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Study on Status and Progress of Quality Academic Research in China 2013

——Macro View Common Governance and Data Accumulation

.....Cheng Hong Chen Chuan 1

Research on the Development Mode of Promoting China's Urbanization Quality

——A Case Study Based on Hougang Town

..... Luo Lianfa 26

An Empirical Study Early-warning for Network Quality Safety of Consumer Based on BP Neural Network information

.....Yu Fan Yu Hongwei Xu Wei 37

Journal of Macro-quality Research

Vol. 1 No. 1 Mar 2014

Contents

- Study on Status and Progress of Quality Academic Research in China 2013
——Macro View Common Governance and Data Accumulation Cheng Hong Chen Chuan (1)
- Research on the Development Mode of Promoting China's Urbanization Quality
——A Case Study Based on Hougang Town Luo Lianfa (26)
- An Empirical Study Early-warning for Network Quality Safety of Consumer Based on BP Neural Network I
nformation Yu Fan Yu Hongwei Xu Wei (37)
-

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World-oriented Research on China's Quality Problems

----- Forward to the *Journal of Macro-Quality Research*

China quality needs construction, especially the academic construction. The publication of the *Journal of Macro-Quality Research* is one foundation project implemented by Wuhan University Institute of Quality Development Strategy to promote the academic construction of China quality.

The *Journal of Macro-Quality Research* is approved by the State Administration of Radio, Film and Television, and is an academic journal publicly issued home and abroad. Today public publications have become scarce resources, and the reason why the *Journal of Macro-Quality Research* gets approved is its academic positioning. China is not short of journals in quality field, but has no truly academic journal. The academic research on quality, especially the public issue of academic papers is of significant meaning to China's quality construction. Although many journals have published some academic papers on quality research, faced with the complex situation of China quality, both the paper quantity and quality, especially the formation of common academic norms need further innovation and development.

The *Journal of Macro-Quality Research* aims to provide a standard, authoritative and high-level publication platform for Chinese scholars' research on quality; collect a series of original, pioneering and creative research achievements; stir up the emergence of new problems and solutions, new methods and tools, new ideas and theories in the field of quality research, and cultivate a team of internationally influential Chinese quality scholars and experts.

The objective of the *Journal of Macro-Quality Research* aims to become the door to academic studies on China's quality and the think tank platform of resolutions to China's quality, and finally become the first-class academic journal with the international influence.

Chinese studies, especially those on relevant problems in contemporary China, have attracted more and more scholars' attention and participation; but in Chinese studies, the issue of China quality is undoubtedly an important object of study. Great power quality, binary quality and transformation quality superpose with each other and constitute the unique phenomena of China quality which cannot be found in other countries. In terms of the "issue of China quality", our journal focuses on studying the internal law of this phenomenon, and endeavors to provide a scientific explanation for it, especially ways and policies of governing China quality. Therefore, our journal advocates studies facing realistic problems of China quality, form the academic form of China quality study, and construct the Chinese school of quality study. Chinese scholars should have such academic confidence, because we are confronted with the most interesting and unique quality problem in world. The science explains problems; if you find problems, you own the most valuable resources to stand in the academic frontier. Chinese scholars' most valuable treasure is the first-hand experience of realistic China quality problems. Our journal is devoted to publishing research paper on China quality problems, and we are firmly confident that new contributions of general theories will be made to the world academic circles.

The most prominent feature of China quality problems lies in “the macroscopic property”. The influence of macroscopic factors can be found behind each quality phenomena, including social and economic development strategies, national laws and policy systems, citizens’ behaviors and cultural under special national situations, the information dissemination and management in the era of big data. Only through studies on the influence of those macroscopic factors on quality problems, can the phenomena of China quality be explained and can effective quality measures be proposed. Our journal particularly encourages interdisciplinary studies on the problem of China quality, and has set up relatively fixed columns: quality theories and strategies, quality system and laws, quality and economic development, quality statistics and analysis, quality observation and cases, etc. our journal will stick to standardized academic research method, put forward conclusions of general meaning through the empirical observance and data statistics of problems, and conduct scientific verification of those conclusions.

“China quality observation” is chosen as the research topic of the first issue of the *Journal of Macro-Quality Research*, so as to perform the tenet of our journal, face up to realistic China quality problems, adopt the inter-disciplinary research method, and endeavor to propose creative theoretical viewpoints and practical measures on the basis of empirical data analysis. “China quality observation” is a huge research project targeted at China quality problems, in which all colleagues in Wuhan University Institute of Quality Development Strategy jointly participate and have worked for three years, and it is also the achievement of the Major Project of National Social Science Foundation of China “Study on China Quality Safety Evaluation and Network Prewarning Method”. This paper research covers various aspects of China quality problems, the analysis of economic perspectives, the research of legal perspectives, the discussion of public management, the data statistical analysis and case analysis. The common research topic of all papers is to explain the current situation of China quality by the inter-disciplinary research method.

From some perspectives, Chinese scholars are quite lucky, especially those studying problems of China quality because we are faced with unique realistic problems of China quality which cannot be found in other countries. Our high-quality research papers will not only provide the scientific support for the resolution of China quality problems, but also contributes Chinese scholars’ efforts to the innovation of the quality science in world. We sincerely invite overseas scholars to join hands with us, and wish that through our unremitting efforts the *Journal of Macro-Quality Research* will become the footstone for the academic progress of China quality, and innovative ideas of China quality will lead the progress of China quality practices.

President of Wuhan University Institute of Quality Development Strategy

Cheng Hong

Chief Editor of the *Journal of Macro-Quality Research*

June, 2013

Study on Status and Progress of Quality Academic

Research in China 2013

——Macro View Common Governance and Data Accumulation

Cheng Hong and Chen Chuan

Abstract: The research about the domestic and international literatures on quality study in 2013 shows this field has increasingly become a common concern. Basing on the specific circumstances of our country's quality study, positive progress has been made in various ways, especially on the macro quality research, big data accumulation, common governance, a number of original achievements has formed. Scholars of different disciplines have high cooperation, involved in the field of quality, done numerous of meaningful attempts on the influence factors of the quality, common governance of quality, the quality models and architectures and statistical analysis of the data on quality, etc. It remains to be strengthened in the following several aspects about quality study: the basic theory study of new quality phenomenon, the big data accumulation in the quality study, the research of the inherent logic of micro and macro quality architecture, the innovative research about the field and scope of the quality study.

Key Words: Academic Research; Macro Quality; Common Governance; Current Situation and Progress

I Distribution feature of literature

Since foreign literature of quality research in 2013 is insufficient, bibliometrics analysis could not be applied. In this section, four aspects will be taken into bibliometrics of quality research, containing distribution of the author, institution, journal and hot spot.

1.1 Data acquisition

Relevant papers of quality research in 2013 are selected as research objects, which are mainly from CAJD (China Academic Journal Network Publishing Database) in CNKI (China National Knowledge Infrastructure). CNKI is the largest database of China academic literature with continuous dynamic update in the world. It contains both Chinese resource, such as academic journal, master's & doctoral dissertation, conference paper, newspaper, yearbook, patent, domestic & overseas standard, scientific & technological achievements, etc., and foreign resource like Springer, etc. Important academic journal published in 2013 is selected to retrieve papers with topics of quality, product safety, product recall, supply chain, etc. With eliminating papers unrelated to the topic, 211 papers are confirmed.

1.2 Literature analysis

1.2.1 Distribution of the author

Analysis of the author distribution is performed from two aspects: the core author and coauthor of papers in quality research. Price's law defines that the number of core author who is productive with writing more than a half of a paper equals to the square root of total science authors, so the core author in a field could be confirmed by Price's law (Price, 1963). In scientific studies, authors could learn from each other in knowledge structure by cooperation, and also scientific research level could be promoted. Author's cooperation could be measured with two indicators, cooperative degree and cooperative rate, which reflects development degree of cooperative intelligence. That is, the higher the values of cooperative degree and rate, the better author's cooperative intelligence develops.

With analyzing paper authors in the quality field, it is found that 211 papers are written by 392 authors within 342 authors are not repeated. There

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are 123 papers written in collaboration with 309 coauthors. Minimum number of papers published by core author is m with a value of $m=0.749$, which refers to the number of published papers that are published by the author with maximum number of papers. In this study the value is 5, then the value of m is about 1.67. There are 32 authors in the midst of 342 authors whose number of published papers is above. According to the Price's Law, the core author should finish half of the total papers, it is acquired that square root of total authors is around 20, and total number of papers published by coauthors is 60, which accounts for only 28.4% of the total papers and is less than half of the total. Therefore, the number of core author who is productive with writing more than a half of a paper is not equal to the square root of total science authors, which is not conform with Price's Law. In conclusion, in 2013, a stable co author group has not yet been formed in domestic quality research

Table 1 Chinese co authors and the number of published papers

Author	Number of Published Papers	Author	Number of Published Papers
Cheng Hong	5	Li Dandan	2
Ren Baoping	4	Li Juanwei	2
Wang Changwei	4	Liao Li	2
Gu Haiying	4	Liu Peng	2
Fei Wei	4	Liu Yaping	2
Xiong Wei	4	Luo Ying	2
Wang zhigang	4	Sun Yamei	2
Li Han	3	Tu Yongqian	2
Luo Lianfa	3	Wang Rong	2
Sun Qiubi	3	Xia Tongshui	2
Ren Shaozhe	3	Yang Jintian	2
Yu Tao	3	Yu Yubing	2
Zhu Lilong	3	Yuan Xiaoling	2
Cao Yanhong	2	Zhang Jihong	2
Guo Yebo	2	Zhong Zhen	2
He Shaowei	2	Fan Jianyong	2

It is shown in Table 1, there are 30 authors with more than 2 published papers. Among them, Professor Cheng Hong from Wuhan University, who holds the most published papers, has published 5 papers about quality in 2013. Professor Cheng Hong, from Wuhan University Institute of Quality Development Strategy, mainly focuses on macro quality management. Topics of published papers mainly cover evaluation of China's quality status in 2012, theory and practice innovation of standard in quality governance (including evaluation on the innovation of theory frame in benefit consistency & system innovation, and research on contract model between legislation and standard), and some big issues on the strategy of prospering the nation with quality.

Authors with 4 published papers are Ren Baoping from Northwestern University, Wang Changwei and Gu Haiying from Shanghai Jiaotong University, Feiwei from Dongbei University of Finance and Economics, Xiong Wei from Zhejiang University and Wang Zhigang from Renmin University of China. Ren Baoping from School of Economics & Management in Northwestern University mainly studies on growth of transition economy in China and development quality. Wang Changwei and Gu Haiying from Antai College of Economics & Management in SJTU are in one group that primarily emphasizes food safety supervision. Fei Wei from School of Mathematics & Quantitative Economics in DUFU mainly focuses on supervision on food safety and agricultural quality safety. Xiong Wei from School of Management in ZJU takes Zhejiang as an example and studies on index system of enterprise quality credit evaluation, effect of implementing government quality prize and its influence on enterprise performance, etc. Wang Zhigang from Renmin University of China mainly emphasizes food safety supervision and economic development quality.

Authors with 3 published papers are Li Han, Luo Lianfa, Sun Qiubi, Ren Shaozhe, Yu Tao and Zhu Lilong. Li Han and Luo Lianfa are both from Wuhan University Institute of Quality Development Strategy. Li Han mainly focuses on government regulation quality safety and responsibility

of quality safety. Luo Lianfa's study is mainly on urban and rural duality of product quality, evaluation of China's quality status in 2012 and strategy of prospering the nation with quality. Sun Qiubi and Ren Shaozhe come from Fuzhou University and their emphasis is technology standard and its impact on economy growth. Yu Tao coming from Shangdong Normal University is in a group with Zhu Lilong and Xia Tongshui, focusing on product quality and supervision on quality. As for research on product quality, it mainly emphasizes contract model of product quality control in two levels supply chain and evaluation on affecting factor of regional product quality based on factor analysis. In quality supervision, quality supervision game between government and enterprise is highlighted.

Among these co authors, Cheng Hong, Li Han, Luo Lianfa, Li Dandan, Liao Li, Luo Ying and Zhang Jihong are all from Wuhan University Institute of Quality Development Strategy. Their research is mainly from the perspective of economics, law, etc. with series of achievements, which constructs the important power in macro quality research.

Cooperation degree = (relevant literature in a specific period) the total number of authors/(relevant literature in a specific period) the total number of papers, cooperation rate = (relevant literature in a specific period) the number of collaborative papers/ (relevant literature in a specific period) the total number of papers. Thus, author's cooperation degree in quality field is $392/211 \approx 1.86$, author's cooperation rate is around 60.7%. Whatever it is, from the perspective of cooperation degree, or cooperation rate, there is a relatively high degree for author's cooperation, which proves that cooperation intelligence among different authors has fully developed, and on the other side, manifests interdisciplinarity of quality research.

1.2.2 Distribution of research institution

With statistics of research institution that published papers are more than three, the result is manifested in Table 2. There are 14 institutions with more than three published papers. Midst the 14 ones, Wuhan University is the institution with the most papers. 22 papers in quality field are published in 2013, which is far ahead of other research institutions. Papers of Wuhan University in quality field are mainly from Wuhan University Institute of Quality Development Strategy. There are 19 quality papers in total that accounts for 86% of all the papers. In addition, the other 3 papers are respectively from School of Political Science and Public Administration, School of Law and School of Economics and Management.

Institution that the number of published papers ranks the second is Renmin University of China. In 2013, 13 papers are published in quality field, which are mainly from School of Agricultural Economics and Rural Development and School of Public Administration and Policy. The research mainly focuses on food safety with 10 quality papers in total 13, which contains quality safety's basic connotation, problem causes, strategy, standard, risk identification, supervision, etc., while the other 3 papers are about environment quality, foreign trade quality and economic development quality.

Renmin University of China is followed by Dongbei University of Finance and Zhejiang University that the number of published papers is 5. The paper of Dongbei University of Finance mainly comes from Fei Wei, and Xiong Wei is the major author of Zhejiang University. There are six universities publishing 4 papers, which cover Chongqing University, Northwestern University, Sichuan University, Shanghai Jiaotong University, Shandong Normal University and Shandong University. In Northwestern University, Ren Baoping is the main force. Research in Sichuan University mainly involves medical product quality, medical service quality. Wang Changwei and Gu Haiying is the main force in Shanghai Jiaotong University. Shandong Normal University places emphasis on product quality. Topics in Shandong University and Chongqing University are relatively scattered. Midst institutions with three published papers, Zhongshan University emphasizes product safety governance, Fuzhou University mainly focuses on standard, and topics of other institutions are relatively scattered. In general, research of each institution is relatively concentrated, which shows certain advantages are held in one field of quality research by the institutions.

1.2.3 Distribution of journal

In 2013, 211 papers in quality field are published in 114 kinds of journals. From a general view, distribution of journal in quality field is relatively scattered. With performing a statistical analysis on journals with more than 3 published paper, the result as shown in Table 2.

It is shown in Table3, there are 13 kinds of journals that the number of published papers is more than three. Most papers are published in *Journal of Macro-quality Research*, which contains 20 papers. *Journal of Macro-quality Research* is a journal based on research of quality management in macro level, which emphasizes research achievements of quality management policy, legislation, system, culture, etc., and is the first journal in macro quality research. So, there are the most papers about quality in this journal. Additionally, papers about quality research are relatively concentrated in *Environmental Protection*, *Soft Science*, *Price Theory & Practice*. From the perspective of journal distribution, papers in quality field mainly published in management journals, such as *Journal of Macro-quality Research*, *Soft Science*, *China Soft Science*, *Modernization of Management*. Then, some papers in quality field are published in economics journals, such as *Price Theory & Practice*, *Inquiry into Economic Issues*,

Reform, Urban Studies. Moreover, there are also many papers in statistical journals and journals of comprehensive social science, and papers concerning environment quality mainly concentrate in *Environmental Protection*.

Table 2 Research institutions' Distribution of the number of published papers

Research institution	The number of published papers
Wuhan University	22
Renmin University of China	13
Dongbei University of Finance	5
Zhejiang University	5
Chongqing University	4
Northwestern University	4
Sichuan University	4
Shanghai Jiaotong University	4
Shandong Normal University	4
Shandong University	4
Sun Yat-sen University	3
Xi'an Jiaotong University	3
Hunan Normal University	3
Fuzhou University	3

Table 3 Distribution of journals

Journal	The number of published papers
Journal of Macro-quality Research	20
Environmental Protection	11
Soft Science	9
Price Theory and Practice	6
China's Soft Science	4
Statistics and Decision (Theory Edition)	4
Statistical Research	4
Inquiry into Economic Issues	4
Journal of Social Sciences	3
Guizhou Social Sciences	3
Modernization of Management	3
Reform	3
Urban Studies	3

Research hot spot could be reflected by high frequency key words of papers in a discipline, and the change of key words reflect research and development tendency in the discipline. With word frequency analysis, statistical analysis on papers in quality field is performed to reveal feature, rule, knowledge structure, and status in the research field, then hot spot and tendency in the field will be acquired, which is prominent for quality research and its development.

By merging and eliminating key words in Chinese literature, 582 key words are selected, and key words appearing frequently are listed in Table 4.

Table 4 Frequency distribution of high frequency key words

Key word	Word frequency	Key word	Word frequency
Food safety	41	Supervision	4
Quality safety	11	Empirical analysis	4
Air quality	7	System quality	4
Service quality	7	Quality control	3
Management of supply chain quality	6	Willingness to pay	3
Information asymmetry	5	Special equipment	3
Economic growth quality	5	Food safety risk	3
Environment quality	5	Social management	3
Urbanization quality	5	Regulation	3
Index system	4	Perceived service quality	3
Food supply chain	4	Risk evaluation	3
Agricultural product	4	Product quality	3
Employment quality	4	WTO	3

It is manifested in Table 4, in 2013 the highest frequency key word in quality is food safety with frequency 41. It is stated that quality research in 2013 concentrates on food safety. In quality research, except for key words concentrating on food safety, quality safety, air quality, service quality, supply chain quality, etc., others are relatively scattered.

With classifying and grouping key words that topics are similar or related, it is found that quality research focuses on the following topics according to sorting key words frequency.

It is clear in Table 5 that research on quality field mainly concentrates on ten fields involving quality safety, quality governance, environment quality, quality evaluation, development quality, management of supply quality, quality information, quality risk, standard, and research method. Midst the ten fields quality safety is the hot spot, and food safety is the hottest in the hot spots. Research on quality governance is also the topic for scholars in 2013. As for research of quality governance, except for discussing it traditionally from the perspective of government, research of common governance with multiple subjects is paid more attention.

Table 5 Topics distribution of key words

Ranking	Topic	Key words
1	Quality safety	Food safety, quality safety, quality safety of agricultural product, food quality safety, milk powder incident
2	Quality governance	Supervision, social management, regulation, quality management system, food safety supervision, responsibility, quality intermediary, quality supervision, quality management, quality management practice, government quality supervision, government regulation, food supervision, food safety supervision of the UK, consumer organization, social responsibility, social supervision, social system
3	Environment quality	Air quality, environment quality, air pollution, air pollution prevention, air quality in Chongqing, sewage discharge, pollution discharge, sewage discharge standard
4	Quality evaluation	Index system, comprehensive evaluation, evaluation, quality evaluation, evaluation index system, evaluation index, evaluation model, evaluation method, evaluation criterion, online product comment
5	Development quality	Economic growth quality, employment quality, urbanization quality, economic growth, income quality, development quality, service quality, perceived service quality

Continued Table 1

Ranking	Topic	Key words
6	Management of supply chain quality	Supply chain, food supply chain, agricultural supply chain, supply chain management, supply chain of safe agricultural product, whole industry chain
7	Information	Information asymmetry, online product quality, online credit, information collection system, information loss, information disclosure, information reveal, information comment
8	Quality risk	Food safety risk, risk evaluation, risk perception, model of quality risk, network early warning, food risk warning, perceived risk, risk early warning, risk factor, risk control, risk communication, risk management, risk matrix, nontraditional food safety risk
9	Standard	Standard, quality safety standard, technology standard, alliance of technology standard, national standard, international standard, WTO, regulation standard, standard system, standard competition, strategy of standard competition, standard product, standard architecture, safety standard, SP agreement, CAC standard, ISO9001 criterion, ISO2600 criterion
10	Research method	Empirical analysis, analysis frame, game, case study, principal component analysis, factor analysis, gravity model

II Research Status

Based on statistical analysis of existing literature, it is shown that there are common hot spots for scholars in different fields, such as quality safety, quality statistical analysis, supply chain quality, quality capacity promotion and development quality.

2.1 Quality Safety

Research of product quality safety involves food, medicine, commodity, automobile, etc. Literature statistics shows that most papers concerning product quality safety still concentrate on food safety. Most of the literature is from the perspective of information asymmetry, and common governance is taken in most cases to promote quality safety.

2.1.1 Food safety is still scholar's focus.

Problem of food safety is mainly studied in terms of government regulation, improving regulatory system, enhancing international cooperation for global governance, etc. Fangwei has studied motivation of quality control in food enterprise and implementation status of high quality & favorable price. The analysis demonstrates that in agricultural leading enterprises, motivation and effect of quality control mainly originates from the following aspects: brand influencing promotion, product sales increasing, product unit price increasing, negotiation strength growing, etc. It is pointed that in the aspect of product quality control, that whether foodstuff leading enterprise could achieve high quality & favorable price or not depends on some key factors, such as the total sales, mode of raw material control, product exporting or not, age of senior manager, knowledge of senior manager, competitive pressure of product quality, etc. Ke Wen indicates that food producer and operator disregard moral principles in pursuit of profits, laws and regulations is imperfect, regulatory system is defective, supervision of law enforcement is lacking, punishment measure is ineffective, etc., and all the above accounts for the problem of food safety despite repeated prohibition. Zhu Mingchun starts with great incidents of food safety happening in developed and developing countries at different stages. Stage character and internal laws of food safety development are concluded from historical and international view. By analyzing governance strategy of food safety, adopted by developed countries in different stages, idea for government management is proposed, which is conform to status of China's present food safety and social economic development. What it includes are zero tolerance to food safety crime to win public confidence, balancing the choose between science and values to get public understanding, disclosing risk of food safety proactively to strive for public support, increasing cost of delinquency to advocate public interest. By exerting model of constant market share and various indexes, Xie Guoe has analyzed the change of China's food trade competitiveness horizontally and longitudinally, and found there is a trend of decline in food trade competitiveness. Then series of methods are put forward to increase our competitiveness in food trade, which contains perfecting laws, strengthening supervision, unifying standards, tracking the international market. Wang Changwei gives a policy choice to subsidize low income group, so optimal level of food safety regulation will be above the optimal level in utilitarian social welfare function, and social welfare will be improved. Public perception of food safety risk based on three cities is investigated by Zhang Jinrong, which shows there are subjective construction factor and artificial amplification effect in public perception of food safety risk. It is accordant and differential in public risk perception of multiple food safety. As for the imputation of food safety, government is attributed more, while

responsibility of individual and corporate is weakened relatively. It is suggested that with the purpose of guiding public to form risk awareness scientifically, and also weakening artificial construction and amplification effect in risk, government should hold the feature and rule of public food safety perception scientifically and comprehensively. Li Weihui holds that the rule and implementation in government regulation are both ineffective, so there causes deep reason for food safety problem. Moreover, it is appealed that the whole society should build a “double effective” market circumstance to solve the problem of food safety fundamentally. On the basis of milk powder scandal, Fan Chunmei analyzes risk of public perception and its trend of change. With contrasting difference of risk perception and change of its persistence among different fractionize groups, it is revealed that change of risk perception has an impact on change of public response and consuming behavior. Then some suggestions are given for food safety management. Yin Jinfeng insists that for spread of food safety, it lacks ethics dimension in food advertising and program spread, and there is frequent ethical conflict in news report of food safety. Internal norm of language between news report and food safety conflicts, which means stigmatized report clashes with enterprise’s healthy development. False supervision report collides with construction of media credit, which makes a negative influence on people’s diet & life, construction of media credit, social development, etc. Song Tongfei mentions that government is both the largest player in social political and public life, and the holder of public power. Government should bear the responsibility of public interest, supervision and guidance in the field of food safety, and handle conflict actively in food safety responsibility. Wang Yue thinks regional management of food safety risk could be taken up from three aspects. Firstly, strategic direction of government development and value orientation of government act should be established under the guidance of reasonable strategic orientation to improve the value system of regional government’s management in food safety risk. Secondly, scientific strategic planning should be guaranteed to achieve and enhance government sense of historical mission, social responsibility and existence. Thirdly, correct political achievement and scientific development view should be set up and implemented based on strategic form conforming to national conditions. Zhou Yingheng pointed out that the lack of food safety supervision, anomie and inefficiency, etc. obstructs performance improvement of China’s food safety supervision. The frame of food safety supervision system consists of three parts: supervision system and capacity, supervision mechanism and supervision measure. It is necessary for government to innovate system of food safety supervision, to promote performance of food safety supervision, to optimize the system & mechanism of food safety supervision and to develop the security system of food supervision. Wang Changwei believes that economist plays an increasingly significant role in making and implementing regulation policy of food safety. Scientizing standard, emphasizing risk evaluation and integrated control have become a major trend in global regulation. Tu Yongqian states that closer international cooperation and global governance are needed for food safety. Conflict between food safety and trade freedom should be coordinated with the *International Health Regulations* to highlight the priority of food safety. According to current status in China, it is put forward that international treaty should be carried out in domestic law to reduce negative impact on food trade caused by unsafe food, and to improve China’s food standard.

2.1.2 Studying quality safety from the perspective of information asymmetry is a general academic vision.

Reducing information asymmetry studied by scholars mainly emphasizes government information disclosure, law and regulation improvement, establishing system of award to report, etc. Pan Lixia points out that with promotion of information disclosure in food safety, food safety supervision should be enhanced to promote public engagement in the process of standard setting, so that food standard will be scientific. Gong Qiang figures that forcing enterprise to disclose information which is the key point in production and transaction is an effective way to promote food safety. With defining what information in production and transaction is needed for enterprise by regulator, the society, the third party and relevant regulatory departments will be provided with a platform for supervision. Information disclosure will increase cost for a single enterprise, but credit in the whole industry will be improved, then consumer is more willing to pay. In the end, industry profit will be promoted, which motivates enterprise to transform to more safety. Wang Changhong has found that contract imperfection makes traditional system of signal transmission and information screening ineffective for experience and credence goods. While some problems caused by contract imperfection could be solved by information transparency and traceability coming from information technology. Then it is offered that market efficiency could be promoted and information disclosure system of the whole supply chain in social welfare could be improved. Zhou Xiaomei indicates there are few reasons for the problem of man made pollution, which contains that market mechanism is ineffective in controlling food safety, relevant law is deficient and lacks authority, and function of food safety control guided by political performance is eliminated. Yan Hai presents that information asymmetry between food trader and consumer is the main cause for frequent food safety incident. As to legislation of food risk announcement, it is necessary to further broaden ways of information collection, to enlarge content of published information, to clearly define subject’s right and responsibility, and to establish a unified publishing platform. Based on limitation of supervision resource, weakness of regulation measure, and microcosm & lag of risk supervision, it is demonstrated that by constructing predictive risk evaluation system of food safety supervision, effectiveness of current supervision system needs to be improved with spot check as the main method.

2.1.3 Common governance of quality safety is a general conclusion in research.

Scholars study on how to govern quality safety by common governance is mainly from the perspective of government supervision, standard governance, etc. Liu Yaping argues that in order to break out of difficulties of current food safety supervision in China, it is required to enhance supervision capacity on large enterprise, to strengthen enterprise responsibility, to construct risk evaluation institution managed vertically by central government, to form a complementary supervision network and to arouse social energy for sharing the responsibility of food supervision. Wang Xiaolong proposes that to solve China's current problem in management of food safety risk, we could set up report system and public engagement system, strengthen the offender's legal responsibility, attempt to evaluate risk benefit, etc. Cui Jinhuan states that basic policy orientation for turning around low efficiency of private governance is to establish steady system environment and to motivate multivariate mixed contract. Fei Wei has built two models which take government, its relevant departments, and the whole society as the supervision subject. With analysis and comparison of offset effect in the two models, it is found that when the total loss is relatively small or large, and even it is serious to a certain extent, taking the whole society as the supervision subject of food safety is more effective. From the perspective of theory, incomplete information theory of instructing government's market intervention, Wang Dianhua corrects mistakes in it. On this basis, government supervision in food safety market is analyzed with step-shaped curve. Then it is pointed out that the reason why government supervision in food safety market is ineffective is that government supervision measure could not meet consumer's diverse demand, and the mechanism of three-part interaction containing government, enterprise and consumer is put forward for supervision on food safety market. Mao Wenjuan makes some suggestions that construction of social benefit framework should be transformed from closure to openness, risk definition should be given from scientific study to social supervision, supervision system should be promoted from breakthrough to capacity building and risk management should rebuild people's behavior and values. Li Mingqiang pointed out that legal system of China's food safety should be further improved, study on enterprise ethic should be promoted, consumer behavior should be explored in depth, and studies on public relations of food safety crisis, green logistics and green supply chain of food safety should be emphasized to improve study's pertinence, practicability and perspectiveness of food safety problem.

2.2 Quality statistical analysis

2.2.1 Quality research starts to focus on macro and regional quality status statistics.

Data across the province and city is adopted by scholars to study on food safety, economic development quality and urbanization quality, so data is macro and regional. With empirical investigation on 657 consumers from Suzhou, Nantong and Huaian in Jiangsu province, Xu Lingling has studied on consumer perception of food additives safety risk and its influence factor. By designing index system of quarterly GDP evaluation that is systematic and strong operability, Zhou Guofu performs an empirical test on quarterly GDP data in provinces and regions based on spatial panel data models. With Zhu Ziyun introducing the concept of technology progress reflected by efficiency, the overall level of technology progress is presented by comprehensive index of capital productivity and labor productivity. Decomposition model in economic growth is constructed with three factors contribution containing capital scale, labor scale and overall technology progress. Meanwhile, time series data in China's 1980-2010 is adopted to analyze the contribution and structure of technology progress in that period empirically. Lin Zhuwei measures employment quality of new-generation migrant worker to support relevant policy making of government. By factor analysis of 735 questionnaires from eight cities in Jiangsu province, seven factors are acquired as mental feelings, harmony of work and family, income, assistance acquiring, employment discrimination, management involvement, and healthy & safety. In addition, employment quality comparison is applied among gender, education, company type, and industry, and then the countermeasure to promote employment quality of new-generation migrant worker is proposed from the aspects of government, enterprise and migrant workers themselves. According to survey data of migrant workers from about ten provinces like Shanxi, Shaanxi, Hunan, Hubei, Guangxi, etc., Wang Xinyi has inferred the formula, universality of migrant worker income utility, and then factors affecting quality of migrant worker income are analyzed empirically based on Logit model. Yuan Xiaoling has constructed an evaluation index system of urban sustainable development that contains economy, society, population, resource and environment. Entropy evaluation method is applied in comprehensive analysis on data from 2001 to 2010 in Shaanxi, which reflects dynamic process of urban sustainable development in Shaanxi. Furthermore, it is believed that urban sustainable development in Shaanxi keeps in a low level, which is caused by serious problems of society, resource and environment. According to "three force model" of industrial evaluation, Xie Jialong sets up evaluation index system including self-dependent innovation, benefit contribution, international competitiveness. Catastrophe progression method is applied to construct an evaluation model of center city development quality. Additionally, comprehensive measure and scatter clustering analysis in three dimensions are performed for development quality in four municipalities and fifteen sub-provincial city. Based on panel data in thirty provinces of Chinese mainland from 2006 to 2010, Yan Yanyang has adopted DEA-Tobit two-stage model to account and explain each provincial government's financial expenditure efficiency on narrowing the gap between urban and rural life quality. By referring to "pressure-status-response" model, Lv Xiongying has established an

evaluation system of eco-environmental quality with 20 indexes from three aspects of natural environment, energy consumption and social development. Then comprehensive index of China's eco-environmental quality is measured by principal component analysis. The result shows pressure index of China's eco-environmental quality presents the trend of earlier increase and later decrease from 1991 to 2010. Status of eco-environmental quality and comprehensive index of response present as downward trend, while comprehensive index of eco-environmental quality increases earlier and decreases later. Comprehensive evaluation system of environment quality with 11 indexes is constructed by Yuan Xiaoling from 6 aspects: air, water, waste, garbage, noise and soil. By applying evaluation method of vertical and horizontal scatter degree basing on overall differences drive, dynamic comprehensive evaluation is performed on quality environment from different perspectives in 30 provinces from 2003 to 2010.

2.2.2 Research Paradigm based on big data statistics starts to get into the field of quality research.

A mass of data is applied by scholars in quality research. Fang Wei takes survey data as the sample to explore quality control motivation and status of "high quality & favorable price", which covers 300 agricultural leading enterprises in national food industry. Chen Wei introduces an intermediary variable, relationship quality, to establish a conceptual model that explains influence on knowledge transaction across enterprises caused by character of supply partner and relationship quality. An empirical study is conducted on the conceptual model by referring to structural equation model and survey data from 256 enterprises in upstream and downstream of supply chain.

Xu Yongbing performs a comparative analysis between comprehensive evaluation on economic development quality in the Latest 14 years and on economic development quality in 10 provinces within Hebei involved. There are some problems of economic development quality in Hebei, which involve that industrial structure is unreasonable and in low level, final demand structure is unreasonable, high and new technology industry is weak, resource consumption is huge, people's livelihood requires further improvement. Luo Ruoyu introduces industrial transfer into analysis frame of local government competition, and states motivation mechanism of local government competition in undertaking industrial transfer. Then some problems of government competition in western undertaking is discussed on the basis of panel data model.

Yang Xiaoli, from the perspective of provincial dynamic panel data, has explored the impact on FDI quality and effect of FDI economic growth, which is led by local government competition of investment attraction preference. Based on defining urbanization quality, Wei Houkai has established comprehensive evaluation index system of urbanization quality within 34 indexes contained. It is constructed from three dimensions: urban development quality, urbanization efficiency and urban & rural coordination degree. On the basis of system data in 2010, urbanization quality is evaluated in 286 cities at regional level or above. He Ping summarizes previous research and sets up an evaluation index system of China's urbanization quality. Moreover, urbanization quality is evaluated throughout the country.

According to previous research and field survey, Zhao Hongfeng selects 12 major environment factors, which closely relate to crested ibis habitat quality, as evaluation index. Three aspects are taken into consideration: habitat, food and man-made interference. Analytic hierarchy process is applied to the 12 impact factors. By comparing between any two factors and giving weight & score, an evaluation system of crested ibis habitat quality is constructed, which contributes to evaluating quality in two habitats. With questionnaire survey, Xian Huichen has got relevant data, which concerns air quality consciousness of Qingdao resident and their willingness to pay for air quality improvement. By introducing demographic variable, economic variable and variable of air quality consciousness, Logit model is constructed to analyze the factor that affects whether to pay, and then to estimate with applying symmetry trimming least-square method that is more suitable for abnormal distribution of error term and heteroscedasticity. By introducing polynomial probability model and the method of hierarchical bayesian estimation, Cao Huaishu has conducted a research based on questionnaire, which explores Beijing public's (focusing on college students group) willingness to pay for long-term air quality improvement.

2.3 Management of supply chain quality

2.3.1 Quality management of agriculture product supply chain turns into focus in scholar's research.

The research on how to promote product quality with supply chain management is mainly conducted in the aspects of theory, mode and information asymmetry of supply chain. Dai Wenbin has established a theoretical frame to analyze transparency of food supply chain. Then consumer, government and enterprise turn to be the major subjects for promoting transparency of food supply chain, which drives to perfect supporting condition of food safety standard, information technology platform, and structure of supply chain governance. Peng Jianfang has built a relation governance mechanism guided by optimizing relationship between the enterprise and farmer, which enhances governance of safe agricultural product in the source of supply chain. Fei Wei has constructed a new mode of food supply chain with leading enterprise as the core. He Huali has established a closed running mode of supply chain, which is integrated by three processes: market access, multistage inspection and information

traceability. Lu Bin presents that every link within supply chain including production, process, packing, transport, distribution, sale and consumption, should be coordinated. Then supervision on the level of legislation, administration and technology outside the supply chain will be enhanced. From the view of quality safety, Zhang Dongling constructs quality system integrated structure of agricultural supply chain based on quality control and risk evaluation of agricultural supply chain. Then the system of quality safety risk evaluation indicator focusing on agricultural supply chain is established based on good agriculture practices. By the method of language information processing, evaluation information characterized by panel data is aggregated to warn quality safety risk early. With agricultural product certification, Deng Shaojun has solved the problem, information asymmetry of agricultural quality safety. Based on constitution and operation feature of dairy supply chain, Zhu Jie points out there are some ways to reform dairy supervision method, such as constructing symmetric supply chain, unifying dairy safety regulator, establishing mechanism of providing trust symbol based on double inspection and guiding consumer to be involved in the mechanism. With referring to survey data, He Huali has analyzed implementation obstacle from following aspects: external motive power, driving force of market and enterprise itself. Policy suggestion to implement closed running mode of agricultural supply chain in supermarket is given from perspectives of government and enterprise. Pan Lixia holds that disclosure of food safety information is not only an obligation for government but also authority, which means government has the authority of obtaining and disclosing information in food safety supervision. Daily supervision information of food safety, risk evaluation of food safety, risk warning information, supply chain information in food production and food safety incident, etc. are all in the positive scope of food safety information disclosure.

2.3.2 Further research on game behavior among supply chain subjects has been conducted.

With legislation, game theory and enterprise knowledge trading, scholars conduct a study on game behavior among subjects in supply chain. Lu Bin holds that to ensure product quality, internal coordination within supply chain should come first, and it should be supplemented effectively with supervision in legal, administrative and technological dimension outside the supply chain. Based on game theory and principal agent theory, Zhu Lilong has studied on design of quality control contract in two-stage supply chain. Meanwhile, with following principal of optimality, a function model of expected revenue between manufacturer and purchaser is established. Chen Wei introduces relation quality as an intervening variable, and constructs a conceptual model that explains the impact on knowledge trading across enterprises that led by feature of supply chain partnership and relation quality. By referring to cultural compatibility, resource dependence and knowledge distance, Zhang Dongling constructs a systematic method concentrating on risk evaluation of agricultural supply chain quality according to quality system integrated structure of agricultural supply chain. Chang Guangshu proposes that enterprise should impact and regulate quality control system of supply chain in accordance with social responsibility thought of ISO26000, so that all the member enterprises could be involved in quality work. Moreover, they could also supervise and control the whole supply chain system effectively.

2.4 Field and scope of factors influencing promotion of quality capacity have been expended.

2.4.1 It is emphasized that promoting quality capacity depends on standard competition.

Influence of standard on quality capacity promotion is studied with respect to alliance standard, co-governance of standard and law, etc. Cheng Hong states that the essential problem of current standard system in China is that there lacks high consistency between standard maker's interest and user's interest, which means conflict is unavoidable between compulsion and voluntary, stability and change, interest of making standard and implementation. Thus, in order to achieve common construction of government standard making subject and social standard making subject, common governance of government standard and group standard, sharing standard basic function and standard innovative function, a national standard system should be established, which is composed of government standard and group standard (within alliance standard included). Liao Li insists that by setting up right and obligation, legislation holds the function of preventing and punishing quality safety incident. However, standard is the technical support to ensure China's quality safety. These two aspects are irreplaceable in sustaining market order and social stability, especially in quality safety. Standard, as a soft law, provides flexibility, desirability, selectivity and self-discipline that are generally deficient in hard law. The values advocated by soft law standard plays an irreplaceable role in quality safety governance, which can not be achieved by hard law. In quality public governance, standard and legislation play the role of supplementing each other and collaborative symbiosis. With introducing duopoly market analysis, Tao Zhongyuan has found that there is a significant impact of switching cost on user critical scale and its stability, which is based on integrated survey, standard product, user and quality. Standard product with higher quality shows some advantage in critical scale. Zhou Qin and others believe in condition of network externality, when quality leadership is beyond that point and market scale is large enough, late-development technology could also become the de facto standard while facing existing technology. Then China will be successful in international standard competition with technological advantage, and more autonomous standard will be practiced as international standard. By analyzing control of standard alliance proprietorship, Sun Biqui and others hold the core of standard alliance is benefit distribution. Although control mode of different proprietorship is selected, the common goal is to explore how to coordinate interest relationship among members of alliance cooperation to achieve

effective cooperation among each independent institution or enterprise with capacity mutual complement. So advantage of alliance competition will be formed. With analyzing control allocation and decision in governance of technological standard alliance, it is held that mode of common control is the only decision mode to achieve sufficient knowledge shared among alliance enterprises.

2.4.2 That quality culture construction promotes quality capacity is emphasized in research.

Influence of quality culture on quality capacity promotion is mainly studied from the perspective of culture and enterprise credit. Zhang Xingjiu deems that cultural soil of loyalty, obedience, cooperation, refinement, dedication, etc. account for Japan's quality miracle. It is maintained that a good system could not only form external control, but also the incentive mechanism, and good quality originates from exerted function of overall levels. Success of Japan's quality results from insistence and interaction among macro government regulation, medium enterprise system and deep cultural tradition. Organized existence and interaction of the three aspects promote Japan's quality together. Enterprise credit is an important reflection of quality culture, and quality credit is an important part of enterprise credit. In research on quality credit, Xiong Wei and others hold evaluation system construction of quality credit is significant to evaluate enterprise quality credit accurately and to prevent quality credit risk. Based on an empirical study on 456 manufacturing enterprises in Zhejiang province, index set of quality credit evaluation containing 11 indexes is established after theoretical analysis and empirical selection. It is constructed from two dimensions: quality of enterprise quality credit and capacity of enterprise quality credit, which means fundamental work in construction of quality credit evaluation system has been finished. In the research of credit and reputation, in order to guide consumer to shop online more accurately and fairly, Zhang Yongzhong has proposed a model for evaluating product quality risk based on credit. Xu Yueheng and others build a conceptual model of logistics service brand including 4 elements: professional skill, enterprise reputation, enterprise commitment and communication. With questionnaire survey of consumer in logistics industry, an empirical study applying structural equation model is conducted, which reaches three conclusions that reputation has a significant impact on quality perception; professional skill and commitment significantly influence consumer credit; moreover, communication has a significant effect on both quality perception and consumer credit.

2.4.3 Research perspectives of certification, income distribution structure, direct investment, etc. are introduced to explore quality capacity promotion.

Some scholars focus on how to promote quality capacity by certification. From the view of agricultural product, Deng Shaojun insists that information asymmetry in agricultural product market is especially obvious. Agricultural product certification holds advantage of avoiding information asymmetry in agricultural product market, which is also helpful in promoting agricultural product quality. Zhu Lili believes that Nash Equilibrium appears in game model between agricultural enterprise and certificate authority, which shows there exists false certification in agricultural products. In order to improve effectiveness of agricultural quality certification, system of agricultural quality certification should be optimized constantly, frequency of certificate authority supervision and violation punishment should be promoted, information disclosure system of agricultural safety incident and standard of agricultural quality certification should be perfected. Some scholars study on how to promote product quality capacity with income distribution. Wen Jiandong insists that quality defect of fake product relates to information asymmetry, while it is determined by income level and productivity. The fundamental cause of current product quality problem in China is that economic development is not enough and income distribution is unequal. Therefore, to solve the problem of product quality fundamentally, on one hand, primary income distribution needs to be improved to reduce product cost, and then purchasing capacity of low-income group will be promoted; on the other hand, improvement measure of income redistribution should be taken in a specific way to reduce the proportion of fake product from demand level. Additionally, some research is conducted on how to promote quality upgrade for export product with foreign direct investment. Li Kunwang holds that there is a transition for China in international trade, from the early stage of development to stage of long-term development. In the early stage, there is no capital and trade interests mainly depends on massive cheap labor, while at present it has been turned to independent innovation and promotion of quality upgrade for export product. For the industry with concentration on capital and massive foreign investment, foreign direct investment is beneficial to quality upgrade of export product, while conversely, for the industry with concentration on labor and little foreign investment, foreign direct investment goes against quality upgrade of export product. Furthermore, research and development intensity, per capita wage, etc. are positive for quality upgrade of export product, and the effect of capital-labor ratio is on the contrary.

2.5 Economic growth quality, urbanization quality and environment quality are all the research focuses of development quality.

2.5.1 Development research focusing on prospering the nation with quality has obtained a series of achievements.

Research on how to develop a quality power, strategic frame of quality power and some major issues is conducted by scholars.

The unique "great power quality" and "transitional quality", put forward by Cheng Hong, is special quality conditions that China is facing.

Complex “big data quality” is both an opportunity and a challenge to China’s quality management. With realistic condition in China that “great power” mixes with “transition”, following measures should be taken to accelerate quality power construction, which involves continuing to deepen reform, innovating mode of quality governance, constructing quality governance mode with government dominating and multi-participation.

Cheng Hong has proposed the strategic frame of prospering the nation with quality. Based on the frame, research on 10 big issues that affect strategy implementation of prospering the nation with quality is emphasized, which contains necessity, environment, goal, content, market, society, government, etc. Then the basic theory, logic relationship, path method and institutional system are established for achieving power, which is followed by implementation model of strategic frame aiming to prosper the nation with quality is obtained.

2.5.2 Research on economic growth quality stresses macro control and structural adjustment.

Currently, research on economic growth quality mainly focuses on how to promote economic growth by macro control and structural adjustment. Ren Baoping explores interrelation between global payment imbalance and economic growth quality. Empirical test on the data demonstrates global payment imbalance in China affects the change of economic growth quality by macro economic stability; there is negative correlation between global payment imbalance and economic growth quality. Therefore, to adjust global payment imbalance benefits promotion of macro economic stability and economic growth quality. From the point of industrial transfer and local government competition, Luo ruoyu discusses the analysis frame that economic growth in western China introduces industrial transfer into local government competition, and states dynamic mechanism of local government competition in undertaking industrial transfer. Luo Wencong, from the perspective of industrial development quality, has explored economic growth quality. He believes that with continuous highlight of deep problem and contradiction, it is imperative to accelerate transition into quality-benefit development mode. Thus, in order to objectively reflect and evaluate industrial development quality, to guide and promote industrial structure’s optimization and upgrade, and to attain fundamental transformation of development pattern, a scientific and reasonable index system is required. Based on innovation input in manufacturing, Huang Zhiji has discussed economic growth quality. He agrees that under the existing environment of economic system, innovation input helps to promote the level of economic growth. Quality promotion of urban economic growth depends on increase of innovation input, so that innovation of urban manufactural enterprise should be promoted in various ways. In the light of promoting innovation input, diverse urban innovation input should be encouraged to promote spillover effect of innovation activity among industries, and to support promotion of the whole urban economic development quality. Meanwhile, each city or area should make full use of spacial spillover effect, brought by technology improvement, to actively integrate into overall layout of regional economic growth in China.

2.5.3 Focus of urbanization quality research is to construct system of quality evaluation index.

Urbanization quality is mainly studied with system construction of urbanization quality evaluation index. Guo Yebo believes that theoretical basis of urbanization quality evaluation is quite weak. The most essential reason is that there is no consensus on nature and connotation of urbanization quality. Therefore, index system construction is guided by the connotation of urbanization quality. He Ping holds that urbanization quality refers to comprehensive level of urbanization development, which also includes its intensiveness, fairness (equalization) and sustainability. On this basis, he establishes an index system with 7 first level indexes containing population employment, economic development, social development, public safety, resident life, resource environment and urban-rural integration. Innovation project team in Chinese Academy of Social Sciences that stresses research on urbanization quality evaluation and promotion path constructs comprehensive evaluation index system of urbanization quality that contains 34 indexes. Taking data availability into consideration, with defining urbanization quality by innovation project team in Chinese Academy of Social Sciences that stresses research on urbanization quality evaluation and promotion path, index system with 34 second level indexes is established from the dimensions of urban development quality, urbanization efficiency, urban and rural coordination degree. In addition, based on system data in 2010, urbanization quality of more than 286 cities at prefecture level and above has been evaluated.

2.5.4 Air quality turns to be the focus in environment quality research.

Environment quality is mainly studied from the view of air quality, which focuses on improvement of regional air quality. Li Jianjun analyzes PM2.5 pollution and holds that it is regional complex air pollution. PM2.5 significantly affects eastern and central city agglomeration, especially in densely populated megacity and its surrounding areas, which forms influence of extensive regional scale. Han Wenke insists that the main cause of worsening environment quality is inadequate urbanization development quality, which is shown that urban economic structure and energy structure is unreasonable for a long time; control of vehicle emission is not powerful; pollution prevention measure of air pollution is not effective; development in urban surrounding areas is gravely unbalanced. So that to improve urban energy clean rate substantially it is required to change economic development mode and to optimize energy structure. Chen Xiaojun lists several factors accounting for air pollution, such as huge coal consumption, unbalanced regional distribution, unreasonable consumption structure, low level of technology, etc. For improving urban and regional air quality, energy production and consumption revolution is required. Willingness to pay is the direct expression of public willingness to improve air quality. By

questionnaire investigation, public willingness to pay on improving long-term air quality could be acquired. Xian Huichen and Cao Huaishu take the public in Qingdao and Beijing as respondent to investigate their willingness to pay on improving air quality. Xian Huichen conducts a study on air quality consciousness of Qingdao resident and their willingness to pay for air quality improvement. It is analyzed that air quality consciousness makes the greatest impact on whether to pay, and income level affect payout amount most. Currently, the total of public willingness to pay on air quality improvement is 1.184 billion a year, which will keep increasing with improved income level and air quality consciousness. Cao Huaishu has conducted a research based on questionnaire, which explores Beijing public's (focusing on college students group) willingness. It is manifested that in order to achieve the goal that the number of days with air quality above class two (API<100) is more than 90% in Beijing within 20 years, public willingness to pay in the future 5 years is RMB 47/person/month, and discount rate basing on time is around 3.8%.

III Progress in Quality Research

3.1 Series of original achievements are obtained in macro quality research.

In the field of macro quality research, scholars put forward some original achievements including quality condition in China, governance mode of quality power, strategic frame of prospering the nation with quality, some big issues concerning strategy of prospering the nation with quality, common governance of government standard and group standard etc. It is manifested that series of original achievements have been obtained in macro quality research.

Accelerating Construction of Quality Power, the headline on People's Daily theory section, published by Cheng Hong, presents quality condition in China. Firstly, it refers to unique "great power quality". China is a big developing country with significant difference in quality, which is demonstrated as difference in areas and difference in income groups. Secondly, it refers to "transitional quality" in the transitional period. Socialist market economy system in China has been basically constructed, but market competition system is not perfect. Fittest survive could not be achieved completely, even bad money driving out good money in some fields. Thirdly, it refers to complex "big data quality". Collection and processing of quality information data is required for government in quality risk management. To manage quality safety effectively, government should promptly get the product quality data of supervision channel, feedback data from consumer, and quality data from enterprise & third-party of quality service institution.

Research on Some Important Issues Concerning the Strategy of Prospering the Nation with Quality, published by Cheng Hong in Journal of Macro-quality Research. Strategic frame of prospering the nation with quality is put forward in this article, which is the basis of 10 major issues affecting implementation of prospering the nation with quality. The issues contains that quality is the important driving force; to carry forward prospering the nation with quality is urgently required by current strategic environment; national income and promotion of enterprise quality capacity is the core objective and focus for prospering the nation with quality; market mechanism of high quality and favorable price is the system basis for a powerful nation; product comparison test is the important way to achieve power; quality big data is the important strategic resource for a nation; group standard motivates powerful innovation for national power; quality service is the strategic industry to promote China's international competitiveness of manufacture; system of quality credit is the soft power base for national power; powerful capacity of quality governance is required for a powerful nation. Based on the above 10 big issues, implementation model for strategic frame of prospering the nation with quality is established, which constructs logic relationship between quality and power. In other words, it specifies that quality is the objective to achieve sustainable growth in per-capita income, and the improvement in enterprise quality capacity is the core to support the objective. Then it has been established that market is the fundamental path to achieve the goal and core of prospering the nation with quality. Market mechanism of high quality and favorable price should be achieved to motivate enterprise to become the subject providing high quality product continuously. Consumer takes the method of comparison test for the sake of guiding enterprise to promote quality capacity from demand side; moreover, by reducing information asymmetry between enterprise and consumer, quality big data that is the important resource for a power should be established. The two ways to achieve prospering the nation with quality are involved in the model: to motivate quality innovation based on social group standard, to transform and upgrade manufacture based on promoting the power with quality service industry. The model has designed system arrangement of supportive path and way, which contains both soft system in quality credit system and hard system in quality governance system. Meanwhile, the model is a structured abstract on strategy of prospering the nation with quality, also an expression of implementation method that how to support power with quality, so that quality and power become a complete system with inherent logic relationship.

Theoretical Frame and System Innovation of Benefit Consistency Standard-A Case Study of "Alliance Standard" is published in Journal of Macro-Quality Research. Based on the case of "alliance standard", the article has explored the problem of current standard system in China and put forward theoretical frame and system innovation of benefit consistency standard. Alliance standard refers to the standard that is set by an industry's

member based on consensus. It reflects intrinsic interest of members and adapts to industrial and technological change, so that it could be carried out preferably. The fundamental problem of current standard system in China is that there lacks high consistency between standard maker's interest and user's interest, which means conflict is unavoidable between compulsion and voluntary, stability and change, interest of making standard and implementation.

3.2 Common governance has been a consensus in quality research.

Common governance is put forward to promote quality in governance model, co-governance of government standard & group standard, quality supervision.

Proposals are given by Cheng Hong in *Accelerating building quality power*. With realistic condition in China that "great power" mixes with "transition", we should keep up the development of times to accelerate quality power construction, which involves continuing to deepen reform and innovating mode of quality governance. The quality governance mode includes that enterprise subject responsibility should be implemented with market mechanism; quality regulator that is integrate and professional should be constructed; function of social organization should be developed in quality governance; governance model with government dominating and multi-participation should be structured.

In *Theoretical Frame and System Innovation of Benefit Consistency Standard-A Case Study of "Alliance Standard"*, Cheng Hong offers to reform current standard system in China, and to establish national standard system that consists of government standard and group standard (with alliance standard included), which aims to achieve common construction of government standard making subject and social standard making subject, common governance of government standard and group standard, sharing standard basic function and standard innovative function.

Liao Li states that in order to enhance consumer rights protection in China, there are several aspects to be improved, which contains safety protection in food and medicine field should be emphasized; petty lawsuit procedure should be established; punitive damages system requires improvement; Consumer public welfare lawsuit system should be set up; education of consumer rights protection needs to be promoted; social development of consumer rights protection organization should be improved. Xiong Wei and others has defined the function of government quality award on enterprise, and its effective pathway and degree. Luo Ying points out that rights of citizen's participation and sharing should be emphasized to improve normalization and legalization in social management, to achieve common governance with sharing, and to form "perfect governance" by "quality sharing". Furthermore, quality public service should be incorporated into national public service system to improve performance of quality public service, to promote effect of quality safety supervision, and to enhance overall level of macro quality management. Fan Ruimin figures that publicity channels should be broadened with diverse ways, such as TV media, public network, etc. Various ways of quality education should be adopted to promote quality public education and social supervision function of consumer organization. The way of cooperation between consumer organization and government quality department should be reformed to build the mechanism of quality infringement and relief that is convenient for people. Wang Xiaolong believes that there are some problems in management of food safety risk, such as evaluation subject lacking independence and fairness, increasing safety risk of non-traditional food, etc. He also proposes some methods to solve them, which involves setting up report system and public engagement system, strengthening the offender's legal responsibility, attempting to evaluate risk benefit, etc. Cui Jinhuan and others propose that blended governance contract should be emphasized; furthermore, basic policy orientation for turning around low efficiency of private governance is to establish steady system environment and to motivate multivariate mixed contract. Song Tongfei figures that government is both the largest player in social political and public life, and the holder of public power. Government should bear the responsibility of public interest, supervision and guidance in the field of food safety; moreover, government should actively dispose conflict of food safety responsibility. Wang Jining and others has built up an evolutionary game model between consumer and food enterprise, whose equilibrium strategies are analyzed respectively by the model. Then it is concluded that consumer's involvement in supervision will affect problem solution of food safety, whose equilibrium strategies are analyzed by the model. Liu Yaping takes food safety as an example with exploring the UK's major challenge and reformation in the national construction process of modern supervision since the industrial revolution. It is figured out four major challenges that is required in national construction process of modern supervision: separation of industrial interest and consumer interest, separation of decision and implementation, separation of risk evaluation and risk management, highlighting public participation. Zhu Lilong and others reveal the internal operation mechanism centering on establishing supervision game of quality management system between government quality supervision department and enterprise. Also he gives some suggestion for government to supervise quality effectively, and for enterprise to promote product quality effectively; moreover, he provides direction for the practical application of supervision game model.

3.3 Research on quality evaluation data based on consumer has made significant progress.

Based on questionnaire, consumer data from the internet, and big data, scholars conduct study on quality problem.

Wuhan University Institute of Quality Development Strategy carries out large-scale quality observation across the country annually. Oof-line

data from consumer is collected by questionnaire survey. A series of achievements have been published based on the data, which contain both general evaluation on national quality status, like *China Quality Development Observation Report in 2012* (Cheng Hong, etc.), and research on a specific problem based on observation data, such as *Research on Government Quality Safety Responsibility* (Li Han), *Research on Duality of Urban and Rural Product Quality* (Luo Lianfa), *Research on Satisfaction Degree of Government Quality Supervision* (Li Dandan), *Research on Consumer Organization* (Fan Ruimin), etc. Based on empirical investigation in Jiangsu province, Xu Lingling conducts a study on public perception of food additives safety risk and its influencing factor. Based on investigation on public perception of food safety risk in three cities, Zhang Jinrong explores public perception of food safety risk and its construction.

Some scholars study on quality with consumer data on the internet. Yu Hongwei has analyzed frame construction and model implementation based on network early warning of consumer quality safety, which is conducted from three aspects: information classification, risk ranking and alert division. Then the general classification of consumer network quality information is concluded as body injury, feeling of insecurity and character change. Taking the feature of network information into consideration, the three types of information are divided into five different levels according to risk severity, which helps to confirm division of early warning alert. With evidence theory, the construction process of early warning model is explained in detail from three steps: recognition framework construction, reliability evaluation acquiring and recursive fusion algorithm. It integrates quality information with different types and different risk levels. This research provides an idea and method for quality network governance in big data times.

3.4 Research abroad

Some quality studies are major conducted on frame and model of product supply chain. Nagurney makes use of mathematic model and establishes the model of optimum production or purchase decision. Jraisat explores factors of quality control (QC) in supply chain, which helps administrator to comprehend factors of QC in supply chain with conceptual frame. Ma states that consumer controlling society & environment and increasing expectation of standardization program should be focused; moreover, sustainable supply chain management (SSCM) should be stressed. Harms proposes that SSCM should be guided by risk. By establishing game theoretical model, Nagurney puts forward that the model is assistant to managing each equilibrium condition that is in the dynamic adjustment process depending on the change of product stream, quality level and price. Cai composes a supply chain and acquires the optimal decision for the three members in it. An incentive plan is put forward to coordinate supply chain, which aims to remove the two sources of “double marginalization” in three-echelon supply chain, and to guide coordination among the three members in supply chain. Zeng has figured out a conceptual model to study on three dimensions of supply chain quality management (SCQM) and their impact on the two types of quality performance (conformance quality and customer satisfaction). It is found that QM in the downstream of supply chain could attune the relationship between internal QM and customer satisfaction, while QM in the upstream does not affect the two types of quality performance directly. Based on accuracy of pollution source in each link of supply chain, Elwyn Piramuthu points out responsibility should be allocated to different roles in perishable food supply chain. Existence meaning of responsibility allocation should be achieved between the upstream and downstream; furthermore, reasonable level of visibility and recall policy should be confirmed. Zeng believes that internal quality management dominates in SCQM, and QM in the downstream of supply chain could attune the relationship between internal QM and customer satisfaction.

Some scholars study on product quality safety from the perspective of product recall and defect. Bae has investigated the number of the US automobile recall, and it is presented that if the recall model is released in the first year, severity of traffic accident injury in the following year will be reduced continuously, which is impossible in the automobile with no recall. There are two reasons account for this phenomenon. On one hand, defect of automobile is repaired continuously; on the other hand, drivers are more cautious during that period. In order to furthest reduce loss in driving, the defect automobiles should be recalled in time and rapidly, and more detailed information should be sent to the owners. Hammond takes use of data from vehicle resale market, and consumer's response to large-scale product recall caused by safety problem is tested. With contrasting the price of Toyota second-hand car with the price of major manufacturer second-hand car at home and broad, it is revealed that enterprise reputation greatly depends on the reputation of high quality product. Pouliot studies on how to protect industrial reputation with promoting traceability and restricting recall scale. With a specific study on some similar small scale farms in a competitive industry, relationship between traceability and food safety level is revealed. Sosa and others explores the impact of architecture decision on product defect level, which provides empirical evidence for relationship between product quality and periodicity (dependence of some elements on others).

Some scholars study on influence of standard on quality. Christina Handschuch and others explores that in international market, influence of food quality and safety standard on peasant in global production and sale. Then, the peasant with small scale production will benefit from market

access and technology upgrade which are caused by standardization. Additionally, some factors are recognized that how do food safety and quality certification standard impact raspberry farm management and income in Chile. Carlos Alberto Costa and others deem that in addition to performance, cost and quality requirement, the design of food industry equipment should focus on safety of health and food. It is discussed that how do information and health are applied as orientation standard in design of food industry equipment. In the research, 85 standards are set based on professional literature, and national & international standard setting valuation health standard. Van de Kaa and others focus on China's standard conflict. By the case of standard conflict, government black box is exposed; moreover, although effect of enforcing standardization policy reduces on the whole, government internal contradiction and the competitive method have been found. Tamura and others explore definition of standardization; in addition, correlation of Japan's standardization and enterprise innovation spirit is discussed. With quantitative analysis, it is testes that base of standardization definition is effective: plan, negotiation and support. In the case of Japan's electrical industry, there is a significant positive correlation between enterprise innovation and standardization activity relating to intellectual property. Paradise and others' research is conducive to a wider range of organizational research issue, which refers to that under the pressure of soft power, global standardization is obviously raised, thus how to cope with managing dynamic of market and hierarchy by local order. This research inquires the effect of "cage" hypothesis and points out coexistence of diversity and standardization.

Some scholars inquire how to promote service quality with quality culture. Cho and others enrich the existing organizational learning frame by the method of competition value mode integration. From the perspective of logic flow between organizational culture and service quality, a new frame is proposed and it is indicated the direction that service quality of knowledge intensive business service should be promoted with suitable organizational culture.

With contrasting literature at home and abroad, it is shown that foreign literature focuses on micro quality research, such as construction of supply chain, while domestic literature stresses macro quality research like economic development quality. The difference is because that macro environment in abroad is more mature than that in domestic. However, there also deserves the similarity that macro factor of quality is being emphasized in foreign literature, such as research of product recall based on consumer, quality standard, quality culture, etc.

IV Limitations of Existing Research

4.1 Study on basic theory of some new quality phenomenon is gravely insufficient.

Scholars put more emphasis on policy suggestion of promoting quality. Zhang Yunfeng states that enterprise should stress dairy quality safety and enhance awareness of unexpected development. Consumer's interest should be put in the first place to achieve honesty, and the primary task is to ensure dairy quality safety. Zhu Mingchun has given an idea for government management is, which is conform to status of China's present food safety and social economic development. What it includes are zero tolerance to food safety crime to win public confidence, balancing the choose between science and values to get public understanding, disclosing risk of food safety proactively to strive for public support, increasing cost of delinquency to advocate public interest. Pan Lixia states that government food safety supervision should be promoted with food safety information disclosure. Ren Baoping believes that construction of economic ethic base should be stressed to promote economic growth quality and to build value judgment. Ethic base exerts positive effect on economic growth quality, which is presented that ethic provides dynamism for economic subject; ethic promotes self-serving behavior to be public; ethic promotes social culture to be humanized.

Research on basic theory of new quality phenomenon requires to be improved, such as cause of quality safety problem, component of economic development quality, boundary of each subject in common governance.

4.2 Internal logic system structure between micro quality and macro quality requires to be constructed.

Scholars focus on the perspective of structure adjustment. Luo Wen puts forward that accelerating industrial restructuring requires optimizing industrial structure and developing strategic emerging industry. Xu Yongbing points out that economic development quality in Hebei province exists some problems, which involve that industrial structure is unreasonable and in low level, final demand structure is unreasonable, high and new technology industry is weak, resource consumption is huge, people's livelihood requires further improvement, etc. So that in order to promote economic growth quality, there are several ways to be followed containing adjusting industrial structure, expanding consumer spending, supporting technology innovation in enterprise, implementing energy saving and emission reduction, perfecting social security system, etc.

By emphasizing constructing macro quality index, scholars conduct research on urbanization quality. Yuan Xiaoling takes use of indexes like per capita GDP, proportion of the third industry, etc. to evaluate urbanization quality in Shaanxi province. Xie Jialong evaluates central city development quality with three indexes: self-dependent innovation, benefit contribution, international competitiveness. Indexes of per capita

financial expenditure that is government welfare, urban and rural income ratio, etc. are involved in Yan Yanyang's research to narrow the gap of living quality between urban and rural. Guo Yebo takes indexes of per capita GDP in a whole city, per capita disposable income of urban resident to study on urbanization quality. Innovation project team in Chinese Academy of Social Sciences that stresses research on urbanization quality evaluation and promotion path constructs comprehensive evaluation index system of urbanization quality that contains 34 indexes. From 7 aspects including employment and others, He Ping constructs 29 indexes to evaluate China's urbanization quality.

Whether it is structure adjustment of economic development quality, or index evaluation of urbanization quality, quality is studied from the macro perspective. Internal logic system structure between micro quality and macro quality requires to be constructed.

4.3 Big data accumulation in quality research is gravely insufficient.

Midst quality literature in 2013, there are 21 literatures basing on empirical study. Investigation questionnaire is designed by Wuhan University Institute of Quality Development Strategy. By issuing 3736 questionnaire in 48 regions of 26 provinces, *2012 China quality development report* is finished. From the perspective of consumer perception, Cheng Hong has constructed an analysis model of macro quality status in China, which includes four dimensions: general feature, structural feature, system design and quality subject. With the model and observation data, it is manifested that quality development is stable and progressive; quality safety status is stable as a whole, and global quality safety risk has not been occurred; structural problem is highlighted in quality development; government public service of providing quality information is not effective; soft power of quality development is not strong enough; consumer's quality action capacity is comparatively weak. Then policy proposals are offered that quality education on citizen should be stressed; solving structural problem in quality development should be highlighted, especially improving soft power; innovation of quality governance system that meets the requirement of modern market economy should be emphasized; introducing quality supervision system like "whistleblower legislation" to promote quality common governance. Yuan Xiaoling conducts a comprehensive analysis on data in Shaanxi province from 2001 to 2010. Sustainable development of Shaanxi urbanization is in a low level, which is caused by problems of society, resource and environment. Xie Jialong performs comprehensive measure and scatter clustering analysis in three dimensions for development quality in 4 municipalities and 15 sub-provincial city. On the basis of system data in 2010, Wei Houkai evaluates urbanization quality in 286 cities at regional level or above

Literature basing on data account for 11% in all, so that big data accumulation in quality research requires to be improved.

4.4 Research field and scope is insufficient.

There are around 70% literature is repeated in quality research, which proposes policy suggestion without data analysis. In research of quality safety, some scholars offer to enhance market environment building and legal construction. In research of economic growth quality, some scholars hold that structure adjustment should be strengthened. In research of supply chain quality, cooperative model of supply chain should be constructed. Some scholars make use of environment index to build index system. Innovation of these research fields and scopes require to be promoted.

V Conclusion

China's quality research in 2013 has increasingly become a common concern in academia. With the above statistic analysis, it is manifested that quality research has made progress in various aspects, especially for original achievements in the aspects of macro quality, big data of quality and common governance. Proceeding from specific quality condition in China, scholars put forward the strategic frame of prospering the nation with quality based on China's transition quality, duality quality and great power quality. Then 10 big issues affecting strategy implementation are stressed, which include necessity, environment, goal, content, market, society and government. The basic theory, logic relationship, path method and institutional system are established for achieving power, which has international advantage in quality research field. Scholars in different fields cooperate to be involved into quality field, and make some significant attempt at influencing factor of quality, quality common governance, quality mode & system structure, and quality statistical analysis based on data. Chinese scholars make original contribution on developing quality, especially on macro quality. However, there are still some aspects to be further promoted: explanation on basic theory of new quality phenomenon should be improved; statistic analysis of quality that is based on data requires to be promoted; internal logic system structure needs to be perfected; quality research based on network data should be strengthened. Confronting huge demand for quality, more efforts should be made on quality basic theory, quality big data accumulation, quality capacity promotion, and achievement innovation. Meanwhile, advantage in macro quality research should be developed to internationalization to make macro quality research become an international paradigm.

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Study on Status and Progress of Quality Academic Research in China 2013: Macro View,Common Governance and Data Accumulation

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Abstract:The research about the domestic and international literatures on quality study in 2013 shows this field has increasingly become a common concern.Basing on the specific circumstances of our country’s quality study,positive progress has been made in various ways,especially on the macro-quality research,big data accumulation,common governance,a number of original achievements has formed.Scholars of different disciplines have high cooperation,involved in the field of quality,done numerous of meaningful attempts on the influence factors of the quality,common governance of quality,the quality models and architectures and statistical analysis of the data on quality,etc. It remains to be strengthened in the following several aspects about quality study: the basic theory study of new quality phenomenon,the big data accumulation in the quality study,the research of the inherent logic of micro and macro quality architecture,the innovative research about the field and scope of the quality study.

Key Words:Academic Research; Macro Quality; Common Governance; Current Situation and Progress

■Editor Wang Xiaoqing

Research on the Development Mode of Promoting China's Urbanization Quality —A Case Study Based on Hougang Town

Luo Lianfa

Abstract: The main task of China's urbanization is to continuously improve the quality of urbanization, and the urbanization quality lies in promoting the people's urbanization, which needs the endogenous sustainable industrial development foundation. When many towns are facing development crisis caused by internal and external shocks, Hougang's economic development is still strong. This paper, based on a case study, concludes that the endogenous urbanization mode roots in market power and establishes the industries based on local comparative advantages, has inherent advantages of improving urbanization. The Hougang urbanization mode is different from the traditional mode, and can be an important mode of China's urbanization quality improvement.

Key Words: Urbanization Quality; Hougang Town; Case Study

I Background

Urban population in China has increased from 170 million in 1978 to 710 million in 2012, and urbanization rate has increased from 17.9% at the beginning of reform to 52.6% in 2012 (State Statistic Bureau, 2013). Until now the major problem of China urbanization is not enhancing the speed, but low urbanization quality, which shows that industrial base is weak; urban public service supply is insufficient; economic development is not stable. The Central Working Conference of Urbanization held on December 12, 2013 advocates that promoting urbanization development quality should be focused to steadily promote urbanization level of registered population; the key of urbanization quality is to promote human-centered urbanization. In the aspect of human-centered urbanization, relevant research institution has performed evaluation on urbanization quality (Chinese Academy of Social Sciences, 2013), and designed quantitative analysis index of urbanization quality. However, study on which urbanization mode is the most beneficial to promote urbanization quality requires further exploration, especially for how to achieve sustainable urbanization development based on the history of China's urbanization development. New urbanization requires to be supported by systematic development mode. This article emphasizes that which urbanization mode is the most beneficial to promote urbanization quality in existing driving force model, and whether this mode could be achieved in reality.

To achieve the goal, typical case analysis is needed based on certain theoretical hypothesis. At present, urbanization internal difference is very big. Generally, east urbanization is developed, while urbanization in central and western region is backward and the task is heavy. Thus, selecting a typical area in central and western region that urbanization is relatively lagging is representative. With field study and experience analysis on urbanization progress in Hougang, Shayang County, Hubei province, there raises a mode of endogenous urbanization development and demonstrates its advantage on promoting urbanization development quality.

The following parts are arranged like this: with concluding research on current evaluation method and mode selection of urbanization quality in Part 2, the research topic will be raised on the basis of literature review; Part 3 contains concept definition and basic theory; Part 4 confirms advantage of endogenous urbanization based on the case analysis in Hougang, Shayang County, Hubei province; Part 5 focuses on conclusion and suggestion.

II Literature Review

Extension of urbanization is wide. This study focuses on urbanization quality and mode relating to quality, so that literature review is mainly

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based on these two aspects. However, there is no differentiation between city-rization and urbanization. According to scholar's opinion, there is significant difference between urbanization and city-rization. For example, city-rization emphasizes development in city, while urbanization stresses development in small & medium-sized city and rural area; city-rization is the process that centralize elements to metropolis and it rejects farmer development, while urbanization mainly aims at process of citizenization which is inclusive to farmer (the opinion comes from interview on Zhang Xiaoshan, Cheng Peng, etc., which is published on China Urban Development Network, <http://www.chinacity.org.cn/csfz/fztl/103791.html>). Expression of urbanization is taken in the Report of the 18th National Congress and document of the Third Plenary Session of 18th CPC, so literature with urbanization and city-rization in titles is contained. In this study "urbanization" will be adopted uniformly.

In published literature, urbanization quality is put forward by YeYumin (2001) at the earliest. He holds that urbanization was city-rization at first. Quality includes two aspects: the first one is core carrier of city-rization, which is also city modernization; the second one is region carrier referring to regional development quality of city-rization. Liu Chuanjiang and Zheng Lingyun (2005) insist that urbanization quality is the quality of urban resident living, urban economic benefit and change of ecological environment. Urbanization quality is defined by State Statistic Bureau, Kong Fanwen, Su Yongling (2006), etc., while the core index is similar. The latest index system of urbanization quality measurement is published by The Chinese Academy of Social Sciences Institute of Urban Development and Environment in 2013 *China Urbanization Quality Report*. It points out that urbanization quality includes three aspects: development quality of town itself, promotion efficiency of urbanization, coordinated development of urban and rural area, which is different from previous research. Not only development quality of town itself is emphasized, but also coordinated development of urban and rural area is highlighted. In other words, urbanization not only depends on town, but rural economic development matching with town development; furthermore, except for citizen's life quality, that whether farmer living condition is improved and whether development of urban and rural area is coordinated should also be taken into consideration. Based on the empirical study relating to urbanization quality research, there are some common focuses. First, urbanization is regarded as a concept that is relative to speed, and emphasizes development rate of town or city, such as sustainability of resource, environment, land, etc. Second, development coordination in urban and rural area and emphasis on human urbanization. Third, city-rization (expansion of the city itself) is stressed much more, and urbanization (rural urbanization) is neglected. Plenty of quality evaluation is actually on city-rization.

Urbanization quality is studied mainly from the point of urbanization mode. Gu Shengzu, Li Zhengyou (1998) hold that there are two types of urbanization mode from the perspective of driving force mode, top-down and bottom-up mode. Top-down mode is a designed urbanization that is arranged by government. It is popular before reform & opening up, and it also has great influence after that. Bottom-up mode is the urbanization that is promoted by public force and induced by market, which is emerging after reform & opening up. Feng Yunting (2005) states that there are two urbanization modes. One is based on agglomeration and diffusion of central city, the other one is based on self-development of small town and village industry. The two modes could also be regarded as "leaving the countryside but not the land" or "leaving the land but not the countryside", which is differentiated from the perspective of space variation. In rural urbanization, Li Qiang, Chen Yulin and Liu Jingming (2012) believe that there are three modes for urbanization dynamic mechanism: government force, market force and public force. Only with coordination among the three force, could urbanization quality be promoted. Deng Dacai (2013) divides urbanization into three modes: body, urbanization, identity urbanization and lives urbanization, and he regards the first two as exogenous urbanization while the last one is endogenous urbanization.

There are so many problems in urbanization development, while the most important is development quality. Specifically, it is because human urbanization has not been achieved actually, which means "leaving the land but not the countryside" is the base or "lives urbanization" has not been reached. Many scholars hold that the main reason of backward human urbanization is the system of household register management, land transfer, etc. Therefore, system of urban and rural household register management should be liberalized to accelerate citizenization of more rural migrant worker (Gu Shengzu, Li Zhengyou, 1998; Liu Chuanjiang, Cheng Jianglin, 2008). Admittedly, systematic factor is obstacle for promoting urbanization quality, while the fundamental premise is sustainable industrial development. Without sustainable endogenous force in industrial development, function of policy implementation, such as household register management, land transfer, etc. will lose the premise, then qualified urbanization can not be achieved. Actually, the reason why urbanization development quality is not high is unsustainability of economic development. For example, there are some problems in economic level containing over dependence on land finance, property bubble, "city without prosperity", etc. (Gu Shengzu, Li Rui, 2013).

Concept of urbanization has been defined in the existing literature; meanwhile, significant research on dynamic mechanism, development mode of promoting urbanization quality is conducted. As for the goal of human urbanization, existing research mainly concentrates on accelerating citizenization of more rural migrant worker, then they shall have the equal right as urban resident. These aspects are prominent to enhance

urbanization quality, while what this study will focus on is economic development of how does urbanization take in farmer employment or furthermore, it is economic development quality of the town and city itself.

III Definition and Basic Theory

In this study, urbanization with driving force mode regarding local resource as advantage is called endogenous urbanization; the urbanization depending on administrative mean or policy guidance (attracting investment) is considered as exogenous urbanization.

With measure index of urbanization quality in existing literature, connotation of urbanization system could be defined.

Table 1 Index of evaluation on urbanization quality in existing literature

Author	Index of urbanization quality
Chinese Academy of Social Sciences (2013)	Economic development quality, social development quality, spacial development quality, economic social efficiency, ecology environment efficiency, income coordination, public service coordination
Zhang Chunmei, Zhang Xiaolin, etc. (2012)	Economic scale, economic efficiency, material life, spiritual life, interactive development between urban and rural area, gap between urban and rural development, resource condition, environment pollution and governance
Deng Fanwen, Su Yongling (2006)	Economic development, social development, infrastructure, human settlement, municipal governance
Liu Siwei, Xiong Xi, Liu Ling (2011)	Population employment, economic development, urban construction, social development, resident lives, ecology environment
Chen Hongbin (2003)	Economic development, facility environment, people's lives, social progress
Ye Yumin (2001)	Economic modernization, infrastructure modernization, people modernization

According to index from table 1, it is found that specific index selection is slightly different in existing index system of evaluation on urbanization quality, but basic idea of index design is similar, which could be concluded as economic development, social development and ecology environment. The indexes possess advantage respectively in evaluating static urbanization quality, which could reflect urbanization quality at a point in time. However, urbanization is continuous changing process of social economy. Only by correct dynamic mechanism, can sustainable healthy development of urbanization be kept. Major problems in existing urbanization mode are urbanization development lacks industry support; land wastage is severe; social security system is comparatively lagging behind; “building city” promoted by external force brings about resource waste; economy like “migratory bird” influenced by external economic environment increases unsteadily. All the problems are because there is no corrective development mode or dynamic mechanism. If urbanization quality is evaluated only at a point in time, it is difficult to find out the problem. For instance, input on economy, society and ecology environment is heavy. It could be supported by a lot external input, while the sustainability depends on its development mechanism. In practice, depressed town appears due to resource depletion, industrial transfer, rising labor cost, etc.

Based on current research on urbanization driving force mode (Gu Shengzu, Li ZHengyou, 1998; Li Qian, Chen Yulin, Liu Jingming, 2012), urbanization mode could be divided into two types: endogenous urbanization and exogenous urbanization. Deng Dacai and other scholars have given the definition of endogenous urbanization, which emphasizes final result status of urbanization only, but not regards endogenous urbanization as a driving force for urbanization development. Endogenous urbanization further stresses market force in development force, localization in development structure and sustainability in development path. Endogenous urbanization and exogenous urbanization are just comparative terms. In development mechanism, exogenous urbanization mainly refers that it requires more dependence on government push in development driving force; external element is dominant in development element; development demand fluctuates more easily. Certainly, this kind of distinction is practically for small town and rural area.

Human urbanization refer to not only farmer's residence transformation, but also transformation of life style, income source, social security, etc. from countryside to city, which means achieving lives urbanization. Many scholars hold that to achieve human urbanization, “dualistic system” requires to be changed, such as household registration system, social security, education, employment, etc. Human urbanization should be better achieved with farmer's city-rization, which is city-rization practically for large and medium-sized city. Expression of city-rization aims to differentiate with urbanization. This study emphasizes development quality in urbanization process in rural area. In the category of driving force, it is “bottom-up urbanization” put forward by Gu Shengzu and others (1998); and in the category of space, it belongs to the development mode of “leaving the countryside but not the land” raised by Feng Yunting (2005).

With the above analysis, it is shown that there are two reasons why human urbanization has not been achieved well. On one hand, it is the problem left over by history, dualistic segmentation system of urban and rural area; on the other hand, it is more important that incorrect driving force mode of urbanization leads to unsustainability of economic development, which could provide support for urbanization development. Thus, to solve the above problem of urbanization development quality, driving force mechanism should follow the road of endogenous urbanization. In part 4, the achievement path of promoting urbanization quality with endogenous urbanization is testified by practical development experience in Hougang town.

IV Quality of endogenous urbanization-based on analysis on Hougang town

4.1 Development survey of Hougang town

Hougang town locates in southern Shayang county, Jingmen city, northern Jiangnan plain, which is hinterland of “Yijiangjing” urban agglomeration. Total population is 76300, and gross production value is 9.75 billion, which rises 23.7% from a year ago and it is 12.4 percentage points higher than overall growth rate in Hubei. Proportion of urban resident is 68%, which is 14.5 percentage points higher than average urbanization level in Hubei, and 15.4 percentage points higher than national average. Compared with coastal towns, there is not any advantage for Hougang in policy, geography or natural resource, which means there is no policy of reform and opening up; it is not adjacent to Hong Kong or Macao; natural resource is not superior. But urbanization in recent years is quick and also high-quality with strong anti-risk capacity on macro economic situation changes in international and domestic. Although depression led by global financial crisis appears in coastal manufacturing in 2008, urbanization development in Hougang still maintains growth rate higher than 30% in 2009.

Currently, industrial structure in Hougang is formed, which is oriented by glass product, and supported by green food and boutique clothing industry. Infrastructure in Hougang begins to take shape, such as the road, square, pollution discharge, water supply, housing, etc. People’s life style has also been changed with shopping plaza, treelawn and small bus. Average price of commercial housing is not more than RMB 2000 per sqm, which is affordable for local resident. Till now, there are more than 200 enterprises in which there are 28 medium-size enterprises and 10 enterprises with asset of more than RMB 100 million. As a latecomer town, there is a big gap of development scale comparing with coastal developed towns, but the development quality is comparatively high and internal basis is held in industrial development, which follows the development road of exogenous urbanization.

4.2 Primary experience of urbanization development in Hougang

There is some experience for achieving high quality urbanization in Hougang.

4.2.1 Endogenous industrial agglomeration

Endogenous development refers that localization is stressed in development. Localization does not mean no use of external resource, but more emphasis on localization in development resource element. This mode is not about no use of external element, but making use of local featured resource to attract external investment and to form local industry. Throughout major industries, it is shown that the industry development depends on local resource advantage but not low-end processing. Additional value brought by product quality is focused, so that there is internal stability in industrial development system. Red Dragonfly grain and oil company introduced by Hougang is invested RMB 200 million from Chongqing COFCO, whose investment mainly depends on rapeseed production advantage in Jiangnan plain. The rapeseed is taken as the most important raw material for green product and industrial transfer is less likely to be occurred, so the development is endogenous. Almost 200 agricultural labors are employed in the enterprise; moreover, farmer’s land is contracted collectively to implement large-scale operation, which promotes large scale production for local agriculture.

Grain and oil industry in Hougang is not the only endogenous advantage industry. Local resource corresponding to each leading industry is shown in table 2.

Table 2 Industry development and resource advantage

Industry	Resource advantage
Glass product	Jingbo Group with 31-year history has accumulated the advantage of technology, entrepreneur and human resource
Green food	Rich fish and aquatic resource, traditional aquaculture and egg technology, advantage of rape planting in Jiangnan plain
Clothing	Entrepreneur and skilled labor resource relying on years of working outside; nearly 4000 clothing bosses and 12000 skilled workers

In the three leading industries, local superior resource is relied, in which some is based on advantage of natural resource (such as green food), some depends on advantage of entrepreneur and human resource (such as glass product). The advantage has been accumulated for years with internal stability. Compared with traditional urbanization, industry in Hougang does not completely rely on low labor cost and low cost of land utilization to attract investment. Whether it is the enterprise founded by local entrepreneur or the factory constructed with external investment, they rely mainly on some local resource, which is irreplaceable and absorptive to investment.

4.2.2 Endogenous capital transformation

Capital input is required for industrial development, while capital searches for profit, which means it will flow from area with low marginal output into the one with higher marginal output. It is the norm in China that massive rural capital flow into city, especially the eastern developed city. Actually, plenty of rural financial institution has become “blood sucking machine” of rural capital. Only by developing local industry with solid foundation, can the direction of capital flow be reversed. Development foundation in Hougang is preferable, and local capital is made the most, so that the proportion of local saving turning into local investment is high, and the capacity to absorb capital is getting stronger.

Table 3 Savings and investment structure in Hougang

	2010	2011	2012
Total household deposite (RMB 10,000)	75000	132600	194000
local investment turned from savings (RMB 10,000)	50000	68000	156000
Capital investment from the outside (RMB 10,000)	80000	110000	140000
Proportion of savings turning to local investment	66.67%	51.28%	80.41%
Ratio of local investment and investment from the outside	0.63	0.62	1.11

It is shown in table 3 that a large proportion of local savings in Hougang could be turned to local investment, which keeps above 50% since 2010 and more than 80% in 2012. Capital inside and outside the town is proportional balancing, and even the local investment exceeds outside investment in 2012. All the above declares industry development in Hougang generates higher investment demand, which is beneficial for local savings flowing into the town. Additionally, it is manifested that urbanization development in Hougang heavily depends on local capital accumulation, but not massive external input or attracting investment, which is more stable.

4.2.3 Endogenous source of public expenditure

Exogenous urbanization requires heavy external investment for infrastructure construction in the early stage, but there is no relevant industrial foundation or industrial development is weak, which results in “city with no prosperity”. Government early public investment is difficult to sustain without tax foundation of economic development. Public expenditure relying on land finance will occur crisis some time. A large amount of attracting investment conditions government duty free and various subsidies. Once preferential policy expires or it could not be supported by government financial resource, risk of capital transfer may occur, which is followed by industrial transfer. Then public expenditure required by urbanization development could not be supported and urban population will outflow, which brings about “empty city”. What is different from exogenous urbanization mode is that in general, industrial development of endogenous urbanization will come first, and then it is massive public infrastructure input; at the same time, there is stable source for fiscal revenue. Therefore, endogenous urbanization is also sustainable. Development experience in Hougang indicates that it is a mode of endogenous public expenditure that depends on local economic development, and fiscal revenue generally corresponds to economic development rate.

Table 4 GDP, gross industrial output value and fiscal revenue growth in Hougang

	2010	2011	2012
Regional gross value of production (RMB 10,000)	603375	788000	972000
Gross industrial output value (RMB 10,000)	406010	657000	836000
Fiscal revenue (RMB 10,000)	12177	14612	17608

It is indicated in table 4 that economy in Hougang grows fast with an average of around 25%. Industrial average growth rate even reaches 40%, and the gross industrial output value is RMB 8.36 billion at the end of 2012, which accounts for 86% of the GDP. Growth of fiscal revenue is faster

while economy is growing rapidly, which maintains average annual growth of 20%. Financial power in town is restricted, while tax revenues created by local enterprise is much more than fiscal revenue in the town. Stable public financial growth provides a solid foundation for social development. According to statistics, at the end of 2012, municipal engineering investment in Hougang increases from 9.6 million in 2011 to 25.79 million in 2012, which has increased 1.69 times.

4.2.4 Endogenous coordinated development of urban and rural area

Endogenous urbanization in Hougang is also reflected by coordinated development of agriculture and industry. Industrial development drives agricultural industrialization, which benefits the farmer. One of the leading industries is green food, which undertakes subsequent processing for the whole agricultural product. Red Gragonfly grain and oil company with RMB 200million investment integrates farmer's land to plant large scale rape. Meanwhile, local farmers are employed by the grain and oil factory, so that the farmers could receive land rent calculated by grain price and income from working in the factory, which shows they have diverse sources of income. In the process of industrialization, farmer's right in land is not only damaged, but its market value has been achieved with the development of industry and it has become the important resource for increasing farmer's income.

Table 5 Income contrast between urban and rural resident in Hougang

	Urban per capita disposable income	Rural per capita net income	Urban and rural income ratio in Hougang	Urban and rural income ratio in Hubei
2010	10995	7480	1.47	2.75
2011	12040	8600	1.40	2.66
2012	14756	9904	1.49	2.65

Data source: It is provided by Hougang government; *Hubei Statistical Yearbook in 2012*.

It is manifested that in the mode of endogenous urbanization, the ration of urban and rural resident income keeps within 1.5, which is far below the ration in the whole province at the same period. Hougang urbanization is the real urbanization combining the city and countryside, which makes urban resident's income increases steadily and ensure rural resident's income; furthermore, urban and rural difference has not been expanded excessively in rapid urbanization process.

4.2.5 Strong capacity for resisting external shock

Economic scale in Hougang is not large, but industrial foundation is preferably with specialty industry. So the influence degree caused by external economic environment is lower. Coastal towns depending on processing trade and labor-intensive industry are far more developed in development scale and speed, but they are sensitive to the change of international economic environment. Because of high capital mobility, risk of enterprise loss will be occurred once local cost advantage disappears. Based on economic development process in Hougang, whether it is in industry of glass product or green food, economy has not been influenced seriously by international financial crisis or European debt crisis in recent years, which is because of solid foundation of industrial development and irreplaceability of local resource.

Table 6 Rate of economic growth in recent 5 years in Hougang

	All over the country	Hubei	Hougang
2008	10.1%	13.40%	51.60%
2009	8.3%	13.50%	36.84%
2010	10.2%	14.80%	13.96%
2011	9.6%	13.80%	28.54%
2012	7.8%	11.30%	22.39%

Data source: State Statistical Bureau, *China Statistical Yearbook in 2012*, research data of Hougang.

It is indicated from the above data in table 6, Hougang economic growth rate has not been directly impacted by the change of international economic environment. Because of international financial crisis in 2008 and 2009, the total economic growth rate in China has declined from 10.1% to 8.2%. Economic growth rate in Hougang also declines, but it keeps a high level of 36.84%. By contrasting economic growth rate of each town in

Dongguan, it is discovered that economic growth periodicity of the towns is highly consistent with external economic environment. There is an evident low of growth rate in 2009. The decline is more than 20% in some towns (data source: Dongguan Statistical Bureau, *Dongguan Statistical Yearbook in 2012*), and even there is negative growth. Hougang economic growth rate also declines from 36.84% to 13.96% in 2010, but it is on account of domestic macro policy. Policy of “energy conservation and emission reduction” is implemented in energy-intensive industry, such as glass industry, which leads to negative influence on leading industry. After industrial transformation, economic growth rate in Hougang has returned to increase more than 20%. Consequently, economic development in Hougang is mainly impacted by national policy regulation, which relates to China’s political and economic environment that marketization is imperfect. But compared with exogenous town like Dongguan, Hougang economic growth is easier to control and more stable.

Based on the above analysis, Hougang follows the way of endogenous urbanization, and the development mode could be presented as in figure 1. Industrial development in Hougang mainly relies on local unique resource advantage and historical accumulation of regional economic development so that distinctive product quality could be formed; meanwhile, local labor resource and human capital are fully utilized to create stable employment and higher income for local farmer. This kind of endogenous industrial development further promotes industrial agglomeration and forms product brand with rigid demand in the market. Then local economy is ensured to resist external market shock to maintain stable economic growth. Solid foundation of fiscal revenue could be constructed by stable economic growth, which ensures government necessary expenditure on public utility. In this process, not only farmer’s land right is not damaged, but there is appreciation of land value. With stable employment of the farmer and government urban construction, the goal of human urbanization has been achieved effectively, and additionally, urbanization development quality has been promoted.

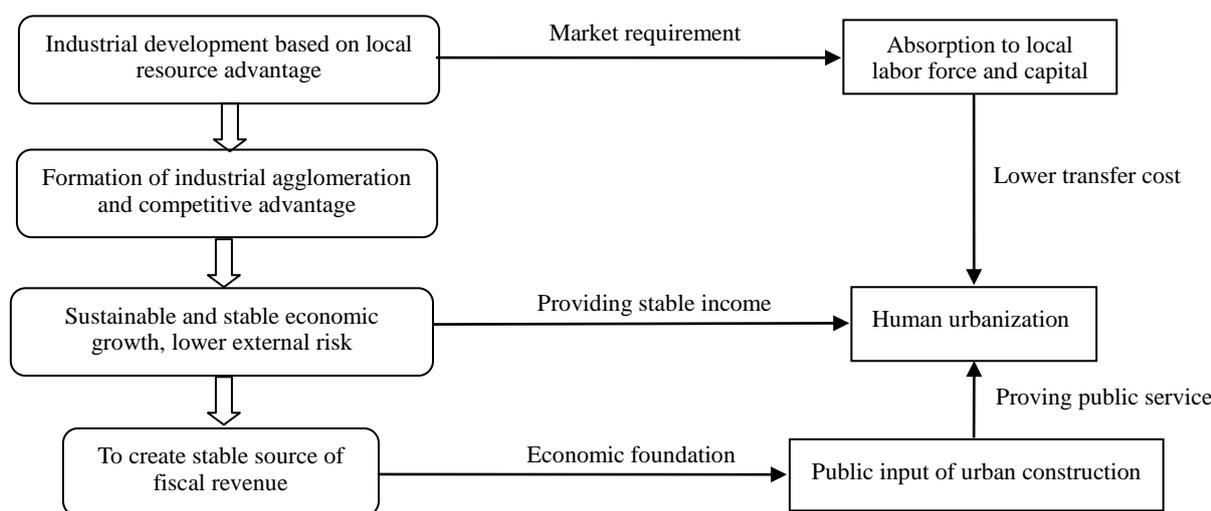


Figure 1 Urbanization development mode of Hougang

4.3 Contrastive analysis of endogenous urbanization and exogenous urbanization

It is explicit in Hougang urbanization process that there are some critical differences between endogenous urbanization and exogenous urbanization, such as driving force mechanism, structural feature and final result of development (see table 7).

Table 7 Contrast between endogenous urbanization and exogenous urbanization

	endogenous urbanization	exogenous urbanization
Major driving force ¹	Market drive as primary	Government drive as primary
Industrial structure	Taking distinctive “little industry” as primary based on advantages of natural resource, human capital, technology, etc.	Taking “big industry” as primary; its demand scale is large but product is similar, which is based on low labor cost and land cost.

¹Note1: Driving force mode focuses on the major driving force, but it is not that there are only these two modes. Actually, there is a “compound mode” stressing on both market driving force and government driving force. It is here for differentiating driving force source of endogenous urbanization and exogenous urbanization.

Continued 7

	endogenous urbanization	exogenous urbanization
Financial burden	There is no special subsidy policy, and financial burden is light.	There are Various policies of duty free and subsidy, and financial burden is heavy.
Degree of urban-rural integration	Industry drives agriculture; farmer could share urbanization benefit; degree of urban-rural integration is high.	Land concentrates in a large scale, which results in conflict of land acquisition; industrial development does not follow the local resource advantage; industry expands excessively; large gap between urban and rural area.
Economic stability	It is mainly influenced by domestic macro policy; local resource is irreplaceable, so that little impact will be exerted by external shock.	It is influenced by international and domestic macro environment, which will lead to large scale capital flow and be harmful to stable economic growth.
Degree of human urbanization	Local resident “Leaving land but not the countryside”; lives urbanization could be achieved with low cost.	A lot migrant workers can not achieve “identity urbanization”; capital flow leads to unstable foundation of urbanization development; human mobility is great.

Contrasting the two modes of China's urbanization, it is explicit that in the aspect of achieving human urbanization, endogenous urbanization holds advantage over exogenous urbanization. However, endogenous urbanization does not hold the advantage naturally, and it is the main reason why many areas follow the mode of exogenous urbanization relying on massive external input but not the endogenous urbanization mode, which relates to institutional environment of progressive market reform development. In the early phase of economic transition, government plays a dominant role in the process of economic development to some extent (top-down urbanization mode). Urbanization rate, as a visible assessment index, impels various preferential policy to attract large external capital input and to promote urbanization rate so that there lacks system environment for endogenous development. Industrial agglomeration depending on demographic dividend and preferential policy of land, tax, etc. could achieve large scale capital accumulation and urbanization prosperity in a short time, while urbanization quality achieved with exogenous force is not high. On one hand, the quality of human urbanization is low. Urbanization development depending on big industry mainly absorbs floating population across regions, which means service of housing, education, health care, social security, etc. could not be shared in the location. Although these people belongs to resident population, they could not be involved in the urban population. According to statistics, the gap between resident population in urban area and registered population has reached about 12 percentage points. About 159 million people live in the city without the city life style (Chinese Academy of Social Sciences, 2013). At the same time, in some regions massive land acquisition for industry results in lots of land-losing farmers, additionally, exogenous industrial capital and market are outside the town so that local cheap labor force is depended on, and then stable employment for local farmer could not be provided. When demographic dividend is ineffective; land supply is in strain; and all the conditions attracting capital investment disappear, the foundation of urbanization development will fade away, so quality of such exogenous urbanization mode is low. On the other hand, government public input is unsustainable. Early urbanization requires massive government input. When industrial development is weak it mainly depends on land and resource overexploitation to collect capital. Enterprise counting on attracting investment could not brings stable revenue for local government, so public input of urbanization is difficult to sustain.

Towns in China's mainland whose geographical condition and preferential policy are less favorable than that of coastal towns, has developed some specialty industries relying on their comparative advantage. In addition, capital accumulation brought by eastern industrial transfer provides external finance supply and gives rise to endogenous urbanization mode. There is no massive government input of “constructing the city” in this mode (taking Hougang town as the typical case), or policy of broaden-based tax relief & land at low price. Instead, local enterprise is the major force. It might develop slowly in early or government public capital is insufficient, but there will be rapid development if external condition is favorable, such as good backflow of capital, labor force, etc. Economic development in Hougang is a real case for the rule. Before 2008 GDP growth rate in Hougang is less than 10%, while during the five years since 2008 there is a trend of rapid growth with average annual growth rate more than 50%. However, in this period labor cost is rising and capital outflows in the eastern region, combined with existing local industrial foundation, which is a good external opportunity for Hougang and accelerates its development.

With the above contrasting, it is found that endogenous urbanization is a realistic path for improving urbanization quality, which coordinates agricultural development with industrial development, improvement of farmer's living standard with improvement of urban resident's living standard. With decreased edge effect of exogenous urbanization and exposure of various problem, the advantage of following endogenous

development stands out. Therefore, due to practical background of economic transition in China, if economic sustainability depends on expanding domestic demand it is required to transform the traditional exogenous way to the endogenous way.

V Conclusion and Suggestion

5.1 Major conclusion

With comparing different modes of urbanization development in China and defining urbanization quality, this study presents that the key to urbanization quality is human urbanization, and it requires stable foundation of economic development. Two modes are put forward from the point of driving force mechanism: endogenous urbanization and exogenous urbanization. Based on the case in Hougang, advantages of endogenous urbanization are manifested as follows: industrial development relies on local resource advantage, which holds internal stability; flow of local capital supply is low; stable industrial development ensures sustainability of public input; urban and rural integration develops coordinately; capacity resisting periodic economic fluctuation is excellent. Therefore, endogenous urbanization is more conducive to promote urbanization quality, and to achieve the goal of human urbanization.

5.2 Policy suggestion

Transformation from exogenous urbanization to endogenous urbanization is a process of induced change in system. To achieve urbanization and promote its quality, government effort in imposed change is required to promote the transformation. Moreover, taking China's current situation into consideration, which involves economy is still in transition; government plays a dominant role in economic development and endogenous urbanization mode is not always successful, so that policy reform is necessary as the following aspects

5.2.1 Market mechanism exerts a decisive effect on promoting endogenous urbanization

The premise of endogenous development is that market should play a decisive role in promoting urbanization. In this process, government responsibility is public service, such as infrastructure construction, management of public utility, etc. Endogenous urbanization development depends on local resource advantage, so "little industry" could be developed based on local feature for each town. Promoting product quality should be regarded as the core competitiveness to form stable and rigid demand in market but not blindly undertake the industry relying on low labor force cost. Especially, traditional specialty industry should be emphasized. With development and agglomeration of local specialty industry, it is beneficial for attracting local farmer employment constantly and accelerating urban construction while expanding the market. Then living service facility for land-losing farmer will be provided; employment opportunity and various urban living security will be offered for "amphibious resident" who lives in both urban and rural area

5.2.2 Policy environment of improving endogenous development in central town

Currently, there is policy restraint for endogenous urbanization development. Preferential policy for coastal area could not be enjoyed by central town, and especially there is a lot restraint in finance. Endogenous town represented typically by Hougang, power of finance and authority is severely unmatched. Proportion of paid local tax is high and there is unfair policy competition with Chengguan town. whether in land, finance or revenue, it is restrained by county-level administration. The relationship should be rationalized in system by central authority or provincial government; furthermore, endogenous urbanization development should be stressed and offered more financial power. Urbanization policy in decision of the Third Plenary Session of 18th CPC should be implemented feasibly. "The town with attracting large population and powerful economic capacity could be offered administration authority that is accordant with population and economy scale. Successful experience of provincial direct management in Shunde, Guangdong province, can be referenced. For enhancing financial independence in some developed towns, elevating administration authority of town-level city and reducing dependence on county-level government administration, the mode of keeping town under the direct management of city could be put into trail.

5.2.3 Creating financing environment in favor of endogenous urbanization development

Endogenous urbanization is mainly driven by market force, so the majority is small and medium-sized private enterprise. However, in current financial system, private enterprise will be discriminated by formal financial department. It is difficult to acquire the fair opportunity in loan, which restricts its development. In order to solve the problem, some measures should be taken; for example, social capital should be introduced into financial field; "Caogen finance" base on petty loan company and rural bank should be encouraged; implementing loose policy in interest rate policy, terms of credit, etc. to meet financing demand of small and medium-sized private enterprise. In public financing, corresponding spending source could be provided by economic development of the town itself, but government monotonous investment is difficult to meet the requirement of economic development in general. For the town with favorable development foundation, it is allowed to acquire financing for public input through financing platform company. More social capital requires to be involved in urban construction; public investment drives private investment, and then

positive development mechanism will be evolved.

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Research on the Development Mode of Promoting China's Urbanization Quality: A Case Study Based on Hougang Town

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Abstract: The main task of China's urbanization is to continuously improve the quality of urbanization, and the urbanization quality lies in promoting the people's urbanization, which needs the endogenous sustainable industrial development foundation. When many towns are facing development crisis caused by internal and external shocks, Hougang's economic development is still strong. This paper, based on a case study, concludes that the endogenous urbanization mode roots in market power and establishes the industries based on local comparative advantages, has inherent advantages of improving urbanization. The Hougang urbanization mode is different from the traditional mode, and can be an important mode of China's urbanization quality improvement.

Key Words: Urbanization Quality; Hougang Town; Case Study

■ Editor Wang Xiaoqing

An Empirical Study Early-warning for Network Quality Safety of Consumer Based on BP Neural Network Information

Yu Fan, Yu Hongwei, Xu Wei

Abstract: To cope with frequently occurred issues of network quality safety, this paper aims to study information early warning for network quality safety by using BP neural network. Data source is all posts about Shengyuan milk powder downloaded from Tianya forum. BP neural network includes three layers: input layer, hidden layer, and output layer. Eight indicators include posts per unit, cumulative posts, posting frequency per unit, cumulative posting frequency, reply per unit, cumulative reply, reply frequency per unit, cumulative reply frequency are constructed, so as to five early warning levels including safety and mild warning, middle warning, serious warning, very serious warning. The empirical study finds out that taking advantage of BP neural network has an efficient impact on early warning. However, the early warning results are lower than expected. And the early warning sensitivity is to be strengthened.

Key Words: BP Neural Network; Network Quality Safety; Information Early warning

I Background

Quality safety information will lead to negative result. Causality behind the incidents could be extracted and applied in current quality safety information, which predicts possible result. Early-warning for quality safety information is an important way for government to predict quality safety incident effectively and to prevent its outbreak (Cheng Hong, 2013). Objective, prompt and comprehensive source of quality information is required for accurate, scientific early-warning result. Facing the status of frequent quality safety incidents, government has taken some measures like more strict standard setting, more severe punishment on quality violation, closer supervision on the whole process including producing, circulation and transaction (Li Han, 2013). However, information asymmetry causes the conflict between limited personnel of government regulator and infinite categories of supervised product, backward technology of government supervision and advanced development of production technology. It is proved that information source acquired by supervision is difficult for effective early-warning whether in objectivity, promptness or comprehensiveness. Dawn of big data time brings moment for government effective early-warning.

Convenience and universality of network enable it to be data platform of quality early-warning. As a major platform for information spread in the age of big data, network has entered people's daily life. The 32nd *China Internet Development Statistical Report* issued in July 2013 shows by the end of June 2013 the amount of China netizen has reached 591 million that is 26.56 million more than that at the end of 2012. Internet penetration is 44.1%, which has increased 2% more than that at the end of 2012 (data source: China Internet Network Information Center, 2013 *The 32nd China Internet Development Statistical Report*). On average one person could surf the Internet in less than three people. In addition, mobile phone and other mobile devices have connected to the Internet, thus we are living in a world covered by network. With close connection with the Internet, people are more inclined to communicate on the Internet. *The white paper on Progress in China's Human Rights* in 2013 points out that by the end of 2012 the amount of China microblog user is 309 million. According to statistics from the 10 most influential websites, the amount of BBS post and news comment is more than 100 million pieces; moreover, information released and forward by microblog is more than 200 million pieces (data source: National People's Congress, 2013: *2012 The white paper on Progress in China's Human Rights*). Frequent exchange of information makes people develop a habit of posting information online. When people are accustomed to posting daily experience on microblog and BBS, quality

safety information will necessarily become one of the focuses in discussion. After people have used the product with quality problem, the experience might appear on Internet as quality safety information. The information not only reflects various quality problems, but could be released on Internet for prime time, which is incomparable for any other platforms. Information of network quality safety is valuable data for product quality early-warning.

Network is virtual and completely free, which makes consumer suspect authenticity of network quality information. There are even some companies that work on Internet rumor and spread false information. However, every time when consumer shops online, information of others' evaluation will be the important criterion for measuring product quality. Evaluation information varies in different ways, so a few different opinions will be covered by big data when there is a high sale for a product. Mainstream evaluation, like the direct impetus, will have an impact on consumer's purchase motive. By analyzing posts with high click rate and response rate, it is found that there is a common character: a lot material that proves the authenticity is provided, such as photo, news link, video, etc. Taking the post of Mengniu Dairy as an example, the view is released online that "The export product quality is better than that in mainland". Because of news screenshot from the thread starter, it attracts 250000 hits and 3000 responses. If the hit only explains that consumers pay close attention to the event, then the amount of responses shows consumers resonate with each other. However, many posts with no click rate and response rate are unable to provide proof for authenticity, which means there might be some problems for the authenticity. Consumer has not paid attention to it, which declares the posts is not important. It is illustrated by the two examples that consumer places full reliance on quality evaluation information online, and meanwhile reference authentic materials will be offered to support the information when they post comments online and expect attention. Character of big data is conducive to filter information that is not in mainstreamed or beneath notice. It could be deduced with three factors that consumer freely release and select network quality information, then big data of network quality is formed. Authentic and noteworthy information will be offered to consumer by big data, while information that is false and not worthy of attention will be weeded out.

Network information spreads rapidly and boundlessly, so the negative effect is as serious as the consequence caused by quality incident itself or even more serious. There are plenty virtual communities, such as Sina microblog and Tianya BBS. The same user could register in different virtual communities, and then there will be different network relation in different communities. Complicated relations encounter in network. The more network relation the user holds, the sooner the quality information will be spread by reprinting or following and then it will lead to network quality incident. Since the melamine incident was reported on September 16th, 2008, posts and responses Synutra in Tianya BBS have increased from 3 and 16 on the previous day to 12 and 306. It shows the speed of network quality information spread is beyond imagination. Quality information asymmetry is minimized by network, which means the more information the consumer holds, the greater risk the enterprise will be at (Research group of China quality observation, 2013). Therefore, rapid spread of network quality information will lead to devastating consequences for enterprise. With network platform, consumers have learned from melamine incident that there is a serious problem in domestic milk powder. Young mothers across the country exchange experience about milk powder through network and share various problems in using milk powder. Finally they choose foreign milk powder firmly. After several years of quality construction, there is not much improvement in domestic milk powder marker.

To sum up, quality of different products could be reflected comprehensively, truthfully, and promptly by information on Internet that is released by consumer. Then network quality information could be applied in early-warning. Additionally, the great negative effect caused by network communication also requires early-warning. Therefore, it is urgent and necessary to keep monitoring closely when consumer releases quality information on the Internet. Tendency of information spreading and development will be controlled to complete early-warning in advance and to avoid great loss. However, spread development rule of quality information and critical node of early-warning are difficult to be discovered for some reasons, for example, network information is complicated; platform and language are different; it spreads rapidly. This is also the reason why early-warning research based on consumer network quality information is insufficient. Consumer network quality information is taken as the research data in this study. By constructing early-warning index, BP neural network information is applied in early-warning model to warn network quality information in advance and to reduce its negative effect.

II Literature Review

Based on different platforms of early-warning, it could be divided as online and offline early-warning. Appearance, development and application of offline early-warning are all earlier than online early-warning, which involves in fields with higher requirement for security. Specifically, early-warning mainly includes the following aspects: financial risk early-warning, environmental early-warning, dangerous workplace early-warning, disease early-warning and food safety early-warning. Different mathematical models are applied in predicting financial risk. Fitzpatrick (1932) performs single variable predictive analysis with financial index. Multivariate analysis model is applied by Altman (1968) to

predict financial crisis. Based on rough set theory, Huang Fuyuan puts forward a fuzzy neural network model for financial risk early-warning. As for environmental early-warning, research emphasizes early-warning on degradation and pollution of land and water. Herrick (2002) conducts monitoring and early-warning on cultivated land. Katlan (1999) studies on early-warning of land desertification. With the method of ecology risk early-warning evaluation, Luo Yan (2013) assesses heavy metal content of agricultural land in southeastern Zunyi. On the basis of Weber-Fechner law, Zhang Lihui (2013) has established an evaluation model of water resource early-warning in reservoir. In the research of dangerous workplace early-warning, researchers conduct early-warning on places with major hidden danger. Lee (1992) predicts the use of equipment with neural network algorithm to prevent safety incident. With various ways of ground pressure monitoring, Ma Jian (2013) has established an early-warning system of integrated monitoring on fully mechanized caving face at a mine. Disease early-warning mainly stresses on high incidence and dangerous disease. Sheng Jingyu (2013) has explored application of deceleration capacity of rate, especially in evaluating autonomic nervous function of patient with hypertrophic cardiomyopathy; moreover, clinical value of early-warning on high risk patient has also been discussed. Early-warning in food safety covers each link from production to sale. Chen Lu (2013) proposes a three-stage network and early-warning information platform of food safety risk monitoring in Kunshan, Jiangsu province.

Rise of online early-warning is relatively late, which emphasizes controlling online public opinion. Ding Juling (2011) has evaluated and predicted the development tendency of online public opinion with BP neural network. Yao Fusheng (2013) insists that topic evolution is the important form of online public opinion evolution and the early-warning information work system of online public opinion topic evolution is constructed including module of information capture & extraction, module of analysis & evaluation, and conclusion report module. After analyzing influence factor and its own property of online public opinion, Wang Tietao (2012) has constructed a model for it based on fuzzy comprehensive evaluation method, and it is proved to be effective and accurate. Liu Yi (2012) has applied Delphi method and analytic hierarchy process to filter index of online public opinion again and to confirm its weight based on triangular fuzzy number. Then index system aiming at a specific public affair or hot topic is constructed. Ding Juling (2011) explores opinion polarity and posts intensity in BBS. Opinion tree based on result of three-granularity mining is constructed, and then early-warning architecture of online public opinion crisis is established. Finally, the feasibility is verified by experiment. Wang Qing (2011) collates and concludes existing index system of online public opinion monitoring. Attributive character of topic public opinion is analyzed by E-R model system, in which the early-warning system contains four dimensions: heat, intensity, inclination and growth rate. As for emergency of online public opinion, Zeng Runxi conducts a questionnaire survey and constructs early-warning index system on the basis of analytic hierarchy process. The early-warning system of online public opinion involves three factors and phenomena containing warning source, warning signal and warning condition.

Although the emphasis of early-warning online and offline is different, the steps are similar as constructing evaluation index, calculating evaluation result, classifying early-warning and judging early-warning result. Evaluation method is very mature so the key of early-warning is to construct scientific index. With contrasting literature of early-warning online and offline, it is found that fields distinguish with each other. For instance, common indexes of financial early-warning contain return on equity, main business profitability, asset-liability ratio, etc. Common indexes of environmental early-warning involve temperature, humidity, wind speed, illuminance, etc. Because of diverse data sources, index of early-warning offline could be constructed in different fields. Data of evaluation index could be collected actively with precision instrument, sampling, questionnaire, etc. Compared with early-warning offline, data source of early-warning online is simplified, and the Internet is the only way to acquire information.

In addition, concerns of early-warning online and offline are also different. There are many ways to collect information offline, and information of product safety index could be acquired precisely. Therefore, early-warning offline mainly stresses early-warning analysis on product safety. For instance, return on equity is a specific index for financial early-warning. When it reaches a certain point, financial situation of an enterprise could be reflected from a specific point. On the contrary, information on the Internet strongly correlates with information spread but not with product, which is because negative effect of information spread online is greater than the negative effect of information itself. Thus early-warning online mainly emphasizes on quality incident spread and information spread of the incident will be paid more attention. Index of early-warning also stresses information spread, such as the amount of hits for post, response, people involved in discussion, etc.

This study mainly focuses on consumer quality information online. According to the above analysis, early-warning index of consumer quality information online will be constructed based on the method of constructing early-warning index online.

III Early-warning index

Selection of early-warning index in this study follows principals of accessibility, objectivity and availability

Early-warning index online is set based on information online, while information provided by different network virtual community is different. Therefore, network virtual community that requires to be studied should be confirmed to check what information the community could provide, which is the basis for confirming early-warning index. Domestic famous BBS, Tianya, is selected as the experimental data source of early-warning. By analyzing related attribute of posts in Tianya BBS, there shows 10 post attributes including the amount of post, post title, nickname of thread starter, release time, the amount of hits, the amount of response, post content, respondent nickname, response time, response content.

In literature about early-warning online, except for the objective information provided online researcher will get some subjective information involved, such as post authenticity, sensibility, topic involvement. This kind of index is acquired by questionnaire and expert decision. There is another index data concerning topic and opinion, which will be obtained from post and response by matching emotional words. Index data obtained with questionnaire and expert decision might be influenced by respondent, expert personal experience and preference. As for the method of matching emotional words, consumers from different areas will discuss in local language. There are some characters in Chinese such as polysemy, different words with similar meaning, and one word with different parts of speech, which reduces matching precision and affects final result of early-warning. However, objective data from the BBS could reflect spread rule of quality information truthfully. In this study early-warning index will be selected from the 10 post attributes.

Because the amount of quality information spread in unit time will be observed in early-warning, some post attributes could not be applied containing post title, thread starter nickname, post content, respondent nickname, and response content. The amount of hits changes over time but it is not provided in BBS, so that four original indexes are selected: the amount of posts, release time, the amount of response and response time. With expanding the original index, 8 indexes are confirmed: post unit amount, post cumulant, post unit frequency, post cumulative frequency, response unit amount, response cumulant, response unit frequency, response cumulative frequency. In the midst of the 8 indexes, unit amount and cumulant respectively refer to amount of posts and responses with unit time and cumulative time; unit frequency and cumulative frequency respectively refer to amount change of posts and responses with unit time and cumulative time.

IV Early-warning of BP Neural Network and Result Analysis

The predecessor of BP (Back Propagation) neural network is error back propagation (EBP). The EBP is put forward by Bryson and applied by Werbos, Parker, and then it arouses wide concern and is introduced into artificial neural network gradually. BP neural network is provided with simple structure, strong enforceability, preferable self-learning, which could solve nonlinear problem effectively. Therefore, in numerous models of artificial neural network, papers taking BP neural network as the research method account for the greatest proportion.

4.1 Algorithm and Model of BP Neural Network

BP neural network contains input layer, hidden layer and output layer (Wang Yu, 2005). Input layer and output layer are responsible for receiving input value and producing output value. Hidden layer is in charge of output expected value and back propagation output value calculating from value of input layer. BP neural network algorithm is a cyclic learning process with error back propagation, whose basic idea is that input layer receives the input value to spread to the hidden layer; after the hidden layer has processed the value, the result will be propagated to output layer. The propagation process is forward propagating. If the error of output result and expected value is large it turns into back propagation. The stage of error back propagation back propagates output error to hidden layer. Each neuron in hidden layer will receive a part of output error, and then neuron adjusts weight according to output error. With continuous learning and adjustment, output value will incredibly close to expected value. Until the time of neural network learning has reached predetermined threshold, neural network will cease.

$$y_j = \frac{1}{1 + e^{-x_j}} \quad (1)$$

$$x_j = \sum_i y_i w_{ji} \quad (2)$$

Model of BP neural network is mainly constructed by formula 1, 2, 3 and 4 (Li Ping, 2008). Formula 1 is Sigmoid activation function of neural network. The activation function is applied in nonlinear mapping translation of input value and output value. Formula 2 is the output of neural network. Neuron in neural network receives the value y_j of activation function and activates formula 2. Then formula 2 is multiplied by weight to get the value x_j of neural network. Finally, the value x_j is substituted into activation function to activate next neuron, followed by recycling, until all the neuron is activated to form neural network.

$$\Delta W = -l \frac{\partial E}{\partial w} \quad (3)$$

$$\frac{\partial E_j}{\partial w_{ji}} = y_j(1 - y_j)(y_j - d_j)y_i \quad (4)$$

When the output value error is greater than expected error, neuron weight will be modified with feedback mechanism. The modified model of neuron weight is shown as formula 3. $\frac{\partial E}{\partial w}$ is the error amount of weight. Learning rate is defined as 1. Minus means weight is adjusted in negative direction. With formula operation, weight error amount could be explained as formula 4. Expected output value is d_j . Weight modification is an iterative process. When weight is less than the set threshold, modification will cease.

4.2 Early-warning structure based on BP neural network

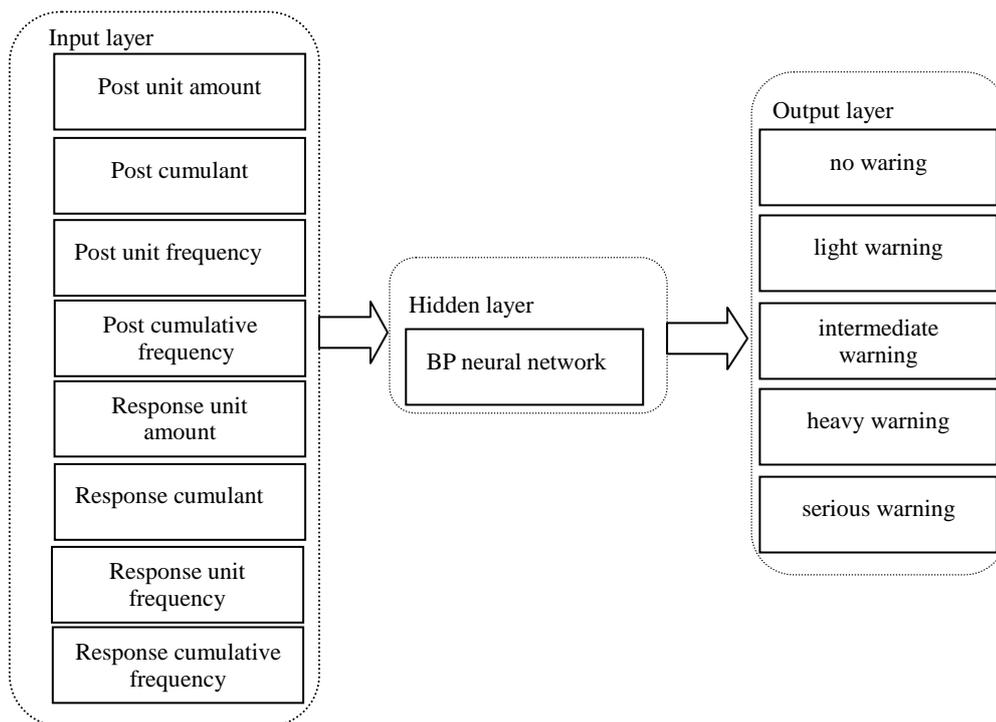


Figure 1 Early-warning structure based on BP neural network

With the above algorithm and model description, it is shown that this study focuses on early-warning of consumer network quality information on the basis of BP neural network. The above 8 indexes are regarded as input layer of neural network, and early-warning grade is output expectation. Value of input and output over a period of time is applied to train and construct BP neural network. Finally, BP neural network is applied in early-warning for consumer network quality information. Early-warning frame is shown in figure 1. Warning levels are divided into no waring, light warning, intermediate warning, heavy policy and serious warning.

4.3 Early-warning procedure

Matlab is applied in early-warning experiment. The procedure is divided into 10 steps, and result will be revealed in corresponding step.

4.3.1 Selecting data source

Posts in Tianya, the domestic famous BBS, are taken as data source, whose topic concerns Synutra milk powder quality. Selected data covers from November 29, 2004 to August 30, 2013.

4.3.2 Obtaining data of input index and grade of output early-warning

By pre-dealing with original posts, original data is concluded in 8 input indexes in the axel of time. Meanwhile, output early-warning level is set, whose five grades respectively correspond to 10000, 01000, 00100, 00010, 00001 from non-policy to serious policy, and the numbers are for convenient calculation.

4.3.3 Normalization of training sample input value

Data is divided into two parts: training sample and test sample. First, BP neural network is constructed with training sample, and then it is

checked by test sample for precision rate of neural network early-warning. For reducing error brought by input value and improving precision of neural network, normalization is required for input value. “premnmx” is applied in this study. Input value before and after normalization is shown in table 1 and table 2. Core function of BP neural network is shown in table 3.

Table 1 Part of input value of training sample

Time	x1	x2	x3	x4	x5	x6	x7	x8	Expected output
2008/9/13	29	2	56	2	334	9	493	3	10000
2008/9/14	31	2	56	0	349	15	499	6	01000
2008/9/15	34	3	57	1	365	16	500	1	01000
2008/9/16	46	12	66	9	671	306	790	290	00010
2008/9/17	77	31	85	19	1422	751	1235	445	00001
2008/9/18	95	18	98	13	2196	774	1258	23	00001
2008/9/19	121	26	106	8	3157	961	1445	187	00001
2008/9/20	137	16	116	10	3541	384	2022	577	00010
2008/9/21	149	12	120	4	3831	290	2116	94	00010
2008/9/22	158	9	123	3	4042	211	2195	79	00010
2008/9/23	166	8	124	1	4250	208	2198	3	00010
2008/9/24	173	7	125	1	4424	174	2232	34	00010
2008/9/25	176	3	129	4	4485	61	2345	113	00100
2008/9/26	176	0	132	3	4522	37	2369	24	01000
2008/9/27	179	3	135	3	4620	98	2430	61	00100
2008/9/28	179	0	138	3	4640	20	2508	78	01000
2008/9/29	179	0	138	0	4643	3	2525	17	10000

Table 2 Normalization value of training sample

Time	x1	x2	x3	x4	x5	x6	x7	x8	Expected output
2008/9/13	-0.8182	-0.8710	-0.6615	-0.7895	-0.8805	-0.9813	-0.7218	-0.9896	10000
2008/9/14	-0.8052	-0.8710	-0.6615	-1.0000	-0.8752	-0.9688	-0.7184	-0.9792	01000
2008/9/15	-0.7857	-0.8065	-0.6554	-0.8947	-0.8694	-0.9667	-0.7178	-0.9965	01000
2008/9/16	-0.7078	-0.2258	-0.6000	-0.0526	-0.7596	-0.3632	-0.5539	0.0052	00010
2008/9/17	-0.5065	1.0000	-0.4831	1.0000	-0.4902	0.5630	-0.3022	0.5425	00001
2008/9/18	-0.3896	0.1613	-0.4031	0.3684	-0.2126	0.6108	-0.2892	-0.9203	00001
2008/9/19	-0.2208	0.6774	-0.3538	-0.1579	0.1322	1.0000	-0.1835	-0.3518	00001
2008/9/20	-0.1169	0.0323	-0.2923	0.0526	0.2700	-0.2008	0.1428	1.0000	00010
2008/9/21	-0.0390	-0.2258	-0.2677	-0.5789	0.3740	-0.3965	0.1959	-0.6742	00010
2008/9/22	0.0195	-0.4194	-0.2492	-0.6842	0.4497	-0.5609	0.2406	-0.7262	00010
2008/9/23	0.0714	-0.4839	-0.2431	-0.8947	0.5243	-0.5671	0.2423	-0.9896	00010
2008/9/24	0.1169	-0.5484	-0.2369	-0.8947	0.5867	-0.6379	0.2615	-0.8821	00010
2008/9/25	0.1364	-0.8065	-0.2123	-0.5789	0.6086	-0.8730	0.3254	-0.6083	00100
2008/9/26	0.1364	-1.0000	-0.1938	-0.6842	0.6219	-0.9230	0.3390	-0.9168	01000
2008/9/27	0.1558	-0.8065	-0.1754	-0.6842	0.6570	-0.7960	0.3735	-0.7886	00100
2008/9/28	0.1558	-1.0000	-0.1569	-0.6842	0.6642	-0.9584	0.4176	-0.7296	01000

2008/9/29	0.1558	-1.0000	-0.1569	-1.0000	0.6653	-0.9938	0.4272	-0.9411	10000
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Table 3 Core function of BP neural network

Function name	Function significance
premnmx	Input value normalization
newff	Constructing BP neural network
postmnmx	Reversed normalization of output value
tansig	Tanh transfer function of hidden layer
purelin	Linear transfer function of output layer
traingdx	Network training function
train	Network training perform function
sim	Calculating similarity

As shown in table 1, the value of x5 and x7 is greater than others evidently. Constructing neural network with the original value will affect precision of neural network. All the value is between -1 and 1 after normalization, which is for convenient construction of neural network.

4.3.4 Constructing neural network

“newff” is applied in constructing neural network. Three-layer neural network is constructed in this study within only one hidden layer. The node number of hidden layer is confirmed by repeated tests in general. Then the node number of hidden layer is confirmed as 10. Tanh function “tansig” is selected as activation function of hidden layer. Linear function “purelin” is selected as activation function of output layer.

4.3.5 Setting network parameter

Common configuration parameter of BP neural network is presented in table 2. With repeated tests, displayed interval of training time is 100; network learning rate is 0.05; maximum time of network training is 10000; network allowing error is 0.05.

Table 4 Configuration parameter of BP neural network

Parameter name	Parameter value	Parameter significance
net.trainParam.show	100	displayed interval of training time
net.trainParam.lr	0.05	network learning rate
net.trainParam.epochs	10000	maximum time of network training
net.trainParam.goal	0.05	allowing error of network training target

4.3.6 Training neural network

“train” is applied in training neural network. Window of training monitoring will be popped up with Matlab, which feeds back error information in real time. When error is less than configuration value, training process is finished and neural network is formed.

Table 5 Neuron weight from input layer to hidden layer

x1	x2	x3	x4	x5	x6	x7	x8
0.2342	-1.1993	0.1986	-1.1135	0.7197	-1.7925	-0.3839	0.2719
0.4441	-0.0644	0.0274	-0.0887	0.4839	0.7663	0.8429	-1.2884
-0.3546	0.2618	-0.8304	0.1967	0.8551	-0.7056	-0.5017	-0.6756
0.6455	-0.9422	-1.2858	0.9243	-0.0477	2.5366	-1.6349	0.5499
0.3996	-0.1971	-0.2732	0.3588	-0.3375	0.4781	0.6965	0.7309
-1.4408	2.0666	-1.3870	-0.7014	-1.5409	-1.1248	-0.6796	-0.1017
-0.9464	-1.1321	-1.5559	0.0893	-0.0404	-0.7975	-0.3998	-0.4209
0.5027	-0.5426	-1.1498	0.0030	0.4882	-0.5123	-0.3895	-0.2911
0.1279	-0.4324	-0.8850	-0.3162	0.7717	-0.8348	-0.4627	0.5662

-0.3502	-0.5965	-0.0084	0.3613	0.6287	-2.2507	-0.2463	-1.0556
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Table 6 Neuron weight from hidden layer to output layer

x1	x2	x3	x4	x5	x6	x7	x8	x9	x10
-0.3129	-0.6333	0.6529	-2.5251	0.0065	1.9116	0.1015	0.1772	0.7752	2.8601
0.2443	-0.0128	-0.8141	1.9691	-0.7051	-1.6393	-0.4506	-1.4188	0.1485	-0.5338
0.2013	-0.7243	-0.6732	0.5182	-0.4999	-1.1333	-0.0759	-0.3086	-0.4428	-1.1044
1.0084	1.6910	-1.1758	0.1154	1.2104	1.0562	0.4838	-0.0303	0.1499	-1.1240
-1.1847	0.0828	-0.5633	0.0591	-0.1531	0.0006	-0.0064	0.4448	0.2342	-0.0084

Neuron weight after forming three-layer neural network is shown in table 5 and table 6. Table 5 is neuron weight from input layer to hidden layer. With 8 neurons in input layer and 10 neurons in hidden layer, weight matrix with 10 lines and 8 columns is acquired. Table 6 presents neuron weight from hidden layer to output layer. With 10 neurons in hidden layer and 5 neurons in output layer, there forms a weight matrix with 5 lines and 10 columns.

4.3.7 Normalization of test sample input value

Normalization is applied in test sample with “premmmx”.

4.3.8 Neural network simulation

Normalization value is input into neural network to check precision of neural network. Simulation function is “sim”.

4.3.9 Reversed normalization of simulation result

Simulation result is the value after normalization, which could not be compared with expected value. Thus “postmmmx” function is applied in reversed normalization.

4.3.10 Comparing result with expected value

Comparing reversed normalization result with expected value aims to check effect of neural network. The result is shown in table 7.

Table 7 Output value of test sample

time	Expected output	Actual output	Total output				
2010/8/6	01000	0.7947	0.0484	0.0797	0.0708	0.0008	10000
2010/8/7	00100	0.6749	0.0699	0.1241	0.1208	0.0008	10000
2010/8/8	00010	0.1232	0.1396	0.3117	0.3739	0.0168	00010
2010/8/9	00001	0.0194	0.1583	0.3434	0.4597	0.0009	00010
2010/8/10	00001	0.0213	0.1730	0.3421	0.3762	0.0509	00010
2010/8/11	00001	0.0531	0.1681	0.3350	0.4179	0.0021	00010
2010/8/12	00001	0.0200	0.1945	0.3369	0.3453	0.0641	00010
2010/8/13	00001	-0.0528	0.2680	0.3304	0.4280	0.0249	00010
2010/8/14	00001	-0.1224	0.1950	0.3194	0.5819	-0.0068	00010
2010/8/15	00001	-0.7889	0.9602	0.5196	-0.0202	0.9852	00001
2010/8/16	00001	-0.5340	0.5795	0.0112	0.8297	0.3570	00010
2010/8/17	00001	-2.0584	1.7758	1.1192	0.0451	-0.0328	-
2010/8/18	00001	-1.3194	1.2859	0.8965	0.0538	-0.0212	-
2010/8/19	00010	0.1324	0.2344	0.4172	0.1315	-0.0255	00100
2010/8/20	00010	-0.1814	0.7966	0.2473	0.1374	-0.0031	01000
2010/8/21	00010	0.4892	0.1908	0.1790	0.1372	0.0058	10000

2010/8/22	00100	0.6209	0.1294	0.1405	0.1080	0.0055	10000
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Continued 7

time	Expected output	Actual output	Total output				
2010/8/23	00100	0.6885	0.1047	0.1151	0.0896	0.0058	10000
2010/8/24	00100	0.7114	0.0969	0.1116	0.0752	0.0054	10000
2010/8/25	00100	0.7710	0.0958	0.0685	0.0696	0.0063	10000
2010/8/26	00100	0.6793	0.1584	0.1134	0.0326	0.0006	10000
2010/8/27	01000	0.8029	0.1352	0.0531	0.0135	0.0036	10000
2010/8/28	01000	0.9143	0.0781	0.0225	0.0020	0.0072	10000

The above result indicates that BP neural network is effective in early-warning and its level slightly lower than expectation. The early-warning result on August 8, 2010 and August 15, 2010 is quite the same with expected value. Early-warning result from August 9 to 14, 2010, keeps heavy warning and the expected value is serious warning, which is one grade lower than expected value. Early-warning result is one grade lower than expected value on August 6, 16, 19, 27 and 28. Other early-warning results are two grades lower than expected value. Generally, early-warning model based on BP neural network could predict the crisis when quality crisis occurs, which is lower than expected value. Early-warning sensitivity requires to be improved.

V Research Conclusion, Suggestion and Outlook

In the age of big data, product quality safety incident based on the Internet occurs frequently. Early-warning with product network quality safety information could effectively avoid quality safety incident to occur in large scale. Consumer and enterprise loss could be minimized. This study attempts BP neural network for early-warning on online consumer product quality information. By empirical test on early-warning of Synutra milk powder quality safety information, it is found that BP neural network is effective in early-warning, but the result is lower than expected value and early-warning sensitivity requires to be improved. In this study only one brand of milk powder is involved in BP neural network early-warning. Future study will focus on more products early-warning with BP neural network, and BP neural network will be applied in product quality big data.

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An Empirical Study Early warning for Network Quality Safety of Consumer Based on BP Neural Network Information

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Abstract: To cope with frequently occurred issues of network quality safety, this paper aims to study information early warning for network quality safety by using BP neural network. Data source is all posts about Shengyuan milk powder downloaded from Tianya forum. BP neural network includes three layers: input layer, hidden layer, and output layer. Eight indicators include posts per unit, cumulative posts, posting frequency per unit, cumulative posting frequency, reply per unit, cumulative reply, reply frequency per unit, cumulative reply frequency are constructed, so as to five early warning levels including safety and mild warning, middle warning, serious warning, very serious warning. The empirical study finds out that taking advantage of BP neural network has an efficient impact on early warning. However, the early warning results are lower than expected. And the early warning sensitivity is to be strengthened.

Key Words: BP Neural Network; Network Quality Safety; Information Early warning

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