So far, there are few multi-objective nonlinear programming models involving supplier selection and procurement amount distribution decision. For example, Sharma et al. (1989) established a multi-objective nonlinear mixed integer programming model targeting at price, quality, delivery and service. Liao and Rittscher (2007) designed a multi-objective mixed integer nonlinear programming model of single-cycle, multi- supply source and single product.

Some researchers use artificial intelligence methods to research on supplier selection. Vokurka et al. (1996) developed an expert system to select suppliers. Cook (1997) case Case-Based Reasoning system is used to choose reasonable suppliers. Khoo et al. (1998) researched on using intelligent software agents to select suppliers. Albino and Garavelli (1998) proposed a Neural Networks based decision support system for selecting suppliers. Choy and Lee (2003) devised a more powerful Case-Based Reasoning based intelligent supplier selection and evaluation system on the basis of the original development. Choi and Chang

(2006) developed a knowledge-based decision support system for dealing with the issues with joint decision-making for e-procurement supplier selection and procurement amount distribution. Gholam et al. (2009) developed a fuzzy expert decision support system (FEDSS) based on objective needs of supplier selection in an uncertain environment. Kuo et al. (2010) developed a supplier evaluation and selection decision system for auxiliary implementation in an uncertain environment based on artificial neural network and fuzzy neural network.

Some researchers also use a combination of methods on supplier selection. Ghodsypour and Bricn (1998) designed a model based on a combination of AHP and linear programming method, applied to supplier selection and procurement quota decisions. Talluri and Narasimhan (2004) designed a combined model for strategic supplier selection in combination of DEA and statistical analysis method. Kulak and Kahramanl (2005) designed a combined model based on axiomatic design and AHP used in the selection of transport service provider. Ceyhun et al. (2007) designed a combined model based on PROMETHEE and FGP and applied it for selection of outsourcing service providers and joint optimization decision for outsourcing distribution. Eleonora and Antonio (2008) designed a combined optimization model based on CA and FAHP to solve the problem of multi-product and multi-supplier selection decision. Lin (2009) designed a combined optimization model based on FANP and MOLP for solving the problems with supplier evaluation and joint decision for order partitioning. Wang and Yang (2009) designed a combined optimization model based on AHP and MOLP and a fuzzy compromise solving algorithm. Wu et al. (2009) developed a combined optimization model based on ANP and MIP for solving the problems with selection of suppliers for single-cycle and multi-product procurement and procurement amount distribution. Mohammad et al. (2009) designed combined optimization model based on AHP and multi-objective linear programming method, and gave the scatter search algorithm. Kara (2011) a combined optimization model based on FTOPSIS and two-stage and single-objective stochastic programming method. Chen (2011) designed a combined optimization model based on DEA and improved T0PSIS.

In addition, researchers use other methods to solve some complex problems with supplier selection. Weber et al. (1998) proposed data envelopment analysis for supplier

selection and optimal decision for procurement quotas. Isao (2000) applied fuzzy object problems in dealing with supplier selection with fuzzy theory. Joe (2004) established a DEA-based buyer-seller game model, and applied it in the decision making for supplier selection. Saen (2007) designed an IDEA-based supplier selection decision model. Bo and Gerhard (2009) applied empirical research methods and pointed out the way managers balanced inherent laws between cost, value, delivery performance and flexible property. Azadeh and Alem (2010) proposed a flexible supplier selection method that is deterministic, stochastic and fuzzy for selective treatment.

Some scholars also analyzed the problems in the process of supplier selection. For example, Davidrajuh (2003) conducted a special research on the process of supplier selection, and proposed three different process models, namely six-stage model of international procurement, multiple potential agents model of partner selection and multi-attribute model of mechanical equipment procurement; Michael and Thomas (1998) pointed out the eight steps for industrial products procurement, including the assessment of alternatives and selection of conventional suppliers.

2. Research on Channel Construction

Marketing channel is an integral part of the supply chain. From the perspective of supply chain management: the process from procurement of raw materials to the provision of final product to consumers constitutes a complete service chain. Marketing channel is a set of service management system built up centering on consumers, consisting of manufacturers, agents, dealers, retailers, specialized service agencies, warehousing and transportation agencies. Marketing channel, as an important part from manufacturer to consumer of the supply chain, achieve efficient operation through executing three functions, *i.e.* logistics, services and information communication.

Duncan (1951) was of the view that the major factors influencing enterprises' selection of circulation channel included general factors and special factors, and that the channel could be divided into three types based on the intensity of distribution channel, *i.e.* open distribution channel, selective distribution channel and exclusive or monopolistic distribution channel. Then, Phillips and Duncan (1954) further researched on the selection of distribution channel.

They believed that, in selection of distribution channels, enterprises were often required to conduct basic or procedural work, determine the degree of openness of channel and determine cooperation or coordination relations among channel members. Although their researches involve theories of channel construction and management, no specific researches have been conducted and the depth of research on channel is not enough.

Alexander and Berg (1965) discussed channel selection in relation to establishment of channel relationship. They thought that enterprises should select or determine channel functions taking full account of product factors, market characteristics and enterprise factors, thus determining the type of channel to be selected. This view is of important guiding significance for enterprises' channel construction.

Walters (1977) researched channel design and channel selection. He considered that channel selection composed of three stages, namely primary channel selection, channel correction and channel creation. However, he failed to further research on the specific selection of channel members.

Sims et al. (1977) argued that, in the long run, the channel selection should ensure that the distribution channel selected could be utilized by products as many as possible to maintain a long-term trading relationship; while, in the short run, channel selection referred to market coverage, inventory capacity or level, personal sales status, promotion capacity or level, etc. His downside is confusion of two sets of concepts, *i.e.* channel design and channel selection, and channel structure design and channel members selection.

Bowersox et al. (1980) argued that a distribution channel being the optimal in a given period could not be always optimal and it's required to correct and adjust the design of distribution channel according to conditions and environment. He proposed the basic idea of 9 steps of channel design. However, he failed to give detailed description and explanation for each process, nor further research on channel structure design neither on selection of specific channel members.

Stern and Ansary (1992) advocated customer-oriented channel design, and divided channel design into 10 stages. He took a new path of analysis to design channel scheme from the perspective of ultimate consumer, and conducted a detailed research on the channel design

process. However, he only discussed re-design of channels without giving consideration to the design of new channels or initial channel design and coverage of channel.

3. Research on Supply Chain Coordination

Along with the rapid development of the supply chain system around the world, many companies are troubled by the coordination issues among players on the supply chain. A large number of particular problems arising from lack of cooperation or conflicts of interest render the supply chain inefficient. A supply chain is based on a mechanism of 'competition-cooperation-coordination' and coordination is the foundation of supply chain operations and the key to successful operations. Usually, a supply chain consists of different economic entities with different optimization goals and private information. However, their optimization goals are often in conflict with that of the overall system. More, a supply chain comes with many uncertainties (for example, disruptions in production due to delivery failure of raw materials or components or sudden equipment failure, and the cancellation of orders by customers due to changes in demand), which requires a high flexible dynamic supply chain system. Coordinated effort and activities are required among supply chain players as well as in a company to make the supply chain function as a whole, to ensure smooth flows of information, logistics and cash within the company and between players, so as to achieve ultimate goals like shorter delivery time, better customer satisfaction, lower costs and improved supply chain performance. According to the estimate in the research on the American food industry by Fisher (1997), USD 30 billion was wasted every year due to the lack of effective coordination among supply chain players. Supply Chain Coordination (SCC) –related research has attracted increasing attention and become a popular pursuit in the field of supply chain management.

Malone (1988) pointed out that coordination was the decision making and communication model among group members in a joint effort to achieve a goal. Hewitt (1994) thought that supply chain coordination involved planning, controlling and adjusting the logistics processes within and between companies and such logistics processes consisted of material transport and information and capital flows in the supply chain. Simatupang et al. (2002) argued that supply chain coordination was combining, adjusting and aligning players'

goals (activities, objectives, decisions, information, knowledge and capital) to achieve the overall goal of the supply chain.

Supply chain can be regarded as an autonomous organization. There are many approaches and types of supply chain coordination. Forrester (1958) researched the Industrial Dynamics and created a precedent for researches on supply chain coordination. Clark and Scarf (1960) researched the multi-echelon inventory and sales system in supply, analyzed a system giving no consideration to bulk supply, and proved that order-up-to-level inventory was the optimal inventory control policy for a multi-echelon system giving consideration to discounted penalty and warehouse cost. Van (1976) et al. pointed out 3 coordination models, namely, non-individual, individual and team coordination. Haq et al. (1991) researched the coordination of a multi-echelon production-inventory-distribution system and used a mixed integer linear program (MIP) model to batch the production and distribution decisions, minimizing the cost of the system. Bhatnagar et al. (1993) examined the coordination between multiple factories in production plans, batch production and safety inventory and divided supply chain coordination into single plant and multi-plant coordination. Zijm and Houtum (1994) analyzed supply chain coordination in a multi-echelon production-inventory system under stochastic demand, provided the structure forming the function, and compared the cost effectiveness between the Base Stock Policy and MRP. Chandra and Fisher (1994) examined coordinated and uncoordinated approaches to production schedule and sales planning management, and developed 2 solutions (coordinated and uncoordinated ones) to production planning and transport routes. Tzafestas and Kapasiotis (1994) examined the coordination in multi-echelon supply-production models, using the hierarchical optimization technology for decision-making. From different perspectives, Kevin (1995) and Wang (2004) conducted respective in-depth researches on secondary supply chain coordination between suppliers and retailers.

Thomas and Griffin (1996) pointed out that the supply chain coordination could be functionally divided into Buyer-Vendor Coordination, Production-Distribution Coordination, and Inventory-Distribution Coordination. Li et al. (1996) improved buyer-vendor cooperation and coordination with inventory control and proved that the quantity discount policy was an

effective mechanism to achieve system-wide coordination. Boyaci and Gallego (1997) examined quantity discount contract coordination in supply chain. Duenyas et al. (1997) analyzed the just-in-time purchasing decision under given contract terms and its impact on the performance under supply chain coordination. Kevin (1997) and Duenyas et al. (1997) examined the changes in profits and costs under coordination mechanisms. Mehring (1998) believed that some approaches he gathered to promote coordination were not mutually exclusive and could be used as an organic combination. Eppen and Iyer (1997) pointed out that distributors-led supply chain coordination was of practical significance. Qu et al. (1999) proposed a solution using decomposition algorithms to minimize long-term average total cost: considered inventory and transportation routing decisions separately, and then coordinated such decisions to bring both inventory and transportation routing decisions close to the optimal level. Tsay (1999) examined how to coordinate a supply chain with quantity flexibility contracts.

Hoque and Goyal (2000) examined a model for joint optimization of a single supplier's and a single buyer's integrated production-inventory coordination system. Erhun and Keskinocak (2000), Majumder and Groenevelt (2001) examined and compared the impact of contract-based and non-contract-based coordination on the performance of a supply chain. Solis (2001) divided supply chain coordination into coordination within a function, among functions and among companies. Chopra and Meindl (2001) examined a range of management approaches to supply chain coordination. Chen et al. (2001) put forth an approach to coordinate a supply chain consisting of multiple single-product retailers. Gavirneni (2001) researched the coordination between a supplier and multiple retailers in the circumstance of independent and identically distributed random variables of market demand, and considered the impact of three scenarios (no coordination, partial coordination and complete coordination) on the performance of a supply chain. Taylor (2001) examined the impact of Midlife Returns and End-of-Life Rebates on supply chain coordination in a dynamic market. Tsay (2001) examined the channel conflict in a supply chain and supply chain coordination problems. Taylor (2002) pointed out that in the scenarios where the market demand was unaffected by retailers' sales efforts, the Target Rebates could help coordinate the

supply chain; and the End-of-Life Rebates helped coordinate the supply chain only if the market demand was correlated with retailers' sales efforts. Barnes et al. (2002) examined the supply chain coordination in the scenarios where the demand was correlated. Boyaci and Gallego (2002) analyzed how to coordinate the pricing and inventory replenishment decisions in a supply chain consisting of a wholesaler and one or more geographically separated retailers on the premise of determined price-sensitive demand. Ding and Chen (2002) analyzed how to coordinate the supply chain for buy-back contracts.

Romano (2003) examined logistics coordination and integration mechanisms in 3 supply chain network structures. Jalbar et al. (2003) focused on the inventory-distribution coordination issues and examined the optimization of the reorder point and minimum total cost (including inventory costs and additional cost). Zhou (2003) targeted at the inventory-distribution coordination issues and examined deterministic inventory replenishment models for multiple warehouses. Luh et al. (2003) put forward approaches to optimal production planning and schedule coordination for a supply chain. Gerchak and Wang (2004) analyzed a supply chain consisting of a manufacturer and multiple suppliers, and compared revenue-sharing contract-based and wholesale-price contract-based coordination.

The aforementioned literatures in relation to research on supply chain management show that scholars’ researches on supplier selection mainly stress supplier selection indicator system research and supplier selection methods; the channel construction is mainly researched from seven channel design theories; Supply chain coordination-related research mostly focuses on the researches and analysis of coordination strategies and approaches for the flow of physical products and considers the supply chain management from the perspective of physical goods, instead of synergies along with working capital.

2.2 Overview of Literature on Working Capital Management

Academic research on working capital management mostly consists of researches using either a single indicator or composite indicators, which are described as follows:

1. Research on Working Capital Management Using a Single Indicator

Research on working capital management starts with research on working capital management using a single indicator. Following scholars have put forward a number of models or methods for inventory optimization, optimal cash holdings and receivables management.

(1) Research on Inventory Optimization

Many scholars have been focused on inventory items accounting for a large portion of working capital. Ford (1913) created the economic order quantity (EOQ) model for the first time. Taft (1918), on this basis, proposed the economic production quantity model. Wilson (1934) took into account the safety stock factor in the model, resulting in extensive application of the EOQ model. Dickie (1951) applied Pareto analysis in inventory management practices, and implemented key management by varieties, general control by categories and flexible management according to the total amount, *i.e.* ABC analysis, depending on the importance of inventory. Merville and Tavis (1973) proposed stock, credit and other optimal planning models. Berman and Perry (2006) extended fixed demand hypothesis and put forward EOQ model for stochastic demand. Silver (2008) concluded related costs in four aspects: replenishment costs, inventory costs, stock-out costs and system control costs. Wheatley (2009) thought that reduction in occupancy and accelerated circulation of working capital could be achieved through super-strong forecast of inventory, purchase procedures and other management procedures.

(2) Research on Optimum Cash Holdings

Baumol (1952) deduced the cash inventory model with the basic principles of optimal inventory level. John (1955) pointed out that cash management should pay attention to accurate prediction of cash flow and measure the relationship between risk and return, to

ensure the success of cash management, indicating that there should be a good cash flow plan or budget. Tobin (1956) created Baumol-Tobin model with interest rate factors, and thus formed a monetary demand theory based on the cash stock model. Miller and Orr (1966) created the Miller-Orr model that could handle cash inflows and cash outflows of daily random changes. Kraus et al. (1973) proposed a trade-off theory in the principle of maximizing shareholder value. When the marginal benefit of cash holdings equaled to the marginal cost, there was an optimal amount of cash holdings. Hager (1976) discussed the cash flow situation in enterprise production process and proposed measures to shorten the cash period. Jacob and Boyan (1980) put net payments, investment portfolio adjustment costs and fluctuations of net payments into the cash model to further explain the model. Opler et al. (1997) found that there was a certain connection between companies with more cash and negotiable securities and high growth, and verified that companies did follow the static tradeoff model of carrying costs and shortage costs.

(3) Research on Receivables Management

Research on receivables management is mainly on analysis and control of credit risk. In respect of analysis of credit risk, there are mainly expert system model, credit scoring model, nonlinear difference model, neural network analysis system, and other models. For credit risk control, whole course management is implemented for receivables at the level of management system improvement. Petersen and Rajan (1997) demonstrated by researches that receivables and profitability were directly related to the extent of access to capital market. Deloof and Jegers (1999) proved the direct relationship between receivables and shortage of funds from the perspective of commercial credit demand. Dennis (2007) proposed that enterprises should report receivables with electronic bills and manage receivables with the payment system, to improve working capital management performance.

Usually, researches using a single indicator can only explain a facet of such management, e.g., inventory optimization, optimum cash holdings and receivables management. Since indicators often contradict and conflict each other and one optimal indicator does not indicate optimum working capital management in general, it is difficult to know the impact of inventory, receivables, payables and turnover and their changes on working capital, and to

analyze whether the improvement of a certain ratio after the change or adjustment of working capital policy can offset the adverse effects on other ratios.

2. Research on Working Capital Management Using Composite Indicators

Knight (1972) pointed out that one optimal indicator did not indicate optimum working capital management in general, that is to say, researches on the optimal level of a current asset is not suitable and one shall consider the investment in each and all current assets for research. The results of a working capital decision should be the highest satisfaction with composite indicators instead of the optimization of one single indictor. Keith (1973) thought that working capital management has become increasingly complicated along with constant change in the market and the rapid development of information technology and explored for the first time working capital planning and control with composite indicators. Richards and Laughlin (1980) pointed out that compared with current and quick ratios, the operating cycles giving consideration to inventory and receivables turnover periods can better reflect a company's liquidity. In Working Capital Management. John and Cecilia (1989) point out that working capital management has expanded from current assets management to credit rating, short-term finance, consumer credit and many other aspects, that is, it considers both profitability and risk and connects the allocation of working capital on hand (investment policy) and capital source (financing policy). From an overall perspective of working capital, the book examines how to develop a reasonable working capital policy, laying a basic framework for working capital management with composite indicators. Tully (1994) analyzed the practice of zero working capital management at American Standards and General Electric and pointed out that the zero working capital goal can be achieved through, among others, strengthening composite indictors-based budgeting to determine the optimal output, building a more flexible manufacturing system, improving the delivery speed to reduce inventory, and speeding up the recovery of receivables. When developing a working capital management plan. Juan (2002) pointed out that comprehensive working capital management included the management of revenue, expenditure and supply chain: he refined an array of indicators of working capital management, and considered how to apply composite indicators to working capital management in business operations.

The research on composite indicators-based working capital management expands the scope of the research and puts forward that the goal of working capital management is the highest satisfaction with composite indicators rather than the optimization of one current asset. The above-mentioned essays emphasize the significance of cash flow to operations management, but have no targeted researches on specific issues or supply chain-based analysis.

In recent years, some researchers have begun to notice supply chain-based working capital management. Working capital management is no longer confined to a company but its focus shifts to supply chain-based optimization and management. Many creative models have been applied, particularly in supply chain inventory management and financial supply chain management. Faced with fierce market competition, companies have started to reengineer their business process, promoting the innovative development of inventory management and control models. For example, Toyota has successfully applied the JIT inventory management and achieved supply chain-based working capital management. Kenneth and Nunn (1981) argued that working capital management should be part of corporate strategy rather than a financial measure. This view helps lay a foundation for the shift of working capital management focus to supply chain optimization. In 1985, Wal-Mart and Procter & Gamble firstly had success with VMI. Later in 1999, UPS set up a specialized financial company for logistics-related financial services and achieved success. To reduce inventory and conserve cash, DELL devised in 2000 an Internet-based supply chain structure, which brought to the Company extra benefits. The 2001 REL/CFO survey report on working capital points out that during an economic downturn, a company that desires a shorter working capital turnover time should consider the financial capabilities of customers and suppliers so as to avoid negative impacts. Subsequent survey reports emphasize the importance of the supply chain optimization and propose a damage-free connection among suppliers, companies and customers. In a research of the international logistics system in the supply chain of the steel industry, Edwards et al. (2001) discovered that a company can enhance the efficiency of working capital management with the optimum balance on the supply chain. Singhal and Hendricks (2002) argued that working capital management has a direct bearing on the

performance of a supply chain. Andrew (2002) argued that a company should consider the motivations and sensitivities of all the internal and external working capital; and this point of view extends working capital-related research to the supply chain and the external macro environment. Avanzo et al. (2003) examined the correlation between supply chain management and financial performance and concluded that good supply chain leaders helped contribute to a market value growth 7%-26% higher than the average level. Pohlen and Goldsby (2003) pointed out that capital costs and commercial risks were often transferred to relevant sections of the supply chain, for example, such measures as to postpone payment to suppliers, demand earlier payment from customers, or unbalanced inventory may benefit a company in the short run but would be detrimental to sustainable development in the long run. Buzacott and Zhang (2004) added, for the first time, asset-backed finance to a basket of elements to be considered in production-related decision-making, and examined how a company with limited funds accessible to external finance could make the optimal decision on production quantity for effective control of flows of goods and capital. Wadhwa et al. (2006) examined how transverse or horizontal cooperation on the supply chain affected the working capital and found that such cooperation could effectively reduce the holding costs of inventory and shorten the order period, thereby enabling manufacturers and retailers to better conserve their working capital.

Currently, the researches at corporate operation level on how to coordinate operations strategies with capital have become the popular pursuits in the field of research on operations and supply chain management (Babich and Sobel, 2004; Ding et al. (2007). Dada and Hu (2008) examined how the newsvendor model applied to procurement for a company with limited funds facing an uncertain demand. Lai et al. (2009) compared how the overstock risk was shared under different procurement models on a supply chain where both retailers and suppliers were financially restricted. Srinivasa et al. (2011) examined how bankers as actual leaders on the supply chain where suppliers and retailers were underfunded made the optimal decisions.

As we can learn from the abovementioned researches, working capital management-related research has expanded from companies to the supply chain. Working

capital management focuses on supply chain management and optimization; and practice goes ahead of research. Related research activities include, among others, theory building, strategy research and case researches. However, due to the disparity in real-world applications, there is a lack of supply chain management-related data and empirical researches. More, the researches mentioned above do not consider the synergies along with working capital.

In short, related research on supply chain and working capital management seem less satisfactory or sufficient regarding: (1) supply chain management-related research does not consider working capital risk; (2) operations management-related research examines management with single indicator or composite indicators, but does not consider systemic supply chain integration and optimization; (3) there is a few supply chain-based working capital management research that considers working capital, but such research is mostly supply chain-based working capital analysis, that is, it considers working capital as an indicator and does not explore supply chain operations strategies. Therefore, this thesis, from the perspective of working capital, attempts to offer some practical operations strategies and risk management mechanism building upon the grouping of suppliers and customers.

Chapter 3: Assessment of Risks with the Working Capital in Company Z's Supply Chain

Company Z is the lightning protection products manufacturer with the most revenue in the domestic communications industry (with the certificate of position in industry issued by the Communications Network Operation & Maintenance Committee, China Association of Communication Enterprises), specialized in the development and manufacture of lightning protection products and lightning protection integrated services. Established in 1987, Company Z is the chief editor or editor of 11 Chinese National Standards (1 national military standard) and 3 industry standards. At present, Company Z has 30 patents, including 11 patents for invention, 15 patents for utility models and 4 appearance patents. Company Z's intelligent lightning monitoring system is listed as a national key new product by the Ministry of Science and Technology, Ministry of Environmental Protection, Ministry of Commerce, General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China. After 28 years of operation and development, Company Z has possessed a full range of lightning protection products with good performance which are mainly applied in such basic industries as communication, electric power, petrochemicals, new energy, aerospace and national defense, construction, rail transit and informatization to satisfy various diversified product demands and the needs of lightning protection engineering services.

Company Z's upstream industries mainly include electronic components, metal materials, plastic parts manufacturers and the downstream industries are mainly consumer groups in the industries of communication, electric power, petrochemicals, new energy, aerospace and national defense, construction, rail transit, informatization , etc., as shown in Figure 3-1:

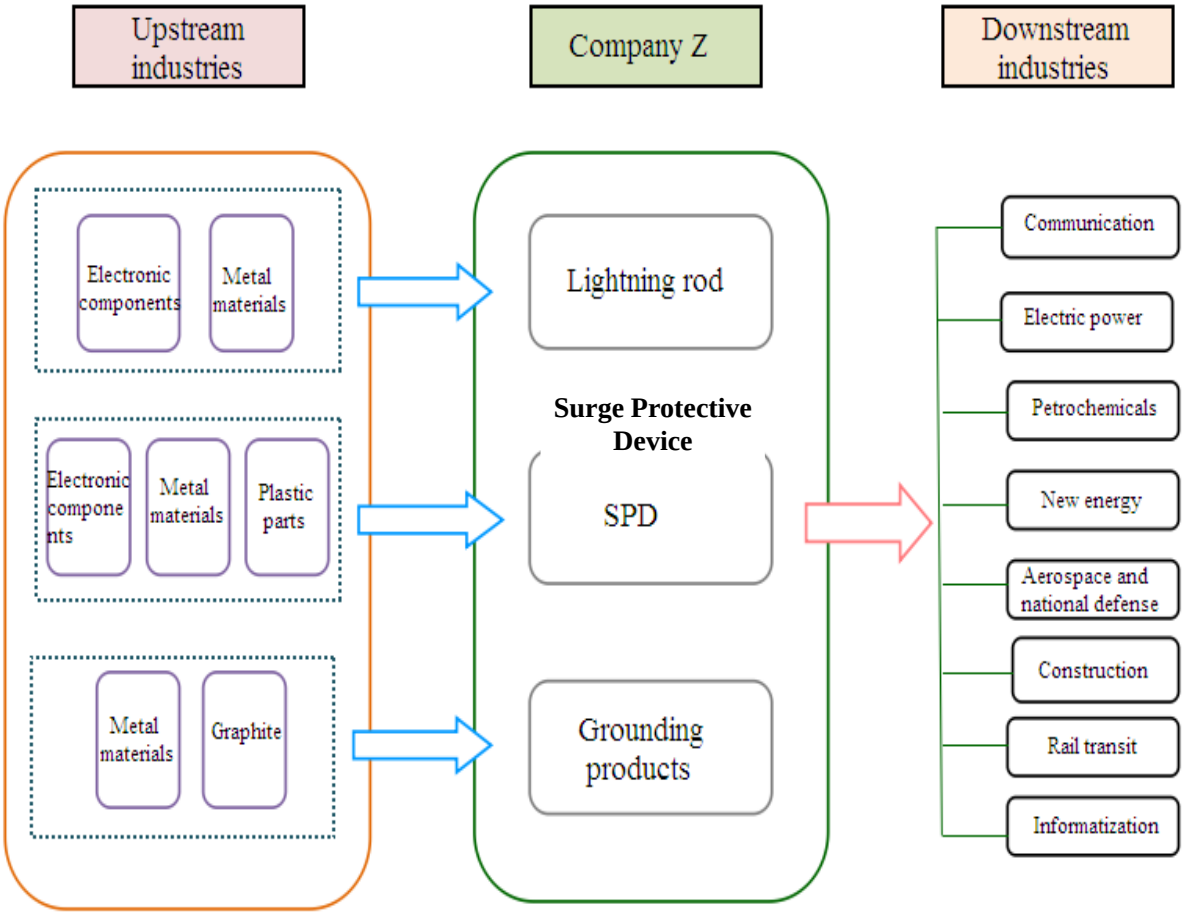

Figure 3-1 Structure Diagram of Company Z's Supply Chain

Source: Author finishing

Company Z has some trouble with its supply chain for from time to time, suppliers and customers are short of short-term funds. This thesis analyzes the status quo of the supply chain consisting of Company Z and its suppliers and customers and discovers some issues. And an indicator system is built for specific analysis of the conditions and existing problems of the supply chain.

3.1 Establishment of Indicator System

3.1.1 Indicators Selection

Some scholars have researched how to select appropriate indicators for working capital risk assessment. Fitzpatrick (1932) first pointed out that financial ratios helped indicate future

financial risk, and argued that the net profit to net asset ratio and the net asset to liability ratio can best tell the business situation of a company. Smith and Winakor (1935) pointed out that the working capital to total assets ratio was the best indicator. Merwin (1942) pointed out that the working capital to total assets, net asset to liability, current assets to current liabilities ratios can show the risk of insolvency earlier. William (1966) argued that, among others, the debt coverage ratio, return on assets, debt to assets ratio, and the balance of assets realization ratio minus debt to asset ratio can better indicate business risk. Altman (1968) used the Z-Score model, a multivariate financial risk discrimination model building upon 5 financial indicators (namely, the ratios of working capital to total assets, retained earnings to total assets, earnings before interest and taxes to total assets, shareholders' equity to total liabilities, revenue from operations to total assets) to analyze and evaluate business risk. Later, Altman et al. (1977) presented the ZETA model - an improved version of the Z-Score model, using 7 financial indicators for assessment of operational risks. Ohlson (1980) discovered that in the Logistic-based early warning model of financial risk, at least 4 out of 9 financial indicators (which include, among others, debt to asset ratio and return on total assets ratio) had a significant impact on a company's financial trouble. Zavgren (1985) conducted a working capital research using financial indicators like inventory turnover, return on investment, degree of financial leverage, total asset turnover, receivables turnover, monetary capital to total operation revenue ratio, and current liabilities to current assets ratio. Deloof (2003) selected inventory, receivables, payables and cash turnover period to evaluate trade on credit, inventory policy and working capital management performance and examined the correlation between corporate profitability and working capital management performance; and discovered that shorter inventory and receivables turnover period can help improve profitability and companies having long payment period were often less profitable. Ioannis and Dimitrios (2006) discovered a negative correlation between corporate profitability and receivables and cash turnover period, a significant positive correlation between profitability and payables turnover period, and an insignificant negative correlation between profitability and inventory turnover period. David (2010) found that the degree of profitability was positively correlated with inventory turnover period, negatively correlated with receivables turnover period, and also positively correlated with payables period.

Building upon existing theoretic researches and extensive consultation with an expert panel of 10 (including teachers in universities and colleges and managers from Company Z and its suppliers and customers), day-to-day working capital management performance along with solvency and profitability are evaluated for the purposes of this thesis, and 9 quantitative indicators are picked, to measure the level of working capital risk, namely, inventory turnover, receivables turnover, payables turnover, cash turnover, working capital allocation rate, cash to current liability ratio cash to current liability ratio, debt to asset ratio, return on net assets, and surplus cash coverage ratio surplus cash coverage ratio. As this section aims at the risk assessment of working capital, some indicators are processed mathematically (to obtain reciprocal as the ratio of each indicator) so as to better match others in order of magnitude. As far as their reflection of working capital risk is concerned, such ratios are in theory not substantially different from the standard indicators.

1. Inventory Turnover Ratio

Inventory turnover refers to the capital turnover process from payment for purchase of inventory, production, sales of inventory to collection of payment for goods. Inventory turnover period is the time required to convert raw materials into finished products and sell the finished products, while the inventory turnover ratio researched in the thesis is the reciprocal of inventory turnover period and is the composite indicator for measuring and evaluating the management of corporate purchase of inventory, production, sales, collection and other sections. In addition, as an important indicator for analyzing the efficiency of corporate operation, inventory turnover ratio plays an important role in analysis of corporate operation state, inventory liquidity, etc. The formulas are as follows:

$$\text{Inventory turnover ratio} = \frac{1}{\text{inventory turnover period}} \qquad (3-1)$$

$$\text{Inventory turnover period} = 360 * \text{average inventory/operating income}$$

$$= 360 * [(\text{beginning inventory} + \text{ending inventory})/2]/\text{operating income} \qquad (3-2)$$

In general, if the business operation goes well, the inventory turnover period will be

shorter and the inventory turnover ratio will be higher, indicating that faster inventory turnover will give rise to stronger liquidity, faster conversion of inventory into cash or receivables, smaller amount of working capital used for inventory, and less risks with collection of working capital. Therefore, inventory turnover ratio is an important positive indicator for analysis of business operation capacity and working capital management, and can be used to measure the inventory operation efficiency in various sections of enterprise's production and operation and reflect day-to-day working capital management performance. The improvement of inventory turnover ratio is vital to the enhancement of enterprise's cashability and operating capability.

2. Receivables Turnover Ratio

The receivables turnover period represents the time from obtaining the right of receivables to collection of funds and realization, *i.e.* the number of days from dispatching commodities to collection of receivables, also known as age of receivables. The receivables turnover ratio researched in this thesis is the reciprocal of the receivable turnover period, reflecting the realization speed of enterprise's receivables. Receivables turnover ratio is financial indicator used to measure enterprise's receivable turnover speed and a major indicator for measuring enterprise's assets operating capacity and day-to-day working capital management performance. The formulas are as follows:

$$\text{Receivables turnover ratio} = \frac{1}{\text{Receivables turnover period}} \qquad (3-3)$$

$$\text{Receivables turnover period} = 360 * \text{average receivables} / \text{operating income} \qquad (3-4)$$

$$= [(\text{Begeinning receivables} + \text{Ending receivables} + \text{Beginning bills receivables} + \text{ending bills receivables})/2]/\text{operating income}$$

In general, the shorter the receivables turnover period is, the higher the receivables turnover ratio will be, indicating enterprise's rapid collection of receivables, short aging, strong liquidity of assets, strong short-term solvency, which can reduce collection expense and bad debt losses, thus increasing the return on investment in enterprise's liquid assets and reducing risks with collection of working capital. Receivables turnover ratio is a key positive

indicator for enterprise's maintenance and appreciation of value. A higher receivables turnover ratio indicates rapid capital appreciation, higher assets operation ratio and smaller working capital risk. Receivable turnover ratio is the same as inventory turnover ratio, and a main indicator for measuring enterprise's assets operation capabilities and working capital risk.

3. Payables Turnover Ratio

Payable turnover period represents the time from receipt of materials for which no payment has been made to the time of cash outlay. The payables turnover ratio researched in the thesis is the reciprocal of the payables turnover ratio, reflecting enterprise's payables liquidity, credit, financial situation and its position in the industrial value chain. The formulas are as follows:

$$\text{Payables turnover ratio} = \frac{1}{\text{Payables turnover period}} \qquad (3-5)$$

$$\text{Payables turnover period} = 360 * \text{average payables} / \text{operating income}$$

$$= [(\text{Begeinning payables} + \text{Ending payables} + \text{Beginning bills payables} + \text{ending bills payables})/2]/\text{operating income} \qquad (3-6)$$

Relatively speaking, the shorter the payables turnover period is, the higher the payables turnover ratio will be, the higher the liquidity of enterprise's payables will be and the faster the repayment will be, indicating shorter occupation of payment due to suppliers by the enterprise and larger risks with the working capital expenditures. Thus, payables turnover ratio is a key negative indicator for measuring capital flow and day-to-day working capital management performance.

4. Cash Turnover Ratio

Cash turnover period, also known as working capital turnover period, represents the period from the payment of cash for purchase of inventory to the recovery of cash, and is one of the most fundamental means to measure cash flow and a comprehensive means to measure corporate working capital management. Cash turnover period gives consideration to the time difference between the payment for purchase of raw materials and receipt of cash from sales

of finished products, and combines relevant factors of balance sheet and profit statement in the time dimension in an effective way for dynamic measurement of enterprise's liquidity. The cash turnover ratio used in the thesis, i.e. the reciprocal of cash turnover period, analyzes the impact of supply chain on enterprise's cash flow from the perspective of cash flow management and mainly measures enterprise's working capital turnover ratio. The index is calculated as follows:

$$\text{Cash turnover ratio} = 1/\text{working capital turnover period} \quad (3—7)$$

$$\text{Working capital turnover period} = \quad (3—8)$$

$$\text{inventory turnover period} + \text{receivables turnover period} - \text{payables turnover period}$$

Relatively speaking, the shorter the cash turnover period is, the faster cash turnover speed will be, the higher the cash turnover ratio will be and the smaller the working capital risk will be. Therefore, cash turnover ratio is a positive core indicator to measure day-to-day working capital management performance. A higher cash turnover ratio indicates a higher utilization efficiency of working capital, thus reducing the possibility of shortage of working capital.

5. Working Capital Allocation Ratio

Working capital is also known as working funds. Broadly, working capital is also called total working capital and refers to the capita invested by an enterprise in current assets, which specifically include capital occupied by receivables, inventory, other receivables, bills payable, bills received in advance, accruals, other payables, etc. In a narrow sense, working capital refers to the difference between enterprise's current assets and current liabilities at a specific time. The working capital allocation ratio represents the ratio of the percentage of current assets in working capital to its role, i.e. the ratio of working capital to current assets. As to working capital in a narrow sense, enterprise maintains a certain amount of working capital as buffer to prevent current liabilities from "exceeding" current assets. The formulas are as follows:

$$\text{Working capital allocation ratio} = \text{working capital}/\text{current assets} \quad (3-9)$$

$$\text{Working capital} = \text{current assets} - \text{current liabilities} \qquad (3-10)$$

Working capital allocation ratio represents the share in 1 unit of current assets to prevent "exceeding" current liabilities. Relatively speaking, a higher working capital allocation ratio indicates a stronger solvency for short-term debts, more working capital and smaller risk of insolvency. Therefore, the amount of working capital can reflect the solvency for short-term debts and working capital risks and can be a positive indicator for measuring solvency.

6. Cash to Current Liabilities Ratio

Net cash flow from operating activities refers to the difference between the inflow and outflow of cash and cash equivalents generated in enterprise's operating activities in a certain period. The indicator measures enterprise's actual solvency from the dynamic perspective of cash inflow and outflow, reflecting the times for the net cash flow to generated in the operating activities for the current period to offset current liabilities. While cash to current liabilities ratio is the ratio of net operating cash flow to current liabilities in a certain period. It can reflect enterprise's solvency of short-term liabilities for the current period from the perspective of cash flow. The formula is as follows:

$$\text{Cash to Current Liabilities Ratio} = \frac{\text{Net Cash Flow from Operating Activities}}{\text{Current Liabilities}} \qquad (3-11)$$

Relatively speaking, larger cash to current liabilities ratio represents more net cash flow generated in enterprise's operating activities, more reliable assurance for enterprise's repayment of debts becoming due and smaller risks with enterprise's working capital. Therefore, the cash to current liabilities ratio is a positive indicator reflecting enterprise's capacity to use net cash flow generated in operating activities for repayment of current liabilities. The larger cash to current liabilities ratio represents enterprise's stronger capacity to use cash or cash flow to repay short-term debts and cope with risks with enterprise's working capital.

7. Debt to Assets Ratio

Capital structure is an important component of corporate governance and can reflect the rights and obligations of enterprise's relevant stakeholders. It affects and decides corporate

governance structure as well as corporate behavior and value. Capital structure is often represented by debt to assets ratio. Debt to assets ratio, also known as leverage ratio, is percentage of total closing liabilities in total assets, i.e. the ratio of total liabilities to total assets, and is a major analysis indicator in balance sheet. Debt to assets ratio reflects the percentage of capital provided by the creditors in total capital (i.e. it reflects that how many total assets are raised by liabilities). Debt to assets ratio is an important composite indicator in the asset structure, and affects and decides enterprise's performance and solvency. The formula is set out below:

$$\text{Debt to Assets Ratio} = \text{Total Liabilities} / \text{Total Assets} \quad (3-12)$$

Relatively speaking, a larger debt to assets ratio indicates more debts to be repaid by enterprise, weaker solvency, lower capacity for guaranteeing working capital and larger working capital risk. Debt to assets ratio is an important negative indicator to measure enterprise's solvency and working capital risk. In addition, debt to assets ratio is also an indicator to measure enterprise's capacity of utilizing creditors' capital for operating activities and reflect the safety in relation to creditors' grant of loans.

8. Return on Net Assets

Return on net assets, also known as net assets yield and return on owner's equity, is the percentage of net profit in average net assets and the percentage of enterprise's profit after tax in average net assets. Return on net assets reflects the income of owner's equity and is used to evaluate the efficiency of all assets used in enterprise operation. Return on net assets is the core indicator reflecting enterprise's profitability and operation and management level. The formulas are as follows:

$$\text{Return on Net Assets} = \text{Net Profit} / \text{Average Net Assets} \quad (3-13)$$

$$\text{Average Net Assets} = (\text{Beginning Net Assets} + \text{Ending Net Assets})/2 \quad (3-14)$$

Net return refers to annual net profit. Net assets are total net assets at the end of the year. A higher return on net assets represents a lower profitability. Return on net assets reflects the capacity of owners' owned capital to gain net return and is an important positive indicator for

comprehensive evaluation of the operation quality of enterprise's total assets, utilization efficiency and working capital risks. A faster return on net assets indicates a higher capital utilization ratio, a higher return on assets and smaller working capital risks.

9. Surplus Cash Coverage Ratio

The surplus cash coverage ratio researched in the thesis is the reciprocal of security surplus cash multiple and is the ratio of net profit to net working capital flow in a certain period, reflecting the security level of enterprise's profitability for the current period. Surplus cash coverage ratio judges the surplus from the perspective of cash flow and reflects the percentage of net profit recovered from operating activities in form of cash. It is the indicator of security of operating cash flow for net profit. The formula is set out below:

$$\text{Surplus Cash Coverage Ratio} = \frac{\text{Net Profit}}{\text{Net Cash Flow from Operating Activities}} \qquad (3-15)$$

Surplus cash coverage ratio is an important negative indicator for analyzing the status quo of enterprise's cash flow and working capital risk. A smaller security surplus cash multiple indicates a higher surplus cash coverage ratio and larger working capital risk.

An indicator system for working capital assessment is built with the abovementioned 9 indicators (See Table 3-1):

Table 3-1 Indicator System for Working Capital Risk Assessment

Primary Indicators	Secondary Indicators	Formula	Impact	Remarks
Day-to-day working capital management performance	Inventory turnover ratio	Inventory turnover ratio = 1 / inventory turnover period	Positive	The higher inventory turnover is, the smaller working capital risk will be
		Inventory turnover period = 360 * average inventory / operating revenue = 360*[(beginning inventory + ending inventory) / 2] / operating revenue		
	Receivables turnover ratio	Receivables turnover ratio = 1/ receivables turnover period	Positive	The higher receivables turnover is, the smaller working capital risk will be
		Receivables turnover period = 360 * average receivables / operating revenue= [(opening accounts receivable + closing accounts receivable + opening bills payable + closing bills payable) / 2] / operating revenue		

	Payables turnover ratio	Payables turnover ratio = 1 / payables turnover period Payables turnover period = 360 * average payables / operating revenue= [(opening accounts payable + closing accounts payable + opening bills payable + closing bills payable) / 2] / operating revenue	Negative	The higher receivables turnover is, the greater working capital risk will be
	Cash turnover ratio	Cash turnover ratio = 1 / working capital turnover period Working capital turnover period = inventory turnover period + receivables turnover period – payables turnover period	Positive	The higher cash turnover is, the smaller working capital risk will be
Solvency	Working capital allocation ratio	Working capital allocation ratio = working capital / current assets Working capital = current assets – current liabilities	Positive	The higher allocation ratio is, the smaller working capital risk will be
	Cash to current liabilities ratio	Cash to current liabilities ratio = net cash flow from operations / current liabilities	Positive	The higher cash to current liability ratio is, the smaller working capital risk will be
	Debt to asset ratio	Debt to asset ratio = total liabilities / total assets	Negative	The higher debt to asset ratio is, the greater working capital risk will be
Profitability	Return on net assets	Return on net asset = net income / average net assets Average net assets = (opening net assets + closing net assets) / 2	Positive	The higher return on net assets is, the smaller working capital risk will be
	Surplus cash coverage ratio surplus cash coverage ratio	Surplus cash coverage ratio = net income / net cash flow from operations	Negative	The higher surplus cash coverage ratio is surplus cash coverage ratio, the greater working capital risk will be

Source: Author finishing

3.1.2 Weights Design

In a qualitative analysis, it is difficult to quantify the data; whereas, in a quantitative analysis, targeted, indicator-supported questionnaire surveys can be designed and researches

on statistical measurement or mathematical models conducted for the data collected from questionnaires. For this thesis, the Delphi method is adopted to help select indicators and the Analytic Hierarchy Process to help analyze the data. Appropriate weights are assigned to each of the abovementioned 9 indicators and the weightings of the risk assessment model for working capital are thereby determined. Supported by a qualitative analysis building upon the expertise of professionals, and by a quantitative risk assessment, the Delphi method and Analytic Hierarchy Process are proven to be a practical combination to help determine the weightings and select the best plan, offering a new idea and approach to evaluate working capital risk in an accurate, objective, quantitative way.

1. Identifying the Panelists for the Expert Panel

Consisting of experts and professionals in relevant fields, the expert panel has 10 members: 2 from its suppliers (deputy GMs or members of the managerial staff at a higher position in charge of sales), 2 from its customers (deputy GMs or members of the managerial staff at a higher position in charge of procurement), 2 supply management experts or professionals from Company Z (a deputy GM and the financial officer), 2 from the same industry (GMs or member of the managerial staff at a higher position from 2 companies), and another 2 from colleges and universities (a finance professor and a supply chain management professor). Each panelist satisfies the following criteria: A. sub-senior technical qualifications or above; B. a professional experience of 8 years or more; C. satisfactory knowledge of supply chain management and financial management.

2. Designing the Scoring Table for the Survey

To help determine the weightings, experts are asked to give a score from 1 to 9 to each of the abovementioned 9 quantitative indicators, *i.e*. inventory turnover, receivables turnover, payables turnover, cash turnover, working capital allocation rate, cash to current liability ratio, debt to asset ratio, return on net assets, and surplus cash coverage ratio, according to how important they think such an indicator in the risk assessment for corporate working capital. Some adjustments have been made after the first survey before the scoring table is finalized for the corporate working capital risk assessment (See Appendix 10).

3. Statistics of Data

After the second survey, experts' scores are summarized in Table 3- 2:

Table 3-2 Statistics of Experts' Scores

S/N	Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liability ratio	Debt to asset ratio	Return on net assets	Surplus cash coverage ratio	Remarks
1	7	8	5	8	6	7	5	8	3	Company
2	8	9	5	6	4	5	4	7	7	Company
3	4	9	2	6	8	9	2	9	2	Customer (Retailer)
4	8	4	5	6	9	9	1	8	5	Customer (Distributor)
5	6	8	6	8	8	9	9	5	5	Fellow trader
6	9	6	3	8	4	7	2	8	3	Fellow trader
7	7	8	3	8	7	7	4	7	3	Supplier
8	8	8	6	8	7	8	8	7	7	Supplier
9	5	5	5	8	7	6	3	2	4	Professor
10	9	9	7	7	7	8	6	7	7	Professor

Source: Author finishing

4. Determining the Weights

Based on the experts' scores on 9 indicators, nine judgment matrices are built to compare the degree of importance between the scoring indicators in pairs according to the rules of judgment matrix. Since the highest score is 9 and the lowest is 1, the degree of importance of the row element relative to the column element is expressed in the judgment matrix as follows:

$$\begin{cases} C_{ij} - C_{ik} & \text{if } C_{ij} > C_{ik} \\ \dfrac{1}{C_{ik} - C_{ij} + 1} & \text{if } C_{ij} \le C_{ij} \end{cases} \quad i, j, k = 1,2,,,9 \tag{3-16}$$

To test the consistency of judgment matrix, the general practice is to build the Concordance Index (CI) and Random Index (RI) where $\mathrm{CI} = \frac{\lambda_{max} = n}{n-1}$ and $\mathrm{RI} = \sum_{j=1}^{m} \alpha_j RI_j$. Accordingly, CI is easy to derive by the eigenvalue of the judgment matrix and the order.

Importantly, RI is derived by the CI of the positive reciprocal matrix of the judgment matrix. For each judgment matrix there is one CI value and RI value. Importantly, CI=0 when the judgment matrix possesses perfectly consistent, and then we must introduce mean RI value in which case is decided by the order of the judgment matrix, and for 9th order matrix, RI=1.45. Last but not least, when the order ≥2, we introduce Random Conformance Rate (CR) to examine the consistency of judgment matrix where $CR = \frac{CI}{RI}$, and the judgment matrix has a satisfactory consistency when CR＜0.1, or it is necessary to adjust the judgment matrix.

Fortunately in this case the CR results are beyond satisfactory, and the final results are given in the following Table 3-3.

Table 3-3 CR Results of Judgment Matrices

No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
CI	0.0187	0.021	0.0433	0.0426	0.0123	0.0363	0.0151	0.0012	0.0256	0.0035
CR	0.0299	0.0294	0.0085	0.025	0.0104	0.0008	0.0177	0.0024	0.0299	0.0294

Source: Author finishing

As we can learn from the above Table 3-3, all the CR results are below 0.05, indicating a high level of consistency. As the calculation proceeds, the data are normalized to get the weights each expert gives before a mean value is calculated for each indicator (See Table 3-4):

Table 3-4 Working Capital Indicator Weightings

w_1	w_2	w_3	w_4	w_5	w_6	w_7	w_8	w_9
0.142	0.161	0.048	0.148	0.114	0.152	0.063	0.121	0.052

Source: Author finishing

Before analyzing the status quo of Company Z's working capital, the thesis first analyzes the industries of computer, communication and other electronic industries, in which Company Z is. It gives an overall analysis of the mean of working capital indicators in the industry, and serves as the standard for working capital assessment.

3.2 Assessment of Working Capital Risk in the Industry

Company Z belongs to the industries of computer, communication and other electronic industries and falls into the category of secondary industry as divided by the National Bureau of Statistics of China mainly including electronic products and information enterprises manufacturing integrated circuit, new components, computer, communication equipment, software network, etc. The thesis analyzes 9 indicators of working capital risk assessment of the public companies in the industries of computer, communication and other electronic industries in 2013, as follows:

1. Sample Selection

The purpose of this thesis is to establish an assessment system of working capital risk, so it's essential to find an assessment criterion. To do so, we download the whole 331 public trading companies which are in the same industries of Company Z in 2013, and then read those companies' financial statements, find the abovementioned 9 indicators. However, there are three types of observations we need to remove otherwise they'll cause negative effects to the assessment system then result in inaccurate consequences

First, after removing 13 observations of which the indicator data cannot be obtained, the sample size becomes 318. For example, some enterprises are removed due to the period of existence, industrial changes, or delisting. Therefore, those observations which 9 indicators cannot be obtained in 2013 are removed.

Second, 35 samples with abnormal indicators are removed. The particularity of some enterprises or the incompleteness of indicator information of the 9 indicators gives rise to impact of these abnormal indicators on the accuracy of judgment results. Therefore, those observations with abnormal indicators must be removed and then the sample size becomes 283.

Third, 4 enterprises with ST (Special Treatment) symbol are removed. In Chinese stock market an ST symbol means the enterprise have problems in operation, bad financial condition or other bad operational conditions in the last year, so it is normal and essential to

remove those observations. After doing so, the sample size becomes 279.

Fourth, considering that negative profit or net cash flow from operating activities in 2013 will cause large capital crisis to the enterprise and that there will be potential working capital risk, such observations will be removed. 25 enterprises with negative profit and 52 enterprises with negative net cash flow from operating activities in 2013 are picked out of the sample. Thus, 202 observations with better financial conditions than those removed ones are chose to establish the standard working capital risk assessment model.

2. Establishment of Working Capital Risk Assessment Model

With reference to the idea of Z-score model built by Altman (1968) and based on the 9 indicators for analysis of working capital risk in the thesis, the functional equation of working capital risk assessment model is set as follows:

$$R=w_1X_1+w_2X_2-w_3X_3+w_4X_4+w_5X_5+w_6X_6-w_7X_7+w_8X_8-w_9X_9 \quad (3\text{-}17)$$

Where:

R: Standard assessed value of working capital risk

X_1: Inventory turnover ratio

X_2: Receivables turnover ratio

X_3: Payables turnover ratio

X_4: Cash turnover ratio

X_5: Working capital allocation ratio

X_6: Cash to current liabilities ratio

X_7: Debt to assets ratio

X_8: Return on net assets

X_9: Surplus cash coverage ratio

W_1, W_2, W_3, W_4, W_5, W_6, W_7, W_8, and W_9 are weights of indicators in the assessment model; their values are given in the table 3-4.

Place the weights of 9 indicators into the assessment model, *i.e.*:

$$R= w_1X_1+w_2X_2-w_3X_3+w_4X_4+w_5X_5+w_6X_6-w_7X_7+w_8X_8-w_9X_9$$

$$=0.142X_1+0.161X_2-0.0483X_3+0.148X_4+0.114X_5+0.152X_6-0.063X_7+0.121X_8-0.052X_9$$

3. Determination of Assessment Standard

In the management of working capital of supply chain, the assessment standard of the working capital risk assessment model can be used to judge whether there is risk of shortage of working capital, *i.e*. whether enterprise will be confronted with working capital shortage due to that the supply of working capital cannot meet the needs of working capital under the current working conditions in a certain period in the future, so that enterprise doesn't have sufficient working capital to guarantee enterprise's normal operation.

Under the existing data and resource conditions, the 9 indicators of the public companies in the industries of computer, communication and other electronic industries in 2013 are calculated, and the standard assessed value (see equation 3-17) of working capital risk in the industry is calculated through placing the industrial mean value obtained by statistics of enterprise's indicators. Then, the enterprise's assessed value of working capital risk is calculated with the Excel software based on the functional equation of working capital risk assessment model. A judgment on whether there is risk of working capital shortage based on the comparison of each enterprise's assessed value and industrial standard assessed value.

The assessed value of working capital R is obtained by multiplying the mean value of each of the aforementioned 202 indicators with weights. The working capital risk can be judged based on the value of R: those larger or equivalent to the standard assessed value are deemed that the enterprises have sufficient working capital and have no working capital risk; those smaller than the standard assessed value are deemed that the enterprises are in shortage of capital and confronted with working capital risk, *i.e*. by way of measuring the R value of each sample and comparing R value with the industrial standard value R_0. The specific determination rules are as follows: first, if the sample's R value is larger than or equivalent to R_0, it can be determined that the enterprise currently has sufficient working capital and there is no working capital risk. Secondly, if the sample's R value is smaller than R_0, it can be determined that the enterprise is currently in shortage of working capital and there is no working capital risk

4. Process and Results of Assessed Value Determination

The mean values of 9 indicators data of 202 public companies are calculated as shown in Table 3-5:

Table 3-5 Mean Values of Industrial Working Capital Indicators in 2013

Inventory turnover ratio	Receivables turnover ratio	Payable turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liabilities ratio	Debt to assets ratio	Return on net assets	Surplus cash coverage ratio
0.0421	0.0124	0.0225	0.0127	0.5416	0.3493	0.3272	0.0824	1.5332

Source: CSMAR financial research database (2013)

The assessed value of working capital risk is calculated through placing the mean values of 9 indicators into the working capital risk assessment model:

$$R=0.142X_1+0.161X_2-0.0483X_3+0.148X_4+0.114X_5+ 0.152X_6-0.063X_7+0.121X_8-0.052X_9$$

$$=0.142*0.0421+0.161*0.0124-0.0483*0.0225+0.148*0.0127+0.114*0.5416+$$
$$0.152*0.3493-0.063*0.3267+0.121*0.0824-0.052*1.5332$$

$$=0.0332$$

Calculate data of 202 sample enterprises' data and place the same into the working capital risk assessment model to calculate each enterprise's R value in 2013 and summarize the results of determination of working capital risk category. The calculation and statistical results and the specific conditions are shown in Appendix 5.

Through comparing each enterprise's R value with the assessed value R_0, the final results show that the R value of 118 out of the 202 enterprises is over 0.0332, representing 58.42% of the total number of samples and the R value of 87 enterprises is lower than 0.0332, representing 42.58% of the total number of samples. Therefore, the standard assessed value of working capital risk under the thesis is 0.0332.

5. Explanations and Instructions of Results

Results indicate that the standard assessed value obtained by the working capital risk assessment model built based on the research of the thesis is 0.0332, which indicates that the method and idea applied for building the model are feasible and scientific. It means that if this

model is applied in practice, *i.e.* assessment of working capital risk, the quantified standard assessed value of risk 0.0332 can be used to indicate whether there is working capital risk with the enterprise and to help us judge the working capital risk with the upstream and downstream enterprises in the supply chain. Improvements can be made to operation and management in a prompt way. Before further increase in the risk of shortage of working capital, the results calculated with the working capital risk assessment model can be utilized and it is necessary to adopt relevant policies to reduce and eliminate the working capital risk with enterprises in the supply chain, thus reducing operating risk of Company Z's supply chain to finally achieve sustainable development of Company Z's supply chain within the acceptable scope of risk.

3.3 Company Z's Working Capital Risk Assessment

Based on the abovementioned 9 indicators, a comprehensive analysis of working capital performance has been conducted on Company Z for 2011 to 2013 (See Table 3-6):

Table 3-6 Analysis of Working Capital Indicators of Company Z for the Recent Three Years

Year	Inventory turnover ratio	Receivable turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liability ratio	Debt to asset ratio	Return on net assets	Surplus cash coverage ratio
2013	0.017	0.0092	0.0128	0.0112	0.6907	0.5905	0.3066	0.201	0.908
2012	0.0156	0.0081	0.0109	0.0104	0.7066	0.7597	0.2631	0.2215	0.9092
2011	0.0171	0.007	0.0085	0.0119	0.5836	0.4489	0.3556	0.2266	0.9774

Source: Financial statements of company Z (2011-2013)

1. Inventory Turnover Ratio

Company Z's inventory turnover ratio fluctuated in 2011-2013. The inventory turnover ratio decreased to 0.0156 in 2012 and rose to be close to the level of 2011 in 2013, indicating that Company Z's inventory turnover speed is unstable despite the increase in operating revenue, which directly result in unstable cash turnover ratio, thus certain working capital risks. The analysis of inventory and major business income indicators is as follows:

(1) Inventory

The thesis mainly analyzes Company Z's working capital from the perspective of changes in ending inventory size and inventory balance in each period in 2011-2013.

① Analysis of Inventory Size

At the end of each period in 2011-2013, the inventories of Company Z were RMB35.3108 million, RMB44.8808 million and RMB42.9385 million. The inventories of 2012 and 2013 increased substantially over 2011.

② Analysis of Changes in Inventory Balance

Details of Company Z's inventory at the end of each period in 2011-2013 are set out in table 3-7:

Table 3-7 Details of Company Z's Inventory in the Recent 3 Years

Unit: RMB 10, 000

Item	2011-12-31		2012-12-31		2013-12-31	
	Balance	Percentage	Balance	Percentage	Balance	Percentage
Raw material	1,845.32	52.26%	1,760.92	39.24%	1,854.64	43.19%
Goods in process	551.92	15.63%	636.16	14.17%	638.03	14.86%
Finished products	1,076.55	30.49%	1,982.57	44.17%	1,634.42	38.06%
Low priced and easily worn articles	1.30	0.04%	0.89	0.02%	-	-
Auxiliary materials	55.99	1.59%	107.54	2.40%	166.76	3.88%
Total	3,531.08	100%	4,488.08	100%	4,293.85	100%

Source: Financial statements of company Z (2011-2013)

The inventory balance at the end of 2012 increased by RMB9.57 million over the end of 2011, mainly due to the increase in the balance of finished products; the inventory balance at the end of 2013 decreased by RMB1.9423 million over the end of 2012, mainly due to the decrease in the balance of finished products. The specific analysis is as follows:

a. Analysis of the balance of raw materials and goods in process

The balance of raw materials and goods in process at the end of each period in 2011-2013 is closely related to the production and operation size. With the increase in production and operation size, in order to ensure orderly production, Company Z is required to maintain an appropriate amount of inventory of raw materials. As Company Z's production size increased in the recent three years, the balance of raw materials also increased.

The balance of goods in process of Company Z is mainly subject to the influence of production size. With the continuous increase in production and operation size, the balance of goods in process at the end of each period in 2011-2013 increases stably. To be specific, the production plan at the end of each period has certain impact on the balance of goods in process due to the characteristics of batch production of Company Z's products. As there are many orders for delivery by Company Z, the balance of products in process in 2012 and 2013 increased over 2011.

b. Analysis of the balance of products in process

Company Z's products are mainly customized products, which are mainly produced depending on sales. The balance of finished products at the end of each period in 2011-2013 is mainly subject to the influence of customers' order demand, as shown in Table 3-8:

Table 3-8 Balance of Company Z's Finished Products in the Recent Three Years

Unit: RMB 10, 000

Item	2011-12-31	2012-12-31	2013-12-31
Balance of finished products	1,076.55	1,982.57	1,634.42
Balance of the finished products with orders	971.36	1,677.42	1,472.17
Order coverage	90.23%	84.61%	90.07%

Source: Financial statements of company Z (2011-2013)

The above table shows that the finished products at the end of each period in 2011-2013 are basically under order coverage.

The balance of finished products at the end of 2012 increased by RMB9.0602 million over the end of 2011, mainly due to the increase in customer order and error of production plan. Although the number of order increased in 2012, the order coverage decreased by 5.62%. Due to the error with production plan, 3.0710 million finished products are additionally planned. In 2013, Company Z strengthened production plan management, resulting in a decrease in the balance of finished products at the end of 2013 by RMB3.4815 million over the end of 2012.

(2) Operating Revenue

In 2011-2013, Company Z's operating revenues were RMB192.7882 million, RMB224.3320 million and RMB267.6132 million, respectively. The operating revenue

increased by 16.36% and 19.29% in 2012 and 2013, respectively. Company Z's products operating income in 2011-2013 are set out in Table 3-9:

Table 3-9 Company Z's Operating Revenue in the Recent Three Years

Unit: RMB 10, 000

Product Type	2011		2012		2013	
	Amount	Percentage	Amount	Percentage	Amount	Percentage
SPD products	15,653.19	81.19%	19,283.94	85.96%	23,446.78	87.61%
Grounding products	900.28	4.67%	760.22	3.39%	892.41	3.33%
Lightning rod	481.26	2.50%	136.91	0.61%	296.53	1.11%
Lightning production engineering	873.98	4.53%	1,066.84	4.76%	1,096.72	4.10%
Others	1,370.11	7.11%	1,185.28	5.28%	1,028.89	3.84%
Total	19,278.82	100%	22,433.20	100%	26,761.32	100%

Source: Financial statements of company Z (2011-2013)

Table 4-10 shows that Company Z's main products are prominent, and SPD product is the main income source of Company Z and its operating revenue represents over 80% of the total operating revenue; in addition, it has a full set of product categories and a complete business chain, covering almost all products and services required for comprehensive lighting protection. The characteristics of Company Z's product operating revenue structure are mainly determined by the characteristics of the demands of downstream market and Company Z's own development orientation. Company Z's product sales is mainly towards communication equipment manufacturers and its supporting enterprises. In the global market, the communication equipment manufacturing industry has a high concentration ratio, mainly including Ericsson, Nokia Siemens, Huawei, ZTE, Alcatel-Lucent, etc.

2 Receivables Turnover Ratio

Company Z's receivables turnover ratio experienced a substantial change in 2012 and further increased in 2013, indicating that the receivables turnover ratio increased with the substantial increase in Company Z's operating revenue, *I.e.* a shorter receivables turnover period and a rapid collection speed will result in a faster assets liquidity. The analysis of bills receivable and receivables is set out below:

(1) Bills Receivable

Company Z's bills receivable in 2011-2013 were RMB7.2729 million, RMB4.3394

million and RMB17.5922 million, respectively. Company Z's bills receivable are mainly issued by ZTE, Shanghai Bell, etc. Company Z's bills receivable at the end of 2013 increased by RMB13.2528 million over the end of 2012, indicating an increase in the time of collection of payments for goods from customers.

(2) Receivables

Company Z's receivables in 2011-2013 were RMB71.9113 million, RMB59.5066 million and RMB90.9846 million, respectively. The overall increase in receivables is mainly due to the increase in the sales size of Company Z. As at December 31, 2013, receivables aging less than 1 year represent over 95%, and there is no risk of loss of large amount of bad debts.

① Analysis of the reasonableness of receivables size

The receivables attributable to the sales of products of Company Z in 2012-2013 represent 90.06%, 94.13% and 95.96% of the balance of Company Z's total balance of receivables, respectively. As the average credit period of Company Z's product sales is about 3 months, the receivables attributable to product sales at the end of each period in 2011-2013 are mainly subject to the impact of the sales in the three months prior to end the period. In combination of the factor of sales credit period, the analysis of the balance of receivables attributable to product sales of Company Z is set out in Table 3-10:

Table 3-10 Balance of the Balance of Company Z's Receivables

Unit: RMB 10, 000

Date	Balance of receivables	Sales in the last three months in the current period (including tax)	Percentage
December 31, 2011	6,888.50	7,759.85	88.77%
December 31, 2012	5,941.74	6,616.97	89.80%
December 31, 2013	9,279.94	9,898.96	93.75%

Note: Sales (including value added tax) = operating revenue from internal sales in the current period ×1.17+ operating revenue from external sales in the current period

Source: Financial statements of company Z (2011-2013)

Table 3-10 shows that the balance of receivables from products sales at the end of each period in 2011-2013 accounts for about 90% of sales in the last three months in the current period, indicating that the receivables from products sales at the end of each period are basically in the 3-month credit period and the recovery efficiency is good. The increase in

receivables is mainly due to the increase in sales size.

② Analysis of the quality of receivables

a. Aging analysis of receivables

At the end of each period in 2011-2013, the aging structure of the balance of Company Z's receivables is as shown in Table 3-11:

Table 3-11 Aging Structure of the Balance of Company Z's Receivables

Unit: RMB 10, 000

Item	2011-12-31		2012-12-31		2013-12-31	
	Amount	Percentage	Amount	Percentage	Amount	Percentage
Within 1 year	7,152.31	93.51%	5,915.38	93.71%	9,194.32	95.08%
1-2 years	353.80	4.63%	249.29	3.95%	223.97	2.32%
2-3 years	70.61	0.92%	120.06	1.90%	145.74	1.50%
3-4 years	31.85	0.42%	19.05	0.30%	87.18	0.90%
4-5 years	27.98	0.36%	5.61	0.09%	10.53	0.11%
Over 5 years	12.16	0.16%	3.19	0.05%	8.80	0.09%
Total	7,648.71	100%	6,312.57	100%	9,670.53	100%

Source: Financial statements of company Z (2011-2013)

In 2012-2013, the receivables within 1 year of Company Z account for above 93% of the balance of receivables, and percentage increases slightly year over year.

b. Analysis of top five customers of receivables

The major customers of receivables are old customers with which cooperation has lasted for years and the quality of receivables is good. As at December 31, 2013, the top five customers of Company Z's receivables are shown in Table 3-12:

Table 3-12 Top Five Customers of Company Z's Receivables

Unit: RMB 10, 000

Name of Company	Amount	Aging	Percentage in the balance of receivables
Skandia (Ericsson)	1,852.11	Within 1 year	19.15%
Nanjing Panda (Ericsson)	1,607.83	Within 1 year	16.63%
ZTE Kangxun	1,165.73	Within 1 year	12.05%
Huawei	879.91	Within 1 year	9.10%
NSN Communication (Nokia Siemens)	364.11	Within 1 year	3.77%
Total	5,869.69	-	60.70%

Source: Financial statements of company Z (2011-2013)

The total of the top five customers of receivables of Company Z accounts for 60.70% of the balance of receivables and the age of such receivables is within 1 year. These customers are mainly famous enterprises including Ericsson, ZTE, Huawei, Nokia Siemens, etc. and are direct users of Company Z's products with good reputation and small risk of bad debt loss having cooperated with Company Z for years.

3. Payables Turnover Ratio

The payables turnover ratio of Company Z in the recent three years was 0.0085, 0.0109 and 0.0128, respectively. The payables turnover ratio substantially increased in three consecutive years, indicating that the reputation of payables improved with the substantial increase in Company Z's operating revenue. The analysis of bills payable and payables is as follows:

(1) Bills Payable

Company Z's bills payable are banks' acceptance bills. At the end of each period in 2011-2013, the balances of bills payable were RMB24.3325 million, RMB19.0550 million and RMB22.8200 million, respectively. Since 2011, the balance of Company Z's bills payable has increased a lot, mainly due to the increase in efforts by Company Z in payment for procurement by way of acceptance bills and the increase in the amount and payment of procurement resulting in an increase in bills payable.

(2) Payables

Company Z's payables are mainly payables for procurement of raw materials by Company Z. The balances of Company Z's payables at the end of each period in 2011-2013 were RMB42.7687 million, RMB27.6670 million and RMB46.9711 million, respectively.

Compared with the end of 2011, the balance of payables at the end of 2012 decreased by RMB15.1017 million, mainly due to the decrease in procurement in the fourth quarter of 2012 as compared with the same period in 2011, resulting in a decrease in the balance of payables in the credit period at the end of 2012 as compared with that at the end of 2011, and the strengthened management of payables of Company Z and the prompt settlement of payment for goods with suppliers.

As compared with the counterpart at the end of 2012, the balance of payables at the end of 2014 is increased by RMB19.3041 million. The aging structure of Company Z's balance of payables is as shown in Table 3-13:

Table 3-13 Aging Structure of Company Z's Balance of Payables

Unit: RMB 10,000

Item	2011-12-31		2012-12-31		2013-12-31	
	Amount	Percentage	Amount	Percentage	Amount	Percentage
Within 1 year	4,147.98	96.99%	2,692.22	97.31%	4,664.16	99.30%
1-2 years	98.72	2.31%	61.25	2.21%	23.65	0.50%
2-3 years	9.44	0.22%	13.22	0.48%	7.94	0.17%
Above 3 years	20.73	0.48%	-	-	1.37	0.03%
Total	4,276.87	100%	2,766.70	100%	4,697.11	100%

Source: Financial statements of company Z (2011-2013)

Company Z's payables are mainly aged for less than 1 year. As at December 31, 2013, the payables within 1 year account for 99.30%. In addition, the percentage of payables within 1 year increased slightly in the recent three years, close to 100%, indicating that Company Z does not occupy suppliers' funds in the long term.

4. Cash Turnover Ratio

Company Z's cash turnover ratio in 2011-2014 were 0.0119, 0.0104 and 0.0112respectively, of which the cash turnover ratio in 2013 was mainly subject to the impact of inventory turnover ratio and experienced a slight decrease; the cash turnover ratio increased in 2013, *i.e.* decrease in cash turnover ratio, indicating a shortened cash turnover period of Company Z. However, it has not reached the cash turnover ratio in 2011, and there is problem of low efficiency with day-to-day working capital management performance.

5. Working Capital Allocation Ratio

Company Z's working capital allocation ratios in 2011-2013 were 0.5836, 0.7066 and 0.6907respectively, of which the working capital allocation ratio in 2012 increased. Company Z's current assets in 2011-2013 were RMB19.27827 million, RMB210.8445 million and RMB 281.0045 million respectively, and increased by 9.37% and 33.28% in 2012 and 2013, respectively. The current liabilities were RMB80.2830 million, RMB61.8648 million and RMB86.9216 million in 2011, 2012 and 2013respectively, of which the current liabilities

decreased by 22.94% in 2012 and increased by 40.50% in 2013. The increase in current assets is larger than the increase speed of current liabilities, indicating a higher working capital allocation ratio, a stronger solvency for short-term debts and more working capital of Company Z; and the working capital allocation ratio in 2013 was stable, indicating that Company Z maintained a strong solvency for short-term debts and its working capital risk decreased.

6. Cash to Current Liabilities Ratio

Company Z's cash to current liabilities ratios in 2011-2013 were 0.4489, 0.7597 and 0.5905respectively, of which the increase in 2012 was large and such ratio was stable in 2013. Company Z's net cash flow from operating activities in 2011-2013 were RMB36.0382 million, RMB46.9969 million and RMB51.3302 million, respectively. The increase in net cash flow from operating activities increased by 30.42% and 9.41% in 2012 and 2013respectively, indicating that Company Z's cash to current liabilities ratio increased, the net cash flow from operating activities increased, there was more guarantee for repayment of debts becoming due as scheduled and enterprise's working capital risk further decreased.

7. Debt to Assets Ratio

Company Z's total assets in 2011-2013 were RMB241.2547 million, RMB 261.8342 million and RMB 334.4754 million respectively, of which the total assets increased by 8.53% and 27.74% in 2013 and 2013, respectively; the total liabilities were RMB85.7930 million, RMB 68.8848 million and RMB 102.5656 million respectively, of which the total liabilities decreased by 19.71% in 2012 and increased by 48.89% in 2013. The increase in total assets is far larger that in total liabilities, indicating that Company Z's solvency and working capital guarantee capacity are enhancing and working capital risk is decreasing.

8. Return on Net Assets

Company Z's returns on net assets in 2011-2013 were 0.2266, 0.2215 and 0.201, respectively. Company Z's net profit in 2011-2013 were RMB 35.2220 million, RMB 42.7329 million and RMB 46.6070 million respectively, of which the increases in 2012 and 2013 were 21.32% and 9.07%, respectively; the net assets of Company Z in 2011-2013 were RMB 155.4618 million, RMB 192.9495 million and RMB 231.9098 million respectively, of which

the net assets increased by 24.11% and 20.19% in 2012 and 2013, respectively. Company Z's capacity of obtaining net profit with self owned capital is weakening, the net assets turnover ratio is slowing down, the capital utilization ratio and the return on assets are decreasing, indicating that enterprise's profitability is decreasing and working capital risk is increasing.

9. Surplus Cash Coverage Ratio

Company Z's surplus cash coverage ratio in 2011-2013 were 0.9774, 0.9092 and 0.9080, respectively. The surplus cash coverage ratio in the recent three years were decreasing, *i.e.* the security surplus cash multiple is increasing, indicating that the guarantee for cash income in the net profit of Company Z for the current period is strengthening and enterprise's working capital risk is decreasing.

10. Contrastive Analysis of Working Capital between Company Z and the Industry

Building upon the results calculated with the risk assessment model with 9 indicators of working capital of Company Z in 2013, a comparative analysis has been conducted against the average performance in the industry (See Table 3-14):

Table 3-14 Comparison of Working Capital Indicators between Company Z and the Industry

Subject	Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liability ratio	Debt to asset ratio	Return on net assets	Surplus cash coverage ratio	Assessment Results
The Industry Average	0.0421	0.0124	0.0225	0.0127	0.5416	0.3493	0.3272	0.0824	1.5332	0.0332
Company Z	0.017	0.0092	0.0128	0.0112	0.6907	0.5905	0.3066	0.201	0.908	0.1312
Deviation	0.0251	0.0032	0.0097	0.0015	-0.1491	-0.2412	0.0206	-0.1186	0.6252	-0.098
Percentage of deviation (%)	59.65 %	26.04 %	43.29 %	12.06 %	-27.53%	-69.06 %	6.28%	-143.90 %	40.78 %	-294.73 %

Source: CSMAR financial research database and Financial statements of company Z (2013)

The comparison of working capital indicators between Company Z and the industry is as shown in Figure 3-2:

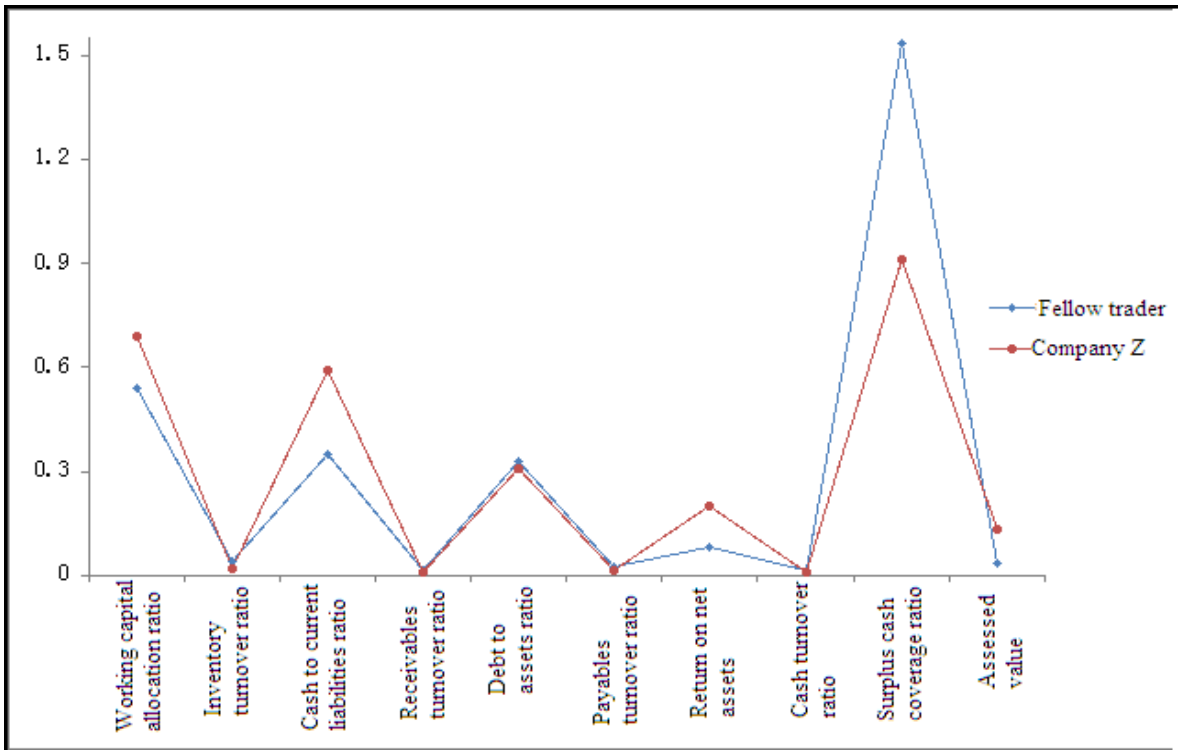

Figure 3-2 Comparison of Working Capital between Company Z and the Industry

Source: CSMAR financial research database and Financial statements of company Z (2013)

It can be seen from Figure 3-2 that:

(1) Company Z's day-to-day working capital management performance indicators are lower than industrial level

Company Z's inventory turnover ratio is 0.017, 59.65% lower than the mean value of public companies in the industry 0.0421, indicating that Company Z's inventory turnover speed is much slower than the industry, *i.e.* long inventory turnover period, low occupation level of inventory, weak liquidity and weak cashability. Company Z's receivables turnover ratio is 0.0092, 26.04% lower than the mean value of public companies 0.0124, indicating that the receivables turnover speed of Company Z is slower than the industry, *i.e.* Long receivables turnover period, slow collection speed, slow capital inflow and weak solvency. Company Z's payables turnover ratio is 0.0128, 43.29% lower than the mean value of public companies in the industry 0.0225, indicating longer payables turnover period, longer occupation of upstream capital and more repayment pressure. Company Z's cash turnover ratio is 0.0112, 12.06% lower than the mean value of public companies in the industry 0.0127, indicating that Company Z's capital turnover speed is slower than the industry, *i.e.* longer cash turnover

period and poor capital utilization effects.

(2) Company Z's solvency indicators are higher the industrial level

Company Z's working capital allocation ratio is 0.6907, 27.53% higher than the mean value of public companies in the industry 0.5416, indicating a strong solvency for short-term debts of Company Z. Company Z's cash to current liabilities ratio is 0.5905, 69.06% higher than the mean value of public companies in the industry 0.3493, indicating that Company Z's net cash flow from operating activities in the current period is sufficient to repay short-term debts. Company Z's debt to assets ratio is 0.3066, 6.28% lower than the mean value of public companies in the industry 0.3272, indicating a strong solvency of Company Z.

(3) Company Z's profitability indicators are higher than the industrial level

Company Z's return on net assets is 0.201, 143.9% higher than the mean value of public companies in the industry, indicating that Company Z's return on net assets is far higher than the industrial level and has a very high capacity of obtaining net income with self owned capital. Company Z's surplus cash coverage ratio is 0.908, 40.78% lower than the mean value of public companies in the industry 1.5332, indicating that Company Z's surplus cash coverage ratio is far higher than the industrial level and there is a very high guarantee for cash income in the net profit for the current period.

Company Z's day-to-day working capital management performance indicators are lower than the industrial level. Therefore, Company Z is confronted with the problem of low working capital day-to-day management performance and it is required to promote the turnover efficiency of inventory, receivables, payables and capital. In addition, Company Z's profit margins of SPD product in 2011-2013 were 42.48%, 40.49% and 37.30%respectively, showing an overall decline trend in the recent three years. With the increasingly fierce competition in the industry and continuous expansion of Company Z's operating size, Company Z's performance growth speed may decrease or there may be risk of performance decline. Therefore, Company Z is confronted with cost pressure and it is required to solve the problems with working capital management, reduce operating costs and improve capital efficiency, thus continuously enhancing Company Z's competitiveness.

3.4 Assessment of Suppliers' Working Capital Risk

3.4.1 Overview of Suppliers

Company Z has 226 suppliers which are divided into important suppliers and general suppliers depending on importance, including 64 important suppliers mainly supplying gas supply pipes, piezoresistor, high voltage capacitor, graphite electrode, connector, breaker, customized chassis, hardware, etc. In 2013, the procurement amount of important suppliers accounts for 80.45% of the total procurement amount; there are 162 suppliers mainly supplying normal resistance, capacitor, wire, standard pieces, packaging materials and others. In 2013, the procurement amounts of general suppliers account for 19.55% of the total procurement amount, as shown in Figure 3-3:

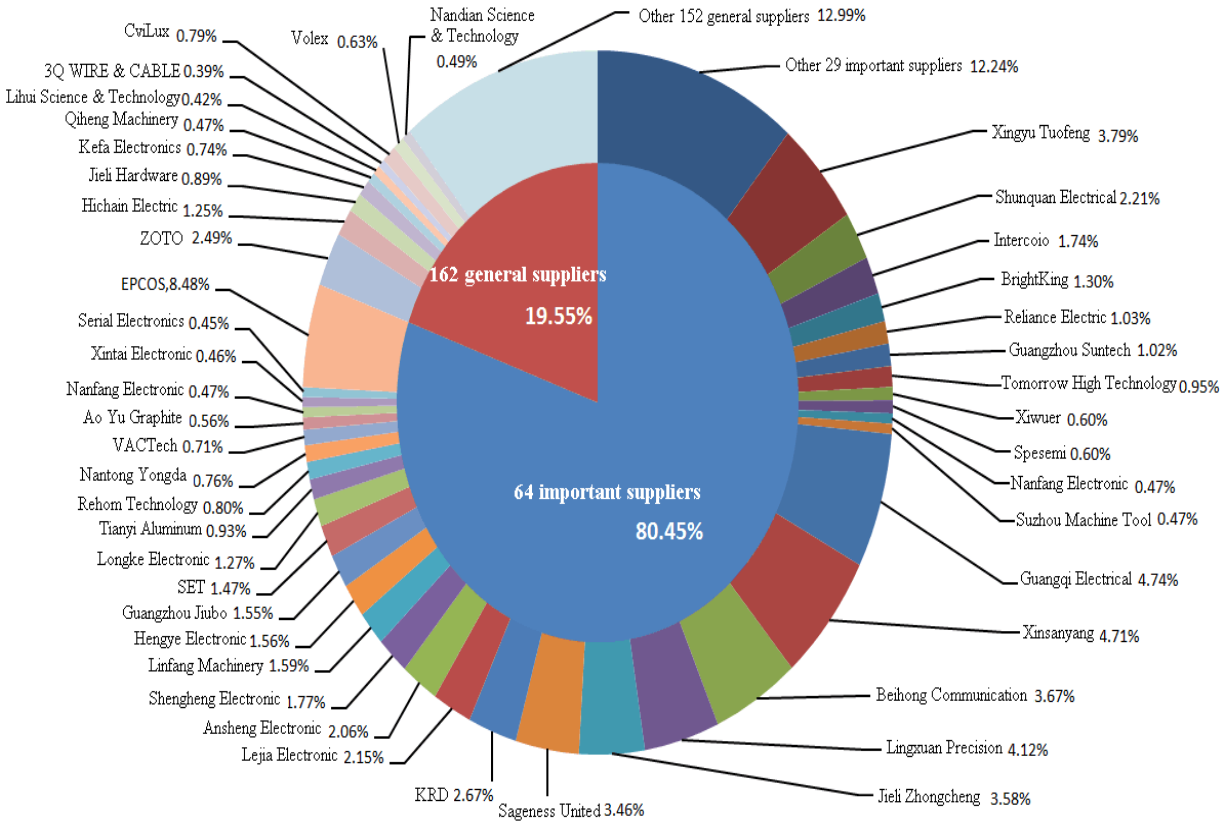

Figure 3-3 Percentage of Procurement of Suppliers in 2013

Source: Financial statements of company Z (2013)

Company Z mainly conducts production according to sales and applies the production model that predicts and makes an overall utilization of production capacity depending on sales and customer demands. It arranges production plan based on the customer order of marketing center and formulates procurement plan according to the raw materials required for production plan and the safe inventory of raw materials. As most lighting production products of Company Z are independently developed and are subject to certain technical barriers, most raw materials of lightning products are not common raw materials and it is required to jointly research or customize procurement with suppliers. Therefore, suppliers' resources are relatively limited, particularly core components. On the other hand, as to the characteristics of the upstream industry of Company Z, most electronic components are core components of lightning production products. Since lightning production products are subject to tremendous lightning energy and these electronic components are basically materials jointly developed and customized with the upstream, Company Z has a strong reliance on these resources in a certain period. The main reason materials of Company Z's products are gas pipes, piezoresistor, printed wiring board and other components, terminals, hardware, plastic and rubber, chassis, etc. The cost composition of Company Z's raw materials in 2013 is as shown in Table 3-15:

Table 3-15 Cost Composition of Company Z's Raw Materials in 2013

Unit: RMB 10, 000

Item		2011		2012		2013	
		Amount	Percentage	Amount	Percentage	Amount	Percentage
Lightning rod	Structural members	158.44	1.37%	51.28	0.38%	129.82	0.77%
	Electronic components	45.31	0.39%	13.46	0.10%	35.81	0.21%
	Package and others	18.01	0.16%	3.76	0.03%	9.36	0.06%
SPD	Electrical inductance	305.85	2.64%	387.41	2.88%	203.67	1.21%
	Cooper wire	204.36	1.76%	231.11	1.72%	405.74	2.42%
	Connecting rod	428.31	3.69%	520.30	3.87%	630.00	3.75%
	Chassis	860.51	7.42%	1,007.67	7.50%	1,481.37	8.83%
	Gas pipe	1,330.51	11.48%	1,623.27	12.08%	1,719.99	10.25%
	Plastic parts	668.08	5.76%	824.55	6.14%	1,089.34	6.49%
	Wiring terminals	797.50	6.88%	911.40	6.78%	1,325.70	7.90%

	Piezoresistor	978.68	8.44%	952.50	7.09%	1,126.02	6.71%
	Printed board	346.00	2.98%	377.56	2.81%	568.86	3.39%
	Other electronic components	1,150.59	9.92%	1,420.11	10.57%	1,853.16	11.04%
	Other structural members	717.84	6.19%	861.13	6.41%	1,376.40	8.20%
	Package and others	239.23	2.06%	248.16	1.85%	440.10	2.62%
Grounding products	Cement	11.70	0.10%	8.80	0.07%	14.23	0.08%
	Graphite	204.18	1.76%	169.97	1.27%	159.20	0.95%
	Iron core	101.54	0.88%	102.17	0.76%	151.09	0.90%
	Package and others	109.28	0.94%	88.20	0.66%	122.05	0.73%
Direct materials of other products		843.50	7.27%	663.86	4.94%	632.41	3.77%
Total of direct materials		9,519.42	82.11%	10,466.67	77.90%	13,474.30	80.30%
Labor cost and manufacturing expenses		1,527.36	13.18%	2,209.43	16.44%	2,511.45	14.97%
Lightning production engineering		546.04	4.71%	760.13	5.66%	794.81	4.74%
Total		11,592.82	100%	13,436.23	100%	16,780.56	100%

Source: Financial statements of company Z (2011-2013)

SPD (Surge Protective Device) refers to the electrical device that restricts transient overvoltage and releases surge current. It includes power supply SPD, antenna feeder SPD, and signal SPD. Power supply SPD refers to the surge protective device used for protecting electronic and electrical equipment in the power supply system; antenna feeder SPD is the surge protective device used to protect the equipment connecting with the antenna and feeder in the communication system; signal SPD is the surge protective device used to protect signal transmission and receiving equipment in the signal system. SPD product, as a leading product of Company Z, is used as electronic element and component in the electronic equipment of downstream industries. It has a great variety of raw materials, of which gas pipe, piezoresistor, printed board, and other electronic components. Such electronic components will have an increasingly higher cost performance and the overall price presents a gradually decreasing trend with the progress of technology, enlarging the profit space of Company Z's products to a certain extent. Such raw materials as electrical inductance, copper wire and connecting rod are mainly made of copper. The purchase price of these materials is subject to the impact of fluctuations in copper price. However, as the aforementioned copper materials account for a

small percentage of operating costs, their percentages in Company Z's operating costs in 2013 were 7.38%, 8.47% and 8.09% respectively.

Suppliers are providers of the above mentioned materials, of which the analysis of top five suppliers in respect of procurement amount in the recent three years is as shown in Table3-16:

Table 3-16 Analysis of Top Five Suppliers of Company Z in the Recent 3 Years

S/N	Name of Customer	Procurement Amount (RMB 10,000)	Percentage	Remarks
Top 5 Suppliers before 2013				
1	EPCOS	1,422.81	8.48%	Gas pipe
2	Shanghai Guangqi	804.07	4.79%	Electronic components
3	Xinsanyang	788.85	4.71%	Hardware, structural members
4	Xingyu Tuofeng	635.29	3.79%	Chassis
5	Beihong Communication	615.15	3.67%	Electronic components
Total		4,266.16	25.43%	
Top 5 Suppliers before 2013				
1	EPCOS	1,427.13	10.62%	Gas pipe
2	Xinsanyang	637.91	4.75%	Hardware, structural members
3	Shenxing Electrical	420.82	3.13%	Hardware, structural members
	Sageness United	155.00	1.15%	Hardware, structural members
	Subtotal	575.82	4.28%	
4	Lingxuan Precision	560.15	4.17%	Plastic parts
5	Linfang Machinery	400.88	2.98%	Chassis, connecting rod
Total		3,601.88	26.81%	
Top 5 Suppliers before 2011				
1	EPCOS	1,169.29	10.09%	Gas pipe
2	KRD	672.14	5.80%	Piezoresistor, etc.
3	Xinsanyang	478.84	4.13%	Hardware, structural members
4	Shenxing Electrical	449.36	3.88%	Hardware, structural members
5	Lingxuan Precision	363.33	3.13%	Plastic parts
Total		3,132.96	27.03%	

Note: Shenxing Electrical and Sageness United have the same legal person.

Source: Financial statements of company Z (2011-2013)

Company Z's suppliers were relatively stable in 2011-2013. Company Z is free of the circumstances that the percentage of procurement from a single supplier exceeds 30% of the total procurement amount or serious reliance on minority suppliers, of which it has a strong reliance on EPCOS. As the gas pipe supplier EPCOS is the core component supplier of Company Z, the amount of procurement from it is also the highest among suppliers, followed by suppliers of other electronic components and hardware suppliers. It cooperated with suppliers in development of tailed components through establishing close technical cooperation relationship with upstream electronic components suppliers, further accelerated the research and development speed of Company Z's products and strengthened technical competitiveness of Company Z's supply chain.

3.4.2 Survey of Suppliers

1. Questionnaire design

The questionnaire for Company Z's suppliers consists of 4 parts: Part I – Background: which states the purposes of the questionnaire, that is, to collect the data that can provide mathematical statistics for research on supply chain operation strategies and risk management mechanism giving consideration to working capital; Part II - Survey Questions: where respondents are asked to comment on their companies' payment period, purchase prices and quantities; Part III – Financial Performance of the Companies Surveyed (2013): where respondents are asked to provide the financial data that can reflect the business situation and financial performance of their companies in 2013 as data support for the working capital risk assessment in this Thesis; Part IV –Questionnaire of Suppliers' Basic Information: suppliers' basic information includes, among others, company profile, main manufacturing equipment, testing devices, sources of raw materials, primary products and major customers, helping deliver a full picture of suppliers. See Appendix 8 for details.

2. Questionnaire release and collection

In this thesis, the questionnaire is sent to 226 suppliers to help collect useful data for analysis via face-to-face, telephone and mail interviews. 226 questionnaires are sent out and 222 get back (the other 4 are not retrieved due to involvement of trade secrecy-related issues);

and out of the 222, two contain obvious errors. Hence, there are 220 valid completed questionnaires, with an effective response rate of 97.35%.

3. Results analysis

Firstly, sort out and summarize the financial data 2013 of suppliers in the 220 questionnaires and then calculate the 9 indicators of each supplier, *i.e.* inventory turnover, receivables turnover, payables turnover, cash turnover, working capital allocation rate, cash to current liability ratio, debt to asset ratio, return on net assets, and surplus cash coverage ratio; finally, apply the 9 indicators of each supplier in the risk assessment model for working capital and calculate the assessed value of working capital risk of each supplier. The assessment of working capital indicators of suppliers is set out in Appendix 1.

Among the 220 suppliers, 79 (or 35.91% of the total valid completed questionnaires) have an R value (assessed value of working capital risk) higher than or equal to the industry standard (0.0332), representing 29.8% of Company Z's total procurement; 141 (or 64.09% of the total valid completed questionnaires) have an R value lower than 0.0332, a negative net cash flow from operating activities and a negative profit represent 69.44% of Company Z's total procurement. This indicates that a large number of Company Z's suppliers have insufficient working capital and face certain business risks and a likelihood of bankruptcy due to lack of capital, which may affect Company Z's procurement resources and even result in a broken link at the upstream of Company Z's supply chain.

A comparative analysis of the mean values of 9 indicators of the 220 suppliers and the computer, communications and other electronics industries in 2013 is shown as follows (See Table 3-17):

Table 3-17 Comparative Analysis of Indicators between Suppliers and the Industry

Subject	Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liability ratio	Debt to asset ratio	Return on net assets	Surplus cash coverage ratio	Assessment Results
The Industry Average	0.0421	0.0124	0.0225	0.0127	0.5416	0.3493	0.3272	0.0824	1.5332	0.0332
Suppliers	0.0149	0.0109	0.0127	0.0132	0.3362	0.1755	0.507	0.1296	1.1227	-0.0044
Deviation	0.0273	0.0015	0.0099	-0.0005	0.2054	0.1738	-0.1798	-0.0472	0.4105	0.0377
Percentage of deviation (%)	64.71%	12.44%	43.70%	-3.72%	37.92%	49.76%	-54.94%	-57.26%	26.77%	-4.21%

Source: CSMAR financial research database and Financial statements of company Z's suppliers (2013)

The comparison of 9 indicators of working capital between suppliers and the industry is as shown in Figure 3-4:

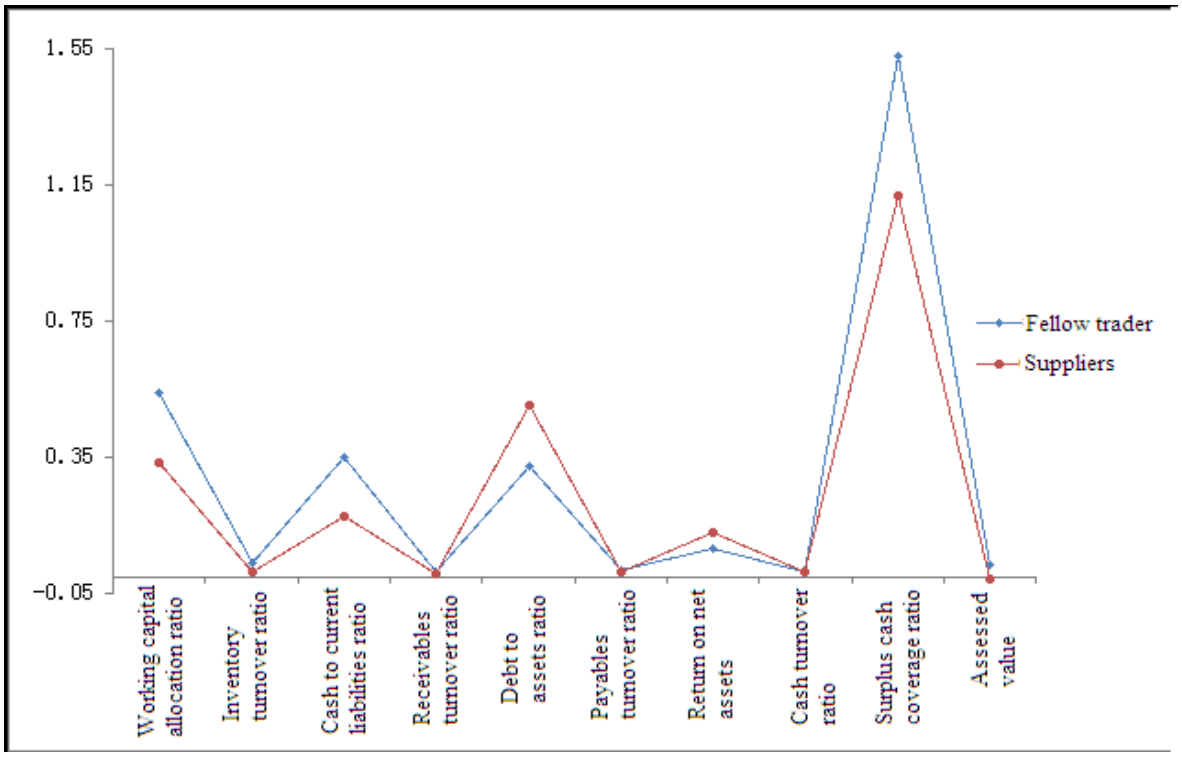

Figure 3-4 Comparison of Working Capital between the Suppliers and the Industry

Source: CSMAR financial research database and Financial statements of company Z's suppliers (2013)

Figure 3-4 shows that:

(1) Suppliers' day-to-day working capital management performance indicators are lower than the industrial level. Suppliers' inventory turnover ratio is 0.0149, 64.71% lower than the mean value of public companies in the industry 0.0421, indicating that suppliers' inventory turnover speed is far slower than the industry, *i.e.* long inventory turnover period, low occupation level of inventory, and weak liquidity and cashability. Suppliers' receivables turnover ratio is 0.0109, 12.44% lower than the mean value of public companies in the industry 0.0124, indicating that suppliers' receivables turnover speed is lower than the industry, *i.e.* long receivables turnover period, slow collection speed and capital inflow, and weak solvency. Suppliers' payables turnover ratio is 0.0127, 43.29% lower than the mean value of public companies in the industry 0.0225, indicating that suppliers' payables turnover speed is lower than the industry, *i.e.* long payables turnover period, long occupation of upstream capital and more pressure of repayment. Suppliers' cash turnover ratio is 0.0132, 3.73% higher than the mean value of public companies in the industry 0.0127 indicating that suppliers' cash turnover speed is slightly faster than the industry, *i.e.* short cash turnover period.

(2) Suppliers' solvency indicators are lower than the industrial level. Suppliers' working capital allocation ratio is 0.3362, namely 37.92% lower than the mean value of public companies in the industry 0.5416, indicating weak solvency of suppliers for short-term debts. Suppliers' cash to current liabilities ratio is 0.1755, 49.76% lower than the mean value of public companies in the industry 0.3493, indicating that suppliers' net cash flow from operating activities in the current period is sufficient to repay short-term debts. Suppliers' debt to assets value is 0.5070, 54.94% higher than the mean value of public companies in the industry 0.3272, indicating the weak solvency of suppliers.

(3) Suppliers' profitability indicators are higher than the industry level. The return on net assets is 0.1296, that is 57.26% higher than the mean value of public companies in the industry 0.0824, indicating that the return on net assets of suppliers is higher than the industrial level and the capacity for self owned capital to obtain net income is very high. Suppliers' surplus cash coverage ratio is 1.1227, 26.77% lower than the mean value of public

companies in the industry 1.5332, indicating that suppliers' surplus cash coverage ratio is higher than the industrial level and there is a high guarantee for cash income in the net profit for the current period.

Suppliers' day-to-day working capital management performance and solvency indicators are lower than the industrial level. Therefore, suppliers are subject to working capital risk and confronted with working capital shortage and difficulty in financing. On the one hand, suppliers have problems with the procurement, production and marketing channels and it is required to strengthen management of inventory, receivables and payables; on the other hand, it is necessary to solve the problems of high debt to assets ratio and difficulty in financing.

3.5 Assessment of Customers' Working Capital Risk

3.5.1 Overview of Customers

The downstream application market of Company Z's products has covered communication, electric power, petrochemical, new energy, aerospace and national defense, building and other basic industries (as shown in Figure 3-1) and a high quality and stable customer base has been formed. At present, customers are mainly large scale electronic equipment manufacturers including Ericsson, ZTE, Huawei, Nokia Siemens, etc. Most of the SPD products required are customized products and there are very high requirements on the consistency and stability of SPD products of electronic components.

Company Z has 128 customers and its business is divided into direct sales business and distribution business according to the influence of products customization degree on sales model. Therefore, customers are divided into direct sales customers and distribution sales. Here are 39 direct sales customers. The products required by such customers are customized products of few types and a large quantity. In 2013, the sales from direct sales customers account for 84.67% of total sales; there are 89 distribution customers. The products required by such customers are common public products of high universalization, many product varieties, large quantity and low unit price. In 2013, the sales from distribution customers accounts for 16.33% of total sales, as shown in Figure 3-5:

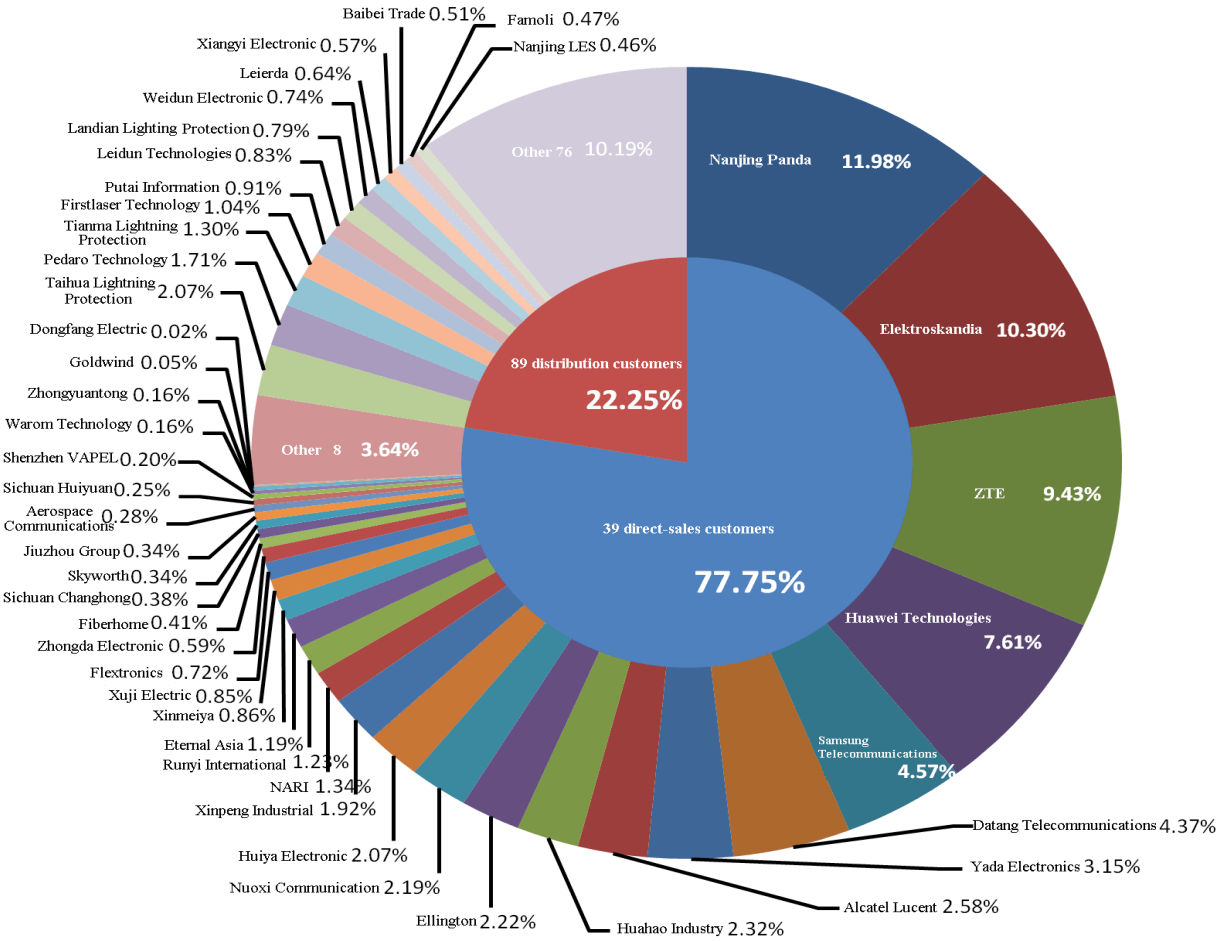

Figure 3-5 Percentage of Customer Sales in 2013

Source: Financial statements of company Z (2013)

At present, Company Z's business is dominated by direct sales. The income from direct sales in 2011-2013 accounted for 83.67%, 83.57% and 77.74% of operating revenue, respectively. The composition of revenue from principal businesses of Company Z in 2011-2013 by sales model is as shown in Table 3-18:

Table 3-18 Composition of Revenue from Company Z's Principal Businesses

Unit: RMB 10, 000

Sales Model	2011		2012		2013	
	Amount	Percentage	Amount	Percentage	Amount	Percentage
Direct sales	22,391.90	83.67%	18,748.23	83.57%	14,988.30	77.74%
Distribution	4,369.42	16.33%	3,684.97	16.43%	4,290.52	22.25%
Total	19,278.82	100%	22,433.20	100%	26,761.32	100%

Source: Financial statements of company Z (2011-2013)

(1) Direct Sales Model

Company Z's products sales are dominated by supporting direct sales. Supporting customers are mainly large scale electronic equipment manufacturers of a high position in the industry instead of the ultimate users of non-lightning protection products. It applies lightning protection products in the complete electronic products as electronic components. Schumacher customers have a large demand for lightning production products and good reputation. At present, Company Z's major supporting customers include Ericsson, ZTE, Huawei, etc. Due to the characteristics of large scale operation, supporting customers implement prudent selection and strict assessment of suppliers. In respect of the overall strength of suppliers, it emphasizes the position in industry, technical research and development capacity, production and quality control capacity of suppliers and requires suppliers to have a complete management system, good capacity of management and control of operating risks, a strong sense of responsibility, awareness of environmental protection and care about staff's occupational health; in respect of product supply, it requires suppliers to have a strong capacity of batch supply and high requirements on products' technical level, stability and consistency. To become a qualified supplier of such customers and achieve batch supply, it is required to pass strict supplier qualification assessment and product reliance test certification. It generally takes 3-5 years from certification to realization of batch supply. Once becoming supplier of such customers, these customers will not change suppliers easily in order to ensure consistency, stability and supply scale of products. Supporting customer sales model applies direct sales. As supporting customers have good reputation, Company Z will generally grant a credit period of 90 days.

(2) Distribution Sales Model

As lightning production prorate currently mainly applied in basic industries that are related to national economy and people's livelihood, such industries involves a broad territory. The market demand pattern is relatively scattered and the overall market has a poor concentration degree with scattered ultimate users and inconspicuous target customers. To this end, Company Z utilizes the customer market apart from the supporting customers developed with the overall resources of enterprise and a distribution sales model will be implemented for the market according to market segmentation. For distributors, they buying out sales model is

mainly adopted for market development as the supplement to Company Z's overall strategic layout of sales. Company Z generally grants a 30-90 days credit period for customers.

3.5.2 Customer Survey

1. Questionnaire design

The questionnaire for Company Z's customers consists of 4 parts: Part I – Background: which states the purposes of the questionnaire, that is, to collect the data that can provide mathematical statistics for research on supply chain operation strategies and risk management mechanism giving consideration to working capital; Part II – Survey Questions: where respondents are asked to comment on their companies' collection period, sales prices and delivery time; Part III – Financial Performance of the Companies Surveyed (2013): where respondents are asked to provide the financial data that can reflect the business situation and financial performance of their companies in 2013 as data support for the working capital risk assessment in this Thesis; Part IV – Questionnaire of Customers' Basic Information: customers' basic information includes, among others, company size, primary products, major customers, position in the industry, business development plan, financial condition and bank credit, helping deliver a full picture of customers. See Appendix 9 for details.

2. Questionnaire release and collection

In this thesis, the questionnaire is sent to 128 customers to help collect useful data for analysis via face-to-face, telephone and mail interviews. 128 questionnaires are sent out, 109 get back (the other 19 are not retrieved due to involvement of trade secrecy) and 5 thereof contain obvious errors. Hence, there are 104 valid completed questionnaires, with an effective response rate of 81.25%.

3. Results analysis

Sort out and summarize the 2013 financial data of customers in the 104 questionnaires and calculate the 9 indicators of each customer, *i.e.* inventory turnover, receivables turnover, payables turnover, cash turnover, working capital allocation rate, cash to current liability ratio, debt to asset ratio, return on net assets, and surplus cash coverage ratio,; apply the 9 indicators of each supplier in the risk assessment model for working capital and calculate the assessed

value of working capital risk of each customer. For assessment of working capital indicators of customers, please refer to Appendix 3.

Among the 104 customers, 38 (or 36.54% of the total valid completed questionnaires) have an R value (assessed value of working capital risk) higher than or equal to the industry standard (0.0332), representing 29.08% of Company Z's total sales; 66 (or 63.46% of the total valid completed questionnaires) have an R value lower than 0.0332, a negative net cash flow from operating activities and a negative profit represent 63.46% of Company Z's total sales. This indicates that a large number of Company Z's customers have insufficient working capital and face certain business risks and a likelihood of bankruptcy due to lack of capital, which may affect Company Z's sales performance and even result in a broken link at the downstream of Company Z's supply chain.

A comparative analysis of the mean values of 9 indicators of the 104 customers and the computer, communications and other electronics industries in 2013 is shown as follows (See Table 3-19):

Table 3-19 Comparative Analysis of Indicators between Customers and the Industry

Subject	Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liability ratio	Debt to asset ratio	Return on net assets	Surplus cash coverage ratio	Assessment Results
The Industry Average	0.0421	0.0124	0.0225	0.0127	0.5416	0.3493	0.3272	0.0824	1.5332	0.0332
Customers' Average	0.0152	0.0103	0.0123	0.0117	0.3533	0.1564	0.5163	0.102	1.4982	-0.0291
Deviation	0.0269	0.0021	0.0102	0.001	0.1884	0.1929	-0.1891	-0.0196	0.035	0.0623
Deviation (%)	63.87 %	17.11 %	45.30 %	8.04%	34.78%	55.23%	-57.79 %	-23.78 %	2.28%	187.53 %

Source: CSMAR financial research database and Financial statements of company Z's customers (2013)

The comparison of 9 indicators of working capital between customers and the industry is as shown in Figure 3-6:

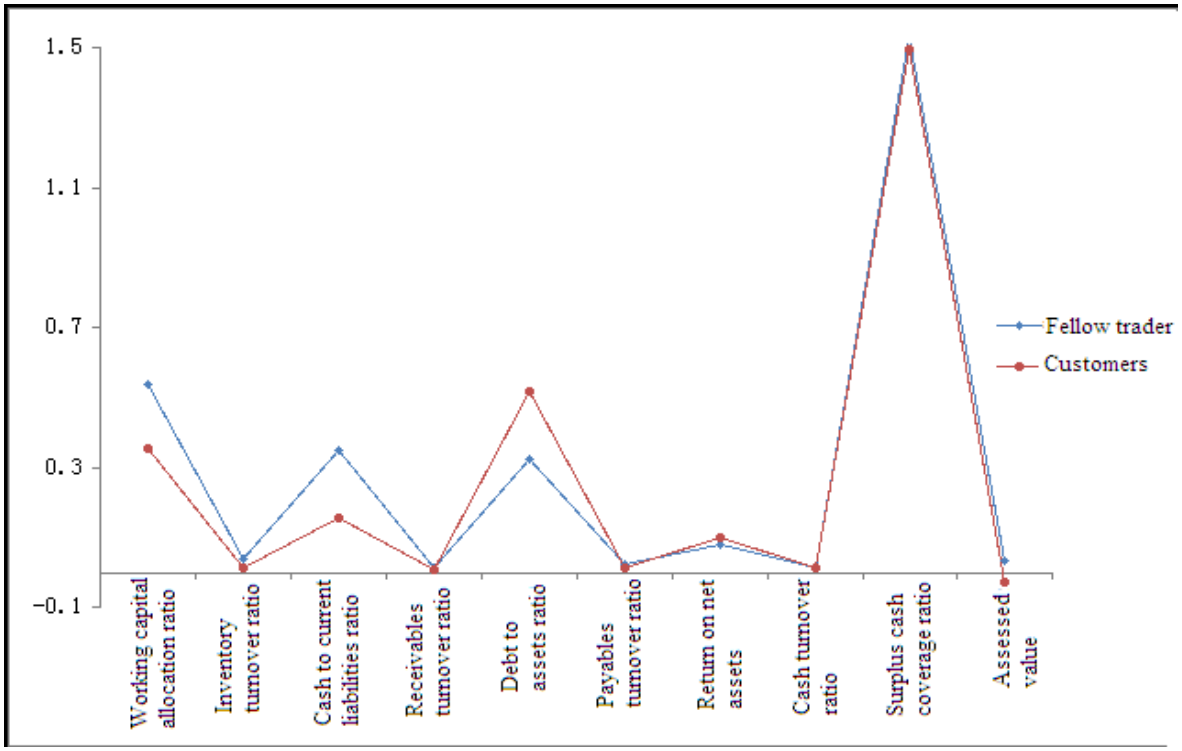

Figure 3-6 Comparison of Working Capital between Customers and the Industry

Source: CSMAR financial research database and Financial statements of company Z's customers (2013)

Figure 3-6 shows that:

(1) Customers' day-to-day working capital management performance indicators are lower than the industrial level

Customers' inventory turnover was is 0.0152, 63.87% lower than the mean value of public companies in the industry 0.0421, indicating long inventory turnover period, low occupation level of inventory and weak liquidity and cashability. Customers' receivables turnover ratio is 0.0103, 17.11% lower than the mean value of public companies in the industry 0.0124, indicating that customers' receivables turnover speed is lower than the industry, *i.e.* long receivables turnover period, slow collection speed and capital inflow, and weak solvency. Customers' payables turnover ratio is 0.0123, 45.30% lower than the mean value of public companies in the industry 0.0225, indicating that customers' payables turnover speed is lower than the industry, *i.e.* long payables turnover period, long occupation of upstream capital and more pressure of repayment. Customers' cash turnover ratio is 0.0117, 8.04% lower than the mean value of public companies in the industry 0.0127 indicating that suppliers' cash turnover speed is slower than the industry, *i.e.* long cash turnover period and

poor capital utilization effects.

(2) Customers' solvency indicators are lower than the industrial level.

Customers' working capital allocation ratio is 0.3533, 34.78% lower than the mean value of public companies in the industry 0.5416, indicating weak solvency of customers for short-term debts. Customers' cash to current liabilities ratio is 0.1564, 55.23% lower than the mean value of public companies in the industry 0.3493, indicating that customers' net cash flow from operating activities in the current period is sufficient to repay short-term debts. Customers' debt to assets value is 0.5163, 57.79% higher than the mean value of public companies in the industry 0.3272, indicating the weak solvency of suppliers.

(3) Suppliers' profitability indicators are higher than the industrial level.

The return on net assets is 0.102, 23.78% higher than the mean value of public companies in the industry 0.0824, indicating that the return on net assets of suppliers is higher than the industrial level and the capacity for self owned capital to obtain net income is very high. Customers' surplus cash coverage ratio is 1.4982 that is 2.28% lower than the mean value of public companies in the industry 1.5332, indicating that customers' surplus cash coverage ratio is slightly higher than the industrial level and there is a slightly high guarantee for cash income in the net profit for the current period.

Customers' day-to-day working capital management performance and solvency indicators are the same with those of suppliers and lower than the industrial level. Therefore, customers are subject to working capital risk and confronted with working capital shortage and difficulty in financing due to excessive liabilities. On the one hand, customers have problems with the working capital performance of procurement, production and marketing channels and it is required to strengthen management of inventory, receivables, payables and capital; on the other hand, it is necessary to solve the difficulty in financing and seek for capital support.

3.6 Analysis of Existing Problems

The above working capital analysis of Company Z and its upstream and downstream

supply chain shows that Company Z has sufficient working capital and that its suppliers and customers have problems related to insufficient working capital:

(1) Relying on its advantages in the industry, Company Z has better profitability and solvency above the industry average; but it faces the challenges of rising costs due to the increasingly fierce competition between industries. Meanwhile, Company Z performs poorly in day-to-day working capital management with low working capital efficiency and performance significantly lower than the industry average. To enhance such performance, efforts shall be made to improve the turnover efficiency of inventory, receivables, payables and capital.

(2) Generally, Company Z's suppliers are below the industry level as to solvency and day-to-day working capital management performance. Many perform poorly in working capital management in sourcing, production and marketing: low inventory turnover period, low occupation level of inventory, poor liquidity and cashability; slower receivables turnover period as compared to the industry, indicating long receivables turnover period, slow collection speed and cash inflow, and poor solvency; slower payables turnover period as compared to the industry, indicating long payables turnover period, long term occupation of upstream capital and more repayment pressure. More, a lot of suppliers are highly leveraged and face the challenge of financing. Hence, efforts are needed to improve inventory, receivables and payables turnover efficiency, and also to address the financing problems.

(3) Similarly, Company Z's customers are below industry level in solvency and day-to-day working capital management performance. Many perform poorly in working capital management in sourcing, production and marketing, with low inventory and receivables turnover rate, high working capital risk (shortage) and debt-to-asset ratio, and financing problems. Hence, efforts are needed to improve management of inventory, receivables and payables, and capital, and also to seek financial support.

On Company Z's supply chain, the debt-to-asset ratio curve has high points at both ends and a low point in the middle: this indicates both suppliers and customers may have financing problems. Meanwhile, low inventory, receivables, payables as well as cash turnover indicate that both suppliers and customers have an overall long working capital turnover period and

may face financial strain with working capital. All these problems can easily result in a broken link and make Company Z's supply chain vulnerable. For Company Z, coordinated working capital-based supply chain management is therefore particularly important.

3.7 Brief Summary

This chapter selects 9 indicators through experts and applies Delphi method and AHP to determine weights and establish indicator system. The standards for assessment of working capital risk are determined through the analysis of the status quo of working capital in the industry. As to the supply chain based working capital analysis for Company Z, it firstly analyzes the status quo and existing problems of Company Z's operation and then introduces the overview of Company Z's suppliers, designs supplier questionnaire, sorts out data of survey questions and conducts a contrastive analysis for suppliers' working capital and working capital of the industry through the working capital risk assessment model and judgment conditions. In the end, it also stresses the introduction of Company Z's customers, designs customer questionnaire, sorts out data of survey questions and conducts a contrastive analysis for customers' working capital and working capital of the industry through the working capital risk assessment model and judgment conditions. It gives a conclusion of the problems of Company Z and its upstream and downstream supply chain.

Chapter 4: Promotion of Supply Chain Operation Strategy Giving Consideration to Working Capital

This chapter mainly researches and considers the working capital of supply chain at the upstream and downstream, conducts a classification analysis for the two-dimensional matrix built for suppliers and customers and proposes different operation strategies for different suppliers and customers to effectively solve the working capital problems with enterprises in the supply chain, promote the integration of the operation of suppliers and customers and guarantee the sustained stability of supply chain, to ultimately achieve the purpose of improving the supply chain's overall operation efficiency and reinforcing international competitiveness.

4.1 Classification Analysis of Suppliers

To further examine their operations strategies, it is required to discuss the method for classification of the degree of working capital shortage by suppliers in the process of operation, and classify suppliers:

The supply segmentation method, *i.e.* Kraljic Matrix method, is applied to the 220 suppliers, and a two-dimensional classification matrix is built based on the degree of working capital risk and value of suppliers; the horizontal axis indicates the exposure of a supplier to working capital risk (to be specific, the degree of financial strain with working capital) while the longitudinal axis indicates the value of a supplier to Company Z, reflected in, among others, the total number and sum of orders as well as the proportion of goods supplied. The specific idea of building the matrix graph is set out below:

(1) Supplier’s exposure to working capital risk: the degree of a supplier’s financial strain with working capital as reflected in, among others, inventory, receivables, payables and cash turnover, working capital allocation ratio, cash to current liability ratio, debt to asset ratio,

return on net assets, and surplus cash coverage ratio, can help Company Z effectively identify suppliers with high working capital risk.

(2) Supplier's value: the degree of importance of a supplier to Company Z, as reflected in, among others, the total supply and the impact of the goods supplied on Company's product quality, material cost and the total cost, can help Company Z effectively identify important and valued suppliers.

Through the above analysis, Company Z's suppliers can be classified in the order of working capital risk and value of suppliers. The two-dimensional classification matrix built is shown as follows (See Figure 4-1):

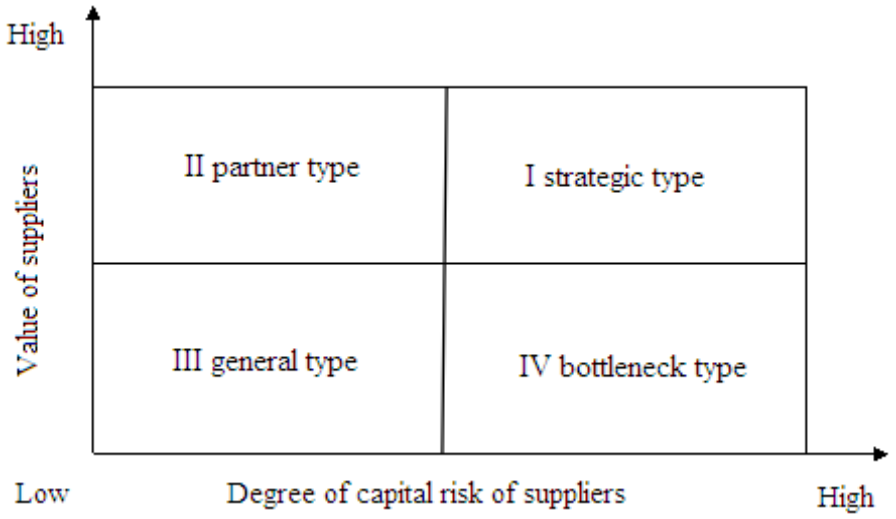

Figure 4-1 Supplier Segmentation Model

Source: Author finishing

Strategic-type Suppliers, as shown in Figure 4-1, are at high working capital risk but their products are of high value to Company Z, usually patented products or technological monopolies for customized needs, and take a big chunk of Company Z's material cost. As it is difficult to find alternatives, Company Z much relies on such suppliers of strategic importance, for they have a direct impact on Company Z's competitiveness in the market. But these suppliers face financial strain and have cash flow problems. If they cannot deliver the order on time, Company Z would incur extra cost and huge loss.

Partner-type Suppliers, are at low working capital risk and their products are of high value to Company Z, usually patented products or technological monopolies for customized

needs, and take a big chunk of Company Z's material cost. To Company Z, such suppliers are of higher strategic importance, for they also have a direct impact on Company Z's competitiveness in the market. And they also have smooth cash flow and sufficient working capital. By supplying Company Z with high-value as well as high-priced products, they contribute to the value added to Company Z's products and have a direct impact on customer experience and satisfaction.

General-type Suppliers, are at low working capital risk and their products, usually generic products in a perfectly competitive market, take a small chunk of Company Z's material cost. Due to an adequate supply in the market, such products are easily available at low cost and therefore have little impact on Company Z's final products. Although they are not important suppliers to Company Z, such suppliers have smooth cash flow and sufficient working capital to keep their business running.

Bottleneck-type Suppliers, are at high working capital risk and their products, usually generic products in a perfectly competitive market, take a small chunk of Company Z's material cost. Due to an adequate supply in the market, such products are easily available at low cost and such suppliers can be easily replaced. Further, these suppliers face a greater risk of cash flow problems and even sudden bankruptcy due to the shortage of working capital.

Company Z's suppliers are hence divided into four types (See Table 4-1):

Table 4-1 Characteristics of Four Types of Suppliers

No.	Type	Quantity of Suppliers	Material properties	Availability	Cost	Risk
1	Strategic	Small	Non-generic	Difficult	High	High
2	Partner	Small	Non-generic	Difficult	High	Low
3	General	Large	Generic	Easy	Low	Low
4	Bottleneck	Large	Generic	Easy	Low	High

Source: Author finishing

The key to supply segmentation is to divide the capital risk degree of materials suppliers and suppliers' value and place different materials at appropriate positions according to both coordinate axes. Common method for suppliers' capital risk degree: the working capital risk is determined with the working capital risk assessment model through calculating enterprise's 9

indicators, *i.e.* inventory turnover ratio, receivables turnover ratio, payables turnover ratio, cash turnover ratio, working capital allocation ratio, cash to current liabilities ratio, debt to assets ratio, return on net assets, surplus cash coverage ratio, and the working capital risk values are compared with the "demarcation point" values of working capital risk in the industries of computer, communication and other electronic industries in 2013 as the basis for division. The basis for division of suppliers' value is the importance of Company Z. As the importance of suppliers for Company Z varies with the development changes of internal and external environments, it is required to advance with the times, properly adjust the segmentation of suppliers according to the changes in market environment and promptly adjust the operation strategy for the suppliers with changes.

4.2 Promotion of Operation Strategy for Suppliers

Different operation strategies are adopted for different types of suppliers at the upstream. A discussion is carried out on the method to guarantee working capital demands of upstream excellent resources to promote suppliers' stable and sustained development. In addition, Company Z's advantages and sufficient working capital are fully exerted to reduce operating costs and promote working capital efficiency, this enhancing the competitive advantages of Company Z's resources.

4.2.1 Promotion of Operation Strategy of Strategic Suppliers

There are 45 strategic suppliers mainly offering dedicated gas pipes, piezoresistor, high voltage capacitor, graphite electrode, connector, breaker and customized chassis, hardware, etc., most of which are patented products or customized components of technological monopoly. The procurement amount of such materials accounts for 56.41% of the total procurement amount. The materials provided by strategic suppliers are non-general. The scope of suppliers available for selection is small and it is difficult to obtain new development resources; there are few strategic suppliers, while the percentage of procurement from such suppliers in the total procurement amount is very large. The analysis of 45 suppliers' data is as shown in Table 4-2:

Table 4-2 Analysis of Indicators of Strategic Suppliers

		Inventory turnover ratio	Receivable turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liabilities ratio	Debt to assets ratio	Return on net assets	Surplus cash coverage ratio
N	valid	45	45	45	45	45	45	45	45	45
	missing	0	0	0	0	0	0	0	0	0
Mean value		0.0105	0.0083	0.009	0.01	0.1335	-0.0186	0.5314	0.0791	0.1171
Standard difference		0.0041	0.0032	0.0031	0.0071	0.9427	0.2119	0.1738	0.0873	3.935
Maximum		0.0183	0.0173	0.0153	0.0424	0.7414	0.3353	0.9487	0.391	14.0147
Quartile 75		0.0133	0.0104	0.0113	0.0134	0.4799	0.1025	0.6577	0.1188	1.1622
Median		0.0098	0.0084	0.0091	0.0082	0.3619	-0.0006	0.5251	0.0446	0.5683
Quartile 25		0.0072	0.0066	0.0071	0.0064	0.1585	-0.0787	0.3863	0.0243	-1.0652
Minimum		0.0032	0.0001	0.0001	-0.0015	-5.0147	-1.1442	0.2523	-0.0785	-17.3028

Source: Financial statements of Company Z's suppliers (2013)

Table 4-2 shows that:

(1) Strategic suppliers' day-to-day working capital management performance indicators are lower than the industrial level

According to table 4-2, the maximum, minimum and mean value of the inventory turnover ratio of 45 strategic suppliers are 0.0183, 0.0032 and 0.0105respectively,, of which the mean value is smaller than the mean value of public companies in the industry 0.0421, indicating that the inventory turnover speed is slower than the industry, *i.e.* long inventory turnover period, low occupation level of inventory and weak liquidity and cashability. The maximum, minimum and mean value of receivables turnover ratio are 0.0173, 0.0001 and 0.0083respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.0124, indicating that the receivables turnover ratio of strategic suppliers is slower than the industry, *i.e.* long receivables turnover period, slow collection speed, slow assets flow and weak solvency. The maximum, minimum and mean value of payables turnover ratio are 0.0153, 0.0001 and 0.0090respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.0225, indicating that the payables turnover speed of strategic suppliers is slower than the industry, *i.e.* long payables turnover period, long occupation of upstream capital and more repayment pressure. The

maximum, minimum and mean value of cash turnover ratio are 0.0424, -0.001 and 0.1000respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.0127, indicating that the cash turnover speed of strategic suppliers is slower than the industry, *i.e.* slightly long cash turnover period and poor capital utilization effects.

(2) Strategic suppliers' solvency indicators are lower than the industrial level

The maximum, minimum and mean value of working capital allocation ratio are 0.7414, -5.0147 and 0.1335respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.5416, indicating that the solvency for short-term debts of strategic suppliers is too weak. The maximum, minimum and mean value of cash to current liabilities ratio are 0.3353, -1.1442 and -0.0186respectively, of which the mean value is far smaller than the mean value of public companies in the industry 0.3493 indicating that the net cash flow from operating activities in the current period of strategic suppliers is badly insufficient to repay short-term debts. The maximum, minimum and mean value of debt to assets ratio are 0.9487, 0.2523 and 0.5314respectively, of which the mean value is slightly higher than the mean value of public companies in the industry 0.3272, indicating that the solvency of strategic suppliers is relatively weak.

(3) Strategic suppliers' profitability indicators are higher than the industrial level

The maximum, minimum and mean value of return on net assets are 0.3910, -0.0785 and 0.0791respectively, of which the mean value is slightly lower than the mean value of public companies in the industry 0.0824, indicating that the return on net assets of strategic suppliers is slightly lower than the industrial level and the capacity for self owned capital to gain net income is slightly low. The maximum, minimum and mean values of surplus cash coverage ratio are 14.0147, -17.3028 and 0.1171respectively, indicating that the difference in surplus cash coverage ratio between strategic suppliers is large. The mean value is very small as compared with the mean value of public companies in the industry 1.5332, indicating that the surplus cash coverage ratio of partner suppliers is far higher than the industrial level and the guarantee of cash income in net profit for the current period is very high.

The day-to-day working capital management performance and solvency indicators of

strategic suppliers are lower than the industrial level. Therefore, strategic suppliers are subject to working capital risk and the problems of shortage of working capital and difficulty in financing.

As important suppliers of Company Z, strategic suppliers impose a large impact on Company Z's production and operation. Strategic suppliers are easy to cause production interruption of Company Z due to the abnormal supply caused by lack of funds, which will affect the final delivery period for customers and will bring about tremendous economic losses to Company Z and affect Company Z's reputation. Therefore, Company Z's development is inseparable from strategic suppliers and cannot neglect management and maintenance of the relationship with strategic suppliers. For the problems of shortage of capital and difficulty in financing of strategic suppliers, the thesis mainly adopts the strategy of supporting development:

1. Shortening payment period

Production capital constraint is a bottleneck constraining strategic suppliers' production and operation and affects the sound development of supply chain system. With the continued aggravation of market competition and rise of raw materials prices and labor costs, production capital is insufficient to be a major factor constraining the development of strategic suppliers. Due to financial strain, long turnover period, large financing costs, etc., strategic suppliers are unable to carry out normal production or expand its production scale, failing to meet the order needs of Company Z, which will reduce strategic suppliers' operating profit and bring about the risk of stockout to Company Z, thus seriously affecting the entire supply chain's competitiveness. Therefore, the way to solve capital constraint for strategic suppliers has become an important problem in the supply chain. It is difficult for strategic suppliers to get the financing amount required due to lack of sufficient mortgage assets and reputation, while Company Z is able to release strategic suppliers' financial pressure through shortening the payment period and plays an important role in respect of relieving strategic suppliers' difficulty in capital. For example, Company Z's payment for part of or all Goodson in advance is actually providing commercial credit for strategic suppliers, and suppliers will repay such short-term debts constituted by the commercial credit with goods. This financing model,

although occupying Company Z's working capital, provides powerful guarantee for Company Z to gain more good sources, win sales channels and expand profit space.

Restricted by the characteristics of its own finished products, strategic suppliers' material costs occupy a very large percentage in Company Z's production and operation costs. Therefore, the management of strategic suppliers' costs has always been the top priority in Company Z's day-to-day management. Strategic suppliers have a more intense demand for obtaining advance payment for goods and are the important object of Company Z in obtaining appreciate discount by shortening the payment period. In order to increase its own profit and reduce the loss caused by stockout, Company Z supports strategic suppliers to provide more reliable products by shortening the payment period in the supply chain system. Company Z supports strategic suppliers by way of payment for part of or all goods, which enriches strategic suppliers' capital flow and relieves strategic suppliers' financial strain. Strategic suppliers' supply reliability will be improved by prompt procurement of raw materials and parts, giving priority to arrangement of production, etc. to ultimately guarantee Company Z's stable supply from suppliers and allow strategic suppliers to gain more profits. Company Z plays a dominant role in financing by shortening the payment period. While making payment for goods to suppliers, it requires strategic suppliers to guarantee a discount against the payment for goods, while strategic suppliers are willing to offer a discount against the advance payment by Company Z in order to attract capital and guarantee safe capital operation. In payment for raw materials, the payment period is shortened by the discount policy with a reasonable design, which, on the one hand, can effectively reduce the procurement costs of raw materials and improves Company Z's market competitiveness and viability, and, on the other hand, provides working capital required for Company Z's survival and development, to achieve a real win-win between Company Z and strategic suppliers.

In the actual operation, due to the delayed payment as a result of difference in game ability of the upland downstream supply chains, capital flow direction, etc., mighty customers often delay the payment to gain the time value of capital; while suppliers want customers to make payment for goods on time and even in advance, so as to relieve the pressure of lead-time reduction and won't time value of capital. However, customers' advance payment

for goods will increase their operating costs. Thus, to balance both parties' operating revenue, suppliers will grant an appropriate discount against advance payment to customers. A typical example is advance purchase of air ticket, in which the purchaser will obtain more discount for earlier order and payment and the purchaser exchanges discount for advance payment with longer lead-time of delivery, while air ticket suppliers exchange time value of capital with discount for advance payment. Therefore, on the condition of advance payment, Company Z is confronted with the decision making problem of how to determine the discount for advance payment so as to maximize corporate profit and the conditions of advance payment accepted by suppliers and Company Z. Generally, the payment period of Company Z's payables is three months (90 days). Among the suppliers with business dealings with Company Z, strategic suppliers are often anxious to collect payment for goods to improve capital flow due to lack of working capital. It is a very good opportunity for Company Z to enjoy price discount through advance payment, thus effectively reducing production and procurement costs. The formula for the amount saved in procurement of appropriate raw materials is set out below:

Amount saved in procurement of appropriate raw materials = total discount- capital costs

Assuming that the payment for raw materials due to the strategic supplier H in the 3-month payment period totals RMB1 million, of which 50% of payables is entitled to price discount by means of advance payment, then:

Payables entitled to discount =1000000*50%= RMB500, 000

Assuming Company Z requests a discount rate of 4% for raw materials for which payment should be made within 10 days and the capital used for advance payment in this part belongs to Company Z's self owned working capital with the capital cost of 2%, than:

Total discount= 50*4%=RMB20, 000

Capital cost= (50-2) *2%*（90-10）/365= RMB 0.21

Amount of procurement costs saved = total discount- capital costs =2-0.21=RMB17, 900. A total of RMB 17,900 Yuan is saved.

Then, there aren’t capital costs saved by procurement costs, *i.e.*:

Total discount = 500, 000*4%=RMB20, 000

Capital costs= (50-2) *19%*80/365≈RMB20, 000

Total costs = capital costs, the amount saved by procurement costs is 0. Then, if the capital costs used by Company Z to make payment for goods in advance is less than 19%, to enjoy a price discount through advance payment will effectively reduce procurement costs. Obviously, 19% of capital costs are extremely high and even higher than the interest of enterprise's commercial loan. Therefore, Company Z should make payment for goods in advance as much as possible on the premises of obtaining consent from strategic suppliers. The profitability of advance payment entitled to price discount is mainly subject to the impact of discount rate, amount of advance payment for goods by enterprise and capital costs. Company Z should conduct earnest calculation and analysis depending on different circumstances.

For example, when the discount rate is 2%, and Company Z makes payment for goods 10 days in advance, the break-even point capital costs of advance payment, *i.e.* capital costs, exceeds 9.1%, Company Z is unprofitable.

If the capital costs remain unchanged at 2%, when the advance payment for goods is RMB500, 000:

Amount saved of enterprise's procurement costs =50*2%-50* (1-2%)*2%= RMB7, 850

The above calculation shows that the higher the discount amount of payment for goods to strategic suppliers is, the more the payment focused materials in advance will be and the fewer the capital costs will be. Then, Company Z will gain more profits from the price discount through advance payment of payables. To reduce a certain amount of procurement costs will increase an appropriate amount of profits because the amount of procurement costs saved is completely equivalent to the increment in Company Z's profit. Therefore, it is required to achieve increase in profit and stability with the upstream important resources through shortening the payment period and advance payment in accordance with the actual conditions of each strategic supplier and the actual self owned capital of Company Z.

Company Z achieves reduction in procurement costs with its own working capital through shortening the payment period, *i.e.* changing the payment period for the payment for goods of strategic suppliers to achieve reduction of products procurement costs. Generally, the

payment period of strategic suppliers is connected to sales price discount. Company Z determines the balance point between payment period and procurement price discount indicators through the coordination of supply chain, which can guarantee the maximization of system profit between strategic suppliers and Company Z. This method can make full use of Company Z's capital and improve Company Z's working capital efficiency, and can also solve the situation of financial strain in a period of operation of strategic suppliers and fully guarantee capital for reproduction of upstream suppliers to provide a means of financing for strategic suppliers and achieve win-win in the supply chain so as to relieve the capital pressure of strategic suppliers in operation. Shortening the payment period can guarantee the prompt recouping of capital by strategic suppliers and the continuity of production and operation, *i.e.* strengthening the guarantee of strategic suppliers' capital flow through saving financial costs caused by stopping production, high cost financing, receivables management, collection, etc. In addition, Company Z can improve the efficiency of capital flow and is able to better manage operating costs due to the accelerated turnover speed of payables. On the condition of shortening the payment period, Company Z and strategic suppliers accept certain discount against the wholesale price to make both parties ' profit getting Pareto improvement. Company Z's provision of financial support to strategic suppliers is an effective solution to achieve win-win with the enterprises in the upstream supply chain.

2. Provision of Financing Guarantee

Strategic suppliers often have insufficient financial strength and require advance payment before commencement of production, which, however, obviously increases the financial pressure of strategic suppliers. The delivery for Company Z's orders may not be made due to lack of capital, which may even cause serious economic crisis to strategic suppliers. If Company Z provides credit guarantee for strategic suppliers to lower the financing threshold for strategic suppliers and facilitate banks and other financial institutions to provide financial support to strategic suppliers, it will promote the establishment of a stable cooperative relationship with strategic suppliers to ensure the overall competitiveness and operating efficiency of the supply chain.

(1) Assist strategic suppliers to solve financial difficulty and provide financial support

for supply chain including provision of financing and investment services. Financing includes order financing, warehouse warrant financing, receivables financing, entrusted loan financing; investment includes cooperative investment trust plan and assets package transfer plan. For financing, simply speaking, strategic suppliers can obtain loans from the banks with cooperative relationship with Company Z upon insuring with third party insurance institutions in accordance with the sales contract, bill of goods, payables and core confirmation documents signed with Company Z. In this part, the lender is bank instead of Company Z. Therefore, Company Z will not obtain income. In the part of investment service, Company Z can obtain income through designing an ingenious circulating system which consists of two parts, *i.e.* assets package transfer plan and trust plan. In the assets transfer plan, strategic suppliers are required to pledge or resell receivables to banks which resell receivables to Company Z by way of wealth management plan to obtain income of wealth management; upon expiry of payables, Company Z will make payment to strategic suppliers which make repayment to banks. After that, Company Z can also obtain investment income according to the trust plan. Previously, the receivables of strategic suppliers were pledged on the platform of Company Z, and Company Z will make uniform repayment to strategic suppliers upon expiry of payables. Subsequent to launching financial services, Company Z can use the receivables due from suppliers as collaterals by way of assets package transfer and trust so that it is able to obtain profit via suppliers' borrowings in a disguised way without using its own funds.

(2) Provide credit guarantee. As strategic suppliers have the difficulty of shortage of working capital, Company Z can provide credit guarantee to strategic suppliers according to its own capital situation to exchange lowered price of materials of strategic suppliers, so as to achieve reduction of Company Z's procurement costs. Credit guarantee is a means of financial support in which guarantee is provided to the debtor in accordance with contract by the guarantee institution established according to law and the guarantee institution assumes the responsibility of repayment under contract when the creditor is unable to repay debts, thus guaranteeing banks' creditor's rights. Credit guarantee is a personalized social material relation that guarantees and promotes value, and is a third party guarantee with the basic

function of guaranteeing the realization of creditor's right and promoting accommodation of funds and circulation of other production elements. Company Z provides credit guarantee as a special intermediary activity between banks and strategic suppliers. It is an intermediary service activity combining reputation certification and assets liability guarantee, in which Company Z provides guarantee to improve the credit status of strategic suppliers. In addition, as Company Z is the potential creditor and assets owner of the guaranteed enterprise, Company Z is entitled to supervise the production and operation activities of strategic suppliers and even participate in its operation and management activities. Due to the intervention of guarantee, the original loan relationship between banks and strategic suppliers has changed into the relationship among banks, strategic suppliers and Company Z. Since the intervention of Company Z shares the risk of bank loans, the security of bank assets obtains higher guarantee, thus strengthening banks' confidence in the loans of strategic suppliers to make the loan channel of strategic suppliers smooth. On the other hand, the financing costs of strategic suppliers consist of bank interest of loans and a certain amount of commission charge, far less than the expenses raised from the public, thus reducing strategic suppliers' financing costs and effectively solving the problem of high financing costs of strategic suppliers. As Company Z had a profound and comprehensive understanding of strategic suppliers, it can use its assets for pledge and give certain credit lines to strategic suppliers as guarantee with banks. Within the scope of credit, Company Z provides guarantee for strategic suppliers which are not required to provide collaterals, so as to rapidly supplement working capital for strategic suppliers and guarantee the effective progress of production business.

When strategic suppliers are confronted with financial constraints, the fund shortage can be solved for strategic suppliers by means of provision of financing guarantee. However, guarantee is in fact the prevention of risk or diversification and transfer of risk. Although the intervention of Company Z shares banks' risk in respect of strategic suppliers' loans, it brings about risks to Company Z. Strategic suppliers are required to reduce the procurement costs of Company Z as the return. Therefore, the way of providing credit guarantee can help Company Z support strategic suppliers and give full play to its own resources and effectively reduce procurement costs.

4.2.2 Promotion of Operation Strategy of Partner Suppliers

There are 17 partner suppliers mainly offering dedicated gas pipes, piezoresistor, high voltage capacitor, graphite electrode, connector, breaker and customized chassis, etc., most of which are patented products or customized components of technological monopoly. The procurement amount of such materials accounts for 23.79% of the total procurement amount. The materials provided by partner suppliers are non-general. The scope of suppliers available for selection is small and it is difficult to obtain new development resources; there are few partner suppliers, while the percentage of procurement from such suppliers in the total procurement amount is very large. The analysis of 17 partner suppliers' data is as shown in Table 4-3:

Table 4-3 Analysis of Indicators of Partner Suppliers

		Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liabilities ratio	Debt to assets ratio	Return on net assets	Surplus cash coverage ratio
N	Valid	17	17	17	17	17	17	17	17	17
	Missing	-	-	-	-	-	-	-	-	-
Mean value		0.018	0.0151	0.0152	0.0173	0.5081	0.48	0.4583	0.1983	0.7212
Standard difference		0.0064	0.0052	0.0055	0.0035	0.2141	0.283	0.1856	0.1353	0.2206
Maximum		0.0393	0.03	0.0288	0.0269	0.7427	1.3101	0.8837	0.5415	0.9712
Quartile 75		0.0182	0.0165	0.0178	0.0195	0.6712	0.6364	0.5351	0.248	0.8586
Median		0.0174	0.0129	0.0134	0.0159	0.5753	0.468	0.4119	0.1387	0.7709
Quartile 25		0.0144	0.0117	0.0118	0.0151	0.3848	0.2594	0.3528	0.1047	0.6547
Minimum		0.0101	0.0107	0.0085	0.0132	-0.0046	0.1751	0.1577	0.0485	0.1782

Source: Financial statements of Company Z's suppliers (2013)

Table 4-3 shows that:

(1) Partner suppliers' day-to-day working capital management performance indicators are higher than the industrial level

The maximum, minimum and mean value of the inventory turnover ratio of 17 partner suppliers are 0.0393, 0.0101 and 0.0180respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.0421, indicating that the inventory turnover speed is much slower than the industry, *i.e.* long inventory turnover period, low

occupation level of inventory and weak liquidity and cashability. The maximum, minimum and mean value of receivables turnover ratio are 0.0300, 0.0107 and 0.0151respectively, of which the mean value is larger than the mean value of public companies in the industry 0.0124, indicating that the receivables turnover ratio of partner suppliers is faster than the industry, *i.e.* short receivables turnover period, fast collection speed, fast assets flow and strong solvency. The maximum, minimum and mean value of payables turnover ratio are 0.0288, 0.0085 and 0.0152respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.0225, indicating that the payables turnover speed of partner suppliers is much slower than the industry, *i.e.* long payables turnover period and long occupation of upstream capital. The maximum, minimum and mean value of cash turnover ratio are 0.0269, 0.0132 and 0.0173respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.0127, indicating that the cash turnover speed of partner suppliers is slightly faster than the industry, *i.e.* relatively short cash turnover period and good capital utilization effects.

(2) Partner suppliers' solvency indicators are lower than the industrial level

The maximum, minimum and mean value of working capital allocation ratio are 0.7427, -0.0046 and 0.5081respectively, of which the mean value is slightly smaller than the mean value of public companies in the industry 0.5416, indicating that the solvency for short-term debts of partner suppliers is slightly weak. The maximum, minimum and mean value of cash to current liabilities ratio are 1.3101, 0.1751 and 0.4800respectively, of which the mean value is larger than the mean value of public companies in the industry 0.3493 indicating that the net cash flow from operating activities in the current period of partner suppliers is sufficient to repay short-term debts. The maximum, minimum and mean value of debt to assets ratio are 0.8837, 0.1577 and 0.4583respectively, of which the mean value is slightly larger than the mean value of public companies in the industry 0.3272, indicating that the solvency of partner suppliers is relatively weak.

(3) Partner suppliers' profitability indicators are higher than the industrial level

The maximum, minimum and mean value of return on net assets are 0.5415, 0.0485 and 0.1983respectively, of which the mean value is much higher than the mean value of public companies in the industry 0.0824, indicating that the return on net assets of partner suppliers

is much higher than the industrial level and the capacity for self owned capital to gain net income is very high. The maximum, minimum and mean value of surplus cash coverage ratio are 0.9712, 0.1782 and 0.7212respectively, of which the mean value is very small as compared with the mean value of public companies in the industry 1.5332, indicating that the surplus cash coverage ratio of partner suppliers is far higher than the industrial level and the guarantee of cash income in net profit for the current period is very high.

The day-to-day working capital management performance and profitability indicators of partner suppliers are lower than the industrial level. Therefore, partner suppliers are subject to working capital risk and have very sufficient capital and good cash flow.

The performance and quality of partner suppliers, as important suppliers of Company Z, directly affect the product use of Company Z; even when it is required to change such potential suppliers, the period will be long and costs will be large, directly affecting the strategic direction and target of Company Z. Therefore, in order to maintain the advantages in respect of procurement of important resources, Company Z is required to engage in mutual cooperation for the sake of long-term profit to jointly reduce costs and enhance common competitiveness. The thesis mainly adopts the strategy of in-depth cooperation:

1. Enter into long-term strategic cooperation agreement to form strategic cooperative relationship with suppliers

Strategic cooperative relationship with suppliers refers to the strategic relationship superior to general dealings formed through mutual attraction between Company Z and partner suppliers relying on their respective core capacities. The work focus of Company Z and partner suppliers is continuous improvement of product quality and service and joint reduction of costs through mutual cooperation for the sake of long-term profit, thus realizing system integration and innovation of business in an effective way so as to enhance their respective core competitiveness and ensure both parties' common profit. For the sake of its own profit, Company Z should strengthen the long term strategic partnership with partner suppliers and provide prediction for a long term or sing long term cooperation agreement to obtain relatively low procurement price, reduce procurement costs and to fundamentally solve the risk with materials supply by such suppliers and enhance the product competitiveness of Company Z. Through entering into long term strategic cooperative partnership, both parties

will strengthen coordination in business dealings. For example, in respect of inventory, too much or too little inventory caused by the information communication and differences in their respective interests will be reduced. An appropriate inventory turnover is conducive to the capital operation of both parties. For common target, both parties will jointly research solution of the existing quality problem to achieve the purpose of zero defect. In respect of technical research and development, no technical terms and preventive measures will be established and it is only required to sign a confidentiality agreement to prevent disclosure to third parties, *i.e.* conducting some relevant technical supports and share to mutually improve efficiency and products' properties and enhance products' competitiveness. This strategic cooperative partnership allows both parties to have the common target. Therefore, in case of problems, Company Z and partner suppliers will proactively carry out mutual cooperation to solve the problems and achieve win-win. Based on the above discussion, the specific implementation steps for establishing partner suppliers are as shown in Figure 4-2:

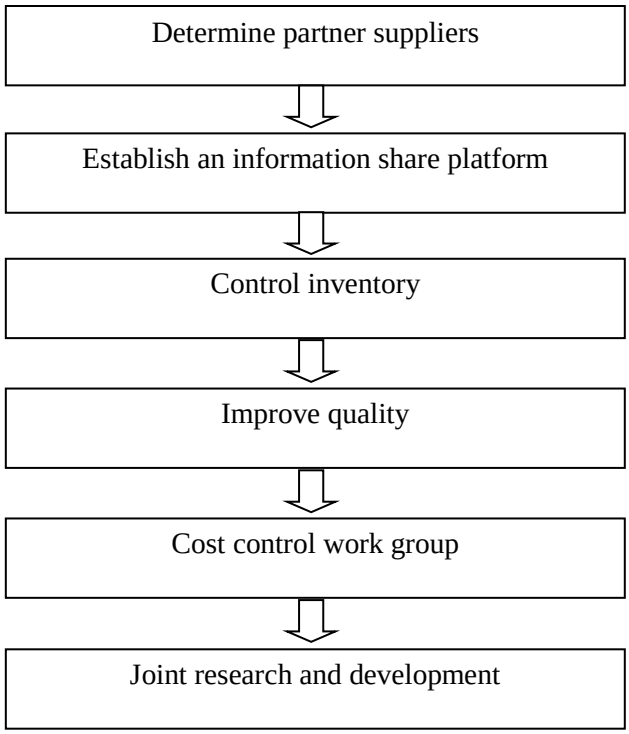

Figure 4-2 Implementation Steps of Partner Suppliers

Source: Author finishing

(1) Determine partner suppliers according to supply segmentation: Company Z has 17 suppliers which are mainly gas pipe, printed board, terminal and transient diode suppliers.

Such suppliers have certain strength and good cash flow.

(2) Establish an information share platform for partner suppliers and Company Z: the establishment of online share of both parties' information allows interaction between partner suppliers and Company Z, e.g. demand information of downstream terminal customers and Company Z, market condition, market prediction, inventory status and delivery plan of partner suppliers, etc.

(3) Manage and control inventory: partner suppliers directly obtain inventory information and organize production and delivery according to the inventory status and the standard of safe inventory. Company Z arranges its internal production plan according to the partner suppliers' delivery plan.

(4) Establish a quality team and promote quality improvement: Company Z records the advantages and disadvantages of partner suppliers through assessing the information obtained. For the problems, dedicated quality personnel will be arranged to cooperate with partner suppliers in analysis and improvement and improvement of product quality and properties.

(5) Establish a cost control work team: partner suppliers look for the parts available for costs reduction in procurement and production and other sections through information share and achieve the purpose of costs saving through joint research, analysis and implementation of both parties.

(6) Common development of research team: in the early development of Company Z's products, partner suppliers will be invited to participate in and professional and reasonable suggestions will be proposed relying on partner suppliers' professional level and advantages in their specific industries to shorten the development period and design costs. In addition, the intervention of partner suppliers in the early stage will contribute to a more comprehensive understanding of Company Z's product properties and a more effective production of materials in sample manufacturing and batch production.

The pursuit of win-win is the basic premise of in-depth cooperation between Company Z and partner suppliers. Cooperation must be based on consistent objectives. Company Z and partner suppliers will establish a mutual trust mechanism from the strategic perspective of obtaining long term competitive advantages to form a strategic alliance of supply chain partners. Both parties continuously conduct in-depth information exchange, establish and

optimize information communication channel, analyze and design system flexibility, and establish a risk prediction, morning and early warning mechanism to ensure optimization for supply chain's overall decision making, eliminate conflicts and maintain the supply chain's overall competitiveness.

2. Option Procurement

Option strategy means to reduce stockout and overstock risks caused by fluctuations through purchasing a certain amount of options. For example, buy-back policies, backup agreements, pay-to-delay capacity reservation, quantity flexibility, etc. are the special application forms of option procurement strategy. For example, in the two-level supply chain of a single period composed of partner suppliers and Company Z, Company Z provides initial order quantity and option purchase quantity to partner suppliers at the start time of the lead time of product production t0, and delivers the products equivalent to the sum of the initial order quantity and option purchase quantity to Company Z at the production commencement time t1. The product production time is from t1 to t2, and the lead time of materials procurement is from t0 to t1. In cooperation, Company Z selects the initial order quantity and option purchase quantity at t0, and obtains the opportunity not exceeding options at t1 to adjust the initial procurement quantity as shown in Figure 4-3:

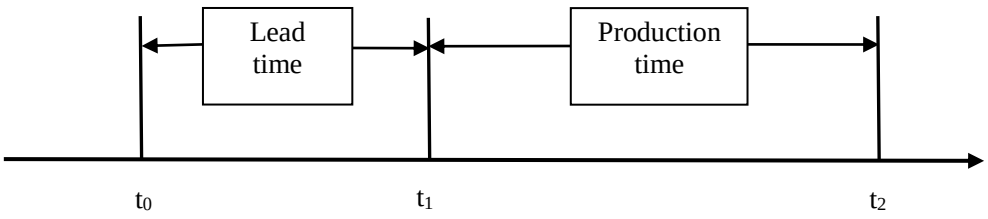

Figure 4-3 Sequence of Decision Making

Source: Author finishing

The specific operation is divided into three stages: for random market demand and long lead time of procurement, Company Z firstly considers that it is required to determine the quantity of real products purchased Q according to prediction at the commencement of lead time t0 and the procurement price is W. In order to reduce the risk of product shortage or surplus caused by demand fluctuation, Company Z improve the flexibility of procurement through purchasing a certain quantity of options M, and the procurement price is W1.

Secondly, partner suppliers enter into an option contract in accordance with their own production capacity and unit production margin costs and start production according to orders. Finally, when the lead time ends and the production time starts at t1, Company Z determines the quantity of options to be executed according to the demand conditions observed and the execution price is W2. The option procurement can increase the flexibility of procurement, and relieve enterprise's financial strain in respect of procurement in the short period because the option procurement price is generally lower than the procurement price of real products. If Company Z has no demand due to the sudden decrease in demands in the downtown market at t1, a comparison will be made based on the purchase costs and idle stock costs. If the idle stock costs are too high, the options may be waived to reduce Company Z's overstock, reducing the risks brought about by the market changes to Company Z.

In the supply chain under the option contract, Company Z is only required to pay royalty to obtain the rights of future transactions instead of obligations, while partner suppliers obtain the royalty and assume appropriate obligations for satisfying transactions. When the future supply price is uncertain, option contact can help Company Z ensure supply and fix price in advance to meet the uncertainty of future demands. In addition, option contract also provides sufficient flexibility. When the demand information is clear, Company Z can determine the quantity of option to be executed according to actual demands.

Each enterprise will be confronted with the challenge of market fluctuations. In particular, for partner suppliers, there is a high degree of material customization. The device procurement and customization period is long, while the sales period for the demands of downstream market is relatively short. The stockout and overstock caused by the uncertainty of market demands bring about tremendous costs and risks to the operation of partner suppliers and Company Z. In order to promote the competitiveness of Company Z's supply chain, it is required to innovate the contract way between traditional partner suppliers and increase the flexibility of cooperation contract, thus realizing income and risk share of supply chain.

3. Delayed Payment

Delayed payment includes delayed payment period or cash acceptance (bank acceptance and commercial acceptance), etc. The delay in payment to partner suppliers can guarantee

Company Z' occupation of capital and allow Company Z to obtain more capital flow. For the circumstance in which partner suppliers have sufficient capital flow, Company Z can give relevant support to partner suppliers so as to obtain delayed payment period or cash acceptance mode. Relevant support performance allow to give certain prediction to strategic suppliers in advance, place orders in advance or collectively, absorb batch materials in advance, etc., so as to coordinate with partner suppliers and seek for balance between the procurement quantity and payment period. Delayed payment period is to extend a certain period on the basis of the existing payment time to extend Company Z's capital flow time, thus winning the flow supplement time of working capital; cash acceptance can prolong the capital outflow time through the outflow of a small amount of guarantee capital in a short period to guarantee Company Z's capital flow in a certain period. Therefore, giving full play to the capital of strategic suppliers, conducting in-depth cooperation and taking strategy of properly changing the payment period for partner suppliers can guarantee Company Z's capital flow and guarantee the stability and competitiveness of upstream supply chain.

4.2.3 Promotion of Operation Strategy for General Suppliers

There are 62 general suppliers mainly offering normal resistance, capacitor, wire, standard components, packaging materials, etc. The procurement amount of such materials accounts for 6.01% of the total procurement amount. The materials provided by general suppliers are general commodities. The scope of suppliers available for selection is large and it is easy to obtain new development resources; there are many general suppliers and material types, while the unit value is low and the percentage of procurement from such suppliers in the total procurement amount is very small. The analysis of 62 general suppliers' data is as shown in Table 4-4:

Table 4-4 Analysis of Indicators of General Suppliers

		Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liabilities ratio	Debt to assets ratio	Return on net assets	Surplus cash coverage ratio
N	Valid	62	62	62	62	62	62	62	62	62
	Missing	0	0	0	0	0	0	0	0	0
Mean value		0.0172	0.0125	0.0138	0.015	0.4872	0.4034	0.4395	0.1813	0.6598
Standard difference		0.0021	0.0042	0.0036	0.003	0.2024	0.2152	0.186	0.1913	0.289
Maximum		0.0254	0.0296	0.031	0.027	0.7427	1.3101	0.9276	0.9294	1.529
Quartile 75		0.0183	0.0123	0.0149	0.0158	0.6627	0.519	0.5312	0.2208	0.8291
Median		0.0174	0.0114	0.013	0.0147	0.4927	0.3391	0.4109	0.1326	0.6898
Q25		0.0165	0.0108	0.0117	0.0135	0.3781	0.2479	0.3365	0.0732	0.4454
Quartile 25		0.0123	0.0079	0.0085	0.0096	-0.1448	0.09	0.1577	0.0121	0.0953

Source: Financial statements of Company Z's suppliers (2013)

Table 4-4 shows that:

(1) General suppliers' day-to-day working capital management performance indicators are lower than the industrial level

The maximum, minimum and mean value of the inventory turnover ratio of 62 general suppliers are 0.0254, 0.0123 and 0.0172respectively, of which the mean value is very smaller than the mean value of public companies in the industry 0.0421, indicating that the inventory turnover speed is slower than the industry, *i.e.* very long inventory turnover period, very low occupation level of inventory and weak liquidity and cashability. The maximum, minimum and mean value of receivables turnover ratio are 0.0296, 0.0079 and 0.0125respectively, of which the mean value is slightly larger than the mean value of public companies in the industry 0.0124, indicating that the receivables turnover ratio of general suppliers is slightly larger than the industry, *i.e.* short receivables turnover period, fast collection speed, and fast assets flow. The maximum, minimum and mean value of payables turnover ratio are 0.0310, 0.0085 and 0.0138respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.0225, indicating that the payables turnover speed of general suppliers is much slower than the industry, *i.e.* long payables turnover period and long occupation of upstream capital. The maximum, minimum and mean value of cash turnover ratio are 0.0270, 0.0096 and 0.0150respectively, of which the mean value is larger than the

mean value of public companies in the industry 0.0127, indicating that the cash turnover speed of general suppliers is slower than the industry, *i.e.* short cash turnover period and good capital utilization effects.

(2) General suppliers' solvency indicators are lower than the industrial level

The maximum, minimum and mean value of working capital allocation ratio are 0.7427, -0.1448 and 0.4872respectively, of which the mean value is slightly smaller than the mean value of public companies in the industry 0.5416, indicating that the solvency for short-term debts of general suppliers is slightly weak. The maximum, minimum and mean value of cash to current liabilities ratio are 1.3101, 0.0900 and 0.4034respectively, of which the mean value is slightly larger than the mean value of public companies in the industry 0.3493 indicating that the net cash flow from operating activities in the current period of general suppliers is sufficient to repay short-term debts. The maximum, minimum and mean value of debt to assets ratio are 0.9276, 0.1577 and 0.4395respectively, of which the mean value is slightly higher than the mean value of public companies in the industry 0.3272, indicating that the solvency of general suppliers is relatively weak.

(3) General suppliers' profitability indicators are higher than the industry level

The maximum, minimum and mean value of return on net assets are 0.9294, 0.0121 and 0.1813respectively, of which the mean value is very higher than the mean value of public companies in the industry 0.0824, indicating that the return on net assets of strategic suppliers is far higher than the industrial level and the capacity for self owned capital to gain net income is very high. The maximum, minimum and mean value of surplus cash coverage ratio are 1.5290, 0.0953 and 0.6598respectively, indicating that the mean value is very high as compared with the mean value of public companies in the industry 1.5332, indicating that the surplus cash coverage ratio of general suppliers is far higher than the industrial level and the guarantee of cash income in net profit for the current period is very high.

The day-to-day working capital management performance and profitability indicators of general suppliers are higher than the industrial level. Therefore, general suppliers are not subject to working capital risk and have very sufficient working capital and good cash flow.

General suppliers are not important suppliers of Company Z. Their products have very

low product costs and risks and are easily available in the market with little impact on Company Z. For general suppliers with sufficient capital flow, the thesis mainly takes the strategy of maintaining its status quo and using by themselves:

1. Vendor Managed Inventory

Vendor managed inventory is a cooperative strategy aiming at letting enterprise and suppliers achieve the lowest cost, in which the vendor manages inventory under a common agreement and continuously supervise agreement execution and amend the agreement contents, to achieve continuous improvement of inventory management. In the traditional order mode, Company Z formulates the procurement plan according to demand prediction and orders and issue orders to general suppliers in accordance with the procurement plan. General suppliers will then organize raw materials procurement, production and delivery based on the orders received, which is often easily to cause bullwhip effects in the supply chain. Different from the traditional order mode, in the VMI mode, Company Z and general suppliers share the current inventory and demand information. Suppliers arrange raw materials production and supply at due time depends on actual consumption and demands. On the premise of guaranteeing Company Z's production and operation, VMI is conducive to general suppliers' reduction of production costs and raw materials supply costs and to the reduction of the inventory of Company Z's raw materials to the lowest level and the occupation of funds, thus realizing win-win of Company Z and improving the working capital management performance of Company Z's procurement channels.

On the basis of sharing inventory and sales data, Company Z and general suppliers exchange their production and procurement plans, so that inventory supplement and distribution plans are also promptly transmitted between the supplier and demander. The specific operation flow of VMI is as shown in Figure 4-4：

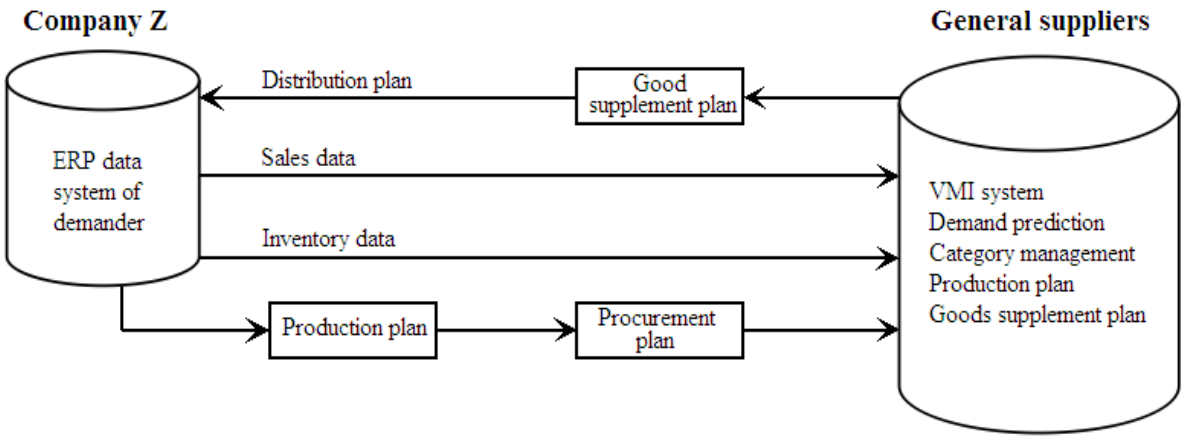

Figure 4-4 Operation Mode of VMI

Source: Author finishing

(1) Data collection, Company Z and general suppliers utilize the data provided by the ERP inventory information system to achieve transparent and visualized operation of production, inventory, in transit, procurement, etc. of Company Z and general suppliers.

(2) Demand prediction. Company Z transmits materials demand information and general suppliers receives information and compare such information with the historical information of materials; Company Z predicts each material with the scientific statistical method; general suppliers conduct reasonable changes and adjustments to the predictions generated as mentioned above according to the feedback information.

(3) Order prediction. General suppliers often make reasonable predictions of order based on the agreed transportation cost target and inventory budget and coordinate the equilibrium relationship between predictions and the conditions preset by the goods supplement system, distribution conditions, service level required by Company Z, safe inventory, and other indicators, to obtain the quantity of orders of the most benefits. General suppliers determine the reasonable inventory according to the specific conditions of Company Z.

(4) Order generation. The generation of Company Z's procurement order is subject to management and control by general suppliers. A reasonable transportation route and reasonable quantity of order will be generated according t to Company Z's existing inventory, quantity ordered, best goods supplement plan generated as well as the calculation results of

automatic goods loading system. The final delivery plan required by Company Z is generated at the terminal of general suppliers.

(5) Order execution. The delivery plan information is transmitted to Company Z by general suppliers to notify Company Z to supplement goods. Upon receipt of an "order confirmation" from general suppliers, Company Z will update the system according to the latest order generated. General suppliers will send a "notice of delivery" along with the goods ordered to precisely inform Company Z of the goods transported and delivery time. Upon receipt of goods, Company Z will send a "notice of receipt" to precisely inform general suppliers of the goods received. General suppliers will compare the order and notice of receipt to check if there is any error, e.g. shortage of quantity, etc.

VMI aims at letting Company Z save the step of arrangement of delivery after placement of orders, reduce and eliminate inventory, and prevent the risk of stockout. Through the implementation of VMI, Company Z will no longer need to get inventory from general suppliers, and general suppliers will promptly arrange delivering goods to Company Z according to the inventory of Company Z to achieve the inventory state of both parties. The establishment of this mode is conducive to general suppliers' arrangement of production with materials in a more reasonable way according to the inventory and stockout conditions as well as their own production takt and period to prevent excessive and too little production, achieve effective costs management and avoid stockout risk of Company Z.

VMI is built on the basis of mutual trust and information share of both parties with the common objective. It is designed in the principle of minimizing both parties' total costs. The framework entered into gives a compromise consideration to both parties' production capacity, production takt, inventory turnover period, etc. and pursues optimal inventory, so as to satisfy ultimate users' demands, respond to market changes rapidly, and will not cause capital accumulation caused by excessive inventory and residual of obsolete goods. In VMI implementation, there will certainly be various problems and it is required to maintain transparent operation and good communication and exchange. Such problems are subject to solution by both parties through negotiation to achieve the requirements of agile supply chain.

2. Purchasing by Invitation to Bid

The raw materials of general suppliers are general commodities and the costs of materials can be reduced by way of invitation to bid. Bid is to recruit personnel or enterprise's for completing the given task plan and is a procurement method that has attracted more and more attentions of and been widely applied by people. Purchasing by invitation to bid, *i.e.* the way of procurement through seeking for the best suppliers by means of invitation to bid, includes two ways: open tendering and invited tendering. Open tendering means that the tenderer invites unspecific bidders by way of tendering advertisement; invited tendering means that the tenderer invites specific bidders by way of invitation for bid. In both tendering ways, in addition to different ways of invitation and their respective advantages, other steps are basically the same, as shown in Figure 4-5.

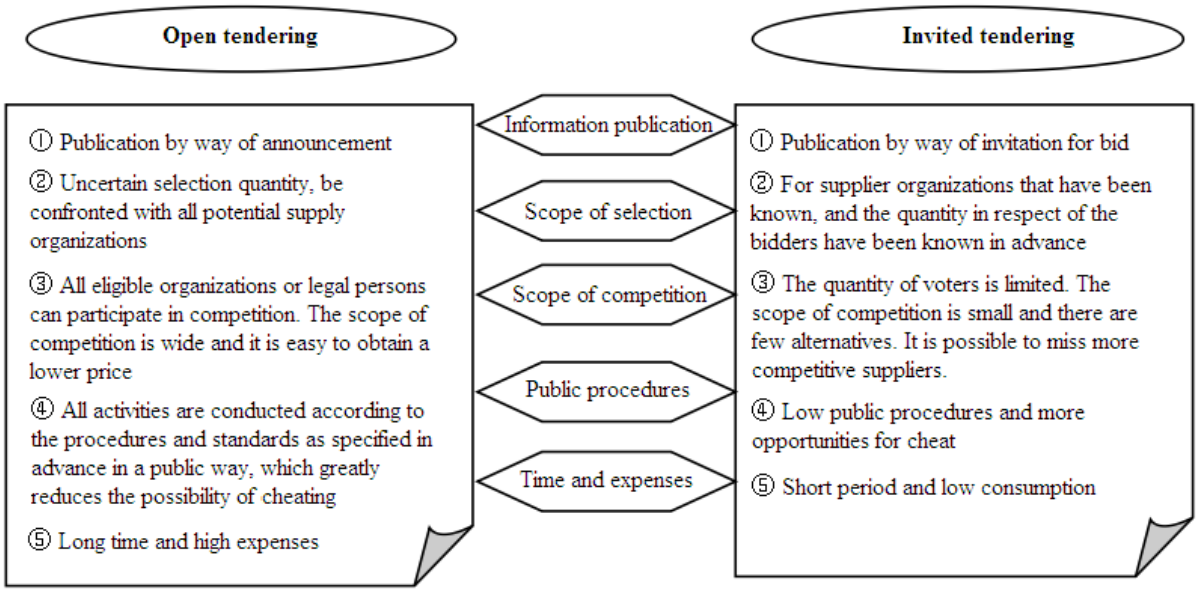

Figure 4-5 Comparison of Both Ways of Tendering

Source: Author finishing

The tendering of goods supply for general suppliers can further reduce the procurement costs, makes the procurement price more reasonable and lets procurement costs under effective management; in addition, the tendering of general suppliers can reduce transaction expenses, and save labor power, material resources and financial resources, thus reducing the total procurement costs.

3. Delayed Payment

Delayed payment, *i.e.* delayed payment period or cash acceptance (bank acceptance and commercial acceptance) delays the payment time of general suppliers, and guarantees the time of occupation of capital by Company Z. The specific measures are the same as the strategy of delayed payment for partner suppliers. Company Z can prolong the outflow time of capital to a certain extent and promote Company Z's working capital management performance by applying delayed payment for general suppliers.

4.2.4 Promotion of Operation Strategy for Bottleneck Suppliers

There are 96 bottleneck suppliers mainly offering normal resistance, capacitor, wire, standard components, packaging materials, etc. The procurement amount of such materials accounts for 0.14% of the total procurement amount. The materials provided by bottleneck suppliers are general commodities. The scope of suppliers available for selection is large and it is easy to obtain new development resources; there are many bottleneck suppliers and material types, while the unit value is low and the percentage of procurement from such suppliers in the total procurement amount is very small. The analysis of 96 bottleneck suppliers' data is as shown in Table 4-5:

Table 4-5 Analysis of Indicators of Bottleneck Suppliers

		Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liabilities ratio	Debt to assets ratio	Return on net assets	Surplus cash coverage ratio
N	Valid	96	96	96	96	96	96	96	96	96
	Missing	0	0	0	0	0	0	0	0	0
Mean value		0.0149	0.0103	0.0132	0.0128	0.3034	0.0653	0.5478	0.1078	1.9642
Standard difference		0.0055	0.0035	0.0122	0.0056	0.2274	0.1019	0.1715	0.1094	5.7364
Maximum		0.0529	0.037	0.1249	0.046	0.7427	0.3353	0.9276	0.9294	35.151
Quartile 75		0.0167	0.0112	0.013	0.0147	0.4744	0.1378	0.6462	0.1519	1.4927
Median		0.0145	0.01	0.0116	0.0114	0.3348	0.067	0.5287	0.0892	0.878
Quartile 25		0.012	0.0087	0.0103	0.0096	0.1296	0.0111	0.4271	0.044	0.4357
Minimum		0.008	0.0054	0.0056	0.0054	-0.2504	-0.2809	0.1577	-0.0019	-8.8915

Source: Financial statements of Company Z's suppliers (2013)

Table 4-5 shows that:

(1) Bottleneck suppliers' day-to-day working capital management performance indicators are lower than the industrial level

The maximum, minimum and mean value of the inventory turnover ratio of 96 bottleneck suppliers are 0.0529, 0.0080 and 0.0149respectively, of which the mean value is very smaller than the mean value of public companies in the industry 0.0421, indicating that the inventory turnover speed is much slower than the industry, *i.e.* very long inventory turnover period, very low occupation level of inventory and weak liquidity and cashability. The maximum, minimum and mean value of receivables turnover ratio are 0.0370, 0.0054 and 0.0103respectively, of which the mean value is slightly larger than the mean value of public companies in the industry 0.0124, indicating that the receivables turnover ratio of bottleneck suppliers is slightly smaller than the industry, *i.e.* long receivables turnover period, slow collection speed, and slow assets flow. The maximum, minimum and mean value of payables turnover ratio are 0.1249, 0.0056 and 0.0132respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.0225, indicating that the payables turnover speed of bottleneck suppliers is much slower than the industry, *i.e.* long payables turnover period and more repayment pressure. The maximum, minimum and mean value of cash turnover ratio are 0.0460, 0.0054 and 0.0128respectively, of which the mean value is larger than the mean value of public companies in the industry 0.0127, indicating that the cash turnover speed of bottleneck suppliers is close to the industry, *i.e.* slightly long cash turnover period and good capital utilization effects.

(2) Bottleneck suppliers' solvency indicators are lower than the industrial level

The maximum, minimum and mean value of working capital allocation ratio are 0.7427, -0.2504 and 0.3034respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.5416, indicating that the solvency for short-term debts of bottleneck suppliers is slightly weak. The maximum, minimum and mean value of cash to current liabilities ratio are 0.3353, -0.2809 and 0.0653respectively, of which the mean value is much smaller than the mean value of public companies in the industry 0.3493 indicating that the net cash flow from operating activities in the current period of bottleneck suppliers is

badly insufficient to repay short-term debts. The maximum, minimum and mean value of debt to assets ratio are 0.9276, 0.1577 and 0.5478respectively, of which the mean value is slightly higher than the mean value of public companies in the industry 0.3272, indicating that the solvency of bottleneck suppliers is relatively weak.

(3) Bottleneck suppliers' profitability indicators are higher than the industrial level

The maximum, minimum and mean value of return on net assets are 0.9294, -0.0019 and 0.1078respectively, of which the mean value is slightly higher than the mean value of public companies in the industry 0.0824, indicating that the return on net assets of bottleneck suppliers is slightly higher than the industrial level and the capacity for self owned capital to gain net income is good. The maximum, minimum and mean value of surplus cash coverage ratio are 35.1510, -8.8915 and 1.9642respectively, indicating that the mean value is lower than the mean value of public companies in the industry 1.5332, indicating that the surplus cash coverage ratio of bottleneck suppliers is lower than the industrial level and the guarantee of cash income in net profit for the current period is relatively low.

The day-to-day working capital management performance and solvency indicators of bottleneck suppliers are lower than the industrial level. Therefore, bottleneck suppliers are subject to working capital risk and have insufficient working capital and difficulty in financing.

Bottleneck suppliers are not important suppliers of Company Z. Their products have very low costs and risks and are easily available in the market with little impact on Company Z. For bottleneck suppliers lack of capital and with supply risks, the thesis mainly takes the strategy of looking for alternative suppliers:

Looking for alternative suppliers can reduce the supply risk brought about by bottleneck suppliers to Company Z. In looking for alternative suppliers, a stable transition period should be ensured in the process of procurement, e.g. first granting a small share, say 20%, for cultivation of newly developed suppliers. In case of problems with bottleneck suppliers or after newly developed suppliers have experienced the transition period, switch is allowed. To Company Z, the alternation of new and old suppliers involves delivery period and quality stability, customer satisfaction, corporate reputation and other issues. Therefore, Company Z

should assist new suppliers' rapid and stable transition and ensure orderly exit of obsoleted bottleneck suppliers, achieve zero loss of Company Z, minimize waste and expenditure, ensure clear settlement records, etc.

In sum, supplier is one of the commercial partners of Company Z. Suppliers' operation strategy affects enterprise's operation strategy and business mode, thus affecting enterprise's business flow and imposing a significant impact on enterprise's working capital management. In addition, suppliers and Company Z should mutually provide commercial credit. The transmission of credit via the financial products of supply chain will also affect enterprise's working capital management performance. Taking proper supplier operation strategies is conducive to the enhancement of Company Z's working capital management performance, effective reduction of enterprise's operating costs and improvement of the competitive advantages of upstream supply chain.

4.3 Classification Analysis of Customers

To further examine their operations strategies, this section discusses the method for classification of the degree of working capital shortage by customers in the process of operation, and classifies customers:

Similarly, the Kraljic Matrix method is used for 104 customers and to build a two-dimensional classification matrix according to the degree of working capital risk and product customization of customers selling products; the horizontal axis indicates the exposure of a customer to working capital risk (to be specific, the degree of financial strain with working capital) while the longitudinal axis indicates the degree of customization. Company Z adopts direct selling and distribution for customer-made products and generic products, respectively. The former are tailored for the needs of direct customers characterized by single product which is customer-made and of a large quantity and certain economics of scale; while the latter are generic and diversified for the general needs of indirect customers and sold to end-users via distributors by way of reselling or direct sales. The specific idea of building the matrix graph is set out below:

(1) Customer's exposure to working capital risk: the degree of a customer's financial strain with working capital as reflected in, among others, inventory, receivables, payables and cash turnover, working capital allocation ratio, cash to current liability ratio, debt to asset ratio, return on net assets, and surplus cash coverage ratio, can help Company Z effectively identify customers with high working capital risk.

(2) Product customization: the degree of product customization is used to measure how much Company Z relies on customers. Such division aims at classified management based on the degree of product customization. Highly customer-made products are mostly sold direct to major clients and subject to key management and direct sales, while generic products are sold by way of distribution. Product customization means that Company Z offers what target customers need and provides relevant personalized services for customers. Company Z offers customization services where a customer directly participates in product design and the tailor-made products better satisfy the customer's needs and enjoy a higher customer satisfaction. Direct sales helps Company Z "flatten" distribution channels, shorten the sales chain, lower distribution costs, and improve service efficiency.

Based on the above analysis, Company Z's customers can be classified according to the degree of capital risk and customization of customers. The two-dimensional BCG matrix is built to group the customers as follows (See Figure 4-6):

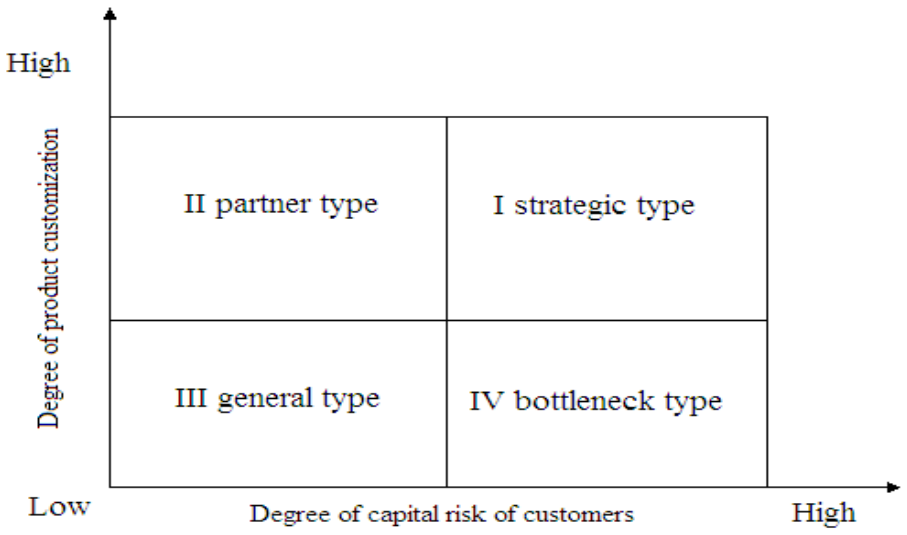

Figure 4-6 Customer Segmentation Model

Source: Author finishing

Strategic-type Customers, designated in Figure 4-6, are at high working capital risk but demand highly customized products, even patented non-generic products. Of less variety but higher value, such products are hardly available in the market, resulting in a co-dependency between such customers and Company Z. To the latter, such customers are of strategic importance and have a direct impact on the Company Z's growth. But these suppliers face financial strain and have cash flow problems. If an ongoing project is underfunded and therefore cannot continue, Company Z would incur huge loss.

Class II represents partner customers, which are at low working capital risk and have a high degree of product customization, as shown in Figure 4-6. The products required by such customers are also highly customized non-general products of fewer varieties and higher single product value, directly affecting Company Z's competitiveness in the market and taking a strategic role for Company Z. Such customers have good cash flow and are important major customers of high quality of Company Z.

Class III represents general customers, which are at low working capital risk and have a low degree of product customization, as shown in Figure 4-6. The products required by such customers are general products of a large demand in the market. Such products are easily available in the perfectly competitive market with sufficient supply and a low single product value. These direct customers are distributors rather than end users. They have sufficient working capital to guarantee normal operation of their own business.

Class Ⅳ represents bottleneck customers, which are at a high working capital risk and have a low degree of product customization, as shown in Figure 4-6. The products required by such customers are general products and are easily available in the perfectly competitive market with sufficient supply and a low single product value, but such products can prone to be substituted by other products. In addition, such customers face greater business risks due to the shortage of working capital.

Company Z's customers are hence divided into four types (See Table 4-6):

Table 4-6 Characteristics of Four Types of Customers

No.	Type	Quantity of Suppliers	Product properties	Sales Model	Product Value	Risk
1	Strategic	Small	Non-generic	Direct sales	High	High
2	Partner	Small	Non-generic	Direct sales	High	Low
3	General	Large	Generic	Distribution	Low	Low
4	Bottleneck	Large	Generic	Distribution	Low	High

Source: Author finishing

The key to customer segmentation is to divide customers' capital risk degree and product customization degree and place different customers at appropriate positions according to both coordinate axes. Common methods for customers' capital risk degree: determine working capital risk with the working capital risk assessment model using 9 indicators, *i.e.* inventory turnover ratio, receivables turnover ratio, payables turnover ratio, cash turnover ratio, working capital allocation ratio, cash to current liabilities ratio, debt to assets ratio, return on net assets and surplus cash coverage ratio, and compare the same with the assessed values of working capital risks of the industries of computer, communication and other electronic industries in 2013 as the basis for division. The basis for redivision of the degree of product customization is the degree of common use and sales model of products.

4.4 Promotion of Operation Strategies for Customers

The operation strategy for customers, as important stakeholders of Company Z, is one of the critical factors affecting Company Z's working capital management efficiency. Customers' participation in the operation of supply chain can obviously improve the efficiency of Company Z's working capital management. In brief, Company Z adopts level-to-level management and differentiated operation strategies for customers of different levels. The effective connection of working capital effects of important customers in the supply chain can allow critical customers enjoy the special treatments provided by Company Z proudly and stimulate them to maintain such an exalted position. In addition, it will stimulate common customers with working capital strength and eliminate customers of poor quality, so that Company Z can generate considerable profit increase while reducing operating costs and working capital risks, and promote win-win with customers, thus effectively improving

Company Z's working capital management efficiency.

4.4.1 Promotion of Operation Strategies for Strategic Customers

There are 17 strategic customers which are electronic equipment manufacturers of a large scale and a high position in the industry and are direct "consumers". Most products required by strategic customers are customized according to their own demands, and are non-general and of few types and high value of a single product. The percentage of strategic customers' demand in Company Z's total sales amount is 45.55%. The analysis of 17 strategic customers' financial data is as shown in Table 4-7:

Table 4-7 Analysis of Indicators of Strategic Customers

		Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liabilities ratio	Debt to assets ratio	Return on net assets	Surplus cash coverage ratio
N	**Valid**	17	17	17	17	17	17	17	17	17
	Missing	0	0	0	0	0	0	0	0	0
Mean value		0.0151	0.009	0.0105	0.0125	0.3576	0.0096	0.5274	0.056	3.6056
Standard difference		0.004	0.0032	0.003	0.0057	0.2033	0.084	0.1767	0.0718	10.2077
Maximum		0.0221	0.0179	0.0192	0.026	0.6797	0.1033	0.7957	0.2635	37.6084
Quartile 75		0.018	0.0099	0.0116	0.0154	0.4817	0.0732	0.6884	0.0772	2.7159
Median		0.0152	0.009	0.0106	0.0112	0.4165	0.0204	0.5383	0.0601	1.1105
Quartile 25		0.0125	0.0068	0.0089	0.0079	0.1763	-0.0077	0.3637	0.023	-0.0545
Minimum		0.006	0.0046	0.0063	0.0064	0.0344	-0.2582	0.2431	-0.1079	-8.9826

Source: Financial statements of Company Z's customers (2013)

Table 4-7 shows that:

(1) Strategic suppliers' day-to-day working capital management performance indicators are lower than the industrial level

The maximum, minimum and mean value of the inventory turnover ratio of 17 strategic customers are 0.0393, 0.0060 and 0.0151respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.0421, indicating that the inventory turnover speed is much slower than the industry, *i.e.* very long inventory turnover period, low occupation level of inventory and weak liquidity and cashability. The maximum, minimum and mean value of receivables turnover ratio are 0.0179, 0.0046 and 0.0090 respectively, of

which the mean value is smaller than the mean value of public companies in the industry 0.0124, indicating that the receivables turnover ratio of strategic customers is slower than the industry, *i.e.* long receivables turnover period, slow collection speed, slow assets flow and weak solvency. The maximum, minimum and mean value of payables turnover ratio are 0.0912, 0.0063 and 0.0105respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.0225, indicating that the payables turnover speed of strategic customers is over 1 time slower than the industry, *i.e.* long payables turnover period and more repayment pressure. The maximum, minimum and mean value of cash turnover ratio are 0.0260, 0.0064 and 0.0125respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.0127, indicating that the cash turnover speed of strategic customers is slightly slower than the industry, *i.e.* relatively long cash turnover period and poor capital utilization effects.

(2) Strategic customers' solvency indicators are lower than the industrial level

The maximum, minimum and mean value of working capital allocation ratio are 0.6797, 0.0344 and 0.3576respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.5416, indicating that the solvency for short-term debts of strategic customers is relatively weak. The maximum, minimum and mean value of cash to current liabilities ratio are 0.1033, -0.2582 and 0.0096respectively, of which the mean value is very small as compared with the mean value of public companies in the industry 0.3493 indicating that the net cash flow from operating activities in the current period of strategic customers is badly insufficient to repay short-term debts. The maximum, minimum and mean value of debt to assets ratio are 0.7957, 0.2431 and 0.5274respectively, of which the mean value is slightly larger than the mean value of public companies in the industry 0.3272, indicating that the solvency of strategic customers is relatively weak.

(3) Strategic customers' profitability indicators are higher than the industrial level

The maximum, minimum and mean value of return on net assets are 0.2635, -0.1079 and 0.0560respectively, of which the mean value is lower than the mean value of public companies in the industry 0.0824, indicating that the return on net assets of strategic customers is lower than the industrial level and the capacity for self owned capital to gain net

income is relatively low. The maximum, minimum and mean values of surplus cash coverage ratio are 37.6084, -8.9826 and 3.6056respectively, indicating that the difference in surplus cash coverage ratio between strategic customers is large. The mean value is very small as compared with the mean value of public companies in the industry 1.5332, *i.e.* 2.3 times the industrial level, indicating that the surplus cash coverage ratio of strategic customers is far higher than the industrial level and the guarantee of cash income in net profit for the current period is very low.

The day-to-day working capital management performance, solvency and profitability indicators of strategic customers are lower than the industrial level. Therefore, strategic customers are subject to working capital risk and the problems of shortage of working capital, difficulty in financing and poor profitability.

The operation strategy for strategic customers plays an important role in Company Z's management. The success of strategic customer management determines the operation performance of the entire Company Z. Strategic customers are those the profit created by whom takes a large proportion in the total profit of the entire enterprise and are the foot stone of corporate profit and one of the most important guarantees for enterprise's sustainable development. Generally, Company Z is required to spend a lot to let the relationship of strategic customers enter a stable and sound state. However, competitors often aim at these customers and wait for opportunities to "attack" or "attract" them. Once Company Z loses strategic customers, its production and operation will be seriously damaged. Therefore, Company Z is required to keep a good relationship with strategic customers to ensure the continued and stable development of its core businesses. For the shortage of capital and difficulty in financing of strategic customers, the thesis mainly takes the strategy of support for development:

(1) Prolonged Collection Period

In accordance with the capital conditions of its own, Company Z will give appropriate fiscal policy support to strategic customers. Company Z exchanges delayed payment with high sales price or less transportation expenses to ensure that Company Z can get more profits. To find a balance point of three indicators of collection period, sales price and delivery period

provides appropriate support for customers' capital demand to exchange for high sales price or less transportation expenses. To reduce strategic customers' pressure of short term payment by prolonging the payment period will let Company Z occupies the time cost of capital due to the delayed payment, thus it is allowed to properly enhance the supply price of strategic customers; or if strategic customers place batch orders, Company Z can carry out batch production according to orders and batch production in advance can reduce production costs. or, if strategic customers give sufficient production and transportation time to Company Z, Company Z can select the optimal way and route of transportation to effectively reduce enterprise's transportation costs and improve enterprise's profitability. For example, strategic customer M needs 1,000 product A, the unit price of product is RMB1,000/unit and the demand period is 30 days; the unit production costs of Company Z for production of less than 1,000 sets and 2,000 sets of product A are RMB700 and RMB650respectively, and the procurement and production period is 25 days, the way of air transportation needs 3 days and the transportation costs of a single set us RMB30; the way of road transportation needs 8 days and the transportation costs of a single set us RMB10, assuming that the period is 2 days; the payment period agreed between Company Z and strategic customers is 3 months, assuming that the capital interest rate is 6%.

① For normal delivery according to order type demands, strategic customer M receives 1,000 sets of product A within 30 days, and is require to pay 1000*RMB1,000=RMB1,000,000 in 3 months; Company Z receives RMB1,000,000 in 3 months. Company Z's gross profit is 1000*(RMB1, 000-RMB700-RMB30) =RMB270, 000 and the gross profit of a single product is RMB270, 000÷1000=RMB 270.

② If strategic customers reaches an agreement with Company Z that the delivery period of 2,000 sets is 30 days and the payment period will be delayed for 5 months due to financial strain, strategic customer M receives 2,000 sets of qualified product A in 30 days and pays RMB1, 000*2000=RMB2, 000,000 in 5 months; Company Z receives RMB2, 000,000 in 5 months. Company Z's gross profit will be 2000*(RMB1, 000-RMB650-RMB30)*(1-6%*2/12) =RMB633, 600 and a single product's gross profit is RMB633, 600÷2000=RMB316.8.

③ If strategic customers reaches an agreement with Company Z that the delivery period

of 1,000 sets is 35 days and the payment period will be delayed for 5 months due to financial strain, strategic customer M receives 1,000 sets of qualified product A in 30 days and pays RMB1,000*1000=RMB1,000,000 in 5 months; Company Z receives RMB2,000,000 in 5 months. Company Z's gross profit will be 2000*(RMB1, 000-RMB650-RMB10)*(1-6%*2/12) =RMB336, 600 and a single product's gross profit is RMB336, 600÷2000=RMB336.6.

④ If strategic customers reaches an agreement with Company Z that the delivery period of 2,000 sets is 35 days and the payment period will be delayed for 5 months due to financial strain, strategic customer M receives 2,000 sets of qualified product A in 30 days and pays RMB1, 000*2000=RMB2, 000,000 in 5 months; Company Z receives RMB2, 000,000 in 5 months. Company Z's gross profit will be 2000*(RMB1, 000-RMB650-RMB10)*(1-6%*2/12) =RMB673, 200 and a single product's gross profit is RMB673, 200÷2000=RMB336.6.

The comparison of the above four schemes shows that the total profit and gross pfennig in schemes 2, 3 and 4 are higher than those of scheme 1. Strategic customers prolong the cash outflow time through delaying the payment period, winning time for cash inflow, which guarantees enterprise working capital in a certain period and promotes enterprise's operation and development.

On the one hand, the strategy of prolonging the collection period adopted by Company Z for strategic customers will result in longer time for recovery of capital and increase the time of occupation of receivables by strategic customers, thus giving rise to working capital pressure and risk to Company Z to a certain extent. However, on the other hand, batch procurement, batch production and selection of optimal way and route of transportation can effectively save procurement costs, manufacturing costs and transportation costs, and reduces the working capital expenditure of procurement, production and sales channels, thus reducing Company Z's working capital pressure and risk to a certain extent. Therefore, Company Z is required to consider the balance of working capital risk among prolonging the collection period, sales price and delivery period based on its own working capital collection and expenditure, so as to guarantee capital support for strategic customers while effectively reducing Company Z's operating costs, improving profitability, promoting the stability of downstream key customers and guaranteeing its own operation edit and sustained

development.

(2) Provision of Financing Guarantee

Company Z provides financing guarantee to strategic customers through the "bridge and tunnel mode" to help them obtain cash flow. The "bridge and tunnel mode" is a new loan guarantee operation mode first proposed and practiced by Zhejiang Zhongxing Uni-Power Guaranty Service Co., Ltd. in 2007. The "bridge and tunnel mode" introduces a fourth party, *i.e.* Company Z, on the basis of traditional financing guarantee mode among strategic customer, bank and guarantee company. The specific operation method is that Company Z and strategic customers enter into a conditional option acquisition contract, *i.e.* some form of commitment. When a strategic customer suffers from financial crisis in operation due to the unexpected changes in capital flow, thus failing to repay bank loans, Company Z will become a shareholder of the enterprise by purchasing shares at a preferential price as previously agreed and rely bank loans with cash flow for the strategic customer to maintain the strategic customer's continued operation. This mode avoids bankruptcy liquidation, thus maintaining strategic customers' potential value to the greatest extent. Therefore, the intervention of Company Z in the "bridge and tunnel mode" actually plays the role of bridge and tunnel connecting the credit market and capital market, forming "the second risk control line" for the guaranteed loan business of bank and strategic customers and effectively sharing the risk of guarantee institutions. This mode is a bridge connecting the credit market and capital market and also a channel connecting strategic customers, guarantee company, Company Z and banks, as shown in Figure 4-7.

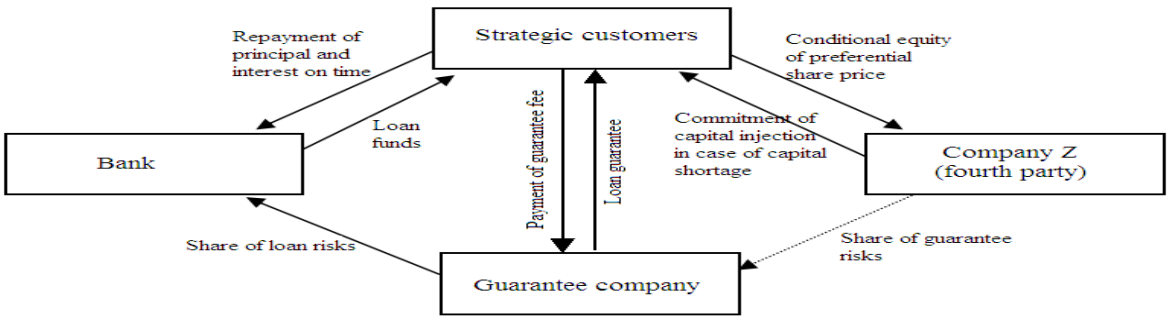

Figure 4-7 Relationship of Four Parties and Operation of the "Bridge and Tunnel Mode"

Source: Author finishing

The most important innovation of the "bridge and tunnel mode" loses in the introduction of financial derivatives into the field of financing guarantee, *i.e.* the option contract entered into between Company Z and strategic customers. When strategic customers are in normal operation and are able to repay loans according to the loan contracts, Company Z cannot execute the option; in case of unexpected changes in strategic customers' cash outflow, affecting their solvency, Company Z executes this option and become a shareholder by purchasing shares at a preferential price as previously agreed to inject capital into strategic customers and obtain part of equity interests of the strategic customers. It is not a standard option contract and it is required to conduct personalized design for the contract contents depending on the difference of strategic customers. The introduction of Company Z into the transaction plays the role of signal transmission and option contract is the signal. Signal transmission can reduce the information asymmetry among strategic customers, banks and guarantee institutions. As an investor in the industry, Company Z has advantages in comprehensive and accurate understanding of the development, operation and prospect of strategic customers. The introduction of Company Z in the traditional three- party mechanism as the fourth party in the "bridge and tunnel mode" partly solves the problem of information asymmetry in transaction. Strategic customers, guarantee company, Company Z and banks are able to gain profit from the new mechanism. The specific performance of four parties in the "bridge and tunnel mode" is as follows:

① For strategic customers, in the operation mechanism of the "bridge and tunnel mode", it is only required to pay normal guarantee charges and conditionally sell par of options to obtain banks' low cost loans. The introduction of Company Z can solve the problem of insufficient collaterals to improve the probability of obtaining loans. If there is no abnormality with the expected cash flow of strategic customers, they can use the loan funds to obtain more profits. In case of bankruptcy liquidation of strategic customers due to failing to repay bank loans, if Company Z injects capital, strategic customers may have the opportunity to overcome the difficulty with the help of Company Z, guaranteeing strategic customers' survival and sustained operation.

② For Company Z, it is able to obtain equity interests at a lower price when the

strategic customers are in difficulties. The reason for Company Z to inject its excess working capital into strategic customers with repayment crisis lies in further locking customers in the long term relying on its own capital advantage and obtain return and continued cooperation in the long term. The implementation of "bridge and tunnel mode" promotes the stability of cooperation between Company Z and strategic customers and provides Company Z with further strategic cooperation with strategic customers and allows to enter the enterprises with good development space in the industry for integration of industrial chain.

③ For guarantee companies, the interest of the "bridge and tunnel mode" lies in three aspects: I. The introduction of Company Z allows some businesses that could not be implemented originally obtain loans and increases the business of guarantee companies; II. Company Z's injection of capital into strategic customers when they are unable to repay loans will reduce guarantee company ' risk of repayment on behalf of such strategic customers; III. The "bridge and tunnel mode" reduces the "contingent risk level" of guarantee company, which will let banks lower down requirements on deposit for loans and even will let relevant regulatory departments loosen the restrictions against the capital amplification times of guarantee company, which is conducive to the business increase of guarantee company and increase in profit space.

④ For banks, as the introduction of Company Z separates two businesses of banks, *i.e.* recovery of loans and tapping potential value of strategic customers, and the latter is outsourced to Company Z. The introduction of Company Z can help banks to select the enterprise with the most development potentials among a lot of enterprises as the objects of loan, thus increasing the probability for realization of strategic customers' value potentials and finally reducing banks' default risks. On the other hand, in case of defaults, Company Z will inject capital into medium and small enterprises according to the agreements to reduce banks' non-performing loan ratio, and provide powerful guarantee for the improvement of banks' loan quality.

The provision of financing guarantee to strategic customers with the "bridge and tunnel mode" will further deepen the cooperation between Company Z and strategic customers, further lock the cooperation with strategic customers to a certain extent, guarantee the

stability of Company Z's sales channel and promote Company Z's continuous development.

4.4.2 Promotion of Operation Strategies for Partner Customers

There are 14 partner customers which are electronic equipment manufacturers of a large scale and a high position in the industry and are direct "consumers". Most products required by partner customers are customized according to their own demands, and are non-general and of few types and high value of a single product. The percentage of partner customers' demand in Company Z's total sales amount is 38.32%. The analysis of 14 partner customers' financial data is as shown in Table 4-8:

Table 4-8 Analysis of Indicators of Partner Customers

		Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital turnover ratio	Cash to current liabilities ratio	Debt to assets ratio	Return on net assets	Surplus cash coverage ratio
N	Valid	14	14	14	14	14	14	14	14	14
	Missing	0	0	0	0	0	0	0	0	0
Mean value		0.0179	0.0097	0.014	0.0064	0.3697	0.3853	0.5221	0.1828	0.6474
Standard difference		0.0091	0.005	0.0126	0.0291	0.2509	0.2928	0.2004	0.2273	0.4426
Maximum		0.0342	0.0189	0.0542	0.0509	0.6993	1.0413	0.9276	0.9294	1.5292
Quartile 75		0.0224	0.0125	0.016	0.0141	0.5749	0.6676	0.6543	0.2056	0.9356
Median		0.0171	0.0089	0.012	0.0102	0.4022	0.2599	0.5482	0.1336	0.6997
Quartile 25		0.0119	0.006	0.0063	0.0062	0.1916	0.1965	0.349	0.0387	0.1224
Minimum		0.004	0.0034	0.0039	-0.0867	-0.1448	0.1159	0.2439	0.018	0.0451

Source: Financial statements of Company Z's customers (2013)

Table 4-8 shows that:

(1) Partner customers' day-to-day working capital management performance indicators are higher than the industrial level

The maximum, minimum and mean value of the inventory turnover ratio of 14 strategic customers are 0.0342, 0.0040 and 0.0179respectively, of which the mean value is 2.3 times smaller than the mean value of public companies in the industry 0.0421, indicating that the inventory turnover speed is much slower than the industry, *i.e.* long inventory turnover period, low occupation level of inventory and weak liquidity and cashability. The maximum, minimum and mean value of receivables turnover ratio are 0.0189, 0.0034 and

0.0097respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.0124, indicating that the receivables turnover speed of partner customers is slower than the industry, *i.e.* Long receivables turnover period, slow collection speed, slow assets flow and weak solvency. The maximum, minimum and mean value of payables turnover ratio are 0.0542, 0.0039 and 0.0140respectively, of which the mean value is smaller than the mean value of public companies in the industry 0.0225, indicating that the payables turnover speed of partner customers is nearly 1 time slower than the industry, *i.e.* long payables turnover period and long occupation of suppliers' capital. The maximum, minimum and mean value of cash turnover ratio are 0.0509, -0.0867 and 0.0064respectively, of which the mean value is nearly 2 times smaller than the mean value of public companies in the industry 0.0127, indicating that the cash turnover speed of partner customers is slightly slower than the industry, *i.e.* relatively long cash turnover period and poor capital utilization effects.

(2) Partner customers' solvency indicators are lower than the industrial level

The maximum, minimum and mean value of working capital allocation ratio are 0.6993, -0.1448 and 0.3697respectively, of which the mean value is slightly smaller than the mean value of public companies in the industry 0.5416, indicating that the solvency for short-term debts of partner suppliers is slightly weak. The maximum, minimum and mean value of cash to current liabilities ratio are 1.0413, 0.1159 and 0.3853 respectively, of which the mean value is slightly larger than the mean value of public companies in the industry 0.3493 indicating that the net cash flow from operating activities in the current period of partner customers is sufficient to repay short-term debts. The maximum, minimum and mean value of debt to assets ratio are 0.89276, 0.2439 and 0.5221 respectively, of which the mean value is slightly larger than the mean value of public companies in the industry 0.3272, indicating that the solvency of partner customers is relatively weak.

(3) Partner customers' profitability indicators are higher than the industrial level

The maximum, minimum and mean value of return on net assets are 0.9294, 0.0180 and 0.1828 respectively, of which the mean value is 2.2 times higher than the mean value of public companies in the industry 0.0824, indicating that the return on net assets of partner

suppliers is much higher than the industrial level and the capacity for self owned capital to gain net income is very high. The maximum, minimum and mean values of surplus cash coverage ratio are 1.5292, 0.0451 and 0.6474 respectively, indicating that the difference in surplus cash coverage ratio between partner customers is large. The mean value is 2.5 times lower than the mean value of public companies in the industry 1.5332, indicating that the surplus cash coverage ratio of strategic customers is far lower than the industrial level and the guarantee of cash income in net profit for the current period is very high.

The day-to-day working capital management performance and profitability indicators of partner customers are higher than the industrial level. Therefore, partner customers are subject to working capital risk and have very sufficient capital and good cash flow.

As important customers of Company Z, partner customers directly affect the operation and development of Company Z. The partnership between Company Z and partner customers are on the premise of long term satisfactory execution of transaction contract, mutual high trust and effective information share. It means that partner customers have good cooperation basis in previous transactions. Only firmly stressing partner customers can allow Company Z maintain competitive advantages and strong resistance against competitors so as to win today when the competition is increasingly fierce. Therefore, the target of partner customer management is to improve partner customers' loyalty, and further enhance the in-depth cooperation with partner customers to promote long term continued cooperation. For partner customers as core important customers with good capital flow, the thesis mainly adopts the strategy of in-depth cooperation:

1. Strength strategic cooperation to form strategic partnership

The cooperation between Company Z and partner customers can form the advantages that cannot be simulated by competitors, bring about long term strategic benefits for both parties and establish a more lasting strategic partnership of more trust and high coordination. Company Z's selection of partner customers to form a strategic partnership directly affects Company Z's continuous development. Company Z and partner customers have the following characteristics:

(1) Both parties have their own available core competitiveness and strategic advantages

can be formed through the mutual supplement of advantages in respect of resources allocation;

(2) Both parties have consistent targets and same values and strategic ideas;

(3) Both parties have an advanced and complete quality system and the organizations to ensure rapid response;

(4) Both parties can conduct in-depth cooperation to form a sustainable advantage that cannot be simulated and substituted by competitors.

Company Z promotes partner customers' cognitive value through enhancing partner customers' efficiency and reducing partner customers' costs and takes the operation strategy of reducing partner customers' costs expectations. The specific measures for enhancing customers' efficiency include earnestly researching market dynamics, prompt adjustments to production takt, and production based on orders; increasing the yield of products of high added value and optimizing product structure; further optimizing resources allocation and increasing partner customers' sense of trust and reliance; maintaining the consistency of partner customers' policy, implementing preferential policies in terms of price, quantity, variety, service, etc. for partner customers. The measures for reducing partner customers' costs include establishing a number of ways of contact to improve communication efficiency and reduce partner customers' communication costs; earnestly researching market demands and accelerating the production takt to reduce partner customers' waiting costs; speeding up the updating of sales information system to achieve interconnection of sales and settlement to achieve no thesis receipt and reduce partner customers' time on the way; eliminating partner customers' concerns about production arrangement, transportation, settlement, etc. through one-on-one marketing services to reduce partner customers' maintenance costs; taking the strategy of low-key propaganda and high-key marketing services to let partner customers feel the changes in Company Z's way of marketing in the actual operation, thus achieving partner customers' expectations.

For its own benefits, Company Z should strengthen long term strategic cooperation with partner customers so as to obtain appropriate sales advantages from the perspective of strategic cooperation. If delivery period is an important indicator of customers, the problems

of partner customers can be solved through proper stocking up to obtain long term cooperation with partner customers or be granted with a sales price support. To provide products or services meeting ultimate consumers' demands of a proper quantity and continuously enhance consumer' satisfaction and loyalty is one of the critical conditions for Company Z to achieve profits and positive cash flow. Company Z does often not directly face ultimate consumers and partner customers often serve as the bridge between Company Z and end users. Therefore, partner customers often know more about consumers' demand preferences, demand potentials, etc. in a more accurate way. As such information is very important commercial information, in order to let partner customers be willing to share such information with it, Company Z must have a long term cooperation and high trust with partner customers, and utilizes such information to benefit partner customers. Partnership can promote downstream key customers to share demand market information with Company Z to let Company Z produce an appropriate amount of products meeting customers' demand preferences and reduce the occupation of capital of finished products, and share the growth value with partner customers while promoting the working capital management efficiency of Company Z's marketing channel.

From the perspective of Company Z, small batch production and distribution will increase production and transportation costs. Large batch production, although saves production costs, will cause increase in inventory and lead to dull of sale. Partnership will promote the realization of strategic supply, *i.e.* partner customers and Company enter into an overall framework in relation to the total quantity of supply, type of products to be supplied, way of payment, etc. in a certain period in the future by way of signing a strategic supply agreement, and then carry out production and supply of specific products within the framework. Therefore, Company Z can obtain the information on product demand types and quantity in a certain period in the future of customers in advance, promptly arrange production and deliver products to customers after the products go off production lines as soon as possible to reduce the occupation of inventory's capital. In addition, as both parties are in a long term partnership under the strategic supply agreement, the speed and quality of collection are generally guaranteed, which is conducive to the reduction of occupation of

receivables. Therefore, partnership is favorable to promoting the realization of strategic supply, thus reducing Company Z's inventory and occupation of receivables and improving the working capital management performance of marketing channels.

2. Advance Sales

Advance sales have become an important common means for sales of new products by retailers. The sales of many electronic products, garments and other new products rely on the advance sales mode. For retailers, they can obtain sales capital and reduce inventory risk by way of advance sales; from the perspective of consumers, advance sales is generally accompanied by certain promotional activities, e.g. price discount, transportation expenses reduction, provision of gift, Tex. Consumers can obtain more concessions through reservation and prevent the possible risk of stockout. The strategy of advance sales, as an important means for coordinated operation and marketing, has been stressed by many theoretical researchers. The present researches are mainly in demand prediction and advance sales, e.g. Kevin and Mahmut (1999) analyzed retailers' decision in combination of optimal order and discount for advance sales, assuming that the demand in the advance sales stage relies on the discount amount in the advance sales stage. Xie and Shugan (2001) proposed to consider consumers' purchase behavior in the advance sales stage, and considered two types of consumption: overestimated type and underestimated type. Boyaci and Ozalp (2010) researched the acquisition of market information by way of advance sales, and determined the production capacity according to market information. Zhao and Stecke (2009) researched the two-stage sales of individual retailers and considered the preferences of consumers in respect of risk avoidance, and conducted a contrastive analysis on whether retailers provide advance sales. Swinney (2011) considered the strategic purchase behavior of consumers and researched consumers' strategic selection of advance sales and normal sales. Prasad et al. (2011) researched retailers' optimal discount strategy in the advance sales stage, *i.e.* appropriate discount and in-depth discount.

The thesis adopts the advance strategy according to the literatures on advance sales and the characteristics of partner customers to obtain capital in a promo way and reduce the risks brought about by market fluctuations. Company Z wants to recover its capital as soon as

possible, while partner customers want to prolong a period to allow them have more working capital used for real-investment to obtain benefits. Therefore, Company Z can conduct advance sales for partner customers and grant discount for the payment for goods so as to recover capital as soon as possible. For example, if partner customers make payment in 3 months, they will not be entitled to discounts; if they make payment ion receipt of goods, Company Z will grant them a 10 percent discount, *I.e.* partner customers are only required to pay 90% of the payment for goods; if partner customers make payment 1 month in advance, they will be granted a 15 percent discount; for payment 2 months in advance, there will be a 20 percent discount. As partner customers will get more returns from other investments using the payables for goods but less discount from Company Z for later payment for goods, partner customers are required to make the optimal decision on the time for payments. Advance sales can lock orders in advance and allows organization of production according to the specific plan and effective inventory management. It can also promote sales of Company Z's products, and let Company Z receive receivables and capital inflow and improve Company Z's working capital management performance. Partner customers are large customers with strong financial strength, which provides certain guarantee for acceptance of advance sales. Furthermore, Company Z and partner customers are in long term cooperation and both parties can invest a certain amount of dedicated assets and have a strong reliance. The poor capital turnover of any party will have an impact on the other, and advance sales are helpful for both parties to maintain a long term contract. Therefore, through commercial communication and coordination with partner customers, Company Z will grant proper preferential measures such as price discount to partner customers to exchange for the capital of partner consumers and accelerate the recovery of capital, so that Company Z's capital flow can be further enhanced and its working capital amount will be increased, thus improving its working capital management performance.

4.4.3 Promotion of Operation Strategies for General Customers

There are 24 general customers which are distributors. The products required by general customers are general products and of more types, large quantity and high value of a single

product. The percentage of general customers' demand in Company Z's total sales amount is 7.31%. The analysis of 24 partner customers' financial data is as shown in Table 4-9:

Table 4-9 Analysis of Indicators of General Customers

		Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liabilities ratio	Debt to assets ratio	Return on net assets	Surplus cash coverage ratio
N	Valid	24	24	24	24	24	24	24	24	24
	Missing	0	0	0	0	0	0	0	0	0
Mean value		0.0168	0.013	0.0135	0.0153	0.4788	0.3368	0.4423	0.1529	0.616
Standard difference		0.0016	0.0051	0.0032	0.0029	0.2197	0.1705	0.1912	0.1854	0.2341
Maximum		0.0192	0.03	0.0265	0.0215	0.7427	0.7886	0.9276	0.9294	0.9671
Quartile 75		0.0179	0.013	0.0146	0.0171	0.663	0.4281	0.5585	0.1562	0.7984
Median		0.0169	0.0112	0.0126	0.0143	0.4805	0.2807	0.4098	0.1162	0.6779
Quartile 25		0.0166	0.0104	0.0116	0.0134	0.351	0.2031	0.2762	0.0578	0.4086
Minimum		0.0121	0.0088	0.0104	0.0118	-0.1448	0.09	0.1577	0.0193	0.072

Source: Financial statements of Company Z's customers (2013)

Table 4-9 shows that:

(1) General customers' day-to-day working capital management performance indicators are higher than the industrial level

The maximum, minimum and mean value of the inventory turnover ratio of 24 general customers are 0.0192, 0.0121 and 0.0168respectively, of which the mean value is 2.5 times smaller than the mean value of public companies in the industry 0.0421, indicating that the inventory turnover speed is much slower than the industry, *i.e.* long inventory turnover period, low occupation level of inventory and weak liquidity and cashability. The maximum, minimum and mean value of receivables turnover ratio are 0.0300, 0.0088 and 0.0130respectively, of which the mean value is slightly larger than the mean value of public companies in the industry 0.0124, indicating that the receivables turnover speed of general customers is slightly faster than the industry, *i.e.* slightly short receivables turnover period, fast collection speed, fast assets flow and strong solvency. The maximum, minimum and mean value of payables turnover ratio are 0.0265, 0.0104 and 0.0135respectively, of which the mean value is 1.67 times smaller than the mean value of public companies in the industry

0.0225, indicating that the payables turnover speed of general customers is nearly 1.7 times slower than the industry, *i.e.* long payables turnover period and long occupation of upstream capital. The maximum, minimum and mean value of cash turnover ratio are 0.0215, 0.0118 and 0.0153respectively, of which the mean value is slightly larger than the mean value of public companies in the industry 0.0127, indicating that the cash turnover speed of general customers is slightly faster than the industry, *i.e.* short cash turnover period and good capital utilization effects.

(2) General customers' solvency indicators are lower than the industrial level

The maximum, minimum and mean value of working capital allocation ratio are 0.7427, -0.1448 and 0.4788respectively, of which the mean value is slightly smaller than the mean value of public companies in the industry 0.5416, indicating that the solvency for short-term debts of general customers is slightly weak. The maximum, minimum and mean value of cash to current liabilities ratio are 0.7886, 0.0900 and 0.3368respectively, of which the mean value is slightly smaller than the mean value of public companies in the industry 0.3493 indicating that the capacity of net cash flow from operating activities in the current period of general customers to repay short-term debts is weak. The maximum, minimum and mean value of debt to assets ratio are 0.9276, 0.1577 and 0.4423 respectively, of which the mean value is slightly higher than the mean value of public companies in the industry 0.3272, indicating that the solvency of general customers is relatively high.

(3) General customers' profitability indicators are higher than the industrial level

The maximum, minimum and mean value of return on net assets are 0.9294, 0.0193 and 0.1529respectively, of which the mean value is very higher than the mean value of public companies in the industry 0.0824, indicating that the return on net assets of general customers is nearly 1.86 times the industrial level and the capacity for self owned capital to gain net income is very good. The maximum, minimum and mean value of surplus cash coverage ratio are 0.9671, 0.0720 and 0.6160respectively, indicating that the mean value is 2.5 times the mean value of public companies in the industry 1.5332, indicating that the surplus cash coverage ratio of general customers is far lower than the industrial level and the guarantee of cash income in net profit for the current period is very high.

The day-to-day working capital management performance and profitability indicators of general customers are higher than the industrial level. Therefore, general customers are not subject to working capital risk and have very sufficient working capital and good cash flow.

General customers are relative to strategic customers and partner customers. Though the general common products required by them are of low unit value, the combination of them can create large value, to create profits for Company Z. Therefore, Company Z is required to focus on and apply more effective strategies to manage general customers, to bring about more profits for Company Z. Maintaining a certain amount of general customers is one of the important guarantees for Company Z to achieve economies of scale and an important means for Company Z to retain the market share, maintain cost advantages and contain competitors. If the enterprise abandons small customers of low value and allows them to choose competitors, the enterprise will loss cost advantages and the customer team and scale may be enlarged. Once competitors have more customers and large production and service scale, their costs will be reduced, which is unfavorable for Company Z. For general customers with sufficient capital flow, the thesis mainly takes the strategy of using by themselves and maintaining the current stable status:

(1) Batch Discount

Batch discount is the basic pricing strategy in reality and one of the effective tools to promote or change the coordinated operation of supply chain. After measuring the increase in inventory expenses due to the decrease in costs and increase of order quantity as a result of batch discount, enterprises are often willing to take batch discount scheme to increase their own profits. A proper batch discount coordination mechanism can be designed to conduct distribution according to its "right of speech" in the system, allowing Company Z and general customers to obtain more benefits as compared with the independent decision, to achieve the purpose satisfactory to both parties. Therefore, the supply and distribution parties can achieve win-win by way of batch discount. Early literatures on batch discount mainly conducted considerations and analysis from the perspective of retailers. Hadley and Whitin (1963), Ladany and Sternlieb (1974), Peterson and Silver (1979) as well as Subramanyam and Kumaraswamy (1981) et al. researched the way of changing the original order strategy according to the batch discount strategy offered by suppliers so as to obtain more benefits

from discount price. Monahan (1988) established the basic theoretical framework for determining the best batch discount. Lee et al. (1986), Joglekar (1988) expanded the basic model of Monahan from different aspects. Viswanathan (2001) researched suppliers' strategy of stimulating retailers to place orders in accordance with the specific time as required by suppliers by way of providing discount. Shin et al. (2007) proposed an improvement model for the barriers in the actual implementation of batch discount coordination to ensure that the batch discount coordination strategy can be accepted by the supplier and demander under simple inventory decision conditions and be smoothly implemented.

The thesis discusses based on the above literatures that batch discount and the demand of general customers are the characteristics of Company Z's normal products and further researches that Company Z adopts batch discount to enhance general customers' procurement amount in case of random demand and asymmetric demand information of general customers so as to improve the interests of supply chain's both parties. General customers predict product sales according to their own sales and place batch orders with Company Z in a lump sum way, to get more preferential price from Company Z; Company Z conducts collective procurement according to the batch orders of general customers and negotiates with the upstream on the batch procurement price, and carries out large scale batch production to reduce the procurement, production and inventory costs and enable Company Z to provide general products of cost competitiveness, thus guaranteeing long term stability of general customers. The purpose of batch discount by enterprises is to increase demand, giving rise to increase in business income and profit. In addition, to stimulate general customers with the batch discount mechanism will enhance the competitiveness of downstream supply chain.

(2) Advance Collection

Advance collection, *i.e.* shortening collection period, includes spot cash and advance collection, etc. As general customers have good cash flow, Company Z can exchange for advance collection with such measures as stocking up for general customers, which can accelerate the recovery of sales amount, improve the prompt inflow of cash, enrich Company Z's working capital and enhance Company Z's working capital management efficiency.

4.4.4 Promotion of Operation Strategies for Bottleneck Customers

There are 49 bottleneck customers. The products required by bottleneck customers are general products and of more types, large quantity and high value of a single product. The percentage of bottleneck customers' demand in Company Z's total sales amount is 9.02%. The analysis of 49 bottleneck customers' financial data is as shown in Table 4-10:

Table 4-10 Analysis of Indicators of Bottleneck Customers

		Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liabilities t	Debt to assets ratio	Return on net assets	Surplus cash coverage ratio
N	Valid	49	49	49	49	49	49	49	49	49
	Missing	0	0	0	0	0	0	0	0	0
Mean value		0.0137	0.0096	0.0119	0.0112	0.2856	0.0534	0.5471	0.07	1.4423
Standard difference		0.003	0.0023	0.0035	0.0034	0.2419	0.0874	0.1682	0.1167	5.5079
Maximum		0.0197	0.0167	0.0255	0.024	0.7355	0.2633	0.9276	0.5972	23.7007
Quartile 75		0.016	0.0111	0.0131	0.0136	0.4697	0.1148	0.6295	0.0902	1.5449
Median		0.0142	0.0094	0.0112	0.0104	0.325	0.0308	0.5312	0.0427	0.552
Quartile 25		0.0114	0.008	0.0097	0.0086	0.1114	-0.0041	0.447	0.0035	-0.2021
Minimum		0.0077	0.0054	0.0061	0.0059	-0.2504	-0.1986	0.219	-0.062	-15.1912

Source: Financial statements of Company Z's customers (2013)

Table 4-10 shows that:

(1) Bottleneck customers' day-to-day working capital management performance indicators are lower than the industrial level

The maximum, minimum and mean value of the inventory turnover ratio of 49 bottleneck customers are 0.0197, 0.0077 and 0.0137respectively, of which the mean value is 3.7 times smaller than the mean value of public companies in the industry 0.0421, indicating that the inventory turnover speed is much slower than the industry, *i.e.* long inventory turnover period, long occupation level of inventory and weak liquidity and cashability. The maximum, minimum and mean value of receivables turnover ratio are 0.0167, 0.0054 and 0.0096respectively, of which the mean value is 1.3 times smaller than the mean value of public companies in the industry 0.0124, indicating that the receivables turnover ratio of

bottleneck customers is slightly smaller than the industry, *i.e.* long receivables turnover period, slow collection speed, slow assets flow and weak solvency. The maximum, minimum and mean value of payables turnover ratio are 0.0255, 0.0061 and 0.0119respectively, of which the mean value is 1.89 times smaller than the mean value of public companies in the industry 0.0225, indicating that the payables turnover speed of bottleneck customers is nearly 1.9 times slower than the industry, *i.e.* long payables turnover period and more repayment pressure. The maximum, minimum and mean value of cash turnover ratio are 0.0240, 0.0059 and 0.0112 respectively, of which the mean value is slightly smaller than the mean value of public companies in the industry 0.0127, indicating that the cash turnover speed of bottleneck customers is slightly slower than the industry, *i.e.* slightly long cash turnover period and poor capital utilization effects.

(2) Bottleneck customers' solvency indicators are lower than the industrial level

The maximum, minimum and mean value of working capital allocation ratio are 0.7355, -0.2504 and 0.2856respectively, of which the mean value is nearly 1.9 times smaller than the mean value of public companies in the industry 0.5416, indicating that the solvency for short-term debts of bottleneck customers is slightly weak. The maximum, minimum and mean value of cash to current liabilities ratio are 0.2633, -0.1986 and 0.0534respectively, of which the mean value is nearly 6.5 times smaller than the mean value of public companies in the industry 0.3493 indicating that the net cash flow from operating activities in the current period of bottleneck customers is badly insufficient to repay short-term debts. The maximum, minimum and mean value of debt to assets ratio are 0.9276, 0.2190 and 0.5471respectively, of which the mean value is higher than the mean value of public companies in the industry 0.3272, indicating that the solvency of bottleneck customers is relatively weak.

(3) Bottleneck customers' profitability indicators are lower than the industrial level

The maximum, minimum and mean value of return on net assets are 0.5972, -0.0620 and 0.0700respectively, of which the mean value is lower than the mean value of public companies in the industry 0.0824, indicating that the return on net assets of bottleneck customers is lower than the industrial level and the capacity for self owned capital to gain net income is poor. The maximum, minimum and mean value of surplus cash coverage ratio are

27.7007, -15.1912 and 1.4423respectively, indicating that the mean value is slightly lower than the mean value of public companies in the industry 1.5332, indicating that the surplus cash coverage ratio of bottleneck customers is slightly lower than the industrial level and the guarantee of cash income in net profit for the current period is relatively high.

The day-to-day working capital management performance, solvency and profitability indicators of bottleneck customers are lower than the industrial level. Therefore, bottleneck customers are subject to working capital risk and have insufficient working capital, difficulty in financing and poor profitability.

Bottleneck customers may be subject to operating risks due to shortage of working capital and will often delay payment and even make Company Z's receivables become bad debts, consuming Company Z's resources. In addition, in case of abnormal operation of bottleneck customers due to working capital, end using enterprises will complain, damaging Company Z's image. For bottleneck customers lack of capital due to their own reasons, the thesis mainly takes the strategy of liberal attitude or withdrawal:

(1) Spot Cash or Advance Collection

Bottleneck customers are subject to large risks due to their own working capital, If Company Z determines a payment period for bottleneck customers, Company Z may not recover the payment for goods in time. In case of continuous deterioration of bottleneck customers' financial position, it will certainly cause serious risks to Company Z's receivables, affecting Company Z's working capital management performance. Therefore, Company Z takes the measures of not determining payment period, spot cash or advance collection to prevent the risk of bad debts due to failure in collection of payment for goods, which can reduce Company Z's working capital risk and improve the utilization efficiency of Company Z's working capital.

(2) Develop New Distribution Channels

Develop bottleneck customers with good capital credit reputation as distribution channels. The shortage of working capital of bottleneck customers may result in poor sales of Company Z in a region. Therefore, in order to prevent poor sales of Company Z among bottleneck customers, it is required to re-find distributors with certain financial strength and good operating conditions. Practice proves that not all customer relations should be retained.

Poor customers will nibble Company Z's profit. To prevent operating risks and consumption of Company Z's profit, it is better to reduce and gradually terminate the business relationship with them to reduce profit loss and invest Company Z's resources in other customer bases. For example, Company Z takes the measures of restricting or stopping delivery of goods to poor distributors with poor credit status and without development prospect to eliminate port distributors. In addition, for the bottleneck customers repudiating payment, Company Z will mobilize all forces to exert pressure and then fight back and even file a lawsuit. Terminating relationship with bottleneck customers without value, or with negative value or poor prospect at due time will let Company Z save the limited resources to seek for and serve new customer that better match their own benefits, growth and positioning targets.

It should be sensed that the relationship between Company Z and customers is dynamic. Company Z's identification of customers should also be a dynamic process. On the one hand, existing bottleneck customers may be lost due to the reasons of customers or Company Z. On the other hand, new customers will establish relationships with Company Z. Therefore, Company Z should promptly respond to the dynamics of bottleneck customers to prevent the adverse impact brought about by existing customers and take active actions for new customers in a prompt way.

4.5 Brief Summary

This chapter mainly conducts a classification analysis of the two-dimensional matrix built for suppliers and customers, and take appropriate operation strategies for different types of enterprises in the upstream and downstream supply chains. Company Z is recommended to support strategic-type suppliers in their growth by way of shortening payment plans and provision of finance guarantees; to enter into a strategic partnership with partner-type suppliers for long-term strategic cooperation and offer options contracts and extended payment plans; to maintain and make the best of the relationship with general-type suppliers, offering vendor-managed inventory schemes, tender procurement, and extended payment plans; to abandon the bottleneck-type suppliers and seek the alternatives; and is also recommended to support strategic-type clients in their growth by way of extending payment

plans and provision of finance guarantees; to strengthen strategic cooperation, establish strategic partnership with partner-type clients, and offer sale in advance; to maintain and make the best of the relationship with general-type customers via bulk discounts and shortened payment plans; to abandon or make no extra effort to keep a relationship with the bottleneck-type customers, by demanding cash on delivery or advanced payment meanwhile starting to develop new distribution channels.

Based on the working capital of supply chain, promotion of entire supply chain's efficiency and reduction of working capital risk are achieved from suppliers to Company Z and to the operation strategies for different customers.

Chapter 5: Supply Chain Risk Management Mechanism Giving Consideration to Working Capital

Normal operation of working capital is the key to enterprise's overall capital operation in the supply chain and undertakes the mission of value supplement and appreciation for enterprises in the supply chain. However, under the impact of many factors of the upstream and downstream supply chains, the working capital risk management in reality often becomes a weak part of supply chain and the working capital risk management measure has become one of the important contents of management of enterprises in the supply chain. Since the adoption of operation strategies for enterprises in the upstream and downstream supply chains, it is required to further manage working capital risk of supply chain.

5.1 Establishment of Early Warning Indicators

The early warning in this chapter is based on the operation strategies of supply chain in the previous chapter. It gives early warning for the risk changes brought about by the operation strategies of supply chain and takes appropriate risk management mechanism. The operation strategies of supply chain will often result in the increase in working capital risk. For example, the adoption of shortening payment period and option purchase strategy for upstream strategic suppliers will result in a decrease in payables period and increase in capital outflow in a short period, thus increasing Company Z's working capital risk; prolonging payment for partner suppliers will give rise to an increase in inventory turnover period, increase in occupation of capital by inventory in the long term and the risk of dull of sale, which will also increase Company Z's working capital risk. Similarly, prolonging the collection period for downstream strategic customers will cause an increase in the receivables turnover period, longer time of capital inflow and increase in Company Z's working capital risk; batch discount and prolonging collection period for general customers will also result in a decrease in inventory turnover ratio, increase in the occupation of capital by inventory in the

long term and the risk of dull of sale, which will ask increase Company Z's working capital risk. In addition, to provide guarantee to partner suppliers and partner customers may also let Company Z assume responsibilities and increase working capital risk. The above circumstances will increase operating risks in the actual operation strategies for supply chain and it is required to strictly manage the supply chain's working capital. If suppliers and customers are subject to serious working capital risks and early warning and management measures are not taken promptly, losses may be caused to the supply chain, thus affecting the entire supply chain's development.

The future uncertainty is risk and the major uncertain factors affecting working capital are in two aspects: supply and demand of working capital. The supply of working capital means the source of enterprise's working capital and varies with enterprise's characteristics of credit line, credit level, solvency for short-term debts, etc. The demand of working capital refers to enterprise's capita needs for guaranteeing normal operation and is the potential application of working capital in enterprise, and varies with enterprise's characteristics of economic environment, industrial characteristics, production scale, capital costs, working capital performance, value chain sections, etc. The balance between the supply and demand of working capital is often the basic principle for enterprise to seek for the optimal working capital size and also the staring point and purpose of improving working capital performance. While the future uncertainty makes it difficult to achieve a balance between the supply and demand of working capital, such imbalance of supply and demand results in the possibility of shortage of working capital and forms working capital risk. Therefore, working capital risk is the possibility of future working capital failing to meet the requirements of working capital under the impact of supply and demand of working capital. The early warning of working capital risk can help judge enterprise's existing conditions of working capital risk to provide decision basis for analysis of supply chain's working capital risk and implementation of relevant risk management.

Usually, it is a gradually deteriorating process when a company at the upstream/downstream of a supply chain sinks into trouble, and such a process can be reflected financially. Therefore, an indicator-based early warning system for working capital risk can help expose in a timely manner business problems and signs of working capital risk, warning

managers to take preventive and control measures to minimize the operating loss.

The early warning model for working capital risk as researched in the thesis is mainly the early warning model for financial crisis, which finds out the risks of enterprise with mathematical models based on financial information, accounting, corporate management and other theories and issues warnings to provide significant suggestions for enterprise to make reasonable decisions. Altman (1968) first utilized multi-variable analysis for discriminant analysis of enterprise's financial crisis and used five financial indicators including working capital/ total assets as discrimination functions established with the linear multivariate discriminate analysis, and the prediction effects in the two years before bankruptcy were the best. After that, many researchers, e.g. Dambolena and Khoury (1980) conducted similar researches. Blum (1974) selected 115 enterprises with financial crisis in the period from 1954 to 1968 as examples and used multivariate discriminate analysis as the research method to build the financial crisis predict model. Amy (1987) pointed out that there were three stages before enterprise's failure and five states were used to assess enterprise's financial position in building model. Platt (1990) used 57 crisis companies in the period from 1972 to 1986 as development samples and 34 crisis companies in the period from 1986 to 1987 as prediction samples, and found that the accuracy of the prediction model built with industrial relative ratios was superior to the prediction model built with general financial ratios. Hopwood (1989) et al. used 60 enterprises bankrupted in the period from 1974 to 1981 and 32 enterprises bankrupted in the period from 1982 to 1985 as later stage samples and built an early warning model for financial crisis with single variable and Logistic regression analysis. Baldwin and Gezen (1992) built a bankruptcy pretty model with annual data and quarter data.

Based on the above review of relevant financial crisis model, the thesis utilizes the financial data of Company Z and enterprises in the upstream and downstream supply chains for research on early warning of working capital risks.

2. Construction of Early Warning Model for Working Capital Risk of Supply Chain

In this thesis, the early warning model for working capital risk is mostly built upon the multivariate discrimination model, on which Altman (1968) built the Z-score model, as well as some earlier single-variable models. Firstly, analyze and identify key factors that may affect working capital through classifying factors affecting working capital risk; then quantify

such impact and define risk assessment criteria with financial indicators that may reflect such factors; based on such financial indicators, build a general functional equation and develop theory for the early warning of working capital risk; further, design the scoring table for the weighting of risk assessment indicators, using the Delphi method, and determine the weight for each indicator, using the AHP; finally, select typical samples among public companies in the computer, and communications and other electronics industries, calculate the average for each of the indicators, input the values into the early warning model and determines the upper and lower limits.

The specific model construction process is as follows:

(1) Indicators Selection

The section uses the 9 indicators determined by 10 experts as set out in chapter 3 of this thesis's the basis for indicators selection. The surplus cash coverage ratio is selected as the judgment indicator, *i.e.* using the positive and negative net working capital flow as the basis for judging whether enterprise's working capital is subject to risks; 8 indicators of inventory turnover ratio, receivables turnover ratio, payables turnover ratio, cash turnover ratio, working capital allocation ratio, cash to current liabilities ratio, debt to assets ratio, and return on net assets are used for judging the working capital conditions of enterprise.

(2) Model Construction

The early warning model for working capital established in this thesis is a quantitative indicator established with financial data, which can prevent the subjectivity of using non-financial data to judge working capital risk and reduce the difficulty in judgment of working capital risks, which is conducive to improving the management efficiency of the working capital of supply chain.

With reference to the Z-score model built by Altman (1968) and idea of working capital risk assessment model in chapter 3, and based on the indicators for analysis of working capital risks selected in the thesis, the functional equation of the early warning model for working capital risk is set as follows:

$$P = w_1X_1 + w_2X_2 - w_3X_3 + w_4X_4 + w_5X_5 - w_6X_6 + w_7X_7 + w_8X_8 \quad (5\text{-}1)$$

Where:

P: Early warning of working capital risk

X_1: Inventory turnover ratio;

X_2: Receivables turnover ratio;

X_3: Payables turnover ratio;

X_4: Cash turnover ratio;

X_5: Working capital allocation ratio

X_6: Cash to current liabilities ratio

X_7: Debt to assets ratio

X_8: Return on net assets

W_1, W_2, W_3, W_4, W_5, W_6, W_7 and W_8 are the weights of the indicators in the assessment model.

(3) Determination of Weights

Quote the weights determined with the Delphi method and AHP in chapter 3 of the thesis and place the weights of 8 indicators in the early warning model, then:

$$P = w_1X_1 + w_2X_2 - w_3X_3 + w_4X_4 + w_5X_5 + w_6X_6 - w_7X_7 + w_8X_8$$

$=0.142X_1+0.161X_2-0.0483X_3+0.148X_4+0.114X_5+0.152X_6-0.063X_7+0.121X_8$

5.2 Upper Early Warning Limits Design

318 public companies (2013) in the computer, communications and other electronics industries are chosen as subjects and the 2013 financial data of each company as a sample for analyzing the early warning of working capital risk with the enterprises in the supply chain. Among the samples, for the purposes of this thesis, 35 with abnormal values in desired indicators are firstly removed; and 69 with negative cash flow from operating activities in 2013 are removed for such negative cash flow would cause severe liquidity crisis. Hence, only 214 samples (sample capacity: 214) are adopted to determine the upper early warning limits.

1. Determination of Upper Limit Standard

The judgment standard of the early warning model for working capital risk built in the

thesis is built on the basis of 8 indicators used for determining the working capital risk degree in building the model. Take the mean value of the indicators of the aforementioned 214 samples and multiply it with weights to obtain the upper limit of early warning of working capital risk P_H. Two circumstances, *i.e.* General working capital risk crisis and high stability without working capital risk crisis: the enterprises with the risk value of P_h and above are deemed as high stability without working capital risk crisis and have sufficient working capital; the enterprises with the risk value of P_H and below are deemed as general working capital risk crisis.

Through calculating the P value of each sample and comparing P value with the industrial risk value P_H, the specific judgment rules are as follows: if the sample's P value is larger than or equivalent to P_H, it can be judged that the enterprise will have very sufficient working capital and not be subject to working capital risk crisis; if the sample's P value is less than P_H, it can be determined that the enterprise will have insufficient working capital and may be subject to working capital risk crisis.

2. Analysis of Results

With the 214 samples, the averages of 8 indicators, namely, inventory turnover, receivables turnover, payables turnover, cash turnover, working capital allocation ratio, cash to current liability ratio, debt to asset ratio, and surplus cash coverage ratio are calculated (See Table 5-1):

Table 5-1 Average Upper Limits of Early Warning Indicators

Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liability ratio	Debt to asset ratio	Surplus cash coverage ratio
0.0406	0.0122	0.0218	0.0129	0.5221	0.3399	0.3345	0.0964

Source: CSMAR financial research database (2013)

Place the mean values of 8 indicators in the early warning model for working capital risk to calculate the upper limit of early warning of working capital risk:

$$P_H=0.142X1+0.161X2-0.0483X3+0.148X4+0.114X5+0.152X6-0.063X7+0.121X8$$

$$=0.142*0.0406+0.161*0.0122-0.0483*0.0218+0.148*0.0129+0.114*0.5221$$

+0.152*0.3399-0.063*0.3245+0.121*0.0964

=0.1848

P_H: The upper limit of early warning of working capital risk

Then, place the data of 214 enterprises in the early warning model for working capital to calculate the P value in 2013 and summarize the working capital risk judgment results. The calculation and statistics of results and the specific conditions are set out in Appendix 3.

Compare each enterprise's P value with the standard value P_H, and judge the early warning model for working capital risk in the industries of computer, communication and other electronic industries established in the thesis according to the judgment standard. The final results of all judgment samples calculated show that there are 126 enterprises with the value of above 0.1848, representing 58.87% of total number of samples; 88 enterprises with the value of less than 0.1848 (including two ST enterprises), representing 41.13% of the total number of samples. Therefore, the upper limit of early warning of working capital risk established in the thesis is 0.1848.

5.3 Lower Early Warning Limits Design

Similarly, 318 public companies (2013) in the computer, communications and other electronics industries are chosen as subjects and the 2013 financial data of each company as a sample for analyzing the early warning of working capital risk with the enterprises in the supply chain. Among the samples, for the purposes of this thesis, 35 with abnormal values in desired indicators are firstly removed; and 214 with positive cash flow from operating activities in 2013 are removed for such positive cash flow would not cause severe liquidity crisis. Hence, only 69 samples (sample capacity: 69) are adopted to determine the lower warning limits.

1. Standard for Determining Lower Limit

The judgment standard of the early warning model for working capital risk built in the thesis is built on the basis of 8 indicators used for determining the working capital risk degree in building the model. Take the mean value of the indicators of the aforementioned 69 samples and multiply it by weights to obtain the lower limit of early warning of working

capital risk P_L. Two circumstances, *i.e.* General working capital risk and serious working capital risk crisis: the enterprises with the risk value larger than or equivalent to P_L are deemed as general working capital risk and may be subject to working capital risk; the enterprises with the risk value lower than P_L are deemed as serious working capital risk and have serious working capital crisis.

Through calculating the P value of each sample and comparing P value with the lower limit value of early warning P_L, the specific judgment rules are as follows: if the sample's P value is larger than or equivalent to P_L, it can be judged that the enterprise has general working capital risk; if the sample's P value is less than P_L, it can be determined that the enterprise may be subject to serious working capital risk.

2. Analysis of Results

With the 69 samples, the averages of 8 indicators, namely, inventory turnover, receivables turnover, payables turnover, cash turnover, working capital allocation ratio, cash to current liability ratio, debt to asset ratio, and surplus cash coverage ratio are calculated (See Table 5-2):

Table 5-2 Average Lower Limits of Early Warning Indicators

Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liability ratio	Debt to asset ratio	Surplus cash coverage ratio
0.0187	0.0087	0.0198	0.0098	0.5316	-0.1993	0.3482	0.0162

Source: CSMAR financial research database (2013)

Place the mean values of 8 indicators in the early warning model for working capital risk to calculate the lower limit of early warning of working capital risk:

$P_L=0.142X_1+0.161X_2-0.048_3X_3+0.148X_4+0.114X_5+ 0.152X_6-0.063X_7+0.121X_8$

$=0.142*0.0187+0.161*0.0087-0.048_3*0.0198+0.148*0.0098+0.114*0.5316$

$+0.152*(-0.1993)-0.063*0.3482+0.121*0.0162$

$=0.0149$

P_L: The lower limit of early warning of working capital risk

Then, place the data of 69 enterprises in the early warning model for working capital to

calculate the P value in 2013 and summarize the early warning judgment results of working capital risk. The calculation and statistics of results and the specific conditions are set out in Appendix 4.

Compare each enterprise's P value with the standard value P_L, and judge the early warning model for working capital risk in the industries of computer, communication and other electronic industries established in the thesis according to the judgment standard. The final results of all judgment samples calculated show that there are 36 enterprises (including one ST enterprise: *ST Yanhuang) with the value of above 0.0149 representing 52.17% of total number of samples; 33 enterprises with the value of less than 0.0149 (including one ST enterprise: *ST Chuangzhi), representing 47.83% of the total number of samples. Therefore, the lower limit of early warning of working capital risk established in the thesis is 0.0149.

The analysis of 283 enterprises is as shown in Figure 5-1.

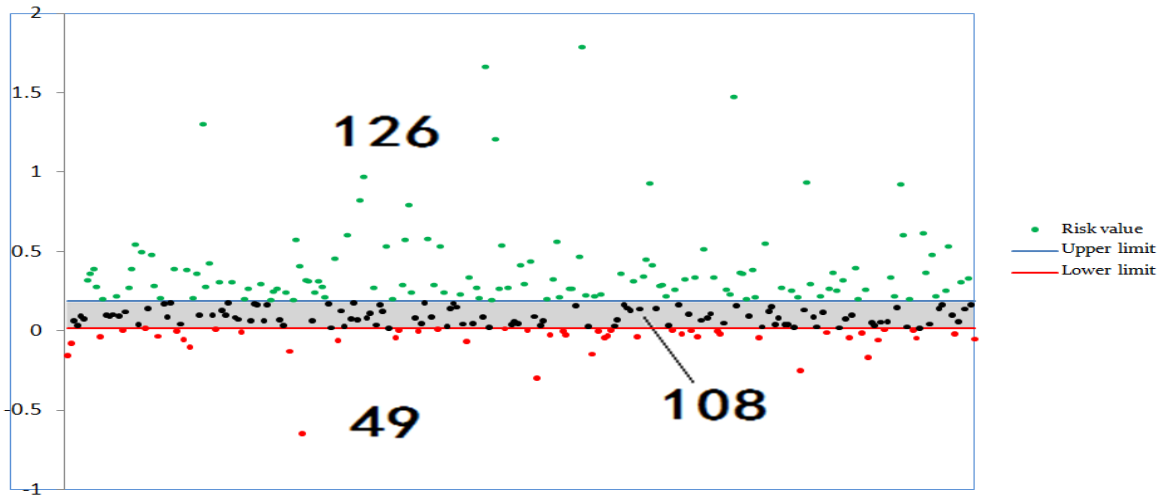

Figure 5-1 Risks of 283 Enterprises in the Industry in 2013

Source: CSMAR financial research database (2013)

Among the 283 enterprises, there are 126 enterprises with the value larger than 0.1848, representing 44.52% of the total number; 108 enterprises with the value lower than 0.1848, representing 33.16% of the total number; and 49 enterprises with the value of less than 0.0149, representing 17.31% of the total number.

5.4 Risk Management Mechanism

The management of risk intervals of enterprises in the supply chain is conducted through judgment of the crisis with working capital of upstream and downstream enterprises. The establishment of an early warning system for working capital risk allows prompt early warning of working capital risk crisis of the upstream and downstream supply chains, and then appropriate risk management measures can effectively improve the working capital management level for the current year, reduce working capital risk and lift the working capital risk value to be above the upper limit of the industry, guaranteeing the safety of working capital. Therefore, the early warning system for working capital risk can effectively manage the working capital risk of supply chain.

5.4.1 Analysis and Management of Early Warning of Company Z's Working Capital Risk

The early warning of working capital risk in this section mainly takes: early warning for 3 level 1 indicators of day-to-day working capital management performance, solvency and profitability and 8 level 2 indicators, and then gives a comprehensive early warning of working capital risk. The comparison of the indicators based on the operation for the current year with the upper and lower limits of early warning can determine whether there is any risk. If it is larger than the upper limit of early warning, it is in the safe zone with little risk; if it is smaller than the upper limit and larger than the lower limit of early warning, it is in the grey zone with certain risks and it is required to take relevant management measures; if it is lower than the lower limit of early warning, it is subject to large risk and requires attention and relevant management measures. It is necessary to conduct real-time monitoring of the execution of operation strategies based on the early warning indicators of working capital risk and early warning model for working capital risk to judge whether Company Z has crisis or financial defect, e.g. Product overstocking, increase in receivables, decrease in the return on net assets, etc. An appropriate feasible capital risk management mechanism should de developed according to the reason and process of formation to relieve damage.

1. Early Warning of Day-to-day Working Capital Management Performance

(1) Early Warning of Inventory

The inventory turnover ratios of Company Z in the period from 2007 to 2014 are shown in Figure 5-2:

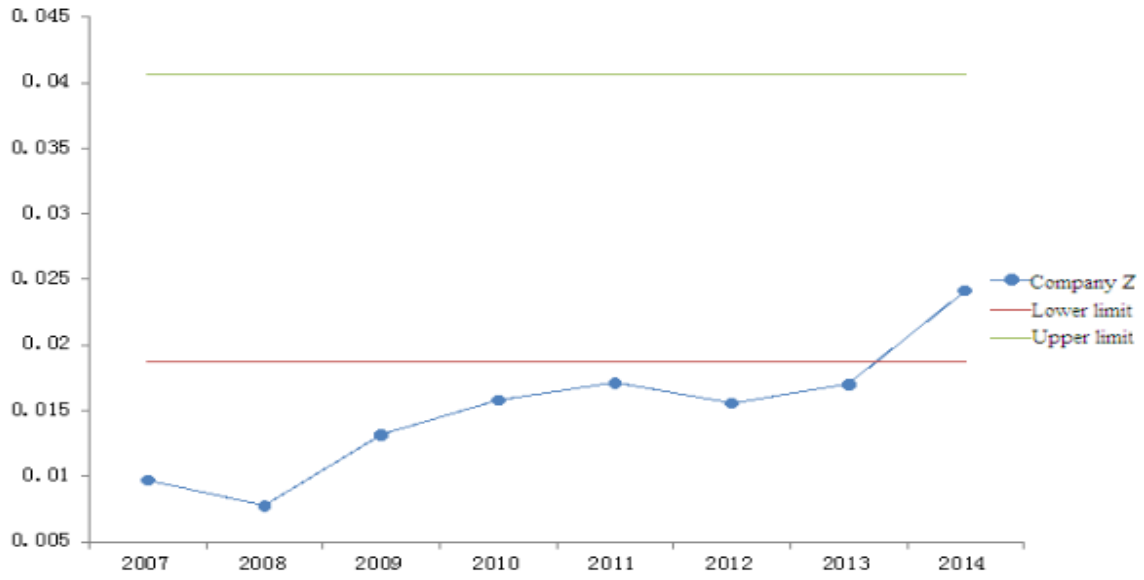

Figure 5-2 Change Trend of Inventory Turnover Ratio of Company Z

Source: Financial statements of company Z (2007-2014)

The inventory turnover period of Company Z in 2007 is very long and the inventory turnover ratio is 0.0097, seriously affecting the efficiency of working capital. In 2008, the quantity of dead inventory increased due to the improper production plan, resulting in a decrease in inventory turnover ratio to 0.0077. In July 2009, Company Z further strengthened the day-to-day accounting management of inventory and utilized ERP for inventory management to further enhance the inventory turnover speed to 0.0132. In 2010-2011, the inventory turnover ratio increased for two consecutive years due to the implementation of lean production and actual zero inventory management mode. At the end of 2013, researches started on the upstream and downstream supply chains and appropriate operation strategies were adopted, and a sales prediction system was built to determine the inventory demand. In 2014, the inventory turnover period shortened substantially and the inventory turnover ratio rose to 0.0268. Therefore, inventory management can be strengthened from the following five

aspects:

① Establish a scientific sales prediction system to determine the inventory demand, strengthen the prediction of the inventory, procurement amount and procurement time of raw materials, determine the inventory demand according to estimates of direct materials in a reasonable way, and implement basing production on sales to maintain a balance between production and sales. The development of a reasonable operation strategy of Company Z will make the inventory structure more reasonable, shorten the inventory storage time, speed up inventory turnover and is an effective means for Company Z to save capital and control costs and expenses.

② Develop a scientific inventory model and implement zero inventory management model. An economic order batch model can be applied to determine the procurement batch when the inventory cost is the lowest and an inventory capital plan should be formulated for reasonable determination of the occupation of inventory capital. The ABC analytical method can be adopted for hierarchical control of inventory capital and control of capital by types, varieties, and specifications to minimize inventory and even achieve zero inventory and greatly improve the flexibility of production supply chain.

③ Adopt lean production and introduce the way of "just-in-time" for production to manage inventory, accelerate materials turnover speed of production and reduce overstock in the process. The so called "just-in-time" is a production system without or with the minimum inventory, targeting at reducing enterprise's inventory, waste and costs, thus reducing inventory risk, ultimately increasing Company Z's profit and enhance enterprise's competitive position.

④ Enterprise should conduct strict day-to-day accounting for the purchase, release and inventory and promptly record the breakdowns and general ledger of inventory. It is required to regularly check the book value of inventory and make reasonable provision for price fall of the inventory with the net realizable value lower than its book value.

⑤ ERP and other advanced management modes can be utilized to strengthen inventory management, and a set of complete inventory early warning system can be established for evaluation, analysis and control of inventory risks.

The turnover ratio of Company Z in 2014 was 0.0242, in the range of the early warning upper limit 0.0406 and lower limit 0.0187 of inventory turnover ratio. Therefore, the inventory turnover ratio of Company Z increased in 2014, *i.e.* inventory turnover period decreased, while further enhancement is required as there is still a large gap with the upper limit of early warning.

(2) Early Warning of Receivables

The receivables turnover ratios of Company Z in 2007-2014 are as shown in Figure 5-3:

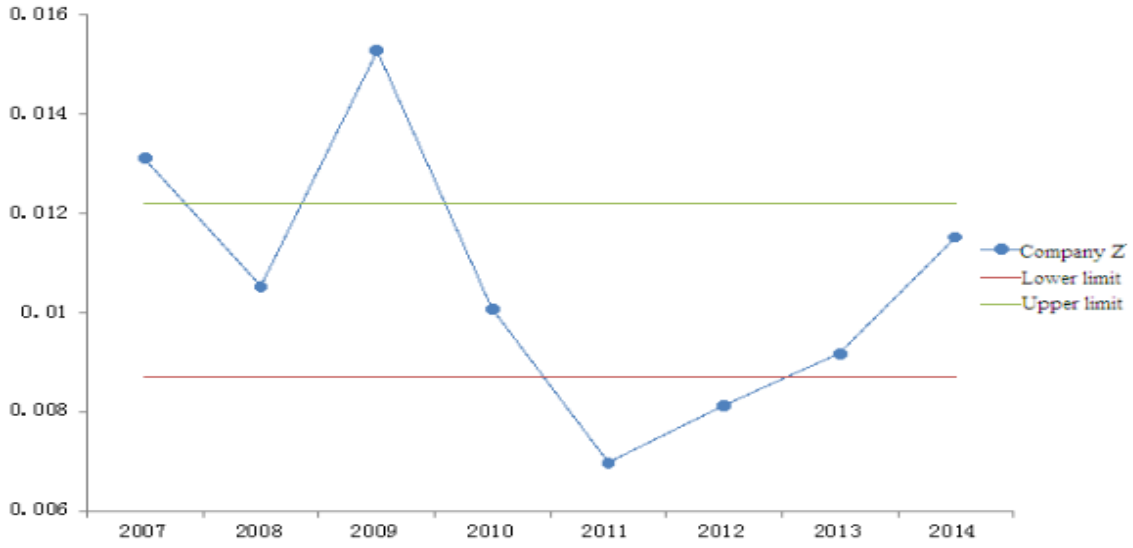

Figure 5-3 Change Trend of Receivables Turnover Ratio of Company Z

Source: Financial statements of company Z (2007-2014)

With the increase in customers and continued growth of operating performance, Company Z fails to attaché importance to receivables management. In 2012, the receivables turnover ratio decreased to 0.0070 and some customers defaulted payment for goods and even caused some bad debt losses, resulting in increase in receivables turnover period and certain working capital risks. In 2012-2104, Company Z started to further stress the management of receivables, and took such measures as establishment of a customer rating system, adoption of reasonable sales in credit policy, improvement of collection system, etc. to further enhance the receivables turnover speed. The receivables turnover speed increased year by year, improving capital appreciation speed and assets operation efficiency. Therefore, the enhancement of receivables management can be conducted from the following 5 aspects:

① Establish and improve the customer rating system to reduce credit risk. Enterprise should expand credit sales in a scientific and reasonable way, striving to increase Company Z's realizable operating income, conduct in-depth investigation and collect customers' credit information, adopt qualitative analysis and quantitative analysis for the information of customers' credit, determine credit conditions, credit period, credit line, credit standard, etc. of receivables and minimize the risk of bad debt loss of receivables.

② Adopt reasonable sales on credit policy. Enterprise should adopt different sales on credit policies according to the specific conditions of Company Z, e.g. guaranteed sales on credit and conditional sales on credit, to prevent bad debt of receivables to the great extent. Company Z can select proper way of settlement depending on customers' profitability, solvency and credit standing, *i.e.* the way with little settlement risk can be applied for the customers with good credit standing, profitability and solvency to promote the buyer and seller to establish a partnership of mutual trust, so as to enlarge the sales channel and improve enterprise's competitiveness; otherwise, a way of settlement with little risk and strong confining ability should be selected to strengthen management of receivables.

③ Establish and improve the receivables collection system. Different collection policies should be adopted for receivables in different circumstances and it is required to clarify the person in charge of receivables collection and measures for award and punishment.

④ Strengthen day-to-day management of receivables. Company Z should analyze and control the operation of receivables in operating activities, promptly find out problems and take measures in advance to prevent losses.

⑤ It is required to regularly conduct aging analysis for receivables and make reasonable provisions for bad debts to reduce the risk of receivables of Company Z.

⑥ A complete receivables early warning system should be established to evaluate, analyze and control the risk of receivables.

The receivables turnover ratio of Company Z in 2014 was 0.0125, in the range of the early warning upper limit 0.0122 and lower limit 0.0087 of receivables turnover ratio. Therefore, the receivables turnover ratio of Company Z continued to increase in 2014, indicating that the receivables turnover period decreased while did not reach the upper limit of

early warning, pending further promotion.

(3) Early Warning of Payables

The payables turnover ratios of Company Z in 2007-2014 are shown in Figure 5-4:

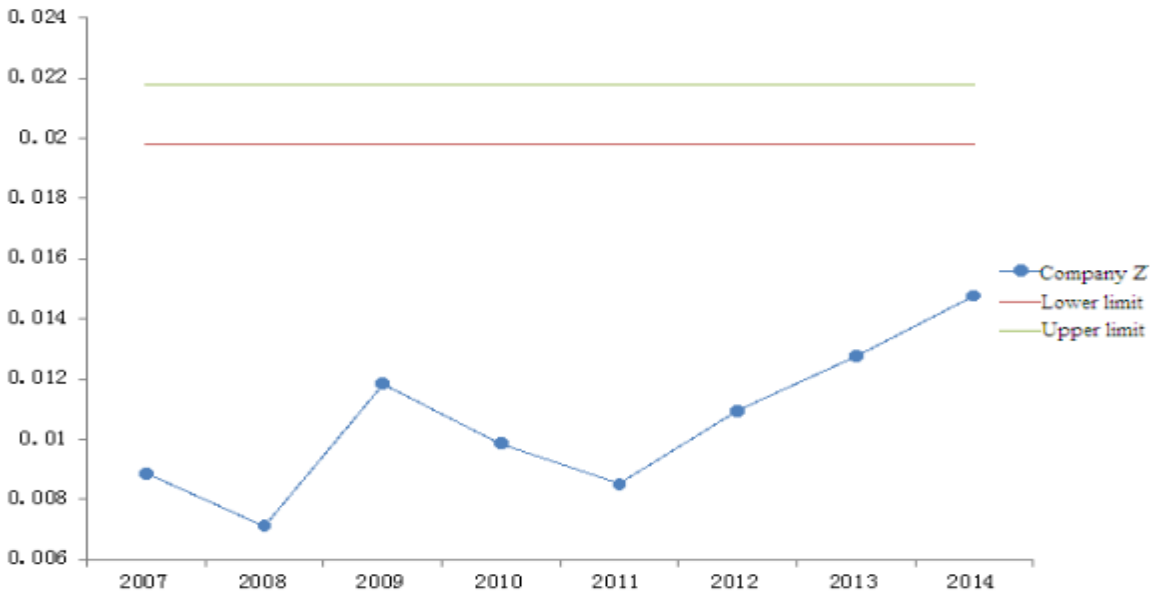

Figure 5-4 Change Trend of Payables Turnover Ratio of Company Z

Source: Financial statements of company Z (2007-2014)

Company Z seriously defaulted the payments for goods due to suppliers in 2007 and 2008, resulting in many suppliers exited Company Z's supply chain, which significantly affected Company Z's production and operation. In 2009, due to the incomplete procurement approval system, most payments for goods were made without the approval by the persons in charge, giving rise to a sharp increase in receivables turnover ratio, *i.e.* A substantial decrease in the receivables turnover period. Then, in2010 and 2011, since it defaulted the payments for goods due to suppliers for a long time, some suppliers refused to sell materials to Company Z on credit. In the recent 3 years, the relationship with suppliers was improved and Company Z's working capital risks were decreased through the following measures:

① Determine the payables control objectives. The factor directly affecting payables is inventory and the exogenous variables of inventory include operating environment, price trend, operation strategy and management mode. Company Z is required to determine a reasonable inventory according to these variables and accelerate inventory turnover to let

capital inflow match with capital outflow and reduce risk of payables on the premise of satisfying production and operation.

② Conduct aging analysis of payables. Aging analysis is used to show the amount of payables available to Company Z in the payment period and the amount of payables beyond the payment period. The payables within the payment period will not cause losses to Company Z. It is better to make payments before the expiry to win the most time value. The payables beyond the payment period may bring about discount loss and even punishment to Company Z. It is required to take measures promptly for remedy to reduce the loss and negative impact caused by breaking promises.

③ Establish multi-level restricting procurement approval formalities and improve Company Z's internal control system. It is necessary to formulate materials purchaser management method, materials procurement price management method, materials procurement tendering management method, materials procurement contract management method, materials procurement capital management method, inventory management method, materials procurement audit management method, etc. to clarify the powers and responsibilities of departments and persons in charge in respect of system. Company Z's payables should be controlled at the optimal level through approval of procurement plan, procurement price, procurement quantity, procurement amount, payment period, etc.

④ Establish a complete payables early warning system to evaluate, analyze and control risk of payables.

The payables turnover ratio of Company Z in 2014 was 0.0148, lower than the lower limit of payables turnover ratio 0.0198. Therefore, Company Z's payables turnover ratio continued to increase in the recent 3 years but was still low and had not reached the lower limit of early warning of payables turnover ratio. There are large risks and it is required to strengthen management of payables.

(4) Early Warning of Capital

Strengthening the day-to-day management of the working capital of internal supply chain can further improve the working capital management performance, thus reducing working capital risks. The cash turnover ratios of Company Z in 2007-2014 are shown in Figure 5-5:

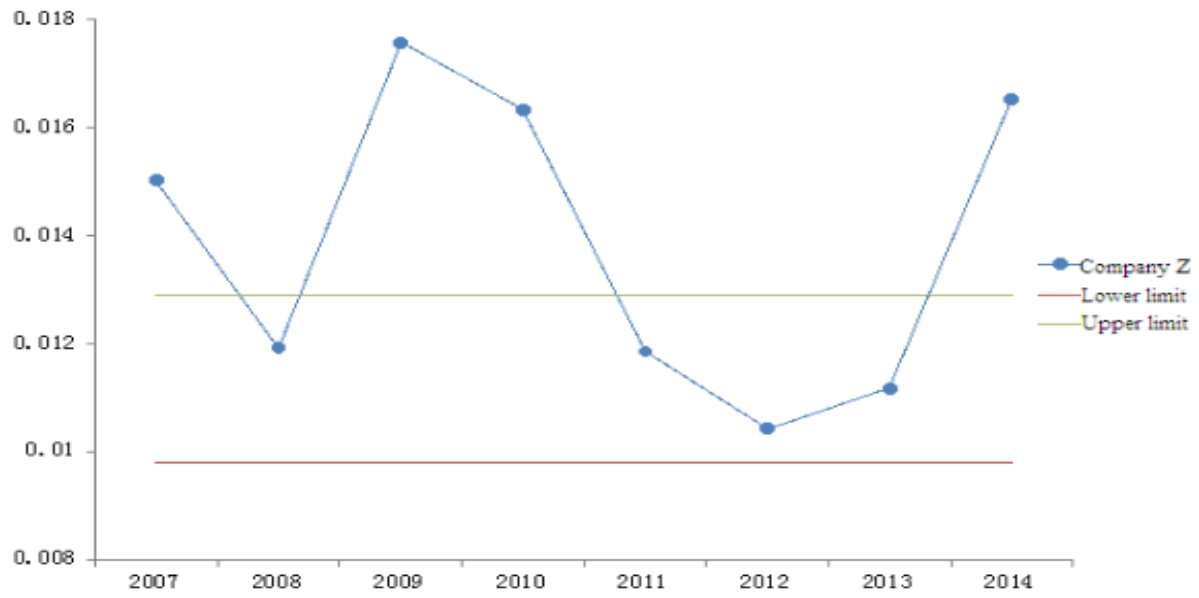

Figure 5-5 Change Trend of Cash Turnover Ratio of Company Z

Source: Financial statements of company Z (2007-2014)

In 2008, Company Z's cash turnover ratio was low due to the impact of inventory, receivables and payables. In 2009 and 2010, the cash turnover period decreased through improving the management of capital, inventory, receivables and payables. However, in 2011 and 2012, due to the increase in operating income, the management of capital plan was neglected, resulting in an increase in cash turnover period; At the end of 2013 and in 2014, consideration was given to the operation strategy of supply chain, which further improved the cash turnover ratio in a rhythmic way and guaranteed sufficient working capital for Company Z, preventing working capital risk.

① The good "hematopoiesis" function of capital can be improved through sound capital budget management and implementing petty cash system for all departments' cash of Company Z, to solve the crisis of temporary financial gap of enterprise. Advance planning can be conducted through capital budget management to assess the possible working capital risks, and appropriate risk strategy can be adopted to control and relieve risks to realize Company Z's operating objectives.

② The way of increasing cash inflow and reducing cash outflow, e.g. strengthening management of current accounts and inventory, can be applied to speed up the turnover of inventory and receivables, make full use of idle capital, accelerate the turnover of capital and

improve the capital utilization efficiency.

③ Investment, financing and corporate assets can be controlled through management of capital budget. Financing via a number of channels can maintain financial flexibility, guarantee the smooth progress of enterprise's day-to-day operating activities and prevent enterprise from benign caught in the financial crisis of capital chain rupture.

④ The effective management of capital flow and capital process can guarantee that capital can satisfy the needs of day-to-day operating activities without idle capital, so that enterprise should determine the optimal capital holdings and strengthen the control over capital shortage costs and carrying costs.

⑤ Strengthen control over capital authorization approval. In 2008, the nonstandard payables approval management of Company Z seriously affected the working capital for the current year, increasing working capital risk. Therefore, it is particularly import to strengthen control over authorization approval. Authorization control refers to the approval of authorization for specified procedures that must be undergone by enterprise in transacting various economic businesses. In respect of capital usage, Company Z should develop hierarchical capital approval standards and authorities based on its own conditions and arrange expenditures according to the approved cash flow budget and capital expenditure budget. Approach restricting measures for capital should be formulated and handlers should obtain approval in conducting business activities. It is not allowed to deal with capital collection and expenditure businesses without authorization. For material businesses and matters, Company Z should implement collective decision making or countersignature system and individuals are not allowed to independently make decisions or change collective decisions at random.

⑥ Establish a complete capital early warning system to evaluate, analyze and control capital risk and strengthen internal control and capital risk management. Enterprise should predict capita risk in advance to prevent more losses.

The cash turnover ratio of Company Z in 2014 was 0.0165, higher than the upper limit of early warning of cash turnover ratio 0.0129. Therefore, the cash turnover ratio indicators of Company Z in 2014 were good with a short cash turnover period and rapid cash turnover.

(5) Early Warning of Day-to-day Working Capital Management Performance

The day-to-day working management performance of Company Z in 2007-2014 is shown in Figure 5-6:

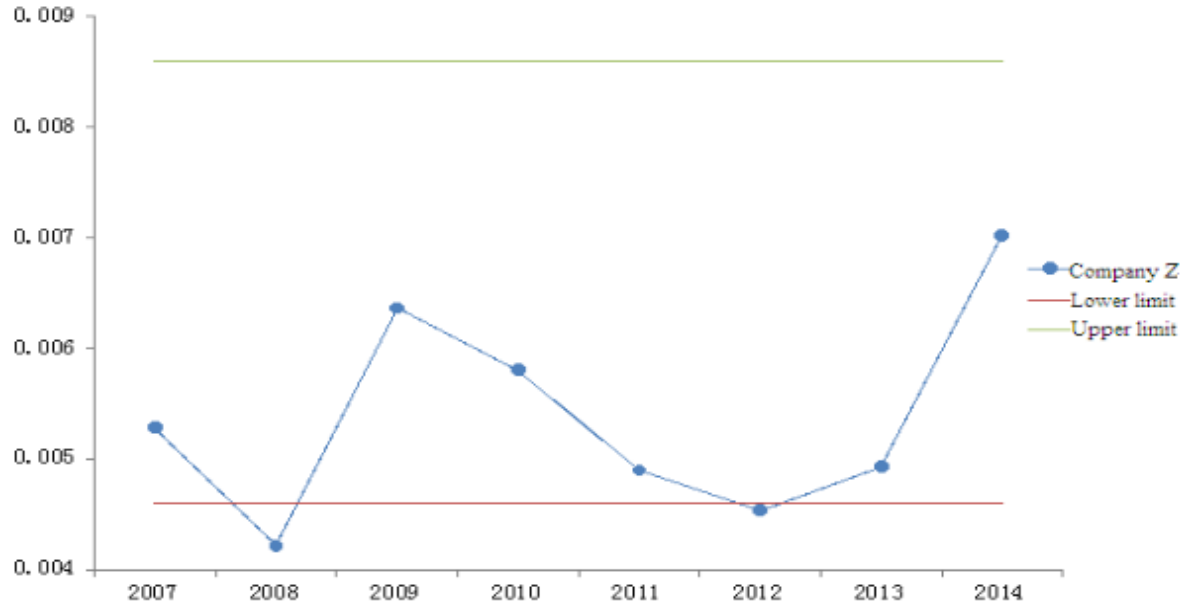

Figure 5-6 Change Trend of Day-to-day Working Capital Management Performance of Company Z

Source: Financial statements of company Z (2007-2014)

The day-to-day working capital management performance of Company Z in 2014 was 0.0070, higher than the average day-to-day working capital management performance in 2009-2013 0.0053, and between the upper limit 0.0086 and lower limit 0.0046 of early warning of day-to-day working capital management performance. Therefore, the day-to-day working capital management performance indicators of Company Z increased in 2014, but had not reached the upper limit of early warning, pending further enhancement.

2. Early Warning of Solvency

(1) Early Warning of Working Capital Allocation

The working capital allocation ratios of Company Z in 2007-2014 are shown in Figure 5-7:

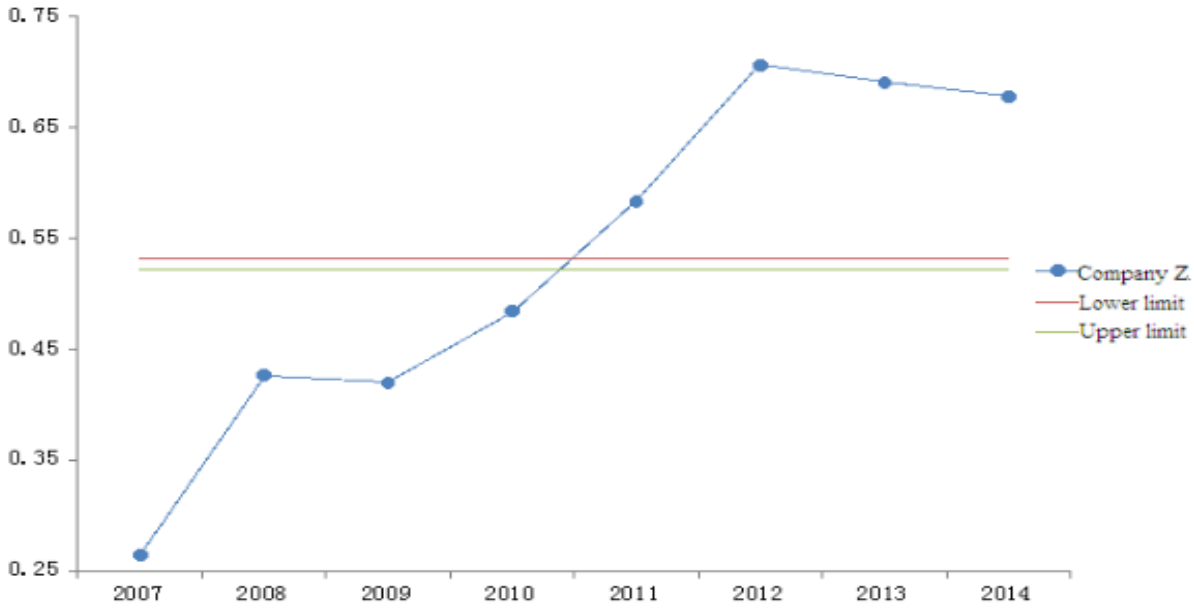

Figure 5-7 Change Trend of Working Capital Allocation Ratio of Company Z

Source: Financial statements of company Z (2007-2014)

The working capital allocation ratio of Company Z increased with the continued increase in sales performance in 2008-2012, and was stable in 2013 and 2014.

The working capital allocation ratio of Company Z in 2014 was 0.6783, higher than the upper limit of working capital allocation ratio 0.5221. Therefore, the working capital configuration indicators of Company Z in 2014 were good.

(2) Early Warning of Cash to Current Liabilities Ratio

The cash to current liabilities ratios of Company Z in 207-2014 are shown in Figure 5-8:

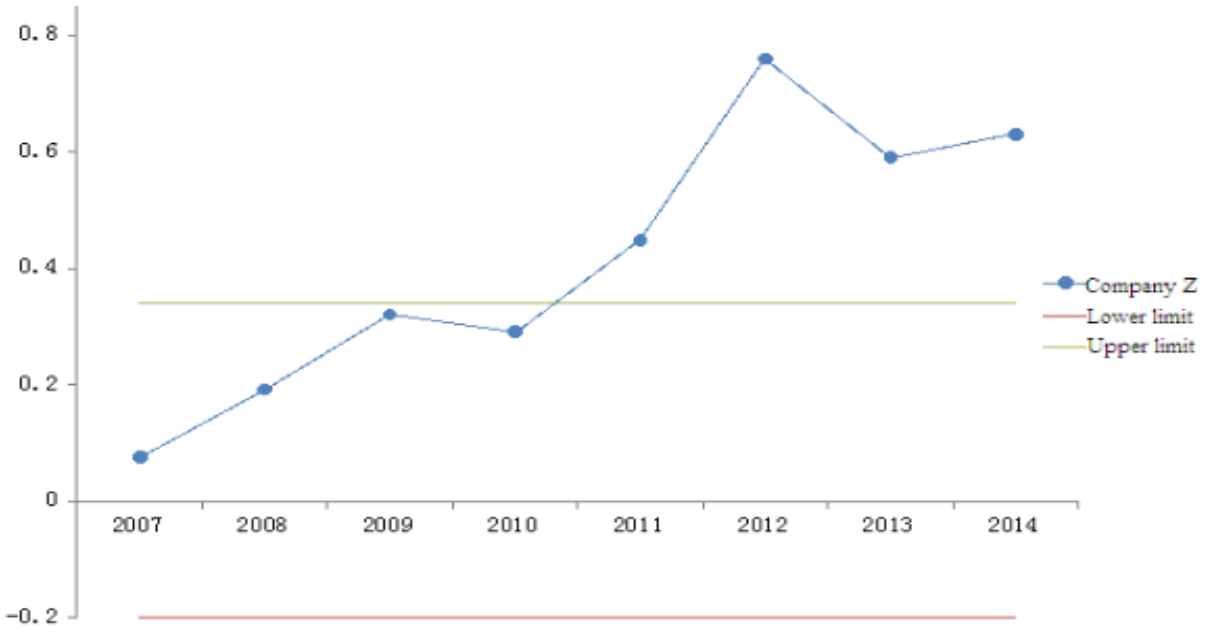

Figure 5-8 Change Trend of Cash to Current Liabilities Ratio of Company Z

Source: Financial statements of company Z (2007-2014)

Company Z's cash to current liabilities ratio continued to increase for two consecutive years in 2008-2009 and slightly decreased in 2010 under the impact of liabilities including payables, etc.; the radio increased in 2011 and reached the maximum in 2012; and finally became stable in 2013 and 2014.

The cash to current liabilities ratio of Company Z in 2014 was 0.6303, far higher than the upper limit of early warning of cash to current liabilities ratio 0.3399. Therefore, the indicators of cash to current liabilities ratio were very good in 2014.

(3) Early Warning of Debt to Assets Ratio

The debt to assets ratio of Company Z in 2007-2014 is shown in Figure 5-9:

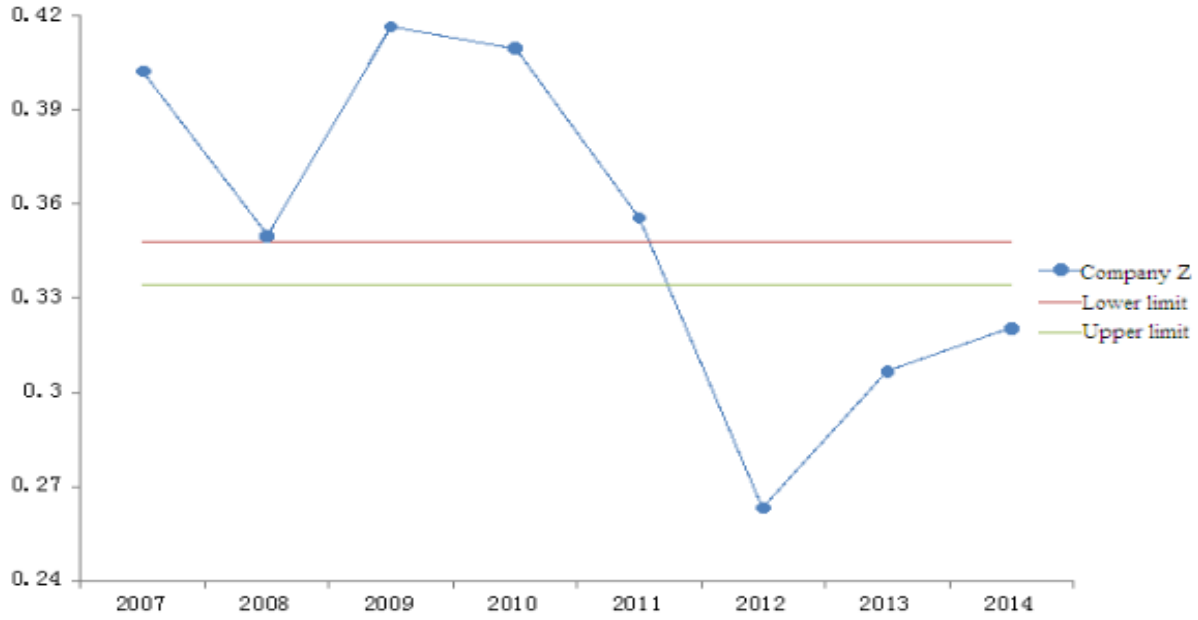

Figure 5-9 Change Trend of Debt to Assets Ratio of Company Z

Source: Financial statements of company Z (2007-2014)

The debt to assets ratio of Company Z decreased in 2009-2012, and reached the lowest at 0.2631. The ratio slightly rose in 2013 and 2014.

The debt to assets ratio of Company Z in 2014 was 0.3205, lower than the upper limit of early warning of debt to assets ratio 0.3345. Therefore, the indicators of debt to assets ratio of Company Z were good in 2014.

(4) Early Warning of Solvency

The solvency of Company Z in 2007-2014 is shown in Figure 5-10:

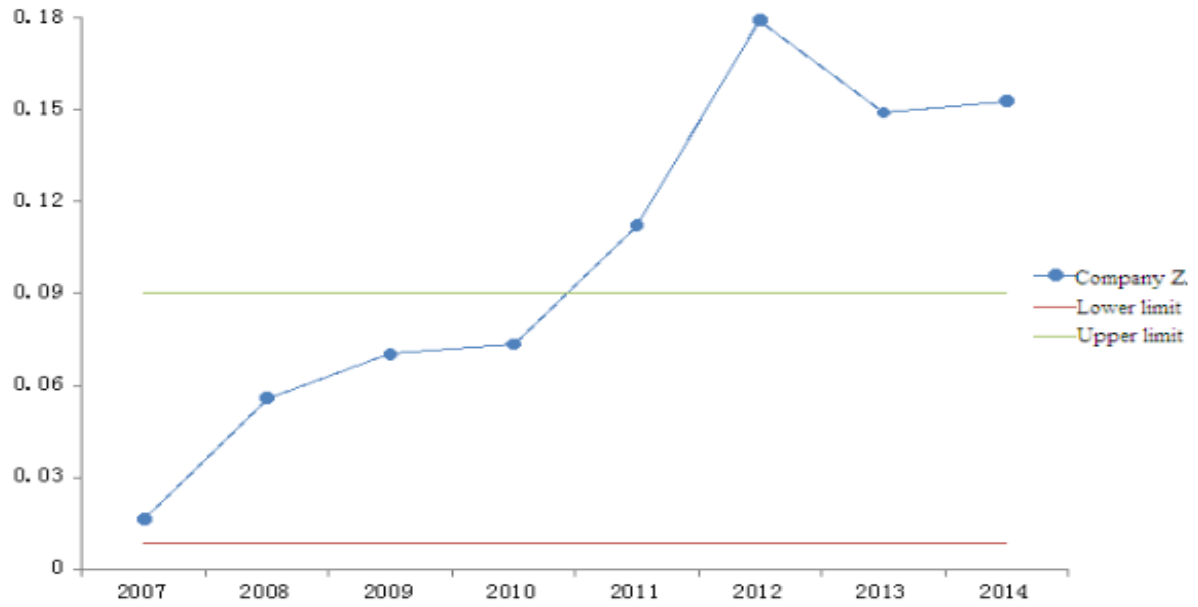

Figure 5-10 Change Trend of Solvency of Company Z

Source: Financial statements of company Z (2007-2014)

The solvency of Company increased in 2009-2012, and reached the highest at 0.1795 in 2012. It then fell and became stable in 2013 and 2014.

The solvency of Company Z in 2014 was 0.1529, higher than the upper limit of early warning of solvency 0.0901. Therefore, the solvency indicators of Company Z in 2014 were very good.

3. Early Warning of Profitability

(1) Early warning of return on net assets

The return on net assets of Company Z in 2007-2014 is shown in Figure 5-11:

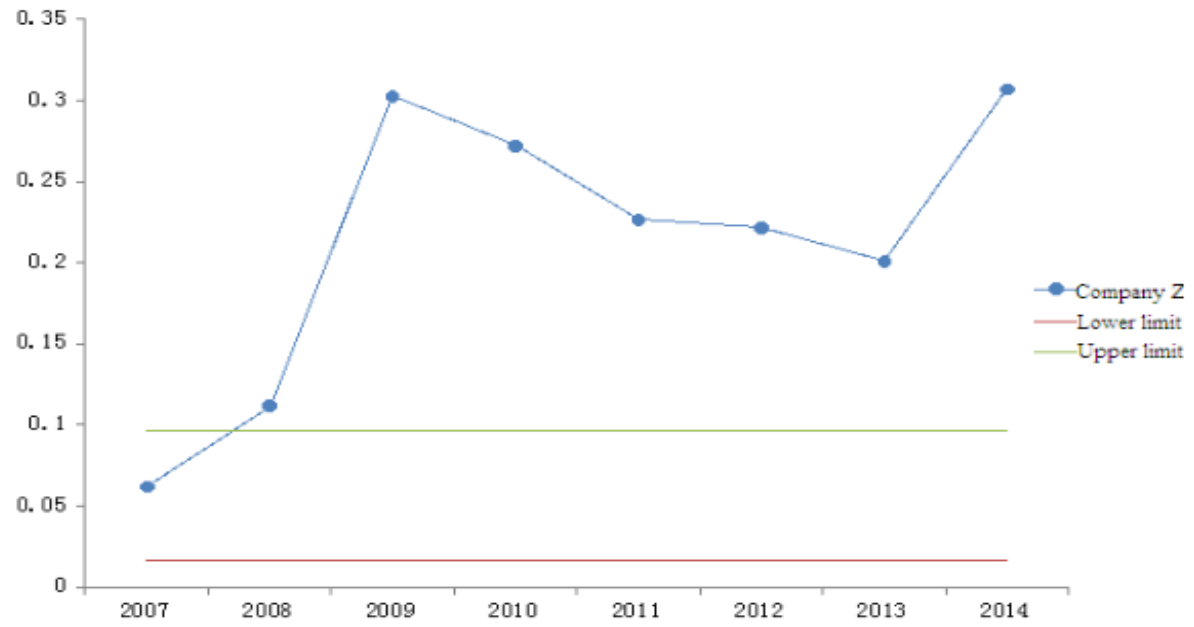

Figure 5-11 Change Trend of Return on Net Assets of Company Z

Source: Financial statements of company Z (2007-2014)

The return on net assets of Company Z rose in 2007-2009 and then decreased in 2010-2013. In 2014, relevant operation strategies effectively reduced costs and increased profit and approached the level of 2009.

The return on net assets of Company Z in 2014 was 0.3071, far higher than the upper limit of early warning of return on net assets 0.0964. Therefore, the indicators of return on net assets were very good in 2014.

(2) Early Warning of Profitability

The profitability of Company Z in 2007-2014 is shown in Figure 5-12:

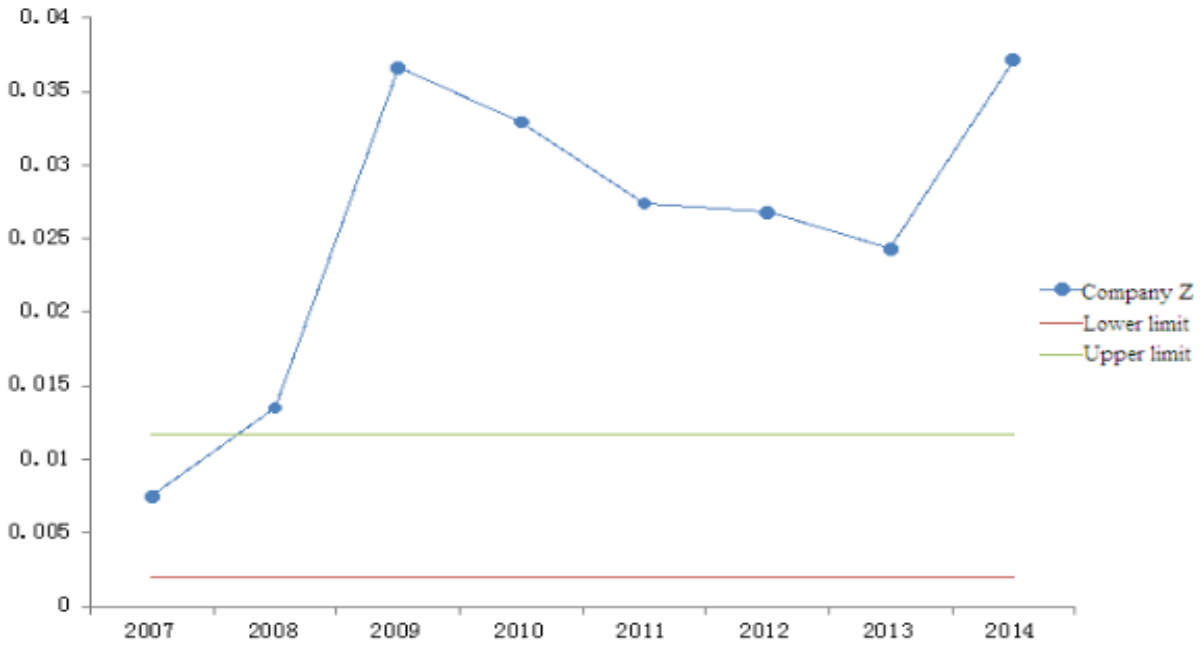

Figure 5-12 Change Trend of Profitability of Company Z

Source: Financial statements of company Z (2007-2014)

The profitability of Company Z increased in 2007-2009 and then decreased in 2010-2103. In 2014, relevant operation strategies effectively reduced costs and increased profit and exceeded the level of 2009.

The profitability of Company Z in 2014 was 0.0372, far higher than the upper limit of early warning of profitability. Therefore, the profitability indicators of Company Z were very good in 2014.

4. Early Warning with the Early Warning Model for Working Capital Risk

The early warning model for working capital risk offers an effective tool for working capital risk management in the long run. When it becomes aware of an early warning, Company Z can take precautions and adjust its operations and management to reduce the risk and maintain it within an acceptable range. Furthermore, the model also provides a set of well-coordinated quantitative standards to measure from a macroscopical perspective the working capital risk in an industry, helping risk management and the development of risk control measures.

Company Z's working capital risk for the recent 8 years is shown in Figure 5-13:

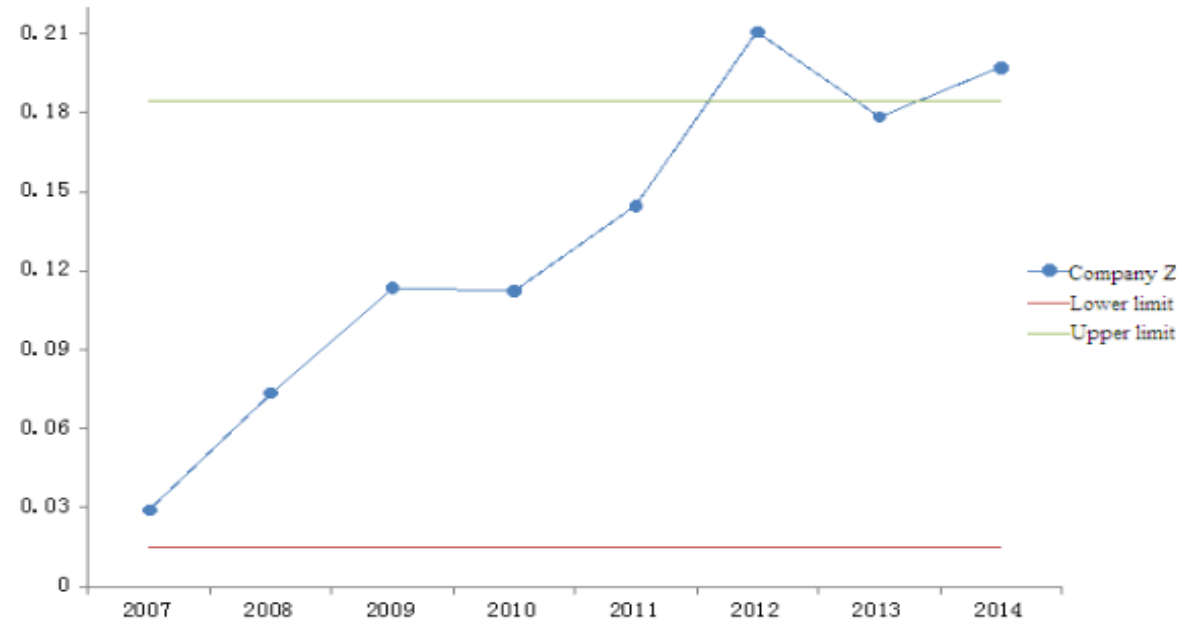

Figure 5-13 Change Trend of Company Z's Working Capital Risk in the Recent 8 Years

Source: Financial statements of company Z (2007-2014)

According to the figure, where the upper limit for the early warning of working capital in the recent 8 years is 0.1849 and the lower limit 0.0149, Company Z's working capital risk has been decreasing over the first 6 years; after it spiked above the upper limit and entered the safe zone in 2012, the curve dips a bit and falls just below the upper limit in 2013 before it ascends back into the safe zone in 2014: the Company had a slight increase of risk in 2013 and it implemented in 2014 new operations strategies helping improve working capital efficiency and reduce working capital risk.

5.4.2 Analysis and Management of Early Warning of Suppliers' Working Capital

In this chapter, the 8 indicators of 220 suppliers researched in chapter 3, *i.e.* inventory turnover ratio, receivables turnover ratio, payables turnover ratio, cash turnover ratio, working capital allocation ratio, cash to current liabilities ratio, debt to assets ratio, and return on net assets, are placed in the early warning model for working capital risk to obtain the working capital risk of each supplier; classification is made through comparison of each supplier's working capital risk P with the upper limit P_H (0.1848) and lower limit P_L (0.0149) of early warning of working capital. If supplier's working capital risk P is larger than or equivalent to

P_H , it is in the safe zone, and it can be considered that the supplier has very sufficient working capital and is basically subject to no working capital risk; if supplier's working capital risk P is larger than PL and less than P_H, it is in the grey zone and it can be considered that the supplier may be subject to working capital risk; if supplier's working capital risk P is less than or equivalent to PL, it is in the dangerous zone and it can be considered that the supplier has serious working capital risk and badly insufficient working capital. The specific risks of suppliers are set out in Appendix 2.

Based on the above analysis, There are 8 suppliers (representing 3.64% of the questionnaire survey respondents and 12.58% of Company Z's total procurement sum) having a P (working capital risk) value greater than or equal to 0.1848 (the upper limit); 155 (representing 70.45% of the questionnaire survey respondents and 54.19% of Company Z's total procurement sum) having a P value below 0.1848 but above 0.0149 (the lower limit); and 57 (representing 25.91% of the questionnaire survey respondents and 32.47% of Company Z's total procurement sum) below or equal to 0.0149. The distribution of suppliers' working capital risk is shown in Figure 5-14:

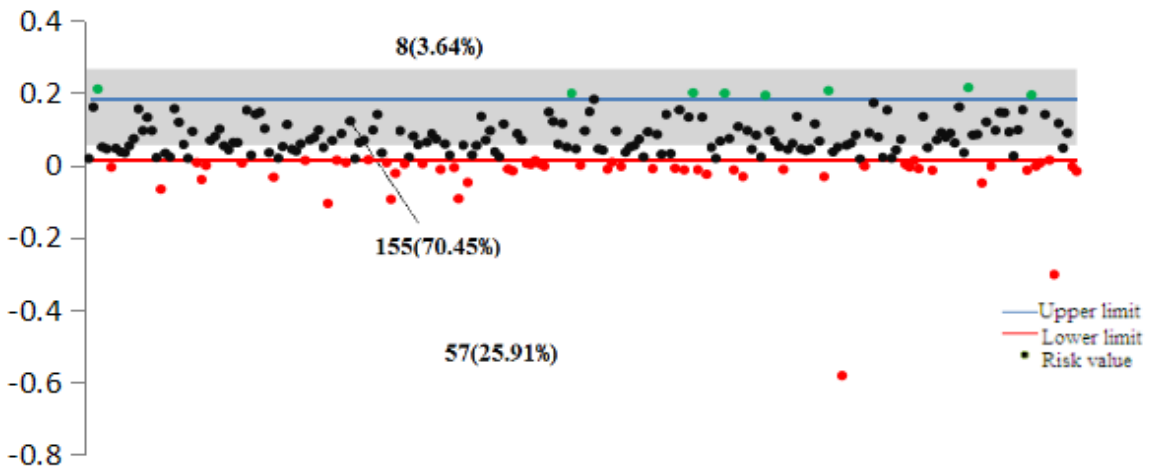

Figure 5-14 Distribution of Suppliers' Working Capital Risk

Source: Financial statements of Company Z's suppliers (2013)

The suppliers with the working capital risk P larger than or equivalent to P_H are in the safe zone, and we can feel completely relieved with such suppliers without working capital risk. The suppliers with working capital risk P larger than PL and smaller than P_H are in the grey zone and it can be considered that the suppliers may be subject to working capital risk

and are noteworthy; the suppliers with working capital risk P less than or equivalent to PL are in the dangerous zone and have serious working capital risk, and if they are core suppliers, it is required to adopt the acquisition mode or seek for alternative materials immediately, and if they are non-core suppliers, they should be replaced immediately.

5.4.3 Analysis and Management of Early Warning of Customers' Working Capital

In this chapter, the 8 indicators of 104 customers researched in chapter 3, *i.e.* inventory turnover ratio, receivables turnover ratio, payables turnover ratio, cash turnover ratio, working capital allocation ratio, cash to current liabilities ratio, debt to assets ratio, and return on net assets, are placed in the early warning model for working capital risk to obtain the working capital risk of each customer; classification is made through comparison of each customer's working capital risk P with the upper limit P_H (0.1848) and lower limit P_L (0.0149) of early warning of working capital. If customer's working capital risk P is larger than or equivalent to P_H , it is in the safe zone, and it can be considered that the customer has very sufficient working capital and is basically subject to no working capital risk; if customer's working capital risk P is larger than PL and less than P_H, it is in the grey zone and it can be considered that the customer may be subject to working capital risk; if customer's working capital risk P is less than or equivalent to PL, it is in the dangerous zone and it can be considered that the customer has serious working capital risk and badly insufficient working capital. The specific risks of customers are set out in Appendix 4.

Based on the above analysis, there are 3 customers (representing 2.88% of the questionnaire survey respondents and 7.42% of Company Z's total sales) having a P (working capital risk) value greater than or equal to 0.1848 (the upper limit); 72 (representing 69.23% of the questionnaire survey respondents and 81.28% of Company Z's total sales) having a P value below 0.1848 but above 0.0149 (the lower limit); and 29 (representing 27.88% of the questionnaire survey respondents and 11.30% of Company Z's total sales) below or equal to 0.0149. The distribution of customers' working capital risk is shown in Figure 5-15:

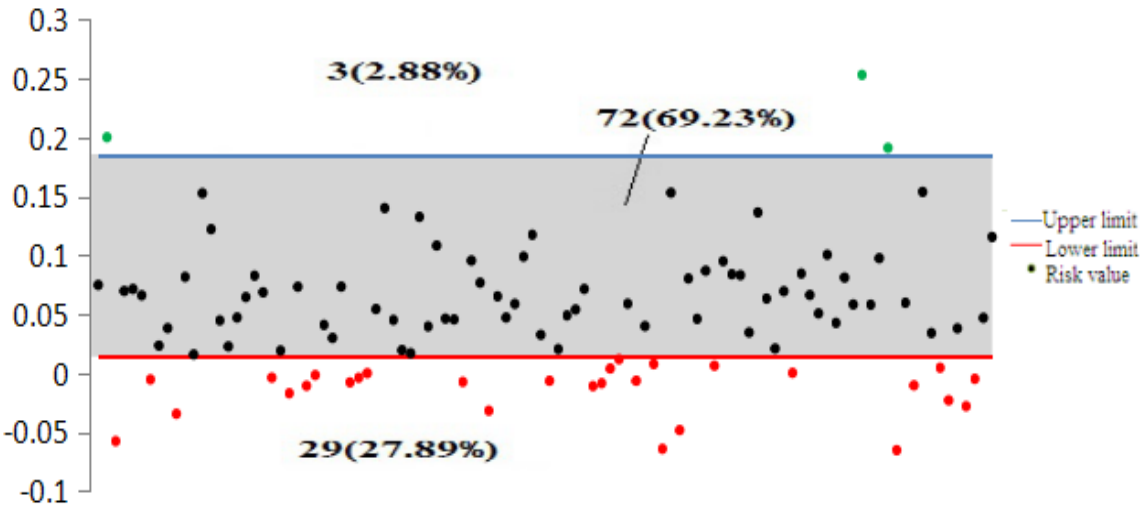

Figure 5-15 Distribution of Customers' Working Capital Risk

Source: Financial statements of Company Z's customers (2013)

Customers with a P value greater than or equal to P_H stay in a safety zone and face no working capital risk; the ones having a P value above PL and below P_H stay in a grey area and may have some working capital risk (Company Z is supposed to be alert and offer some support as appropriate); the ones having a P value less than or equal to PL stay in a dangerous zone and are believed to have serious working capital shortage (for such a customer, whether a core client or not, Company Z must demand advance payments or cash on delivery.

At present, Company Z's working capital risk is low, while most suppliers and customers are subject to large working capital risk, which actually causes large risks to Company Z's supply chain. Company Z's suppliers and customers have very high assets and liabilities. In particular, most suppliers are small and medium sized enterprises and have difficulty in financing. Therefore, it is required to establish a capital circulation platform to solve the difficulty in financing of supply chain.

5.4.4 Establishment of A Capital Circulation Platform of Supply Chain

The thesis intends to vitalize cash flow of supply chain, strengthen the liquidity of supply chain's capital, solve the difficulty in financing of supply chain and reduce the financing costs through establishing a credit system of supply chain and a supply chain based financing platform, thus effectively reducing working capital risk of supply chain to achieve an overall

win-win situation of supply chain.

1. Establish a Credit System of Supply Chain

Company Z further promoted Company Z's overall working capital efficiency through investigating the credit of upstream and downstream suppliers and establishing a credit system of supply chain, thus reducing working capital risk. The specific measures are mainly in the following 3 aspects:

(1) Investigate and file the credit of suppliers and customers and set credit ratings. Credit rating assessment: investigating enterprise's registered capital; credit in respect of repayment; whether there is any record of punishment due to tax in arrears; whether there is any loan owing to suppliers in arrears; other comprehensive evaluation of enterprise. Implementing different credit policies for suppliers and customers of different degrees to reduce the risks of sales on credit; promptly updating the information of suppliers and customers, extensively collecting credit information of suppliers and customers in the recent period, and implementing track management for suppliers and customers, and taking dynamic management method. Particular attention should be paid to some key suppliers and customers.

(2) Establish a credit management system. In case of defaulting or repudiating receivables by customers, Company Z should first analyze to see if there is any mistake in the existing credit standards and approval procedures and then re-investigate the credit rating of default customers. According to the empirical results, there’re 72 customers’ P value is between P_H and P_L in which case it means sometimes for those enterprises there will be problems like insufficient working capital or have trouble in turnover of capital thus result in deferring payment. Moreover, there’re 29 customers’ P value is lower than the lower limit P_L, the minimum P=-0.0641, in other word, the risk of working capital is pretty high and with no doubt the enterprises with such a low risk value will end up in deferring payment even defaulting payment. The customers of poor credit quality engaged in malicious default will be deleted from the credit list and no sales on credit will be granted to them, and more efforts will be made to collection with a tough attitude. For customers with good credit records, in addition to an electronic letter, an interview may be conducted to properly solve the problem

of default.

(3) Establish strict approval procedures to clarify approval personnel's way of approval, authorities and procedures for sales and collection and specify business handlers' responsibilities and work requirements in transacting sales and collection businesses. For provision exceeding the rectified credit quantity, it is required to obtain special approval according to the process; if it is unable to obtain approval, it is only necessary to reduce the credit size or abandon such business, so as to prevent abundant bad debts in sales and reduce risks.

2. Establish a Capital Circulation Platform

The supply chain based capital circulation platform is a finance company established in the name of Company Z set with a dedicated account for supply chain. The platform adopts the way in combination of entrusted wealth management and entrusted loan of the members of supply chain, which will transfer a certain amount of capital to the dedicated account for the capital circulation platform of supply chain of the finance company established by Company Z. In the mode of capital circulation platform of supply chain, the accounts of Company Z and members of supply chain are generally set with separated revenue and expenditure (*i.e.* wealth management account and loan account) for separated management.

This thesis establishes a capital circulation platform of supply chain, *i.e.* a special institution established by Company Z- financial company, from the perspective of serving the upstream and downstream supply chains to provide financing services for the members of upstream and downstream supply chains, and it is a functional enterprise engaged in independent capital operation. Finance company is a non-bank financial institution established under Company Z with the approval of the People's Bank to provide development supporting financial services for members of supply chain. It collects capital from members of the supply chain. Part of the capital from the balance in the bank account of one or more members of the same supply chain is actually transferred to the account of capital circulation platform of supply chain under the name of a real financial company, which is often managed and maintained by Company Z. When members need capital, they are required to obtain capital from the account of capital circulation platform of supply chain under the name of financial

company. The way is mainly used for interest hedging, *i.e.* An account of capital circulation platform of supply chain under the name of finance company is established in the name of Company Z, the members of supply chain obtain entrusted loan from the finance company and each member transfer a certain amount of cash to the account of capital circulation platform of supply chain. In case the account is lack of working capital for payments for the supply chain, banks can provide overdraft to the extent of enterprise's credit line. According to prior agreement, the interest of entrusted loan will be settled in a fixed period and appropriated via banks.

Capital management is very important for Company Z and members of the supply chain. The capital circulation platform of supply chain has become a capital management tool that many enterprises want to have a try due to its low cost, loose financing conditions, rapid release of loans and other advantages. The thesis intends to collect the capital of supply chain in the mode of capital circulation platform of supply chain via Company Z to achieve appreciation.

(1) Significance of the capital circulation platform of supply chain

① Avoid legal risks. Inter-enterprise loans are strictly restricted by laws. The capital concentration and transfer between enterprises is capital transfer between the accounts of different legal persons. Such transfer is actually a kind of capital loan due to lack of trade background and the realization of paid concentration of capital and internal adjusting agent of supply chain should rely on entrusted wealth management and entrusted loans. The capital circulation platform of supply chain is a capital management scheme in which bank embeds entrusted wealth management and loan products into services. Company Z can apply the way in combination of entrusted wealth management and entrusted loans to achieve capital transfer based on the actual demands to effectively avoid legal risks.

② Reduce financing costs. The capital circulation platform of supply chain achieves circulation of enterprise's capital of supply chain to convert external financing into internal financing of supply chain. In the capital circulation platform of supply chain, financing in the supply chain is completed through management of core enterprises, which simplifies financing formalities and satisfies the demand of enterprises in the entire supply chain for

loans. In addition, the costs of enterprises in the supply chain are far lower than the bank loan interest for the same period and, after capital concentration, the financing capacity of enterprises in the supply chain will be strengthened for lower capital costs, greatly reducing financing costs and financial expenses.

③ Enhance financial monitoring level. The detailed understanding of enterprise's operating business and financial position of members of supply chain by Company Z's finance company and bank improves the transparency of enterprises of supply chain and reduces financing risks. With the capital circulation platform of supply chain, Company Z is able to understand capital flow and operating financial position of enterprises of supply chain in a prompt manner, so that managers of Company Z can manage the demand for capital and credit risks at the level of supply chain and strengthen the efficacy of internal control.

(2) Example of Company Z's capital management in the mode of capital circulation platform of supply chain

Before adopting the mode of capital circulation platform of supply chain for capital concentration management, Company Z is confronted with the problems of single financing channel, badly insufficient financing capacity, high financial expenses, etc. The application of the mode of capital circulation platform of supply chain can better solve these problems for enterprises.

Preparations in the early stage. Before adopting the mode of capital circulation platform of supply chain for capital concentration management, Company Z adopts the mode of capital centralization management of supply chain and establishes an appropriate finance company based on the business and industrial characteristics of supply chain. The establishment of finance company is conducive to the realization of unified settlement, unified management and centralized financing of capital, and can reduce capital costs, optimize capital allocation and strengthen capital flow direction. Before the establishment of financial company, a preparation group should be built to conduct relevant subsequent works.

Specific implementation steps. After completing a series of preparations in the earlier stage, the specific implementation steps of capital circulation platform of supply chain are as shown in Figure 5-16:

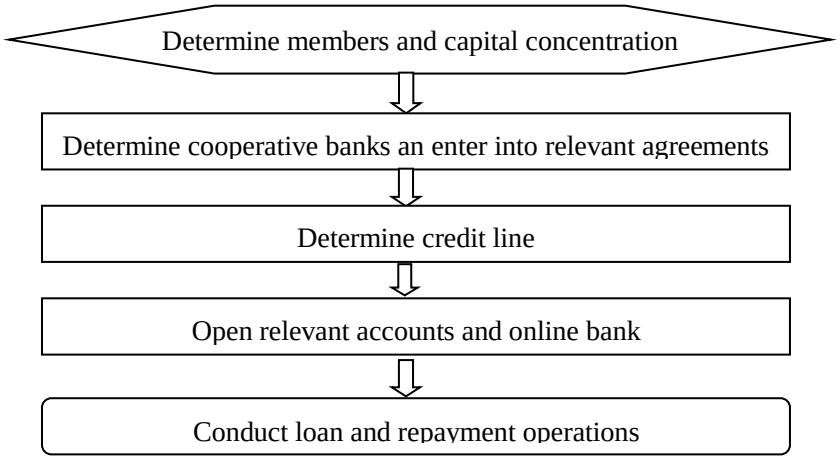

Figure 5-16 Implementation Steps of Capital Circulation Platform

Source: Author finishing

① Determine supply chain members of the capital circulation platform of supply chain and capital concentration. Coordinate with supply chain members (including suppliers and customers) to determine enterprises that will make contributions to the establishment of capital circulation platform of supply chain. The enterprises as members should be entitled to loans from the capital circulation platform of supply chain. The minimum investment for each enterprise is RMB 200,000. Assuming 30 of the 62 upstream important suppliers join in, and the average contribution of each enterprise is RMB 500,000, *i.e.* RMB 15 million can be raised at the upstream; similarly, 10 of the 31 downstream important customers join in, *i.e.* RMB 5 million can be raised at the downstream; assuming that Company Z invests RMB 20 million for the capital circulation platform of supply chain according to its own capital conditions. The capital injection in supply chain is shown in Figure 5-17:

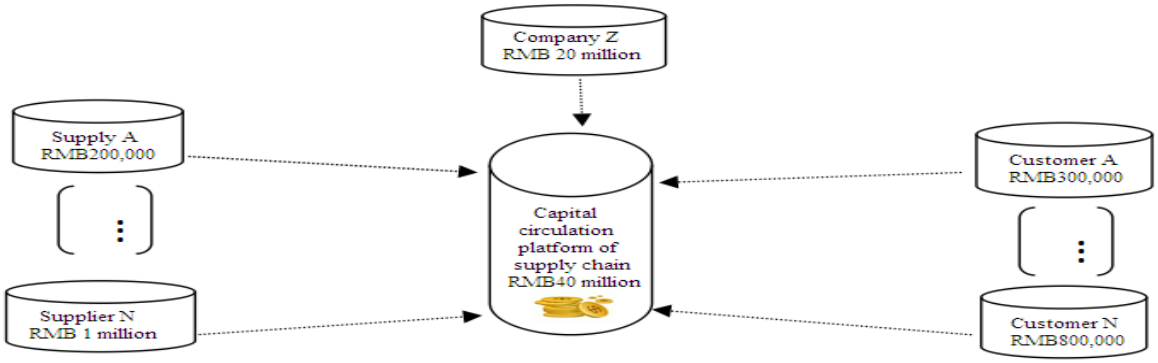

Figure 5-17 Capital Injection into Supply Chain

Source: Author finishing

② Determine cooperative banks and enter into relevant agreements. After determining cooperative banks, the person in charge of the finance company of Company Z should promptly negotiate with banks to reach a consensus on relevant matters. In negotiation with banks, the structure of capital circulation platform of supply chain, the opening and cancellation of accounts, determination of credit line, and means of charge are the aspects that should be attached with great importance by the finance company of Company Z to maximization of corporate profits. Since "revenue from current accounts = interest income of account - interest expenditure of account- business tax of interest income- stamp duty", tax and interest in the capital circulation platform of supply chain are the major factors affecting the revenue of the finance company of Company Z. In negotiation, the finance company of Company Z and banks should determine the loan interest rate to ensure that the profits of the finance company of Company Z will not be subject to material impact. After selecting the cooperative banks of the capital circulation platform of supply chain, the finance company of Company Z should first enter into a bank-enterprise agreement with cooperative banks to uniformly open a special bank account for wealth management in the name of the finance company of Company Z. A three-party cash management agreement should be signed to specify that the bank system shall transfer the income of each member according to the requirements of the finance company of Company Z, and transact loan business according to the capital instructions of the finance company of Company Z to transfer loans to the account of the members of supply chain, which should open an investment and wealth management account and loan account with the cooperative banks to achieve separated management of revenue and expenditure.

③ Determine credit line. In order to ensure effective operation and dispatching, the finance company of Company Z and bank grant credit line to members of supply chain. Through negotiation and cooperation with bank, the bank and the finance company of Company Z will grant credit to members of supply chain according to the total capital credit scope. If supplier A is granted with a credit line of RMB1 million with a loan period of 60 days, supplier is entitled to a loan of RMB1 million and can obtain an unsecured loan with a low interest rate of RMB1 million from the account with the capital circulation platform of

supply chain. Similarly, supplier B is granted with a credit line of RMB2 million with a loan period of 120 days, supplier C is granted with a credit line of RMB1.5 million with a loan period of 30 days and supplier D is granted with a credit line of RMB2 million with a loan period of 90 days. The specific capital outflow of supply chain is as shown in Figure 5-18. In accordance with the agreement, members of supply chain join the capital circulation platform of supply chain with a minimum investment of RMB 200,000, which will be deposited into the account designated by the finance company of Company Z, which grants credit line according to the amount deposited by each member in the capital circulation platform of supply chain, production and operation needs and financial position of each member. More capital to join the supply chain will contribute to more credit line. Capital allocation should be in strict accordance with the requirements on capital authorization management and capital internal control and it is required to clarify the way, procedures and responsibility of capital expenditure approval to let the approver fulfill duties within the scope of authorization. Significant expenditures must be subject to level-by-level approval based on authorization levels to ensure the safety of capital expenditure.

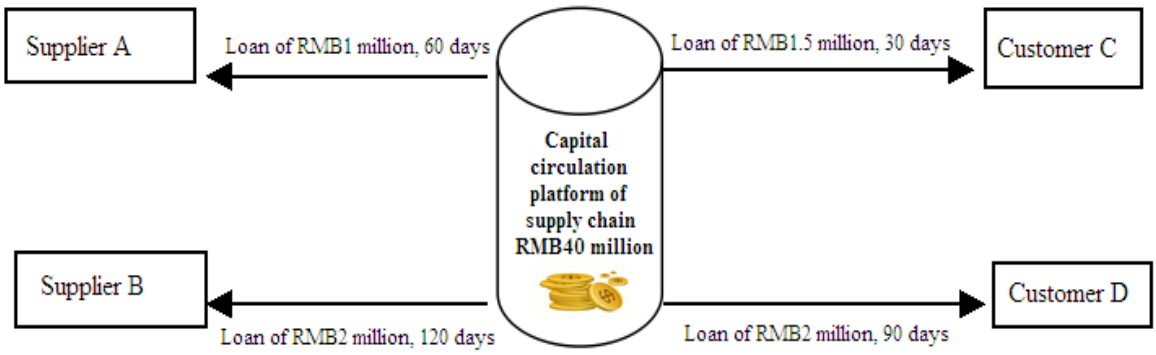

Figure 5-18 Capital Outflow of Supply Chain

Source: Author finishing

④ Open relevant accounts and online bank. For centralized management of bank accounts, it is required to note the following aspects: each member should open an investment and wealth management account and a loan account to separate revenue and expenditure. The capital source of investment and wealth management account is the capital deposited by Company Z and members of supply chain and the loan account is only used for loan and

repayment of members of supply chain, which can accelerate the speed of capital recovery and reduce capital occupation.

⑤ Conduct loan and repayment operations. When members of supply chain want to use capital, they can apply to the finance company and then capital of the amount within the scope of credit line will be released according to the arrangement of finance company. When the loan expires, the loan enterprise shall repay the loan as scheduled and pay appropriate interest. Enterprises at the upstream and downstream of supply chain (suppliers and customers) are encouraged to deposit surplus working capital into the capital circulation platform of supply chain to help enterprises of supply chain to raise capital in a faster and more effective way and make full use of surplus capital to gain profits. Assuming that Company B has surplus working capital of RMB2 million used for wealth management in the capital circulation platform of supply chain for a term of 120 days with the annual interest rate of 6%. When it comes due, in addition to the principal of RMB2 million, it is also required to pay interest of RMB2 million *6%*120/360=RMB 40,000. The specific operations are shown in Figure 5-19:

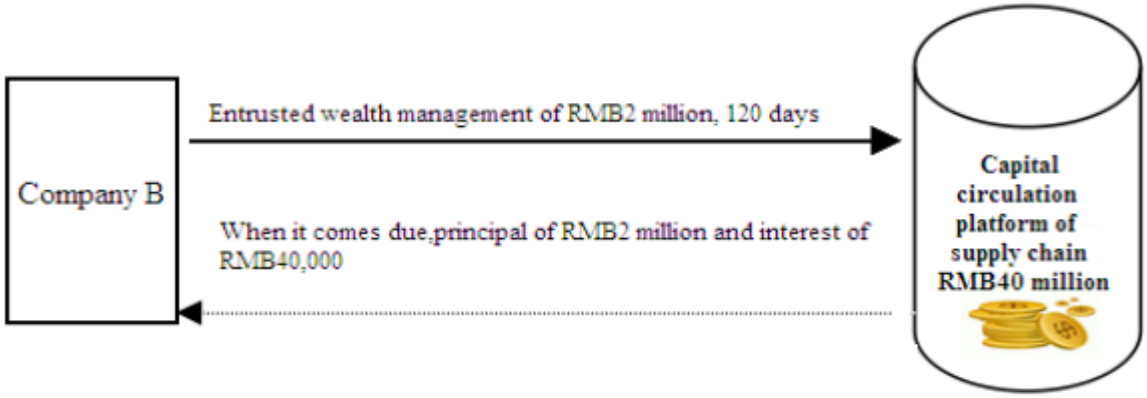

Figure 5-19 Entrusted Wealth Management of Supply Chain

Source: Author finishing

Moreover, when the suppliers or customers in supply chain are lack of capital at a specific time, they can enjoy loans from the capital circulation platform of supply chain according to specific conditions to reduce financing difficulty and improve financing efficiency. Company Z is able to conduct unified wealth management in an effective way to increase revenue. Suppliers or customers in supply chain can deposit surplus capital into the

capital circulation platform for other investment and wealth management activities. Suppliers and customers in supply chain combine the capital circulation platform of supply chain with business for reasonable wealth management of their own sufficient cash resource and maintaining the stability of supply chain in its operation and business's competitive fields and growth in the future market.

The capital circulation platform of supply chain brings about appreciation benefits for Company Z and the enterprises of supply chain. In daily operation, Company Z can better utilize the rich financial advantages of its own and upstream enterprises, raise a lot of idle funds and provide entrusted wealth management and entrusted loan to enterprises of supply chain, thus increasing additional investment income for enterprises. Through cooperation with bank, Company Z is able to make intelligent investment in value added financial assets , e.g. monetary foundation, etc. through its own business with the capital circulation platform of supply chain, making full use of the circulating capital and temporarily idle capital in the operation of enterprises of supply chain. Company Z can set investment plan flexibly and make periodic fixed investment or redemption according to the characteristics of changes in its own capital size. If the capital balance of enterprises of supply chain has obvious characteristics of periodic changes, a cyclic investment plan can be set through the capital circulation platform: investment with surplus capital and redemption in case of insufficient capital. The investment plan will be automatically implemented in a cyclic way to give full play to idle capital. If the changes in capital balance of enterprises are not obvious, there are sufficient capital and external payments are concentrated, the part exceeding the minimum target balance in the account can be used for real-time investment though the capital circulation platform of supply chain to fully utilize spare capital for more benefits. When it is necessary to use capital, the accumulated capital in monetary foundation can be redeemed for payment. The operation efficiency of the capital circulation platform of supply chain is highly related to the enterprise's capital liquidity prediction. Company Z is able to have an accurate understanding of the cyclic characteristics of its own collection and payment and the circulation laws of working capital, thus significantly increasing capital income through the capital circulation platform of supply chain. In addition, the capital circulation platform of

supply chain simplifies Company Z's operation burdens and the bank allows independent online opening of the business of capital circulation platform of supply chain via online banking, saving the trouble of treatment at bank counter and really achieve automatic investment and wealth management.

In the framework of capital circulation platform of supply chain, the finance company of Company Z and members of supply chain are the entrusted borrowers and borrowers. Overdraft by members from the pool is loan and interest is required; on the contrary, the deposit in the pool is release of loan bearing interest. Therefore, the capital circulation platform of supply chain lets Company Z form a close strategic alliance relationship with commercial banks and has unique management effects. The introduction of the capital circulation platform of supply chain makes the capital management system and process of Company Z, which manages capital through the finance company, more effective.

The management of capital circulation platform of supply chain launched by Company Z is to achieve centralized capital operation by way of transfer and dispatching of capital without trade background, interest hedging, separable account balance and account balance concentration to achieve flexible application of entrusted loan to the greatest extend. In the cooperation between Company Z and bank, the bank is the lender and Company Z and members of supply chain are entrusted borrowers and borrowers. The businesses that should be handled one by one previously are changed into intensive businesses and process through the package entrusted loan agreement with electronic bank, realizing unified operation and centralized management of Company Z's surplus capital and the capital raised in the upstream and downstream supply chains. The financial strain between the members of the entire supply chain can be solved through the capital circulation platform of supply chain, further guaranteeing the sound and continued operation of supply chain.

The unified operation and centralized management of Company Z's surplus capital and the capital raised in the upstream and downstream supply chains are achieved through the establishment of a capital circulation platform of supply chain, which help upstream and downstream important suppliers and customers solve the problem of working capital shortage and allow them to raise capital with lower costs. The suppliers and customers of supply chain

join the capital circulation platform of supply chain. Through investing a certain amount of capital into the capital circulation platform of supply chain, they can obtain loans from the platform to the extent of their credit to solve their difficulty of working capital shortage. Company Z establishes a finance company as the domestic and foreign currency circulation platform of supply chain to strengthen centralized management of the capital of supply chain through innovative service items. According to the development needs of enterprises of supply chain, efforts are made to allocate and manage capital flow, inventory and increment in a centralized and unified way, adjust capital surplus and shortage among enterprises of supply chain in a paid manner, optimize the allocation of capital resources of supply chain, and activate the idle and accumulated capital in the supply chain to reduce the external financing size of supply chain, satisfy internal financing demands of members of supply chain in industrial development, reduce supply chain' loans from external circulating capital, improve working capital management in wealth management activities, save a lot of capital costs and facilitate the realization of the target of reducing working capital of supply chain. The information based management of the daily settlement and budget of capital achieves automatic expiry prompt of settlement and budget, automatic alarm of overdue, and automatic cancellation upon settlement as well as systematic, process-based and automatic settlement and management of capital, ensuring the objectivity and transparency of settlement and providing a good system and platform for Company Z's prior prediction of capital and real-time monitoring of daily cash flow as well as management of the capital circulation platform of supply chain. It is helpful for understanding the cash flow and balance of all enterprises of supply chain and Company Z and promptly find out and solve cash difference to ensure the soundness and overall balance of supply chain's cash flow.

5.5 Brief Summary

In implementation of working capital operation strategy, it is required to manage the working capital of supply chain. Therefore, the thesis mainly researches on guaranteeing the stable and sustained development of enterprises at the upstream and downstream of supply chain through building the early warning indicators of working capital risk of supply chain

and implementation of appropriate management measures. Through building the early warning model for working capital risk of supply chain, the indicating data of public companies in the industries of computer, communication and other electronic industries in 2013 is taken as the basis to set upper limit and lower limit of early warning of working capital risk of supply chain and provide early warning for the risks with Company Z and the enterprises at the upstream and downstream of supply chain. In addition, the establishment of capital circulation platform of supply chain of Company Z will reduce the financing costs of supply chain and promote the operation efficiency of supply chain.

Chapter 6: Conclusion and Prospects

On the basis of summarizing and reviewing the research contents in this thesis, this chapter obtains the major conclusions, points out shortcomings of the thesis and proposes issues deserving further research and discussion.

6.1 Conclusions

This thesis focuses on supply chain operations strategies and risk management mechanism giving consideration to working capital and arrives at the following conclusions:

1. Assessment of Working Capital Risk in the Supply Chain of Company Z

Firstly, work with an expert panel to identify 9 indicators for working capital performance assessment, and assign a weight to each indicator using the Delphi method and Analytic Hierarchy Process. Secondly, based on an industry analysis using 202 public trading companies' data, then build an assessment model and determine a criterion assessed value of working capital risk (R=0.0332). Then, compare Company Z's working capital performance with the industry averages across the 9 indicators then we find that Company Z's inventory turnover ratio (0.017), receivables turnover ratio (0.0092), payables turnover ratio (0.0128) and cash turnover ratio (0.0112) are lower than the average industrial levels, turning out that Company Z's daily operational capital management performance is lower than the average industrial level; However, Company Z's working capital allocation ratio (0.6907) and cash to current liability ratio (0.5905) are higher than the average industrial levels but debt to asset ratio (0.3066) is lower than the average industrial level, turning out that Company Z has a higher debt paying ability than the average industrial level; Moreover, Company Z's return on assets (0.201) and surplus cash coverage ratio (0.908) are lower than the average industrial levels, proving that Company Z has a higher profitability among the industry. Meanwhile, conduct a efficient questionnaire survey with 220 suppliers and 104 customers, collect and analyze the data obtained, and examine the working capital performance of those suppliers

and customers, and the final empirical result shows that for the suppliers, inventory turnover ratio (0.0149), receivables turnover ratio (0.0109) and payables turnover ratio (0.0127) are lower than the average industrial levels and the cash turnover ratio is little higher than the average industrial level, turning out a lower daily operational capital management performance among industry; Suppliers' working capital allocation ratio (0.3362) and cash to current liability ratio (0.1755) are lower than the average industrial levels and a higher debt to asset ratio (0.507) than the industry level turns out a bad debt paying ability. But a high ROA (0.1296) and surplus cash coverage ratio (1.1227) turn out a higher profitability among the industry. For the customers, low inventory turnover ratio (0.0152), receivables turnover ratio (0.0103) and payables turnover ratio (0.0117) give a strong signal of bad daily operational capital management performance among industry; Customers' working capital allocation ratio (0.3533) and cash to current liability ratio (0.1564) are lower than the average levels but a higher debt to asset ratio proves that those customers have a weak debt paying ability; However, a higher ROA (0.102) and a little lower surplus cash coverage ratio (1.4982) mean that the customers have a higher profitability among industry. Finally, point out that considering Company Z itself, its working capital is slack, in the supply chain, however, Company Z's upstream suppliers and downstream customers have different degree of problems in working capital thus lead to a long working capital turnover period and tense working capital not for the Company Z but for the whole supply chain. Therefore, the whole supply chain is fragile and there exists a potential risk of supply chain broken once the capital chain breaks. This thesis combines supply chain management with working capital management and considers the synergies of working capital in the supply chain, offering a good supplement to working capital management and supply chain management theories. Moreover, in this thesis, the Delphi method and Analytic Hierarchy Process are proven to be a practical combination to help determine the weightings and select the best plan, by taking the advantage of a quantitative risk assessment as well as a qualitative analysis building upon the expertise of professionals. They offer a new approach to evaluate working capital risk in an accurate, objective, quantitative way.

2. Supply Chain Operations Strategies Improvement

Use a two-dimensional classification matrix to divide Company Z's suppliers and customers into groups, analyze the working capital risk of each group, and devise operations strategies accordingly. Based on their exposure to working capital risk and their value to Company Z, its 220 suppliers are divided into four groups; and building on operations analysis of each group, operations strategies are devised accordingly. 45 strategic suppliers' procurements are 56.41%. For those type of suppliers, the Company Z will shorten their payment period and provide with financing guarantee; 17 partner suppliers' procurements are 23.79%. Company Z will make long term cooperation agreement with those suppliers in order to form a strategic relationship, and will offer policies like option procurement and delayed payment for those suppliers; For those 62 general suppliers, whose procurements are 6.01%, Company Z will provide with policies like vendor managed inventory, purchasing by invitation to bid. For the rest 96 bottleneck suppliers, Company Z will take actions to find substitute suppliers to reduce the supply chain risk. Similarly, its 104 customers are also divided into four groups based on their exposure to working capital risk and Company Z's product customization for them; and operations strategies are devised for each group building on operations analysis. 17 strategic customers' sales are 45.45%. For those crucial customers, Company Z provides with policies like prolonged collection period and provision of financing guarantee to enhance the cooperation relationship; 38.22% sales goes to 14 partner customers. For those vital customers, Company Z is willing to strengthen strategic cooperation to form strategic relationship, and will offer advance sales policy; 24 general customers' sales are 7.31%. Company Z will maintain the present status and provide general customers with batch discount and advanced collection policies; For the rest 49 bottleneck customers, the sales are 9.02%. But in order to reduce the working capital risk, Company Z would like to take strategies like spot cash or advanced collection or develop new distribution channels to find superior customers or channels. Such group-based analysis and strategy design help explore the way to guarantee sufficient working capital at the downstream and upstream links of the supply chain, providing an effective solution to working capital problems in the supply chain and contributing to integrated operations, reduction of operating cost, and improvement of working capital efficiency and general competitiveness of the supply chain.

3. Supply Chain Risk Management Mechanism Development

Identify early warning indicators and define the upper and lower limits for early warning of working capital risk based on an industry analysis. According to the 202 public trading companies' data, we determine the upper limit P_H=0.1848 and lower limit P_L=0.0149 to evaluate the working capital risk. For each enterprise's P value, we consider that it is safe when it is dangerous when a firm's P value is lower than P_L, and when it means the firm must pay attention to its working capital. And then we use this criterion to analyze the Company Z recent 8 years' working capital risk and the result indicates that a risk reducing (P increasing) trend year by year in the first 6 years (but the P value is still lower than the P_H and between P_H and P_L, see figure 5-13). In 2012, the P value was the first time beyond P_H to the safe zone. In 2013, the working capital risk increased a little. But in 2014, the working capital risk returned to the safe zone. For the 220 upstream suppliers, there are 8 (3.64%) suppliers' P value are equal to or greater than P_H, and the procurements are 12.58%; 155 (70.45%) suppliers' P value are between P_H and P_L, and the procurements are 54.19%; 57 (25.91%) suppliers' P value are lower than P_L, and the procurements are 32.47. For the 104 downstream customers, there are 3 (2.88%) customers' P values equal to or greater than P_H, and the sales are 7.42%; 72 (69.23%) customers' P values are between P_H and P_L, and the sales are 81.28%, and 29 (27.88%) customers' P values are lower than P_L, and the sales are 11.30%. Use the early warning system to analyze the working capital risk faced by the players on Company Z's supply chain, and propose risk management mechanism accordingly; finally, design a supply chain-based finance platform. An indicator-based early warning system with appropriate risk management mechanism can help control the risk of the group-based operations strategies. And a supply chain credit system and supply chain-based finance platform can make the best of the working capital on Company Z's supply chain, helping improve cash flow and liquidity, provide finance solutions and lower financing cost, and ultimately reduce the working capital risk for a sustainable supply chain in general.

This thesis researches the status quo of the working capital of supply chain and industrial working capital of Company Z, providing reference for further research on the supply chain of other industries by the academic circles and enterprises.

6.2 Prospects

This thesis researches the operation strategy and risk management mechanism of enterprises at the upstream and downstream of supply chain from the perspective of working capital. To research supply chain management from the perspective of working capital management is a topic of extremely large research value and prospects. This thesis mainly starts from theories of supply chain management and working capital management, and builds the assessment model for working capital risk of supply chain and early warning model for working capital risk from the perspective of working capital. It conducts basic research on the innovation of supply chain operation strategy and risk management method and has achieved certain preliminary results. It is just the start of management and research of supply chain from the new perspective of working capital and more works should be further conducted in the future:

1. Increasing Research Objects, Analyzing the Supply Chain of Other Industries and Verifying the Research Results

Due to time rush and limited data, the thesis only makes a preliminary research on the working capital of the industries of computer, communication and other electronic industries, and a phased achievement of working capital management application in the research on supply chain management. In the future, further research will be made on the working capital conditions of other industries, and the research results in the thesis will be verified. Detailed and unified analysis will be made on the working capital risk of different industries and risk early warning management model, and develop with the development of environment.

Operation strategy is a research object that cannot treat different things as the same. The operation strategy of different industries and different types of enterprises are different. To let the research of operation strategy really serve the enterprises of supply chain requires further detailed research. To be specific, a certain amount of enterprises will be selected from the perspective of the characteristics and targets of various industries for survey and detailed research will be done based on the challenges and risks of different industries. In addition, specific researches should also be conducted on the enterprises of the supply chains of

different types of enterprises.

2. Extending from Single Supply Chain to Supply Network

The research on this thesis is on a single supply chain. The actual supply chain not only contains the upstream and downstream supply chains, but also includes peers, banks, guarantee companies, etc. Therefore, exploration will be extended to the supply chain network in the future.

3. Analysis of Operation Mechanism and Risk of Capital Circulation Platform

This thesis establishes capital circulation platform based on supply chain and the platform only serves as an application platform. The risk brought about by capital circulation platform should be shared. The future researches in this respect can be further made on the rights invested in the financing platform, quantity invested, investors, investment amount, interests occupied, investment authorization, etc. For the risk brought about by the capital circulation platform built, appropriate operation mechanism and risk analysis management should be adopted and in-depth research is required. In addition, while focusing on necessary qualitative researches, attention should also be paid to the application of qualitative methods to make it more persuasive.

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Annexes

Appendix 1: Assessment of Working Capital Indicators of 220 Suppliers in 2013

No.	Name of Enterprise	Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liabilities ratio	Debt to assets ratio	Return on net assets	Surplus cash coverage ratio	Assessed value
1	EPCOS	0.0393	0.0135	0.0194	0.0207	0.0797	1.3101	0.4205	0.1568	0.1782	0.2013
2	Sinna	0.0187	0.0114	0.0164	0.0124	0.0797	1.3101	0.4205	0.1568	0.1782	0.197
3	Yuda Metal	0.0185	0.0109	0.0137	0.0136	0.6631	0.895	0.2656	0.1174	0.5313	0.1872
4	Zhicheng Precision	0.016	0.0128	0.0142	0.0142	0.7427	0.7007	0.1577	0.0618	0.4888	0.1691
5	Weyer Electric Appliances	0.0132	0.0105	0.0122	0.0113	0.7427	0.7007	0.1577	0.0618	0.4888	0.168
6	Tongcheng Special	0.0192	0.0114	0.0143	0.0143	0.7427	0.7007	0.1577	0.0974	0.7709	0.1589
7	Reliance Electric	0.0161	0.0129	0.0143	0.0143	0.7427	0.7007	0.1577	0.0974	0.7709	0.1587
8	Taiyu Electromechanical	0.0167	0.0106	0.0127	0.0132	0.6621	0.7886	0.2487	0.1235	0.8003	0.1584
9	3Q Cable	0.0184	0.0121	0.0153	0.014	0.2877	0.5574	0.7505	0.8758	0.748	0.1432
10	Chengdu Magnetic	0.0177	0.0159	0.018	0.0157	0.6522	0.5747	0.4102	0.1131	0.3629	0.1372
11	Xingyu Tuofeng	0.018	0.03	0.0265	0.0195	0.3788	0.7218	0.4119	0.1372	0.3039	0.1367
12	Guangtong Communication	0.0169	0.0285	0.0248	0.0185	0.3788	0.7218	0.4119	0.1372	0.3039	0.1363
13	Thinking Electronic	0.0176	0.0158	0.0179	0.0156	0.6522	0.5747	0.4102	0.2471	0.7931	0.131
14	Upun Electrical	0.015	0.0126	0.012	0.0159	0.5753	0.6322	0.5883	0.2489	0.6205	0.1284
15	Atianhao	0.0144	0.012	0.0114	0.0153	0.5753	0.6322	0.5883	0.2489	0.6205	0.1281
16	Q&D Circuits	0.0132	0.0172	0.0121	0.0194	0.3909	0.6406	0.45	0.2188	0.446	0.1238
17	Changtian Electromechanical	0.017	0.0112	0.0123	0.015	0.3909	0.6406	0.45	0.2188	0.446	0.1227

18	Zhangqi Changfeng	0.0193	0.0117	0.0125	0.0174	0.4589	0.5792	0.3077	0.143	0.5554	0.116
19	Sandi Electrical	0.0185	0.0112	0.0133	0.0148	0.7355	0.4092	0.219	0.0808	0.7053	0.1113
20	Zhenghe Qili	0.0182	0.0109	0.0119	0.016	0.6797	0.5078	0.3556	0.1205	0.8644	0.108
21	Tams	0.018	0.0107	0.0117	0.0157	0.6797	0.5078	0.3556	0.1205	0.8644	0.1079
22	Baoxinda	0.0181	0.0115	0.013	0.0154	0.7427	0.3158	0.1577	0.0289	0.5069	0.1059
23	Huajing Communication	0.0178	0.0109	0.0127	0.0144	0.3927	0.5006	0.5649	0.2559	0.4099	0.1007
24	Zhongyuan Hardware	0.0188	0.0123	0.0166	0.0135	0.3909	0.5167	0.45	0.1239	0.3132	0.0993
25	Maochao Science & Technology	0.0188	0.0111	0.013	0.015	0.6627	0.4559	0.525	0.1387	0.6889	0.0988
26	Xindali	0.0172	0.0103	0.0112	0.0151	0.6797	0.3275	0.3556	0.0265	0.2943	0.0986
27	QExpress	0.0175	0.012	0.015	0.0135	0.6627	0.4559	0.525	0.1387	0.6889	0.0984
28	Xiwuer	0.0171	0.0117	0.0147	0.0132	0.6627	0.4559	0.525	0.1387	0.6889	0.0983
29	Guangzhou Suntech	0.0184	0.0137	0.0162	0.0152	0.5047	0.476	0.3657	0.2267	0.833	0.0973
30	Jiangbin Electronic	0.0174	0.0129	0.0153	0.0144	0.5047	0.476	0.3657	0.2267	0.833	0.0969
31	Song Long Lishang	0.0182	0.011	0.013	0.0145	0.5047	0.476	0.3657	0.2267	0.833	0.0969
32	Vimicro	0.0169	0.0127	0.0149	0.014	0.5047	0.476	0.3657	0.2267	0.833	0.0968
33	Yunteng Electronic	0.0173	0.0143	0.0114	0.0253	0.2179	0.6011	0.5312	0.2343	0.4417	0.0961
34	Chengdu Zhongbo	0.0254	0.0118	0.0176	0.0148	0.6893	0.3481	0.4077	0.0485	0.4817	0.0935
35	Wusite	0.0141	0.0092	0.0117	0.0107	0.6621	0.5011	0.2487	0.1235	1.2595	0.0899
36	SCC	0.0142	0.0079	0.0106	0.0097	0.5047	0.3495	0.3657	0.019	0.0953	0.0892
37	Taixun Electronic	0.0136	0.0116	0.0101	0.0163	0.7355	0.3122	0.219	0.0808	0.9245	0.0849
38	Tengfei Spring	0.0134	0.0114	0.01	0.0161	0.7355	0.3122	0.219	0.0808	0.9245	0.0849
39	Ruibao Electronics	0.0168	0.0104	0.0122	0.0135	0.4807	0.4042	0.346	0.128	0.6721	0.0804
40	Guofang Electronic	0.0155	0.0102	0.0126	0.012	0.2877	0.3281	0.7505	0.8758	1.271	0.0803
41	Hangtian Sipu	0.0193	0.0121	0.015	0.0148	0.4807	0.3805	0.346	0.128	0.714	0.0754
42	Alltek Technology	0.0125	0.0081	0.01	0.0096	0.5753	0.3824	0.5883	0.2489	1.0258	0.0675
43	Haibo Package	0.0185	0.0153	0.0122	0.027	-0.0046	0.5257	0.5312	0.3849	0.6461	0.0674

44	Nanhai Kaiyi	0.0179	0.0114	0.0138	0.0141	0.0797	0.5262	0.4205	0.1568	0.4438	0.0643
45	Saiwei Electronic	0.0173	0.0296	0.0254	0.0192	0.3788	0.3429	0.4119	0.1372	0.6399	0.0615
46	Zhenjiang Tianan	0.018	0.0124	0.0141	0.0153	0.6073	0.2805	0.539	0.112	0.7514	0.0585
47	Hengshenghe	0.0171	0.0117	0.0134	0.0144	0.6073	0.2805	0.539	0.112	0.7514	0.0582
48	JayElec	0.0169	0.0116	0.0133	0.0143	0.6073	0.2805	0.539	0.112	0.7514	0.0581
49	Zhenjiang Leitai	0.0181	0.0112	0.0117	0.017	0.4804	0.2201	0.8293	0.4097	0.6591	0.0576
50	Wuxi Youfaun	0.0174	0.0105	0.0124	0.0138	0.6615	0.1669	0.2652	0.0444	0.7364	0.0567
51	Valspar	0.0168	0.0119	0.0133	0.0147	0.5643	0.2809	0.3878	0.1501	0.9671	0.0563
52	Wucheng Electronic	0.0174	0.0107	0.0126	0.014	0.4603	0.22	0.4746	0.0418	0.2287	0.0548
53	Spesemi	0.0184	0.0152	0.0121	0.0269	-0.0046	0.468	0.5312	0.3849	0.7257	0.0544
54	Xindi Electronic	0.0172	0.0118	0.0148	0.0133	0.6627	0.1112	0.525	0.0121	0.2473	0.0536
55	Yongqiang Spring	0.0172	0.0119	0.013	0.0153	0.3788	0.3176	0.4119	0.1372	0.6908	0.0522
56	Weixun Electronic	0.0167	0.0132	0.0116	0.0202	0.6893	0.1967	0.4077	0.0485	0.8527	0.0512
57	Baorong Electronic	0.0256	0.0119	0.0178	0.015	0.6893	0.1967	0.4077	0.0485	0.8527	0.0512
58	Intercoio	0.0178	0.0233	0.0288	0.0155	0.4807	0.2903	0.346	0.128	0.9356	0.0512
59	Yinzhou Electric Appliances	0.0101	0.0211	0.0112	0.0175	0.6065	0.1794	0.3501	0.0732	0.7709	0.05
60	Xinruida	0.0191	0.0113	0.0131	0.0156	0.6065	0.1794	0.3501	0.0732	0.7709	0.0493
61	Zhongheng Materials	0.0176	0.0106	0.0128	0.0137	0.6065	0.1794	0.3501	0.0732	0.7709	0.0487
62	Hongxun Electronic	0.0159	0.0109	0.0113	0.015	0.4804	0.1946	0.8293	0.4097	0.7453	0.0486
63	Changfeng Package	0.0191	0.0251	0.031	0.0167	0.4807	0.2703	0.346	0.1192	0.9356	0.0476
64	Rosenberger	0.0183	0.0132	0.0139	0.0171	0.1587	0.3353	0.4117	0.0371	0.1659	0.0456
65	Tianyuan Machinery	0.017	0.0113	0.0117	0.0161	0.3212	0.2716	0.6259	0.1807	0.4082	0.0452
66	Kefa Electronics	0.0178	0.0105	0.0114	0.0158	0.4792	0.2308	0.271	0.0692	0.8062	0.0451
67	Tomorrow High Technology	0.0138	0.0111	0.0085	0.0223	0.3761	0.2384	0.8837	0.5415	0.9712	0.0451
68	BSB	0.0154	0.0133	0.014	0.0146	0.1587	0.3353	0.4117	0.0371	0.1659	0.0448
69	Bridgold	0.0168	0.011	0.0115	0.0158	0.3761	0.2384	0.8837	0.5415	0.9712	0.0444

	Copper										
70	Sichuan Hongfa	0.0174	0.0119	0.0124	0.0164	0.4804	0.1751	0.8293	0.4097	0.8287	0.0418
71	Xinrong Metal	0.02	0.0114	0.0172	0.0125	0.4202	0.2511	0.4956	0.1881	0.8109	0.0411
72	Hichain Electric	0.0148	0.015	0.0113	0.022	-0.1448	0.1653	0.9276	0.9294	0.5581	0.0408
73	Kaipu Electronics	0.0171	0.0113	0.0153	0.0122	0.6667	0.09	0.2918	0.0307	0.8277	0.0373
74	Tongda Timber	0.0123	0.0269	0.016	0.0178	0.2814	0.2796	0.4479	0.1582	0.6989	0.0371
75	Globallinks Electronic	0.0179	0.0116	0.0149	0.0134	0.3487	0.2223	0.6635	0.1411	0.3492	0.0363
76	Xinlong Electrical Appliances	0.0138	0.0111	0.0085	0.0145	0.3761	0.2384	0.8837	0.2643	0.474	0.0362
77	Yuhao Science & Technology	0.0193	0.0108	0.0124	0.0158	0.3578	0.2761	0.4065	0.1799	0.9515	0.0357
78	NEFAB	0.0158	0.0098	0.0131	0.0112	0.7355	0.1888	0.219	0.0808	1.529	0.0339
79	Baoyuhua	0.0146	0.0091	0.0116	0.0108	0.4589	0.2681	0.3077	0.143	1.2	0.0332
80	D-First Electronics	0.0182	0.0111	0.0116	0.0168	0.445	0.202	0.6049	0.1532	0.7701	0.0281
81	Hongjiada	0.0173	0.0105	0.0111	0.016	0.445	0.202	0.6049	0.1532	0.7701	0.0278
82	BrightKing	0.0164	0.0141	0.0148	0.0155	0.1587	0.3353	0.4117	0.1975	0.8832	0.0273
83	Keqiang Printing	0.0142	0.0122	0.0129	0.0134	0.1587	0.3353	0.4117	0.1975	0.8832	0.0265
84	Yongchengzhan	0.0168	0.0115	0.011	0.0179	0.5031	0.1714	0.447	0.1266	0.9997	0.0249
85	Mbsafe	0.0183	0.0109	0.0134	0.014	0.4496	0.1695	0.5231	0.1595	0.8576	0.0246
86	Huatai Electronics	0.0183	0.0109	0.0134	0.014	0.4496	0.1695	0.5231	0.1595	0.8576	0.0246
87	NS-Tech	0.0181	0.0107	0.0131	0.0137	0.4496	0.1695	0.5231	0.1595	0.8576	0.0245
88	Xiaozhong Electromechanical	0.0179	0.0115	0.0125	0.016	0.3453	0.1734	0.7605	0.1687	0.4094	0.0231
89	Weixin Science & Technology	0.0116	0.0068	0.0088	0.0083	0.7355	0.0474	0.219	0.0156	1.1726	0.0217
90	Fastprint Circuit	0.0097	0.0076	0.0073	0.0103	0.5155	0.1739	0.3695	0.0986	1.0816	0.0214
91	Kangtesi	0.0207	0.0129	0.0126	0.0215	0.4827	0.1378	0.4921	0.092	0.8466	0.0197
92	Hanson Electronic	0.0168	0.0125	0.0113	0.0197	0.2512	0.2031	0.4974	0.1142	0.5683	0.0192
93	Tianhua Electronic	0.0167	0.0123	0.0112	0.0194	0.2512	0.2031	0.4974	0.1142	0.5683	0.0191

94	Fuji Terminal	0.0174	0.0108	0.0106	0.0181	0.4827	0.1378	0.4921	0.092	0.8466	0.0185
95	Hualong Electronics	0.0173	0.0108	0.0105	0.018	0.4827	0.1378	0.4921	0.092	0.8466	0.0184
96	Baoxiang Hardware	0.0165	0.0118	0.0115	0.0172	0.325	0.1551	0.4543	0.067	0.552	0.0176
97	Yongzhi Precision	0.0168	0.0104	0.0134	0.0124	0.4827	0.1378	0.4921	0.092	0.8466	0.0173
98	Dongnan Elctronics	0.0136	0.0087	0.0121	0.0095	0.6073	0.1723	0.539	0.112	1.2229	0.0156
99	Kaierwo	0.0174	0.0108	0.0159	0.0115	0.3446	0.1688	0.5968	0.198	0.792	0.0153
100	Xilong Chemical	0.0191	0.0106	0.0128	0.0147	0.2183	0.2633	0.5567	0.1973	0.8727	0.0143
101	Sageness United	0.0102	0.0092	0.0117	0.0082	0.2222	0.208	0.4003	0.0686	0.5877	0.013
102	Aoke Metal	0.0148	0.0108	0.0111	0.0144	0.2512	0.1843	0.4974	0.1142	0.626	0.012
103	Yilong Lightning Protection	0.008	0.0097	0.0101	0.0078	0.4807	0.1529	0.346	0.0833	1.1566	0.0095
104	CviLux	0.0143	0.0117	0.0126	0.0132	0.169	0.1527	0.5326	0.0443	0.2561	0.0062
105	Hezhong Lixiang	0.019	0.011	0.0131	0.015	-0.0236	0.2543	0.5604	0.0508	0.2254	0.0012
106	Hengdeli	0.0132	0.0088	0.0107	0.0105	0.3909	0.1935	0.45	0.2188	1.4761	-0.0003
107	Oulu Electronic	0.0138	0.0111	0.0085	0.0223	0.3761	0.0807	0.8837	0.0536	0.284	-0.0022
108	Brio	0.0173	0.011	0.0123	0.0148	0.445	0.0745	0.6049	0.059	0.8046	-0.0049
109	Xingsheng Electronic	0.0194	0.012	0.0146	0.0151	0.146	0.1495	0.5401	0.0796	0.5144	-0.0055
110	Lihui Science & Technology	0.0181	0.0114	0.0155	0.0128	0.0986	0.2052	0.5081	0.0942	0.6385	-0.0058
111	Chaoshuo Electronic	0.0152	0.0131	0.0138	0.0143	0.1587	0.163	0.4117	0.0826	0.7599	-0.0068
112	Nateng Electronic	0.0188	0.0118	0.0133	0.0159	0.1665	0.1179	0.7445	0.2217	0.6139	-0.0088
113	Shunquan Electrical	0.018	0.0105	0.0128	0.0138	0.1665	0.1179	0.7445	0.2217	0.6139	-0.0094
114	Zing EAR	0.0166	0.0097	0.0118	0.0128	0.1665	0.1179	0.7445	0.2217	0.6139	-0.0098
115	Jieli Hardware	0.0171	0.0109	0.0126	0.014	0.0708	0.1402	0.5287	0.0393	0.3149	-0.0099
116	Artech	0.0184	0.0152	0.0133	0.0222	-0.0046	0.1854	0.5312	0.1351	0.643	-0.0152
117	Haotian Science & Technology	0.0119	0.0079	0.0106	0.0086	0.3212	0.1036	0.6259	0.1807	1.0696	-0.0171

118	Youshi Science & Technology	0.0154	0.0093	0.0131	0.0103	0.0797	0.2013	0.4205	0.136	1.0058	-0.0181
119	Dakang Machinery	0.0101	0.0087	0.0105	0.0085	0.7427	0.0744	0.1577	0.0289	2.1527	-0.0188
120	Jensor Electronic	0.0157	0.0113	0.0161	0.0111	0.325	0.0815	0.4543	0.067	1.0511	-0.0208
121	Qiheng Machinery	0.0154	0.0136	0.0103	0.0241	-0.0342	0.1469	0.665	0.1053	0.3639	-0.0222
122	Dingjingxin	0.0181	0.0117	0.0085	0.0424	-0.0088	0.1125	0.7605	0.1687	0.4094	-0.0224
123	Xinzheng Environmental Protection	0.0149	0.0109	0.0131	0.0121	0.4496	0.0902	0.5231	0.1482	1.4982	-0.023
124	He Chuang Li	0.0105	0.0082	0.0095	0.0089	0.4804	0.075	0.8293	0.3372	1.5927	-0.0244
125	ZhanChuang Precision	0.0142	0.0092	0.0067	0.0334	-0.0088	0.1125	0.7605	0.1687	0.4094	-0.0246
126	Mentech	0.0158	0.0096	0.0126	0.0113	0.2975	0.0998	0.5312	0.1351	1.1944	-0.0253
127	Hongan Electronic	0.0108	0.0173	0.011	0.0167	0.0873	0.1069	0.6462	0.1234	0.632	-0.0262
128	Huanhuan Electric Appliances	0.0391	0.0134	0.0193	0.0206	0.0797	0.1031	0.4205	0.0555	0.8014	-0.0269
129	Shudu Electronic	0.0152	0.0068	0.0081	0.0113	0.6667	0.0376	0.2918	0.0307	1.9823	-0.0315
130	Xianqu Kangteng	0.0154	0.0095	0.0116	0.0119	0.4807	0.0102	0.346	0.0069	1.4438	-0.0348
131	ZOTO	0.0173	0.0104	0.0105	0.0169	0.169	0.0562	0.5326	0.0509	0.7989	-0.035
132	Lingxuan Precision	0.0098	0.0089	0.0112	0.008	0.3971	0.1088	0.4706	0.1599	1.7473	-0.0359
133	Patron Test	0.0171	0.011	0.0124	0.0146	0.0873	0.0888	0.6462	0.1234	0.7609	-0.0361
134	Zhongyi Precision	0.017	0.0119	0.013	0.0152	-0.0677	0.1247	0.7102	0.1923	0.636	-0.0374
135	Liankun Electronic	0.0144	0.0118	0.0124	0.0135	0.2488	0.0717	0.9021	0.0445	0.5934	-0.0377
136	ELODA	0.0092	0.0074	0.0056	0.0123	0.3761	0.0491	0.8837	0.1196	1.0416	-0.041
137	Suyin Group	0.0152	0.0098	0.0126	0.0113	0.4827	0.0664	0.4921	0.092	1.757	-0.0413
138	Sichuan Huafeng	0.0131	0.0072	0.0101	0.0086	0.445	0.0426	0.6049	0.059	1.4062	-0.0431
139	Zhengtian Electrical	0.0121	0.0099	0.0104	0.0113	0.2488	0.0426	0.9021	0.0248	0.5568	-0.0435
140	FRD	0.0082	0.0066	0.0111	0.0054	0.3788	0.1114	0.4119	0.1372	1.9702	-0.0492
141	Ningbo Degson	0.0126	0.0202	0.0129	0.0195	0.0873	0.0676	0.6462	0.1234	1	-0.0502
142	Xinzhonglian	0.0102	0.0067	0.0107	0.0066	0.3761	0.0155	0.8837	0.0378	1.0436	-0.0571

143	Longrun Trade	0.0178	0.0116	0.0132	0.0151	-0.2504	0.0705	0.6129	0.0183	0.2168	-0.0595
144	Zhiyuan Electronic	0.0097	0.0079	0.0084	0.0091	0.2488	0.0217	0.9021	0.1525	1.0902	-0.0598
145	Nanfang Electronic	0.0138	0.0113	0.0119	0.0129	0.2488	0.0277	0.9021	0.0248	0.8553	-0.0606
146	Zhenjiang Electronic	0.0108	0.0101	0.0101	0.0109	0.2512	0.068	0.4974	0.1115	1.6578	-0.0608
147	Yunxin Technology	0.0126	0.0092	0.0101	0.0112	-0.2504	0.0705	0.6129	0.0183	0.2168	-0.0611
148	KRD	0.0061	0.0086	0.0061	0.0085	0.038	0.098	0.4985	0.1019	1.2427	-0.0613
149	Yangtian Packaging	0.0102	0.0078	0.0099	0.008	0.0986	0.0485	0.5081	0.0387	1.1105	-0.063
150	Nantong Yongda	0.0127	0.0084	0.0065	0.0227	0.3448	0.0169	0.75	0.0318	1.3168	-0.0638
151	Xinrui Packaging	0.0159	0.0094	0.0118	0.0118	0.2183	0.1176	0.5567	0.1973	1.9532	-0.0651
152	Samtec	0.0163	0.0126	0.0112	0.0192	0.1242	0.0274	0.7224	0.0767	1.0736	-0.0671
153	Citel	0.0149	0.0113	0.0111	0.0153	0.1242	0.0274	0.7224	0.0767	1.0736	-0.0681
154	Langsheng Technology	0.0149	0.0113	0.0111	0.0152	0.1242	0.0274	0.7224	0.0767	1.0736	-0.0681
155	Yidel	0.011	0.008	0.0075	0.012	0.3788	0.083	0.4119	0.1172	2.2588	-0.0692
156	Yikong Science & Technology	0.0093	0.0076	0.0087	0.008	0.1242	0.0274	0.7224	0.0767	1.0736	-0.0704
157	Trelleborg	0.0124	0.0098	0.0109	0.011	0.2488	0.0371	0.9021	0.0445	1.1461	-0.0726
158	Nandian Science & Technology	0.0116	0.0073	0.0097	0.0084	0.0708	0.0361	0.5287	0.043	1.3402	-0.0806
159	Greatrich	0.0147	0.0107	0.012	0.0128	0.1665	0.0199	0.7445	0.0865	1.4175	-0.083
160	Yimai Electronic	0.011	0.0064	0.0093	0.0071	0.0797	0.0165	0.4205	0.0157	1.4171	-0.0835
161	Xiwu Huanyu	0.0126	0.0086	0.0099	0.0106	0.3909	0.0622	0.45	0.1239	2.5999	-0.0903
162	Recodeal	0.0111	0.0105	0.0123	0.0096	0.6627	0.01	0.525	0.0121	2.7352	-0.0927
163	Desheng Electric Appliances	0.0146	0.0087	0.1249	0.0057	0.3487	0.0168	0.6635	0.0645	2.1066	-0.1029
164	Beizhan Electronic	0.013	0.0084	0.0091	0.0116	0.3453	0.0298	0.7605	0.1687	2.3835	-0.1031
165	Yusheng Science & Technology	0.0529	0.037	0.0414	0.046	0.6893	0.0421	0.4077	0.0449	3.6897	-0.1089
166	Xintai Electronic	0.0097	0.0079	0.0095	0.008	0.3444	0.0646	0.4821	0.2251	3.8152	-0.1491

167	Jite Technologies	0.0112	0.0073	0.0068	0.0127	-0.6157	0.0184	0.5422	0.0189	1.3675	-0.166
168	Beihong Communication	0.0085	0.0088	0.0069	0.0117	-0.1572	0.0183	0.9487	0.0342	1.9714	-0.1692
169	Hanli Science & Technology	0.0142	0.0101	0.0155	0.0096	0.3446	0.0308	0.5968	0.198	4.3456	-0.1913
170	Gaosheng Zhiyuan	0.0122	0.0069	0.008	0.0097	0.6797	0.0105	0.3556	0.0143	4.9976	-0.1976
171	SYM	0.0085	0.0044	0.0051	0.0069	0.28	0.0036	0.6797	0.0311	4.341	-0.2296
172	Yatai Machinery	0.0119	0.0096	0.0119	0.0096	0.6615	0.0204	0.2652	0.0444	6.0237	-0.242
173	Longke Electronic	0.0062	0.0083	0.0093	0.0057	0.4202	0.0023	0.3724	0.0067	5.4832	-0.2569
174	Volex	0.0139	0.0092	0.0114	0.0107	-0.1448	0.0131	0.9276	0.9294	7.0432	-0.3223
175	Zhongyuda	0.0104	0.0071	0.0011	-0.0015	-2.628	0.0149	0.526	0.2051	2.555	-0.4362
176	Seaward Electronics	0.0141	0.01	0.0126	0.0109	0.0873	0.0079	0.6462	0.1234	8.5153	-0.4528
177	Chuangtian Electronic	0.0074	0.0068	0.0081	0.0063	0.6171	0.0034	0.3077	0.0235	14.0147	-0.6717
178	Shenguangfu	0.012	0.0104	0.011	0.0113	0.1587	0.0065	0.4117	0.0826	19.0955	-0.9853
179	Zhaocheng Tools	0.0101	0.0094	0.0107	0.0089	0.352	0.0021	0.4117	0.0344	24.503	-1.2517
180	Fscreen	0.0111	0.0088	0.0115	0.0086	0.3578	0.0091	0.4065	0.1799	28.937	-1.4627
181	Sanxing Aluminum	0.0124	0.0108	0.0108	0.0123	0.5047	0.0022	0.3657	0.0438	35.151	-1.7829
182	Hengye Electronic	0.0114	0.0074	0.0084	0.0096	-0.6119	-0.0006	0.6789	0.0201	-17.3028	-
183	Shanghai Xiyi	0.015	0.0089	0.0123	0.0102	0.3927	-0.0231	0.5649	0.2559	-8.8915	-
184	A-BIT Electronics	0.0107	0.0087	0.0115	0.0083	0.4771	-0.0095	0.6705	0.0687	-7.8909	-
185	Weihong Science & Technology	0.0125	0.01	0.0125	0.0099	0.4792	-0.0206	0.271	0.04	-5.2225	-
186	Lejia Electronic	0.0132	0.0086	0.012	0.0091	0.682	-0.1022	0.3035	0.0924	-2.3404	-
187	HiSeTec	0.0138	0.01	0.0112	0.0119	0.6627	-0.0149	0.525	0.0139	-2.1016	-
188	Yafeng Electronic	0.0119	0.0065	0.0085	0.0084	0.6631	-0.229	0.2656	0.1174	-2.0763	-
189	Ansheng Electronic	0.0064	0.0089	0.0073	0.0076	0.6494	-0.1066	0.2833	0.0562	-1.5261	-
190	Hangling Circuits	0.0155	0.0101	0.0138	0.011	0.7427	-0.2274	0.1577	0.0521	-1.2713	-

191	SET	0.0065	0.0094	0.0091	0.0067	0.6162	-0.0724	0.3483	0.0368	-1.1762	-
192	Suzhou Machine Tool	0.0124	0.0076	0.0114	0.0081	0.4229	-0.0108	0.3093	0.0062	-1.4062	-
193	Rehom Techonlogy	0.0051	0.0041	0.0081	0.0031	0.7414	-0.0941	0.2673	0.0249	-0.8558	-
194	Shengheng Electronic	0.0058	0.0057	0.0067	0.005	0.543	-0.0392	0.406	0.0258	-1.0307	-
195	Xinsanyang	0.0089	0.0103	0.0117	0.0081	0.3952	-0.3038	0.5251	0.391	-1.2223	-
196	Xinganxian	0.0125	0.0073	0.0082	0.0106	-0.0236	-0.0279	0.5604	0.0508	-2.0571	-
197	Chunyu Screws	0.009	0.0069	0.0102	0.0063	0.4202	-0.0179	0.4956	0.0174	-1.0561	-
198	Hongxin Electronic	0.015	0.0107	0.0162	0.0101	0.3711	-0.1986	0.5312	0.2501	-1.1112	-
199	Zhongyihao	0.0107	0.0072	0.0096	0.0078	0.4045	-0.0228	0.5754	0.0328	-1.0996	-
200	Yachuang Chemical Engineering	0.0135	0.0085	0.0113	0.0098	0.5643	-0.2809	0.3878	0.1501	-0.9671	-
201	Tainuo Materials	0.0131	0.0117	0.026	0.0081	0.146	-0.0049	0.5401	0.008	-1.5838	-
202	Jinjiang Electronic	0.0154	0.0092	0.0137	0.0099	0.2814	-0.1594	0.4479	0.1582	-1.2257	-
203	Hualiang Packaging	0.0097	0.0054	0.008	0.0061	0.4603	-0.0814	0.4746	0.0418	-0.618	-
204	Wuhan Topwin	0.0158	0.0093	0.0119	0.0114	0.6065	-0.0072	0.3501	-0.0002	0.0579	-
205	Zhouzheng Electronics	0.0095	0.0133	0.011	0.0113	0.1543	-0.0055	0.6321	0.0113	-1.2387	-
206	Welldone	0.0043	0.0037	0.004	0.0039	0.2247	-0.0118	0.6692	0.0249	-1.1097	-
207	Guangzhou Jiubo	0.009	0.0036	0.0085	0.0037	0.6093	-0.1817	0.3067	0.0239	-0.3051	-
208	Hanlongda	0.0119	0.0084	0.0103	0.0095	-0.0677	-0.0558	0.7102	0.1923	-1.42	-
209	Guangqi Electrical	0.0068	0.0036	0.0079	0.0034	0.3849	-0.0851	0.5151	0.0439	-0.5944	-
210	Dinkle	0.0159	0.0107	0.0158	0.0107	-0.0342	-0.0049	0.665	0.0128	-1.3334	-
211	Tianyi Aluminum	0.0115	0.0076	0.0081	0.0104	0.3752	-0.0482	0.3303	0.0016	-0.0709	-
212	Saifeng Metal	0.007	0.0081	0.0085	0.0067	0.5165	-0.2473	0.4385	0.0235	-0.1638	-
213	VACTech	0.0095	0.0063	0.0085	0.0069	0.1583	-0.0136	0.8589	0.027	-0.5988	-
214	Jieli Zhongcheng	0.0032	0.0051	0.012	0.0024	0.2663	-0.1596	0.5896	0.0595	-0.2839	-
215	Skytex	0.0032	0.0001	0.0001	0.0001	0.2661	-0.1612	0.5897	0.0446	-0.2131	-
216	Ao Yu Graphite	0.0086	0.0044	0.0054	0.0064	0.4727	-0.0986	0.5995	-0.0785	0.8372	-

217	Yayuan Science & Technology	0.0134	0.0098	0.0094	0.0142	0.3619	-0.0255	0.557	-0.0434	1.5342	-
218	Linfang Machinery	0.0146	0.0097	0.0153	0.0094	0.7273	-1.1442	0.2523	0.0783	-0.2763	-
219	Parkson Packaging	0.0152	0.0115	0.0142	0.0121	0.5031	-0.001	0.447	-0.0019	2.7115	-
220	Serial Electronics	0.0095	0.0043	0.006	0.0058	-5.0147	-0.0647	0.5558	0.2528	-3.4298	-

Appendix 2: Risks of Suppliers of 220 Enterprises in 2013

Supplier	Risk Value	Supplier	Risk Value	Supplier	Risk Value	Supplier	Risk Value	Supplier	Risk Value
EPCOS	0.2106	Yayuan Science & Technology	0.0022	Chengdu Zhongbo	0.1185	Tianyuan Machinery	0.0664	Nateng Electronic	0.0231
Reliance Electric	0.1988	Saifeng Metal	-0.0006	Zhongyuan Hardware	0.1156	Kangtesi Electronics	0.0637	Zhaocheng Tools	0.0224
Thinking Electronic	0.1722	Dingjingxin	-0.0011	Ruibao Electronics	0.1154	Fuji Terminal	0.0625	Zing EAR	0.0221
Upun Electrical	0.1607	SYM	-0.0039	Xindali	0.1139	Gaosheng Zhiyuan	0.0623	Xingsheng Electronic	0.0212
Tams	0.1529	Ao Yu Graphite	-0.0057	NEFAB	0.1134	Yongzhi Precision	0.0614	Beizhan Electronic	0.0209
Xingyu Tuofeng	0.1525	Citel	-0.0122	Hangtian Sipu	0.1125	Xinlong Electrical Appliances	0.0609	Yachuang Chemical Engineering	0.0195
Q&D Circuits	0.147	Welldone	-0.0137	Valspar	0.1066	Xilong Chemical	0.0597	CviLux	0.0195
Guangzhou Suntech	0.1406	Nanfang Electronic	-0.0161	Haibo Package	0.101	He Chuang Li	0.0584	Chunyu Screws	0.0189
Xiwuer	0.1341	Zhouzheng Electronics	-0.0171	Zhenjiang Tianan	0.0976	Kaierwo	0.0564	Artech	0.0182
Taixun Electronic	0.133	Jieli Zhongcheng	-0.0228	JayElec	0.0972	Xinzheng Environmental Protection	0.055	Hualiang Packaging	0.018
Intercoio	0.0998	Skytex	-0.0254	Changfeng Package	0.0963	Globallinks Electronic	0.0545	Huanhuan Electric Appliances	0.0148
Hengshenghe	0.0973	VACTech	-0.0319	Weixun Electronic	0.0956	Rosenberger	0.0542	Hongxin Electronic	0.0135
Tomorrow High Technology	0.0956	Beihong Communication	-0.0667	Baoyuhua	0.0956	BSB	0.0534	ELODA	0.0132
Baorong Electronic	0.0956	Linfang Machinery	-0.0931	Wuxi Youfaun	0.095	FRD	0.0532	Hezhong Lixiang	0.0129
Spesemi	0.0922	Jite Technologies	-0.0949	Bridgold Copper	0.0949	Hangling Circuits	0.0513	Oulu Electronic	0.0126
Yinzhou Electric Appliances	0.0901	Hengye Electronic	-0.1064	Saiwei Electronic	0.0948	Wuhan Topwin	0.0508	Shenguangfu	0.0077
Sichuan Hongfa	0.0849	Zhongyuda	-0.3033	SCC	0.0941	Suyin Group	0.05	Desheng Electric	0.0066

								Appliances	
Fastprint Circuit	0.0776	Serial Electronics	-0.5833	Dakang Machinery	0.0931	Recodeal	0.0495	ZOTO	0.0065
BrightKing	0.0732	Yuda Metal	0.2148	Zhenjiang Leitai	0.0919	Tianhua Electronic	0.0487	Jieli Hardware	0.0065
Huatai Electronics	0.0691	Sinna	0.2062	Xinruida	0.0894	Yidel	0.0483	Patron Test	0.0035
Hongjiada	0.0679	Taiyu Electromechanical	0.2001	Zhongheng Materials	0.0888	HiSeTec	0.0467	Jinjiang Electronic	0.0032
Hualong Electronics	0.0624	Tongcheng Special	0.199	Yongqiang Spring	0.0881	Baoxiang Hardware	0.0463	Ningbo Degson	0.0018
Lejia Electronic	0.0583	Zhicheng Precision	0.1945	Nanhai Kaiyi	0.0873	Xiwu Huanyu	0.0449	Xinzhonglian	-0.0029
Rehom Techonlogy	0.0578	Weyer Electric Appliances	0.1934	Hongxun Electronic	0.0873	Sanxing Aluminum	0.0449	Zhiyuan Electronic	-0.0031
Chuangtian Electronic	0.057	3Q Cable	0.1821	Kefa Electronics	0.087	Aoke Metal	0.0446	ZhanChuang Precision	-0.0033
Lingxuan Precision	0.055	Atianhao	0.1604	Yuhao Science & Technology	0.0851	Xiaozhong Electromechanical	0.0444	Qiheng Machinery	-0.0033
Ansheng Electronic	0.0499	Chengdu Magnetic	0.1561	Xinrong Metal	0.0833	Volex	0.044	Zhongyi Precision	-0.0043
Xintai Electronic	0.0493	Wusite	0.1554	Yusheng Science & Technology	0.083	Weihong Science & Technology	0.0435	Yangtian Packaging	-0.0053
Hanson Electronic	0.0488	Zhenghe Qili	0.153	Weixin Science & Technology	0.0827	Fscreen	0.042	Liankun Electronic	-0.0068
SET	0.0448	Guangtong Communication	0.1521	Kaipu Electronics	0.0803	Yafeng Electronic	0.0418	Greatrich	-0.0093
Sageness United	0.0436	Sandi Electrical	0.148	Dongnan Elctronics	0.0792	Shanghai Xiyi	0.0411	Yimai Electronic	-0.0098
Shengheng Electronic	0.0357	Guofang Electronic	0.1464	Yongchengzhan	0.0769	Xianqu Kangteng	0.0403	Seaward Electronics	-0.01
Suzhou Machine Tool	0.0315	Changtian Electromechanical	0.1459	Hengdeli	0.0764	Haotian Science & Technology	0.0385	Nandian Science & Technology	-0.011
Longke Electronic	0.0282	Zhangqi Changfeng	0.1449	Tongda Timber	0.0734	Brio	0.0369	Samtec	-0.0113
Guangzhou Jiubo	0.0274	Jiangbin Electronic	0.1402	Keqiang Printing	0.0724	Mentech	0.0368	Langsheng Technology	-0.0122
A-BIT Electronics	0.0226	Song Long Lishang	0.1402	Shudu Electronic	0.0716	Xinrui Packaging	0.0365	Trelleborg	-0.013

Shunquan Electrical	0.0225	Vimicro	0.1401	Yatai Machinery	0.0712	Hanli Science & Technology	0.0346	Tainuo Materials	-0.0135
Tianyi Aluminum	0.0188	Maochao Science & Technology	0.1346	Hichain Electric	0.0699	Youshi Science & Technology	0.0342	Zhengtian Electrical	-0.0145
Xinsanyang	0.0167	QExpress	0.1342	Yilong Lightning Protection	0.0697	Parkson Packaging	0.0339	Yikong Science & Technology	-0.0146
Zhongyihao	0.0138	Tengfei Spring	0.1329	Mbsafe	0.0691	Jensor Electronic	0.0338	Xinganxian	-0.032
Hongan Electronic	0.0067	Baoxinda	0.1323	NS-Tech	0.0691	Chaoshuo Electronic	0.0327	Hanlongda	-0.0337
Guangqi Electrical	0.0055	Huajing Communication	0.122	D-First Electronics	0.0682	Sichuan Huafeng	0.0301	Dinkle	-0.0402
Nantong Yongda	0.0047	Alltek Technology	0.1208	Wucheng Electronic	0.0667	Lihui Science & Technology	0.0274	Longrun Trade	-0.0482
KRD	0.0034	Yunteng Electronic	0.1191	Xindi Electronic	0.0664	Zhenjiang Electronic	0.0254	Yunxin Technology	-0.0498

Appendix 3: Assessment of Working Capital Indicators of 104 Customers in 2013

No.	Name of Enterprise	Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liabilities ratio	Debt to assets ratio	Return on net assets	Surplus cash coverage ratio	Assessed value
1	Yada Electronics	0.0194	0.0061	0.0172	0.0064	0.6993	1.0413	0.2439	0.2172	0.8936	0.2063
2	Ellington Electronics	0.0342	0.0085	0.0121	0.0155	0.651	0.7088	0.248	0.1382	0.6006	0.1597
3	Baibei Trade	0.0166	0.0106	0.0127	0.0131	0.6621	0.7886	0.2487	0.1235	0.8003	0.1584
4	Goldwind	0.0105	0.0034	0.0039	0.0077	0.402	0.8224	0.5987	0.031	0.0451	0.1375
5	Famoli	0.018	0.03	0.0265	0.0195	0.3788	0.7218	0.4119	0.1372	0.3039	0.1367
6	DOCOMO interTouch	0.0158	0.0127	0.0141	0.0141	0.7427	0.4322	0.1577	0.0618	0.7926	0.1124
7	Taihua Lightning Protection	0.0182	0.0108	0.0118	0.0159	0.6797	0.5078	0.3556	0.1205	0.8644	0.108
8	Fan'an Science & Technology	0.0179	0.0109	0.0128	0.0145	0.3927	0.5006	0.5649	0.2559	0.4099	0.1008
9	Weiguan Electronic	0.0181	0.0106	0.0133	0.0134	0.6631	0.4158	0.2656	0.0701	0.6825	0.1007
10	Kailan Science & Technology	0.0168	0.0104	0.0122	0.0135	0.7355	0.3103	0.219	0.0808	0.9304	0.0841
11	Chongqing Hongsheng	0.0168	0.0104	0.0122	0.0135	0.4807	0.4042	0.346	0.128	0.6721	0.0804
12	Wande Electronics	0.0192	0.0108	0.0123	0.0157	0.3578	0.3905	0.4065	0.0193	0.072	0.0793
13	Dongfang Electric	0.004	0.0063	0.0064	0.0039	0.1117	0.6538	0.7611	0.129	0.0641	0.0783
14	Xinpeng Industrial	0.0329	0.0187	0.0156	0.0509	0.5495	0.2565	0.3293	0.0413	0.5321	0.0727
15	Haichen Communication	0.0173	0.0088	0.011	0.0124	0.4792	0.2308	0.271	0.0398	0.4643	0.0585
16	Ylelec	0.0179	0.0123	0.0141	0.0152	0.6073	0.2805	0.539	0.112	0.7514	0.0585
17	Kunming Putai	0.0167	0.016	0.0132	0.0214	0.5643	0.2809	0.3878	0.1501	0.9671	0.0579
18	Tianyi Electronic	0.017	0.0102	0.0121	0.0135	0.6615	0.1669	0.2652	0.0444	0.7364	0.0566
19	Xiaotong Engineering	0.0167	0.0115	0.0126	0.0149	0.3788	0.3176	0.4119	0.1077	0.5425	0.0561
20	Hailai Science and Trade	0.0187	0.0154	0.0164	0.0174	0.0797	0.4533	0.4205	0.0828	0.2721	0.0543

21	Leierda	0.0166	0.0131	0.0115	0.0201	0.6893	0.1967	0.4077	0.0485	0.8527	0.0512
22	Tongpu Integration	0.0176	0.012	0.0151	0.0136	0.6627	0.1901	0.525	0.0565	0.6733	0.0489
23	Tianma Lightning Protection	0.0146	0.01	0.0104	0.0139	0.4804	0.1946	0.8293	0.4097	0.7453	0.0482
24	Xinmeiya	0.0049	0.0044	0.0039	0.0058	0.4286	0.2542	0.6512	0.018	0.059	0.0477
25	Xincheng Kexin	0.0166	0.0112	0.0114	0.0161	0.3212	0.2716	0.6259	0.1807	0.4082	0.0451
26	Lulite	0.014	0.0094	0.0108	0.0118	0.3212	0.2716	0.6259	0.1807	0.4082	0.0438
27	Baotong Communication	0.0146	0.0147	0.0111	0.0215	-0.1448	0.1653	0.9276	0.9294	0.5581	0.0407
28	Nuoxi Communication	0.0124	0.007	0.0082	0.0099	0.6797	0.2871	0.3556	0.1205	1.5292	0.0377
29	Tianlei Didun	0.017	0.0112	0.0153	0.0121	0.6667	0.09	0.2918	0.0307	0.8277	0.0372
30	Hongtian Commerce and Trade	0.0121	0.0265	0.0157	0.0176	0.2814	0.2796	0.4479	0.1582	0.6989	0.037
31	Withub	0.0177	0.0115	0.0148	0.0132	0.3487	0.2223	0.6635	0.1411	0.3492	0.0363
32	Xuji Electric	0.0205	0.0055	0.0084	0.009	0.4672	0.2147	0.5396	0.2018	0.9486	0.0317
33	Xiangyi Electronic	0.0143	0.0094	0.0116	0.0111	0.2877	0.2339	0.7505	0.3616	0.7361	0.0312
34	Flextronics	0.0148	0.0152	0.0133	0.0173	-0.1448	0.1264	0.9276	0.9294	0.7295	0.0253
35	Huawei Technologies	0.0282	0.0115	0.0205	0.0136	0.4024	0.202	0.6274	0.2435	0.9312	0.025
36	Litian Science & Technology	0.0163	0.0112	0.0107	0.0173	0.5031	0.1714	0.447	0.1266	0.9997	0.0247
37	Nanjing LES	0.0183	0.0135	0.0168	0.0145	0.3446	0.1688	0.5968	0.1133	0.4532	0.0236
38	Ningde Lighting Protection	0.0118	0.0065	0.0084	0.0083	0.6631	0.1848	0.2656	0.0683	1.497	0.0209
39	Guangxi Lighting Protection	0.0173	0.0107	0.0126	0.0139	0.4603	0.0919	0.4746	0.0418	0.5473	0.0188
40	Landian Lighting Protection	0.016	0.0115	0.0111	0.0168	0.325	0.1551	0.4543	0.067	0.552	0.0175
41	Talent	0.0155	0.0112	0.0107	0.0163	0.325	0.1551	0.4543	0.067	0.552	0.0173
42	Skyworth	0.0166	0.0189	0.0542	0.0105	0.0064	0.2682	0.4058	0.0251	0.1419	0.0159
43	Indserve	0.0197	0.0167	0.0245	0.0143	0.4202	0.0565	0.4956	0.0188	0.3606	0.0152
44	Yixing Electric Power	0.0191	0.0106	0.0128	0.0147	0.2183	0.2633	0.5567	0.1973	0.8727	0.0143
45	Elektroskandia	0.0157	0.0104	0.012	0.013	0.2183	0.2633	0.5567	0.1973	0.8727	0.0136
46	Jintong	0.0175	0.0108	0.0145	0.0124	0.0986	0.2052	0.5081	0.0319	0.2161	0.0084

	Century										
47	Pedaro Technology	0.0083	0.0064	0.0094	0.0059	0.4202	0.1683	0.4956	0.1744	1.1215	0.0077
48	Zhongda Electronic	0.0177	0.0108	0.0147	0.0123	0.3487	0.1159	0.6635	0.1411	0.67	0.0032
49	Kangpudun	0.0163	0.0089	0.0105	0.0127	0.3487	0.1074	0.5778	0.1223	0.723	0.002
50	Samsung Telecommunications	0.0187	0.0094	0.0058	-0.0867	0.3554	0.1801	0.4011	0.1261	1.0457	-0.0054
51	Sichuan Changhong	0.013	0.0103	0.0117	0.0114	0.24	0.0861	0.6685	0.0388	0.2621	-0.006
52	Palite	0.0147	0.0127	0.0134	0.0138	0.1587	0.163	0.4117	0.0826	0.7599	-0.007
53	Weidun Electronic	0.0144	0.0118	0.0124	0.0135	0.2488	0.0717	0.9021	0.274	0.5934	-0.0099
54	Aerospace Communications	0.0182	0.0179	0.0138	0.026	0.1485	0.0798	0.7082	0.0259	0.1491	-0.0115
55	Sprt	0.011	0.0083	0.0106	0.0086	0.0986	0.066	0.5081	0.0055	0.1154	-0.0124
56	Fiberhome	0.006	0.0074	0.0063	0.007	0.4551	0.0824	0.5499	0.1002	1.1679	-0.0161
57	Sichuan Huiyuan	0.0177	0.0071	0.0084	0.0129	0.4332	0.0667	0.537	0.0747	1.1105	-0.0179
58	Chaofan Science & Technology	0.016	0.011	0.0127	0.0134	-0.0342	0.1469	0.665	0.1053	0.3639	-0.0242
59	Xu’an Science & Technology	0.0101	0.0078	0.009	0.0086	0.4804	0.075	0.8293	0.3372	1.5927	-0.0246
60	Aptech	0.0149	0.0062	0.0074	0.0109	0.6667	0.0376	0.2918	0.0307	1.9823	-0.0317
61	Leidun Technologies	0.0185	0.0107	0.0127	0.0146	-0.0236	0.1222	0.5604	0.0508	0.4691	-0.0318
62	ZTE	0.0175	0.0082	0.0077	0.0204	0.202	0.0426	0.7639	0.0607	0.5568	-0.0338
63	Shichuang Electronics	0.0145	0.0093	0.0108	0.0119	0.0873	0.0594	0.6462	0.0697	0.6425	-0.0419
64	V&T Technologies	0.0127	0.007	0.0097	0.0083	0.445	0.0426	0.6049	0.059	1.4062	-0.0432
65	NARI Technology	0.0126	0.0046	0.0064	0.0072	0.4165	0.1033	0.5383	0.2635	2.19	-0.0494
66	Lianshengxin	0.0167	0.0109	0.0127	0.0137	-0.0677	0.0596	0.7102	0.0504	0.3481	-0.0499
67	Tebo Trade	0.0178	0.0116	0.0132	0.0151	-0.2504	0.0705	0.6129	0.0183	0.2168	-0.0595
68	Yinruitong	0.0163	0.0144	0.0112	0.024	0.1242	0.0274	0.7224	0.0767	1.0736	-0.0661
69	Jiuzhou Group	0.0185	0.0059	0.0097	0.0083	0.3185	0.0265	0.5396	0.0515	1.6966	-0.0713
70	Shengguang Commerce and Trade	0.0115	0.0072	0.0096	0.0083	0.0708	0.0361	0.5287	0.043	1.3402	-0.0807
71	Firstlaser Technology	0.0133	0.0111	0.0145	0.0104	0.3446	0.0308	0.5968	0.0978	2.1463	-0.0889
72	Huahao	0.0124	0.0078	0.0094	0.0098	0.1587	0.0072	0.4117	0.0088	1.8203	-0.0963

	Industry										
73	Runyi International	0.0131	0.009	0.0109	0.0105	0.445	0.0063	0.6049	0.0201	3.2418	-0.1482
74	Shiji Wanglei	0.0146	0.0096	0.0119	0.0112	-0.1448	0.0131	0.9276	0.5972	4.5253	-0.2313
75	Shenzhen VAPEL	0.0119	0.0093	0.0103	0.0106	0.6615	0.0204	0.2652	0.0444	6.0237	-0.2418
76	Yuantai Lightning Protection	0.0092	0.0083	0.0087	0.0088	0.2512	0.0048	0.4974	0.0255	5.3957	-0.2759
77	Huoya Science & Technology	0.0121	0.0099	0.0106	0.0112	0.169	0.0108	0.5326	0.0677	5.5473	-0.2885
78	Warom Technology	0.0152	0.0095	0.0122	0.0112	0.4827	0.0065	0.4921	0.092	18.0506	-0.8977
79	Yunnan Xintong	0.0113	0.0089	0.01	0.0099	0.2488	0.0004	0.9021	0.0111	23.7007	-1.2555
80	Zhongyuanton g	0.0154	0.0095	0.0116	0.0119	0.4807	0.0039	0.346	0.0691	37.6084	-1.9088
81	Zhongguang Shihang	0.0156	0.0105	0.0156	0.0105	-0.0342	-0.0038	0.665	0.1132	-15.1912	-
82	Huiya Electronic	0.0146	0.0141	0.0106	0.0223	0.1939	0.0217	0.3718	-0.1079	-8.9826	-
83	Yadongya	0.0092	0.0054	0.0061	0.0077	0.6797	0.0006	0.3556	-0.0012	-6.8112	-
84	Darin Machinery	0.0127	0.0071	0.0096	0.0087	0.5047	0.0007	0.3657	-0.0016	-3.9615	-
85	Lantian Leidian	0.0134	0.0085	0.0112	0.0096	0.5643	-0.024	0.3878	0.0427	-3.2241	-
86	Asura	0.0096	0.0059	0.0079	0.0068	0.7355	0.0235	0.219	-0.0141	-2.1451	-
87	Xingkang Communicatio n	0.0131	0.0105	0.0132	0.0104	0.4792	0.0206	0.271	-0.0208	-2.7158	-
88	Nanjing Panda	0.0216	0.009	0.0098	0.0178	0.642	-0.0861	0.2431	0.0601	-2.1766	-
89	Hengyi Telecommunic ations	0.0113	0.009	0.0118	0.0088	0.3578	-0.0091	0.4065	0.0133	-2.1399	-
90	Weitong Electronic	0.0077	0.0092	0.0096	0.0074	0.4807	-0.0143	0.346	0.0039	-0.5844	-
91	Tianrun Weather	0.0142	0.0101	0.0155	0.0096	0.3446	-0.0138	0.5968	0.0198	-0.9672	-
92	Alcatel Lucent	0.0105	0.0064	0.0107	0.0064	0.6797	-0.0265	0.3556	0.0002	-0.0326	-
93	Jinjiedi	0.0138	0.01	0.0112	0.0119	0.6627	-0.0149	0.525	0.0008	-0.1283	-
94	Datang Telecommunic ations	0.0161	0.006	0.0107	0.0074	0.0344	-0.0192	0.775	0.0796	-1.3135	-
95	Roder	0.015	0.0079	0.0111	0.0097	0.2183	-0.0056	0.5567	0.003	-0.6177	-
96	Huaxiang Electronic	0.0131	0.0092	0.0141	0.0088	0.3711	-0.1986	0.5312	0.079	-0.3511	-

97	Honghao Science & Technology	0.0128	0.0115	0.0255	0.0079	0.146	-0.0279	0.5401	0.008	-0.2758	-
98	Dongnan Lihao	0.0148	0.0111	0.0138	0.0118	0.5031	-0.0952	0.447	-0.0314	0.4457	-
99	Eternal Asia	0.0221	0.011	0.0192	0.0118	0.0868	-0.2582	0.7957	0.0701	-0.0764	-
100	Bangde Electrical	0.0117	0.0074	0.0099	0.0084	-0.0677	-0.0081	0.7102	-0.062	3.1715	-
101	Hua'an Lightning Protection	0.0111	0.0073	0.0116	0.0071	0.3761	-0.0004	0.8837	-0.0092	8.9132	-
102	Sitong Electronic	0.0112	0.0082	0.009	0.0099	-0.2504	-0.0007	0.6129	-0.0069	8.4207	-
103	Shuyu Petroleum	0.0087	0.008	0.0091	0.0077	0.352	-0.0054	0.4117	-0.0398	11.104	-
104	Xiangyun Science & Technology	0.0147	0.0087	0.0131	0.0094	0.2814	-0.0044	0.4479	-0.0596	16.8795	-

Appendix 4: Risks of 104 Customers in 2013

Abbreviation of Enterprise	Risk Value	Abbreviation of Enterprise	Risk Value	Abbreviation of Enterprise	Risk Value	Abbreviation of Enterprise	Risk Value	Abbreviation of Enterprise	Risk Value
Yada Electronics	0.2528	Skyworth	0.0233	Leierda	0.0955	Withub	0.0544	Yuantai Lightning Protection	0.0046
Ellington Electronics	0.191	Runyi International	0.0204	Tianyi Electronic	0.0949	Guangxi Lighting Protection	0.0472	Shiji Wanglei	0.004
Goldwind	0.1399	Jiuzhou Group	0.0169	Tianma Lightning Protection	0.0869	Nanjing LES	0.0472	Xiangyun Science & Technology	0.0003
Nuoxi Communication	0.1173	Sichuan Changhong	0.0077	Xiaotong Engineering	0.0844	Landian Lighting Protection	0.0462	Huoya Science & Technology	0
Xinpeng Industrial	0.1004	Huahao Industry	-0.0016	Tongpu Integration	0.0839	Talent	0.046	Chaofan Science & Technology	-0.0053
Dongfang Electric	0.0816	Aerospace Communications	-0.0038	Wande Electronics	0.0831	Lantian Leidian	0.0456	Roder	-0.0064
Xuji Electric	0.081	Huiya Electronic	-0.0039	Haichen Communication	0.0826	Jinjiedi	0.0451	Sprt	-0.0064
Huawei Technologies	0.0734	ZTE	-0.0048	Tianlei Didun	0.0803	Xingkang Communication	0.0426	Leidun Science & Technology	-0.0074
Shenzhen VAPEL	0.0714	Datang Telecommunications	-0.0344	Litian Science & Technology	0.0767	Kangpudun	0.0396	Huaxiang Electronic	-0.0078
NARI Technology	0.0645	Eternal Asia	-0.0653	Asura	0.0748	Darin Machinery	0.0382	Shichuang Electronics	-0.0085
Flextronics	0.0632	Baibei Trade	0.2	Hongtian Commerce and Trade	0.0733	Weitong Electronic	0.0345	Yinruitong	-0.0103
Elektroskandia	0.0589	DOCOMO interTouch	0.1536	Aptech	0.0714	Indserve	0.034	Hua'an Lightning Protection	-0.0107
Nanjing Panda	0.0587	Taihua Lightning	0.153	Baotong Communicat	0.0697	Palite	0.0325	Shengguang Commerce	-0.011

		Protection		ion				and Trade	
Alcatel		Famoli		Xiangyi		V&T		Honghao	
Lucent	0.054		0.1525	Electronic	0.0695	Technologies	0.0299	Science & Technology	-0.017
Xinmeiya		Weiguan		Hailai	0.0685	Firstlaser	0.0227	Yunnan	-0.023
	0.0507	Electronic	0.1362	Science and Trade		Technology		Xintong	
Samsung		Kailan		Xincheng	0.0663	Weidun	0.0209	Zhongguang	-0.028
Telecommunications	0.049	Science & Technology	0.1325	Kexin		Electronic		Shihang	
Zhongyuanto		Fan’an		Pedaro	0.066	Jintong	0.0196	Lianshengxin	-0.0318
ng	0.0469	Science & Technology	0.1221	Technology		Century			
Fiberhome		Chongqing		Lulite	0.0651	Hengyi	0.0192	Tebo Trade	-0.0482
	0.0447	Hongsheng	0.1154			Telecommunications			
Warom		Kunming		Yixing	0.0597	Dongnan	0.0159	Bangde	-0.0576
Technology	0.0409	Putai	0.1082	Electric Power		Lihao		Electrical	
Sichuan		Ningde		Xu’an	0.0582	Shuyu	0.0118	Sitong	-0.0641
Huiyuan	0.0399	Lighting Protection	0.0988	Science & Technology		Petroleum		Electronic	
Zhongda		Ylelec		Yadongya	0.058	Tianrun	0.0063		
Electronic	0.038		0.0975			Weather			

Appendix 5 Assessment of Working Capital Indicators of 202 Public Companies in 2013

Stock Code	Abbreviation	Inventory turnover ratio	Receivables turnover ratio	Payables turnover ratio	Cash turnover ratio	Working capital allocation ratio	Cash to current liabilities ratio	Debt to assets ratio	Return on net assets	Surplus cash coverage ratio	Assessed value
300264	AVIT	0.0136	0.0029	0.0228	0.0026	0.9585	2.5625	0.0394	0.0271	0.2756	0.4869
300074	AVCON	0.0135	0.0051	0.034	0.0042	0.9435	2.5024	0.0462	0.1021	0.9492	0.4497
300359	QTONE Education	0.3633	0.0119	0.1143	0.0129	0.8717	1.9998	0.1001	0.1955	0.9423	0.4216
002279	Join-Cheer	0.9295	0.0125	0.2722	0.0129	0.8736	1.4175	0.0688	0.0833	0.8199	0.401
300333	Sinosun	0.0144	0.1405	0.1129	0.0148	0.9655	2.1417	0.0305	0.0842	1.25	0.4003
600563	Faratronic	0.0172	0.0086	0.0314	0.007	0.845	1.465	0.1234	0.1821	0.939	0.2878
300353	Kyland	0.0183	0.0071	0.0197	0.0069	0.8588	1.2072	0.0979	0.0823	0.6571	0.2548
300046	Techsem	0.0069	0.0069	0.0122	0.0048	0.8996	1.0255	0.0854	0.0484	0.5593	0.232
600485	Xinwei Group	0.0052	0.0054	0.0357	0.0029	0.8176	1.0218	0.2305	0.032	0.1551	0.2301
002273	Crystal-Optech	0.0153	0.0102	0.025	0.0081	0.864	1.085	0.0842	0.1019	1.2483	0.2093
600037	BGCTV	0.0567	0.1137	0.0202	-0.0433	0.7153	0.9682	0.4394	0.0654	0.3667	0.2088
002222	CASTECH	0.0054	0.0111	0.0277	0.0042	0.7231	1.0218	0.116	0.061	0.6288	0.207
300102	Changelight	0.0119	0.003	0.0138	0.0029	0.8788	0.8955	0.1002	0.059	0.7522	0.1999
002681	Fenda Technology	0.0295	0.0222	0.018	0.0427	0.7775	0.8534	0.1761	0.1316	0.7398	0.1979
300170	HAND	0.9171	0.0085	0.1588	0.0089	0.898	0.5188	0.0854	0.1062	2.2524	0.1969
300042	Netac	0.0229	0.0136	0.0941	0.0094	0.9174	0.6563	0.0701	0.0073	0.2418	0.1905
002104	Hengbao	0.0138	0.0326	0.015	0.0275	0.68	0.8732	0.2149	0.2081	0.8969	0.1858
002635	Anjie Technology	0.0163	0.0069	0.017	0.0068	0.8251	0.8421	0.1669	0.1186	0.848	0.1854
002194	Fingu	0.0119	0.0064	0.0135	0.006	0.8088	0.6964	0.1554	0.0251	0.198	0.184
603005	Wafer Level	0.0473	0.0265	0.0124	-0.0463	0.4622	1.0501	0.2926	0.2048	0.7543	0.183
300051	35 Interconnection	0.2435	0.0185	0.0192	0.1592	0.7096	0.411	0.2016	0.0219	0.2364	0.1812
002153	Shiji Network	0.0179	0.014	0.0285	0.0108	0.7062	0.8589	0.2218	0.1954	0.9223	0.1778
300113	Shunwang Science & Technology	0.6338	0.0091	0.0509	0.011	0.6164	0.3817	0.3034	0.1168	0.7148	0.1768
600271	Aisino	0.0594	0.0564	0.0561	0.0597	0.7182	0.6629	0.2426	0.212	1.0126	0.164
002467	263	0.1629	0.0436	0.0707	0.0669	0.5438	0.6423	0.1717	0.1043	0.7834	0.1573
600570	Hundsun	0.0436	0.0255	0.1186	0.0186	0.6154	0.7248	0.2461	0.1929	0.8546	0.1511
002049	Tongfang Guoxin	0.012	0.0061	0.0115	0.0063	0.8178	0.7636	0.2359	0.1163	1.1744	0.1505
002405	NavInfo	0.0918	0.0103	0.0307	0.0133	0.8288	0.4973	0.1348	0.0496	0.6765	0.1476

002609	JSS	0.012	0.0172	0.0214	0.0106	0.7518	0.5943	0.2217	0.0995	0.6211	0.1468
002106	Laibao Hi-tech	0.0193	0.0097	0.0135	0.0124	0.7303	0.5048	0.1961	0.0163	0.162	0.1467
002308	Vtron	0.0136	0.0078	0.0198	0.0066	0.8429	0.7271	0.1361	0.1411	1.3873	0.1462
002449	Nationstar	0.0124	0.0088	0.0117	0.0092	0.8608	0.5729	0.3086	0.044	0.6281	0.1424
002587	Auto Electronics	0.0127	0.0124	0.0176	0.0097	0.8219	0.5591	0.1629	0.0857	0.8681	0.138
300380	Amarsoft	0.0185	0.0079	0.0895	0.0059	0.8361	0.7211	0.1516	0.2091	1.6245	0.1367
002618	Danbon Technology	0.0426	0.0086	0.0591	0.0081	0.7672	0.5074	0.2592	0.0347	0.4466	0.135
300002	Ultrapower	0.0471	0.0067	0.0747	0.0063	0.7939	0.6835	0.1327	0.1426	1.4165	0.1348
000917	TV & Broadcast Media	0.009	0.0539	0.0133	0.0186	0.5574	0.595	0.4196	0.0587	0.2961	0.1313
002484	Jianghai Capacitor	0.0149	0.0096	0.0182	0.0086	0.7756	0.5604	0.145	0.0893	0.9833	0.1282
002439	Venustech	0.0329	0.0069	0.0174	0.0085	0.6298	0.5319	0.2719	0.0918	0.4859	0.1275
300319	Microgate	0.0091	0.0087	0.0132	0.0067	0.765	0.5301	0.1784	0.0818	0.8629	0.1246
300248	NewCapec	0.0099	0.005	0.0194	0.004	0.8776	0.4544	0.1229	0.0478	0.8795	0.1233
002465	Haige Communications	0.0075	0.0059	0.0169	0.0041	0.7881	0.517	0.1721	0.0734	0.8667	0.1232
300219	Honglitronic	0.0282	0.0137	0.017	0.0203	0.6365	0.5091	0.2279	0.0782	0.5876	0.1229
300077	Nationz Technologies	0.009	0.006	0.0157	0.0047	0.9575	0.167	0.0465	0.0017	0.2577	0.1206
002446	Shenglu Communication	0.0134	0.0033	0.0062	0.0046	0.7116	0.3405	0.2153	0.0056	0.0606	0.1197
002161	Invengo	0.0111	0.0051	0.0297	0.0039	0.8093	0.4531	0.0848	0.0331	0.8268	0.1184
300036	SuperMap	0.2649	0.0067	0.0139	0.0123	0.6508	0.3598	0.213	0.0856	0.9481	0.1164
300303	jufei optoelectronics	0.037	0.0057	0.0095	0.0103	0.6613	0.5036	0.269	0.1419	0.8289	0.1163
300340	Keheng	0.0069	0.0046	0.0171	0.0033	0.8534	0.2015	0.1263	0.0042	0.1514	0.114
300373	Yangjie Technology	0.0243	0.0083	0.015	0.0106	0.5818	0.5888	0.2716	0.2592	1.2677	0.1098
002261	Talkweb	0.021	0.0102	0.0591	0.0078	0.8227	0.4035	0.1323	0.0555	0.9046	0.1094
300311	Surfilter	0.0188	0.0175	0.0277	0.0134	0.7699	0.3701	0.2376	0.0535	0.6223	0.1093
002657	Sinodata	0.0084	0.0595	0.0265	0.0102	0.6672	0.3951	0.4812	0.0791	0.3742	0.1069
300115	Changying Precision	0.0136	0.0103	0.0203	0.0082	0.5281	0.5291	0.2489	0.1292	0.7491	0.1055
300245	DragonNet	0.0424	0.0088	0.0361	0.0091	0.835	0.4751	0.1338	0.1036	1.4123	0.1051
300253	WinningSoft	0.0587	0.0067	0.0307	0.0075	0.8469	0.4824	0.15	0.1244	1.5633	0.1032
300177	HiTarget	0.0123	0.0087	0.0202	0.0068	0.8476	0.5349	0.117	0.1063	1.6086	0.103
600130	Bird	0.0576	0.108	0.0257	-0.0813	0.6777	0.3725	0.2385	0.0825	0.7346	0.1029
000970	Zhong Ke	0.0113	0.011	0.0221	0.0074	0.7643	0.4192	0.2293	0.0937	0.9515	0.1017

002185	San Huan Hua Tian Technology	0.029	0.0158	0.0169	0.0258	0.4723	0.5192	0.4456	0.1017	0.5177	0.0997
300079	Sumavision	0.0099	0.0029	0.0268	0.0024	0.9484	0.6171	0.0483	0.0532	2.0496	0.0997
002654	Mason Technology	0.0156	0.0079	0.0076	0.0166	0.4408	0.4814	0.3215	0.082	0.3979	0.098
300241	Refond Optoelectronics	0.0269	0.0082	0.0099	0.0173	0.458	0.4611	0.3375	0.0936	0.4241	0.0975
300211	Yitong Technology	0.019	0.0053	0.0103	0.007	0.7415	0.332	0.1628	0.0467	0.7238	0.0968
300127	Galaxy Magnets	0.0136	0.0078	0.0439	0.0056	0.9105	0.4735	0.0726	0.0565	1.6047	0.0965
300327	Sinowealth	0.014	0.0191	0.0229	0.0125	0.8974	0.3555	0.0933	0.0459	1.2638	0.0961
002579	China Eagle Electronics	0.0157	0.0105	0.009	0.0205	0.6271	0.2904	0.2407	0.0194	0.2658	0.0955
300134	Facfook	0.0184	0.009	0.0089	0.0186	0.6082	0.3038	0.2506	0.0269	0.2722	0.0952
300231	Trust & far Technology	0.1179	0.0081	0.0162	0.0142	0.7531	0.3765	0.2034	0.1331	1.3845	0.0937
600588	Yonyou	0.5789	0.0087	0.0372	0.0111	0.1945	0.2458	0.5349	0.1691	0.7684	0.0898
002396	Star-net	0.0185	0.012	0.0149	0.0143	0.5982	0.3836	0.3362	0.1632	0.8565	0.0865
002463	WUS	0.027	0.0108	0.012	0.0215	0.5713	0.3449	0.2968	0.0532	0.524	0.0862
600601	Founder	0.0293	0.0121	0.0124	0.0279	0.3389	0.3831	0.3198	0.0162	0.0962	0.0833
300331	SVG Optronics	0.0164	0.0059	0.0155	0.006	0.7323	0.1993	0.187	0.02	0.478	0.083
002474	Rongji	0.0101	0.023	0.0297	0.0092	0.8401	0.263	0.1454	0.0464	1.0975	0.0802
300167	Dvision	0.0096	0.0034	0.0118	0.0032	0.6598	0.0932	0.265	0.0035	0.1074	0.0693
601929	Jishi Media	0.0373	0.0474	0.0069	-0.0103	-0.2495	0.7456	0.3223	0.0939	0.3721	0.0677
000670	InfoTM	0.0019	0.007	0.0378	0.0016	0.6435	0.1497	0.3544	0.017	0.2068	0.0649
002577	Rapoo	0.0156	0.0189	0.0162	0.0181	0.9185	0.2382	0.0599	0.0238	1.5864	0.0647
300250	CNCR-IT	0.0166	0.0046	0.015	0.0047	0.8786	0.3842	0.0977	0.0806	1.9388	0.0644
600289	BOCO Inter-Telecom	0.0205	0.0066	0.0076	0.0147	0.5243	0.2182	0.3374	0.0379	0.3411	0.0643
002138	Sunlord Electronics	0.0173	0.0082	0.023	0.0073	0.1938	0.4906	0.3603	0.1085	0.5299	0.0633
002268	Westone	0.0201	0.0054	0.0092	0.0079	0.7299	0.2026	0.291	0.0561	0.8471	0.0628
002017	Eastcompeace	0.0077	0.0167	0.0104	0.0107	0.4613	0.2673	0.4978	0.0525	0.252	0.06
002296	Splendor Science & Technology	0.0066	0.0027	0.0055	0.0029	0.8114	0.2316	0.1711	0.0551	1.2532	0.0599
300155	Anjubao	0.0151	0.0141	0.0239	0.0105	0.8322	0.3361	0.1398	0.0892	1.798	0.0593
300188	Meiya Pico	0.0107	0.0083	0.0279	0.0056	0.7368	0.2757	0.1861	0.0739	1.2835	0.0587
600171	Shanghai Belling	0.0186	0.0077	0.0102	0.0118	0.7385	0.1866	0.1496	0.0238	1.0214	0.058

300096	Yilianzhong	0.0161	0.0044	0.0121	0.0049	0.7936	0.2214	0.1787	0.0577	1.2563	0.0577
002232	Qiming Information	0.0146	0.0164	0.0114	0.0243	0.435	0.1607	0.3822	0.0033	0.0384	0.0561
300227	Sunshine	0.0186	0.0059	0.0223	0.0056	0.4818	0.2711	0.2639	0.0585	0.685	0.0543
601231	USI	0.0241	0.0114	0.013	0.0193	0.3555	0.2885	0.5517	0.1484	0.4254	0.053
000823	Goworld	0.0186	0.0084	0.0133	0.0102	0.4102	0.2735	0.4314	0.0749	0.4481	0.0518
300213	Jiaxun Feihong	0.0078	0.0069	0.0142	0.0049	0.6866	0.1908	0.2893	0.0651	0.9207	0.0513
002189	Lida Optical	0.0224	0.0089	0.017	0.0102	0.4308	0.1784	0.3287	0.0192	0.2323	0.0511
600410	Teamsun	0.0262	0.0068	0.0147	0.0085	0.5397	0.1616	0.5625	0.0203	0.1562	0.0503
002156	Fujitsu	0.0206	0.0144	0.0118	0.0298	0.2451	0.2929	0.388	0.0269	0.196	0.0501
002636	GDM	0.0422	0.0071	0.008	0.0249	0.3874	0.1837	0.4	0.0259	0.2127	0.0494
000997	Newland	0.0034	0.0144	0.0093	0.0039	0.4492	0.2532	0.5395	0.1427	0.5246	0.0486
002281	Accelink Technologies	0.0101	0.0073	0.0083	0.0086	0.5389	0.2305	0.3677	0.0978	0.7834	0.0479
600435	North Navigation	0.0051	0.004	0.0057	0.0037	0.4163	0.199	0.3375	0.0257	0.2681	0.0472
300351	Yonggui	0.0085	0.0039	0.012	0.0034	0.8872	0.3235	0.101	0.0714	2.0746	0.0465
000050	A Tianma	0.0245	0.0113	0.011	0.0262	-0.0139	0.4983	0.5881	0.0869	0.2008	0.0458
000561	Fenghuo Communication	0.0058	0.0034	0.0052	0.0037	0.5434	0.1364	0.4053	0.0304	0.339	0.0449
300297	Bluedon	0.0584	0.006	0.0141	0.0089	0.5356	0.1624	0.3709	0.0467	0.6403	0.0446
600460	Silan Microelectronics	0.0092	0.0078	0.0152	0.0059	0.5616	0.1918	0.4497	0.0519	0.582	0.0436
600366	Ningbo Yunsheng	0.0144	0.0182	0.042	0.0099	0.6631	0.2804	0.2175	0.1207	1.5507	0.0429
002025	Aerospace Electronics	0.0099	0.0053	0.015	0.0044	0.7743	0.2688	0.2003	0.091	1.6779	0.0425
600183	Shengyi Technology	0.019	0.0072	0.0137	0.0085	0.4507	0.2551	0.4266	0.1229	0.7774	0.0422
300053	Optimal	0.0065	0.0038	0.0291	0.0026	0.9163	0.3715	0.0628	0.0441	2.3245	0.042
300078	Century	0.0215	0.018	0.0383	0.0132	0.9382	0.4715	0.0542	0.0726	2.9107	0.0387
000948	Nantian Information	0.0145	0.0157	0.0126	0.0188	0.3741	0.1247	0.4519	0.003	0.0321	0.0386
000725	BOE	0.033	0.0163	0.0166	0.032	0.1724	0.342	0.5877	0.0779	0.3318	0.038
002519	Yinhe Electronics	0.0126	0.0062	0.0096	0.0073	0.6747	0.2033	0.2726	0.0973	1.3058	0.0379
002368	Taiji Shares	0.1015	0.0087	0.0149	0.0173	0.3021	0.1986	0.5131	0.0957	0.4623	0.0375
300150	Ireal	0.0105	0.0023	0.0088	0.0025	0.8821	0.1983	0.116	0.0468	1.8041	0.037
600360	Sino-Microelectronics	0.0141	0.0073	0.0064	0.0198	0.3872	0.1487	0.4394	0.0189	0.2193	0.0358
600756	Inspur	0.0117	0.0089	0.0062	0.0277	0.3547	0.1122	0.4523	0.0046	0.0519	0.0337
002214	Dali Technology	0.0029	0.0029	0.0289	0.0015	0.8297	0.204	0.3828	0.0702	1.5265	0.0303

600562	Glarun Technology	0.0053	0.0088	0.0102	0.0049	0.5713	0.1748	0.402	0.1194	1.0667	0.0278
002655	Gettop Acoustic	0.0119	0.007	0.0109	0.0074	0.2636	0.1618	0.3789	0.0243	0.2578	0.0237
300301	CF lighting	0.0115	0.0129	0.0069	0.0508	0.0646	0.23	0.422	0.0363	0.2243	0.0194
002045	GGEC	0.0188	0.0104	0.0151	0.0121	0.2082	0.2024	0.5239	0.0589	0.3155	0.0176
000810	Skyworth	0.0166	0.0189	0.0542	0.0105	0.0064	0.2682	0.4058	0.0251	0.1419	0.0159
000988	Huagongtech	0.0071	0.0051	0.0083	0.0046	0.4825	0.0677	0.3486	0.0213	0.6561	0.0139
300232	Unilumin	0.007	0.0147	0.0086	0.0107	0.4006	0.1311	0.4045	0.0659	0.7676	0.0127
002179	China Aviation Optical-Electrical	0.0138	0.0044	0.0092	0.0052	0.6308	0.1382	0.4552	0.0888	1.2628	0.0123
002426	Victory Precision	0.018	0.0108	0.0113	0.0168	0.3577	0.15	0.4167	0.0878	0.8197	0.0116
300378	Digiwin Software	0.4081	0.0085	0.0398	0.0105	0.5207	0.1127	0.3738	0.1535	2.2982	0.011
002642	United Electronics	0.0153	0.0093	0.0134	0.0102	0.5882	0.1601	0.2434	0.0772	1.5277	0.0105
600703	San’an Optoelectronics	0.01	0.0066	0.0155	0.0054	0.4121	0.2804	0.4753	0.1471	1.3462	0.01
002402	H&T	0.0162	0.0085	0.0104	0.0122	0.6158	0.1014	0.2529	0.0469	1.3662	0.0093
600083	Booxin Investment	0.0389	0.0215	0.0216	0.0386	0.0754	0.2085	0.6407	0.2367	0.6478	0.0085
002331	Wantong Technology	0.016	0.0111	0.008	0.0362	0.528	0.1256	0.3587	0.094	1.3467	0.0071
600525	Changyuan Group	0.0128	0.0052	0.019	0.0046	0.3245	0.1765	0.4363	0.116	0.8915	0.0064
002151	BDStar Navigation	0.0123	0.0067	0.0107	0.0072	0.2702	0.1658	0.4977	0.0761	0.5932	0.0064
002119	Kangqiang Electronics	0.0126	0.0076	0.0182	0.0064	0.1269	0.1678	0.5332	0.0291	0.1651	0.0044
600888	Xinjiang Joinworld	0.0103	0.0125	0.0091	0.0149	0.3415	0.0971	0.5379	0.0233	0.4637	0.0038
600060	Hisense	0.0237	0.0074	0.0125	0.0103	0.447	0.1365	0.4882	0.1596	1.2345	0.0016
000016	A Konka	0.0145	0.0082	0.0148	0.0081	0.0968	0.2022	0.7281	0.014	0.0262	0.0001
000733	Zhenhua Science & Technology	0.0109	0.0078	0.0186	0.006	0.5362	0.0748	0.3403	0.0409	1.1949	-0.0033
000100	TCL Group	0.0196	0.0156	0.0141	0.0226	0.2249	0.1395	0.7444	0.1445	0.5567	-0.0036
600718	Neusoft	0.0227	0.0124	0.024	0.0121	0.5043	0.1055	0.4117	0.0697	1.2655	-0.0039
600839	Sichuan Changhong	0.013	0.0103	0.0117	0.0114	0.24	0.0861	0.6685	0.0388	0.2621	-0.006
002436	Fastprint	0.046	0.0097	0.0161	0.016	0.0586	0.2064	0.2945	0.0705	0.8497	-0.0065

000021	Kaifa Technology	0.0659	0.0252	0.0379	0.0351	0.2035	0.0514	0.6386	0.032	0.354	-0.007
600667	Taiji Industry	0.0338	0.0252	0.025	0.0342	-0.3975	0.4028	0.6194	0.0522	0.0954	-0.009
002065	DHC	0.0094	0.0084	0.0282	0.0053	0.688	0.2056	0.3819	0.2075	2.4563	-0.0149
600797	Insigma	0.0198	0.0123	0.016	0.0145	0.1344	0.0744	0.605	0.0268	0.2524	-0.0152
600498	Fiberhome	0.006	0.0074	0.0063	0.007	0.4551	0.0824	0.5499	0.1002	1.1679	-0.0161
000938	Unisplendour	0.0465	0.0286	0.0198	0.1721	0.1764	0.0658	0.5979	0.1084	1.134	-0.0177
000586	Huiyuan Communication	0.0177	0.0071	0.0084	0.0129	0.4332	0.0667	0.537	0.0747	1.1105	-0.0179
002130	Woer Heat-Shrinkable Material	0.0166	0.0093	0.0198	0.0085	0.0728	0.1458	0.4413	0.079	0.7172	-0.0209
300269	LianTronics	0.0094	0.0066	0.0061	0.0106	0.4982	0.0323	0.3795	0.0249	1.2692	-0.0215
000636	Fenghua	0.0183	0.0108	0.0119	0.0159	0.2439	0.0724	0.4022	0.0384	0.9044	-0.0228
300088	Token Sciences	0.0282	0.0073	0.0229	0.0078	0.4135	0.231	0.2649	0.1589	2.1819	-0.0234
300010	Lanxum	0.0174	0.0054	0.0336	0.0047	0.481	0.1171	0.29	0.0836	1.769	-0.0251
002289	Success Electronics	0.0091	0.0053	0.0064	0.007	0.0265	0.0627	0.5992	0.0069	0.0762	-0.0254
002456	O-Film Tech	0.0207	0.015	0.0125	0.0287	0.0341	0.1232	0.6569	0.1749	0.8274	-0.0316
000063	ZTE	0.0175	0.0082	0.0077	0.0204	0.2086	0.0426	0.7639	0.0607	0.5568	-0.033
600845	Baosight	0.0186	0.0051	0.0077	0.0083	0.3562	0.0874	0.5723	0.1692	1.4932	-0.035
200468	B Nanjing Putian	0.0151	0.0087	0.0068	0.0295	0.0717	0.0285	0.7777	0.0276	0.2773	-0.04
002241	GoerTek	0.0304	0.0094	0.0133	0.0156	0.1447	0.1381	0.4904	0.2064	1.5649	-0.0423
002389	Nanyang Technology	0.0148	0.006	0.0222	0.0053	0.748	0.0625	0.1309	0.0235	2.6894	-0.0477
600406	NARI Technology	0.0126	0.0046	0.0064	0.0072	0.4165	0.1033	0.5383	0.2635	2.19	-0.0494
600446	Jinzheng	0.0138	0.0235	0.0229	0.014	0.1711	0.0926	0.5768	0.1637	1.4088	-0.0495
002475	LuXshare	0.0233	0.0087	0.0124	0.0129	0.2003	0.1079	0.4911	0.1473	1.5703	-0.0495
300322	Speed	0.0203	0.0084	0.011	0.0129	0.4374	0.0718	0.3182	0.0656	2.0089	-0.0502
002583	Hytera	0.0131	0.0055	0.014	0.0054	0.393	0.0605	0.4222	0.0683	1.7633	-0.0532
002089	New Seaunion	0.0101	0.0041	0.013	0.0038	0.1369	0.0844	0.439	0.069	1.2384	-0.0532
002055	Deren Electronics	0.0135	0.005	0.008	0.0067	0.2321	0.0586	0.5339	0.0897	1.3588	-0.0548
300209	Tiza	0.0238	0.0081	0.042	0.007	0.9273	0.0481	0.0615	0.0096	3.3123	-0.0582
002253	Wisesoft	0.0079	0.0052	0.0146	0.004	0.7988	0.1974	0.1242	0.0838	3.5452	-0.0591
600330	TDG	0.011	0.0124	0.0097	0.0145	-0.3319	0.0653	0.5353	0.0117	0.1676	-0.0637
600584	Changjiang Elec. Tech	0.0232	0.0158	0.012	0.0439	-0.5901	0.2058	0.6518	0.0185	0.0602	-0.0662
000801	Jiuzhou Group	0.0185	0.0059	0.0097	0.0083	0.3185	0.0265	0.5396	0.0515	1.6966	-0.0713
300111	Sunlogin	0.0129	0.0166	0.009	0.0386	-0.2389	0.0616	0.5961	0.035	0.5814	-0.0716

300366	TROY Information	0.0638	0.0053	0.0089	0.0109	0.628	0.1203	0.3425	0.2092	3.4307	-0.0737
300339	HopeRun	0.0427	0.0083	0.0191	0.0109	0.6719	0.104	0.3213	0.1052	3.2116	-0.074
300300	Hakim	0.0067	0.0077	0.0079	0.0066	0.6084	0.0624	0.334	0.0901	2.8782	-0.0782
300292	Wutong Communication	0.0098	0.0066	0.008	0.0079	0.5477	0.0393	0.3152	0.0408	2.7445	-0.086
300114	ZEMIC	0.0112	0.0102	0.0177	0.0077	0.6434	0.0684	0.2376	0.0638	3.3672	-0.0951
600100	Tsinghua Tongfang	0.0101	0.0117	0.0093	0.0129	-0.0896	0.0372	0.68	0.0791	1.2483	-0.0979
002369	Zowee	0.0221	0.0137	0.0134	0.0228	0.2014	0.0369	0.409	0.0656	2.6431	-0.1186
002376	SNBC	0.0177	0.006	0.0128	0.0069	0.5229	0.1	0.3025	0.1429	4.0324	-0.1328
300128	Jinfu New Materials	0.0209	0.0079	0.0147	0.0094	0.6507	0.052	0.2748	0.0818	4.224	-0.14
002660	Moso Power Supply	0.019	0.0056	0.0077	0.0099	0.5804	0.0175	0.3302	0.0341	4.0145	-0.1519
600850	East China Computer	0.0106	0.0185	0.0185	0.0106	0.3431	0.0315	0.6389	0.2034	3.6728	-0.1576
600118	China Spacesat	0.0252	0.0081	0.0068	0.0596	0.5365	0.025	0.4224	0.0803	4.6476	-0.1802
600288	Daheng Science & Technology	0.0111	0.023	0.0299	0.01	0.3213	0.0055	0.4664	0.0184	3.8321	-0.1836
002544	GCI Science & Technology	0.0183	0.0072	0.0078	0.015	0.4299	0.0216	0.4834	0.0914	4.5323	-0.1972
300182	Jetsen	0.0269	0.0084	0.0245	0.0086	0.695	0.0735	0.2507	0.1446	5.918	-0.2104
300075	Aegova	0.0244	0.0062	0.029	0.006	0.8157	0.0741	0.1582	0.0882	6.8913	-0.2494
300324	Watertek	0.0161	0.009	0.0165	0.0089	0.7953	0.0317	0.1613	0.0425	6.9879	-0.2687
300025	Huaxing Chuangye	0.0333	0.003	0.0096	0.0039	0.4609	0.0185	0.4564	0.0945	6.5573	-0.2976
002429	MTC	0.0194	0.0145	0.0208	0.0138	0.4974	0.027	0.4695	0.166	7.311	-0.3227
300369	Nsfocus	0.1093	0.0057	0.0224	0.0071	0.5998	0.044	0.364	0.2365	9.3944	-0.3913
000536	CPT Technology	0.0442	0.0054	0.0253	0.006	0.1855	0.0108	0.6196	0.1264	8.1095	-0.4158
300168	Wanda Information	0.0316	0.0101	0.0717	0.0085	0.6303	0.0208	0.2872	0.0926	11.692	-0.5359
600405	Dynamic Power	0.0083	0.0036	0.0048	0.0054	0.2901	0.0033	0.5689	0.0439	10.7528	-0.5538
300296	Leyaro	0.0086	0.0061	0.0116	0.0052	0.5286	0.0124	0.407	0.109	13.4259	-0.646
300044	Sunwin Intelligent	0.0054	0.0078	0.0106	0.0046	0.583	0.0061	0.3636	0.0498	14.3927	-0.6957

Appendix 6: Working Capital Risks of 214 Public Companies in 2013

Name of Enterprise	Risk Value	Name of Enterprise	Risk Value	Name of Enterprise	Risk Value	Name of Enterprise	Risk Value	Name of Enterprise	Risk Value
Sunwin Intelligent	1.7882	Ultrapower	0.3625	Invengo	0.2574	Unisplendour	0.1654	Teamsun	0.0749
Leyaro	1.6634	Anjubao	0.3595	Zhong Ke San Huan	0.2549	Huiyuan Communication	0.1652	Sino-Microelectronics	0.0714
Wanda Information	1.4756	WinningSoft	0.3586	Xinwei Group	0.2531	Nationz Technologies	0.165	A Tianma	0.0701
Dynamic Power	1.3012	Kyland	0.3586	Yinhe Electronics	0.2521	SVG Optronics	0.1632	Gettop Acoustic	0.0654
Nsfocus	1.2053	Ireal	0.3435	Nationstar	0.2457	Sinodata	0.1621	GGEC	0.0651
CPT Technology	0.9718	Tongfang Guoxin	0.3396	Hytera	0.2436	Shengyi Technology	0.1618	*ST Printronics	0.0641
Watertek	0.9351	DragonNet	0.3369	jufei optoelectronics	0.2425	Refond Optoelectronics	0.1596	Qiming Information	0.0623
Aegova	0.9321	Rapoo	0.3363	JSS	0.2423	Mason Technology	0.1569	ZTE	0.0559
MTC	0.922	Token Sciences	0.3348	H&T	0.24	New Seaunion	0.1527	CF lighting	0.0538
Huaxing Chuangye	0.8254	Zowee	0.3307	Shanghai Belling	0.2319	Bluedon	0.1498	Kaifa Technology	0.0504
Jetsen	0.7959	Changelight	0.3229	Netac	0.2315	Changyuan Group	0.1466	Nantian Information	0.0438
China Spacesat	0.6141	Techsem	0.3229	Wantong Technology	0.2287	Victory Precision	0.1428	Inspur	0.0422
Sinosun	0.6064	Aerospace Electronics	0.3217	San’an Optoelectronics	0.2251	Sunlord Electronics	0.1418	Skyworth	0.0374
AVCON	0.6016	Anjie Technology	0.3178	Bird	0.2201	Keheng	0.1397	Sichuan Changhong	0.0347
Jinfu New Materials	0.5808	Trust & far Technology	0.3172	China Aviation Optical-Electrical	0.22	China Eagle Electronics	0.1391	Kangqiang Electronics	0.0294
GCI Science & Technology	0.5758	Hengbao	0.3158	35 Interconnection	0.2195	Facfook	0.139	Insigma	0.0252
HAND	0.5737	Shiji Network	0.3137	Changying Precision	0.2194	Silan Microelectronics	0.138	Sunlogin	0.0247
QTONE Education	0.561	Aisino	0.3135	Yitong Technology	0.2164	Unilumin	0.1375	HC SemiTek	0.0186
SNBC	0.5476	Fenda	0.31	Jiuzhou Group	0.216	Fastprint	0.132	B Nanjing	0.0047

		Technology						Putian	
Wisesoft	0.544	Sinowealth	0.3092	Fingu	0.2152	Shenglu Communication	0.1295	A Konka	0.0029
Moso Power Supply	0.5385	CASTECH	0.3084	Honglitronic	0.2151	Fenghua	0.129	Zhenxin Science & Technology	0.0027
Century	0.5335	Yangjie Technology	0.2977	Star-net	0.2149	Huagongtech	0.1248	Taiji Industry	0.0012
Join-Cheer	0.5328	NARI Technology	0.2976	Surfilter	0.2105	Newland	0.1221	Success Electronics	-0.0131
AVIT	0.5313	Ningbo Yunsheng	0.2966	Danbon Technology	0.2081	Jishi Media	0.1207	TDG	-0.0361
Tiza	0.5136	Speed	0.2894	Neusoft	0.2066	Goworld	0.1202	Zongyi Group	-0.0525
TROY Information	0.4945	Wafer Level	0.2887	LuXshare	0.2043	BOCO Inter-Telecom	0.1188	Dongguang Micro-electronics	-0.0569
ZEMIC	0.4797	Jianghai Capacitor	0.2875	GoerTek	0.2034	USI	0.1086	Changjiang Elec. Tech	-0.058
Daheng Science & Technology	0.4771	Shunwang Science & Technology	0.2863	Baosight	0.2028	Tsinghua Tongfang	0.1084	Hareonsolar	-0.1293
HopeRun	0.4689	Dali Technology	0.2859	Jiaxun Feihong	0.2027	Taiji Shares	0.1059	Sunwave Communications	-0.1465
East China Computer	0.4532	263	0.2802	Westone	0.2026	Fenghuo Communication	0.0998	*ST Chaori	-0.1538
Sumavision	0.4478	Auto Electronics	0.2779	Yonyou	0.2023	BDStar Navigation	0.0998	Great Wall Computer	-0.1688
Optimal	0.4388	Hundsun	0.2756	Venustech	0.2005	InfoTM	0.0986	Xingxing Science & Technology	-0.2505
Faratronic	0.4282	Meiya Pico	0.2718	Zhenhua Science & Technology	0.1985	Founder	0.098	Hedy	-0.2975
Nanyang Technology	0.4147	Lanxum	0.2708	Glarun Technology	0.1978	Eastcompeace	0.0972	Hanvon	-0.6483
Crystal-Optech	0.413	Splendor Science & Technology	0.2701	Hisense	0.1958	Woer Heat-Shrinkable Material	0.0936		
Hakim	0.4089	SuperMap	0.27	LianTronics	0.195	Booxin Investment	0.092		
Yonggui	0.3967	NewCapec	0.2696	Hua Tian Technology	0.177	North Navigation	0.0905		
Amarsoft	0.3924	Yilianzhong	0.268	TV &	0.1755	O-Film Tech	0.0903		

				Broadcast Media			
CNCR-IT	0.3901	United Electronics	0.2654	Jinzheng	0.1744	Lida Optical	0.0889
Digiwin Software	0.39	Rongji	0.2645	Fiberhome	0.1739	Dvision	0.0875
DHC	0.385	BGCTV	0.2644	Laibao Hi-tech	0.1727	BOE	0.086
Wutong Communication	0.3839	Haige Communications	0.2643	Accelink Technologies	0.1716	GDM	0.0831
Vtron	0.3691	Microgate	0.264	WUS	0.1704	Xinjiang Joinworld	0.0812
HiTarget	0.3684	Talkweb	0.2592	Deren Electronics	0.1695	Fujitsu	0.0808
Galaxy Magnets	0.3673	NavInfo	0.2586	Sunshine	0.1657	TCL Group	0.0753

Appendix 7: Working Capital Risks of 69 Public Companies in 2013

Name of Enterprise	Risk Value	Name of Enterprise	Risk Value	Name of Enterprise	Risk Value	Name of Enterprise	Risk Value	Name of Enterprise	Risk Value
VRV	0.1013	Golden Laser	0.0461	Huahong Jitong	0.0289	Chaohua Tech	0.0049	Shenzhen Huafa A	-0.0332
BO Telecom	0.0973	Ledman Optoelectronic	0.0441	Santai Elec	0.0268	JPMF	0.0027	Datang Telecommunications	-0.0344
GQY	0.0948	China Shipping Network	0.0431	Eastone Century	0.0241	Toyou Feiji	-0.0009	Sea Star	-0.0371
INESA-E	0.0882	Eastcom	0.0428	Lianovation	0.0232	Geeoa	-0.0035	Allwin Telecommunication	-0.0375
Fuxing Xiaocheng	0.0843	Sunyes	0.0409	Sunway Communication	0.021	Sunsea Telecommunications	-0.0038	Keybridge Communications	-0.0418
Thunisoft	0.0798	Addsino A	0.0409	Enjoyor	0.0189	Risen Energy	-0.0039	Shanghai Putian	-0.042
Infinova	0.0771	New Century	0.0405	PCI	0.0162	Sunnada	-0.004	YITOA	-0.0434
Guide Infrared	0.0724	New Jialian	0.0382	CS&S	0.0159	Gosuncn	-0.0088	COPOTE Science & Technology	-0.0438
Highlander	0.0678	IRTOUCH	0.036	Tatwah Smartech	0.0143	e Hualu	-0.01	CEC CoreCast	-0.0457
TYDIC	0.0659	Sevenstar Electronics	0.035	Meteno	0.0127	Coship Electronics	-0.0181	Huadong Electronics	-0.0603
UniStrong	0.064	GreatWall Information	0.0345	Philisense	0.0103	Goodark	-0.0193	Inspur	-0.0673
Nanjing Panda	0.0587	*ST Yanhuang	0.0339	ROUTON	0.0089	CITIC Guoan	-0.0199	Powerise	-0.081
Sunline	0.057	Hirisun	0.0325	Yangtze Communic	0.0065	Transinfo	-0.0237	ECEC	-0.1021
Tongfeng Electronics	0.0491	A SED Electronics	0.0301	Sun Create Electronics	0.0054	BringSpring Science & Technology	-0.0243		

Appendix 8: Questionnaire for Suppliers

Part I: Background

Dear Madam or Sir:

Thank you for taking the time to participate in this survey!

The survey is designed to collect the information about how your company weighs the benefits and risks of the payment period, purchase price and quantity purchased by clients. Such information will be used to as statistical support for a research on working capital-conscious supply chain operations strategies and risk management mechanism.

This is a non-anonymous survey. And the data collected and the results obtained will be used for academic research only. All the information furnished would be kept confidential. Please complete the questionnaire and return it to us within 20 days after receiving this letter:

(1) You may send a mail, using the return envelope enclosed;

(2) Send an E-mail to cjx81607078@aliyun.com;

(3) Hand it back.

Should you have any questions or inquiries regarding the questionnaire, please contact Mr. Chen at 1398-0673-568 or cjx81607078@aliyun.com. Furthermore, we do hope that we could continue to communicate with your company regarding the research. If you or your company is/are interested in the conclusions of the research, such results will be made available upon request. And you may also contact us for information about the researches.

Thank you for your cooperation and support! Such support would be critical to our success in the thesis.

Part II: Questions: You are expected to comment on how your company is affected by clients' payment period, purchase prices and quantities purchased. (Please check appropriate description in the answer line where the options are given in a 5-point scale: 5 is the highest rating and 1 the lowest).

Q1: How much your company is affected by the payment period of clients, in the size of the effect?

A1: □ Very Small (1) □ Small (2) □ Medium (3) □ Large (4) □ Very Large (5)

Q2: How much your company is affected by the purchase prices, in the size of the effect?

A2: □ Very Small (1) □ Small (2) □ Medium (3) □ Large (4) □ Very Large (5)

Q3: How much your company is affected by the quantities purchased, in the size of the effect?

A3: □ Very Small (1) □ Small (2) □ Medium (3) □ Large (4) □ Very Large (5)

Q4: 4-1. Between the payment period and the purchase price, which one is more valued by your company?

A4: 4-1: □ Payment Period □ Purchase Price

4-2. How much the more valued factor affects the other, in the size of the effect?

4-2: □ Very Small (1) □ Small (2) □ Medium (3) □ Large (4) □ Very Large (5)

Q5: 5-1. Between the payment period and the quantity purchased, which one is more valued by your company?

A5: 5-1: □ Payment Period □ Quantity Purchased

5-2. How much the more valued factor affects the other, in the size of the effect?

5-2: □ Very Small (1) □ Small (2) □ Medium (3) □ Large (4) □ Very Large (5)

Q6: 6-1. Between the purchase price and the quantity purchased, which one is more valued by your company?

A6: 6-1: □ Purchase Price □ Quantity Purchased

6-2. How much the more valued factor affects the other, in the size of the effect?

6-2: □ Very Small (1) □ Small (2) □ Medium (3) □ Large (4) □ Very Large (5)

Part III: Financial Performance of Your Company (2013) (Note: The financial performance consists of two parts. The left part lists the items to be surveyed, and the right part is for you to complete based on your actual conditions.)

No.	Item	Closing Amount (CNY)	Opening Amount (CNY)
	Assets		
1	Bills Receivable		
2	Accounts Receivable		
3	Inventory		
4	Current Assets		
5	Assets, Total		
	Liabilities		
6	Bills Payable		
7	Accounts Payable		
8	Current Liabilities		
9	Liabilities, Total		
	Income(2013)		
10	Total Revenue from Operating Activities		
11	Financial Costs		
12	Gross Profit		
13	Net Profit		
14	Net Cash Flow from Operating Activities		
15	Ownership Interest		

Part IV: Basic Information of Suppliers

Company Name (Affix Company Seal Here)		Registered Office		Legal Representative	
Contact		Tel		Mode of Operations	☐ Direct Sales ☐ Distribution
Fax		Mob:		E-mail	
Manufacturing Premises: □sq.meters ☐Taken on Lease ☐ Owner-occupied		Documentation Requested: Business License (copy) and Taxpayer Registration Certificates (copy) with the latest annual inspection record; main contact list; certification of authorized distributor (to be furnished by a distributor, where applicable)			
Website:					
Manufacturer Certifications: Attach the photocopies.					
Product Certifications (RoHS/3C/UL/etc.): Attach the photocopies.					

General Information			Main Manufacturing Equipment					
	Business Category			Description	Model &Specifications	Quantity	Year Acquired	Capacity
	Date of Incorporation							
	Registered Capital							
	Fixed Assets (value)							
	Liquidity							
	Output Value (yr. before the last)							
	Output Value (prev. yr.)							
	Output Value (current yr., estimated)		Testing Devices	Description	Model & Specifications	Quantity	Year Acquired	Accuracy
	Profit Growth (%)							
	Total Staff							
	Quantity of Quality Control Staff							
	Quantity of Technical Staff							

Sources of Raw Materials	Description of Raw Material	Supplier	Purchase Period	Primary Products	Description	Model & Specifications	Monthly Output	Purchase Period	Annual Supply

Major Clients	Customer's Name	Product Category	Years of Cooperation	Annual Supply

Please note that:

1. Complete the form fully and faithfully. Any discrepancy between the information furnished herein and the fact discovered in an ensuing field inspection would result in the end of cooperation in this thesis.
2. A distributor shall fill in the blanks the manufacturer's information (manufacturing equipment, testing devices, and sources of raw materials) and must mark out on the raw material list the materials for XX.

Completed by (signature):

- End of Questionnaire –

Thank You!

Appendix 9: Questionnaire for Customers

Part I: Background

Dear Madam or Sir:

Thank you for taking the time to participate in this survey!

The survey is designed to collect the information about how your company weighs the benefits and risks of their suppliers' payment collection period, sales prices and lead time. Such information will be used to as statistical support for a research on working capital-conscious supply chain operations strategies and risk management mechanism.

This is a non-anonymous survey. And the data collected and the results obtained will be used for academic research only. All the information furnished would be kept confidential. Please complete the questionnaire and return it to us within 20 days after receiving this letter:

(1) You may send a mail, using the return envelope enclosed;

(2) Send an E-mail to cjx81607078@aliyun.com;

(3) Hand it back.

Should you have any questions or inquiries regarding the questionnaire, please contact Mr. Chen at 1398-0673-568 or cjx81607078@aliyun.com. Furthermore, we do hope that we could continue to communicate with your company regarding the research. If you or your company is/are interested in the conclusions of the research, such results will be made available upon request. And you may also contact us for information about the researches.

Thank you for your cooperation and support! Such support would be critical to our success in the thesis.

Part II: Questions: You are expected to comment on how your company is affected by suppliers' payment collection period, sales prices and lead time. (Please check appropriate description in the answer line where the options are given in a 5-point scale: 5 is the highest rating and 1 the lowest).

Q1: How much your company is affected by suppliers' payment collection period, in the size of the effect?

A1: □ Very Small (1) □ Small (2) □ Medium (3) □ Large (4) □ Very Large (5)

Q2: How much your company is affected by the sales prices, in the size of the effect?

A2: □ Very Small (1) □ Small (2) □ Medium (3) □ Large (4) □ Very Large (5)

Q3: How much your company is affected by the lead time, in the size of the effect?

A3: □ Very Small (1) □ Small (2) □ Medium (3) □ Large (4) □ Very Large (5)

Q4: 4-1. Between the collection period and the sales price, which one is more valued by your company?

A4: 4-1: □ Collection Period □ Sales Price

4-2. How much the more valued factor affects the other, in the size of the effect?

4-2: □ Very Small (1) □ Small (2) □ Medium (3) □ Large (4) □ Very Large (5)

Q5: 5-1. Between the collection period and the lead time, which one is more valued by your company?

A5: 5-1: □ Collection Period □ Lead Time

5-2. How much the more valued factor affects the other, in the size of the effect?

5-2: □ Very Small (1) □ Small (2) □ Medium (3) □ Large (4) □ Very Large (5)

Q6: 6-1. Between the sales price and the lead time, which one is more valued by your company?

A6: 6-1: □ Sales Price □ Lead Time

6-2. How much the more valued factor affects the other, in the size of the effect?

6-2: □ Very Small (1) □ Small (2) □ Medium (3) □ Large (4) □ Very Large (5)

Part III: Financial Performance of Your Company (2013) (Note: The financial performance consists of two parts. The left part lists the items to be surveyed, and the right part is for you to complete based on your actual conditions.)

No.	Item	Closing Amount (CNY)	Opening Amount (CNY)
	Assets		
1	Bills Receivable		
2	Accounts Receivable		
3	Inventory		
4	Current Assets		
5	Assets, Total		
	Liabilities		
6	Bills Payable		
7	Accounts Payable		
8	Current Liabilities		
9	Liabilities, Total		
	Income(2013)		
10	Total Revenue from Operating Activities		
11	Financial Costs		
12	Gross Profit before Interest and Taxes		
13	Net Profit		
14	Net Cash Flow from Operating Activities		
15	Ownership Interest		

Part IV: Basic Information of Customers

Company's Name		No.			
Registered Office		Zip Code		Fax	
Contact		Position		Tel	
Website		E-mail			
Business Category	☐ Company limited by shares ☐ Company of limited liability ☐ Others:	Size	☐ Large ☐ Medium ☐ Small		
Total Staff		Staff with intermediate/senior professional qualifications (%)			
Primary Products					
Major Clients					
Position in the Industry	☐ Leading ☐ Upper-middle ☐ Middle ☐ Lower-middle ☐ Start-up				
Market Reach	☐ Global ☐ China ☐ Local Province				
Goodwill	☐ Excellent ☐ Good ☐ Satisfactory				
Creditability in the Industry	☐ Excellent ☐ Good ☐ Satisfactory				
Competition	☐ With the Archrival ☐ In competition ☐Customer-targeted strategy ☐ Others:				
Business Growth Plan	☐ Cling onto the strategy in practice ☐ ( )-year plan ☐ ( )-year plan ☐ Long-term plan				
Liquidity	☐ Sufficient ☐ Satisfactory ☐ Insufficient ☐ Scarce				
Credit Rating with Banks	☐ Excellent ☐ Good ☐ Satisfactory				

Completed by (signature):

- End of Questionnaire –

Thank You!

Appendix 10 Scoring Table for Calculation of Weights for Corporate Working Capital Risk Assessment Indicators

This table serves corporate working capital risk assessment. You are expected to give your score for each indicator listed below according to how important you think such an indicator in the risk assessment. Please check a score on a 9-point scale (9 is the highest score and 1 the lowest). The results are for research use only.

No.	Indicator	Weighting Value	Actual Score	Remarks
1	Inventory turnover ratio	9	□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9	Inventory turnover ratio = operating revenue / inventory * 360 This indicator is the inverse of inventory turnover period; the higher ratio value, the smaller working capital risk.
2	Receivables turnover ratio	9	□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9	Receivables turnover ratio = operating revenue / (accounts receivable + bills receivable) * 360 This indicator is the inverse of receivables turnover period; the higher ratio value, the smaller working capital risk.
3	Payables turnover ratio	9	□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9	Payables turnover ratio = operating revenue / (accounts payable + bills payable) * 360 This indicator is the inverse of payables turnover period; the higher ratio value, the greater working capital risk.
4	Cash turnover ratio	9	□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9	Cash turnover ratio = inventory turnover ratio + receivables turnover ratio – payables turnover ratio This indicator is the inverse of cash turnover period; the higher ratio value, the smaller working capital risk.
5	Working capital allocation ratio	9	□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9	Working capital allocation ratio = (current assets – current liabilities) / current assets The higher ratio value, the more liquidity provided by long-term capital, the smaller working capital risk.
6	Cash to current liability ratio	9	□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9	Cash to current liability ratio = net cash flow from operating activities / current liabilities The higher ratio value, the smaller working capital risk.
7	Debt to asset ratio	9	□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9	Debt to asset ratio = total liabilities / total assets The higher ratio value, the greater working capital risk.
8	Return on net assets	9	□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9	Return on net asset = after-tax income / total ownership interest The higher ratio value, the smaller working capital risk.
9	Surplus cash coverage ratio	9	□ 1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9	Surplus cash coverage ratio = net income / net cash flow from operating activities This indicator is the inverse of the related multiple; the higher ratio value, the greater working capital risk.

By: (Signature) Date (MM-DD-YY):