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# An Overview of "Optimal Input-Output Planning Model and Cross-Boundary Economic Management Information System"

## —Organic Combinations and Connections between the Optimal Input-Output Planning Model and Big Data, New Cloud Computing Technology, Internet of Things or New Internet Industry

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## Abstract

Cross-boundary, which is the key word of IT industry in 2010, swept down from upstream industries to downstream terminals, PC, software, internet… no exception in all areas. With the combination of mobile and internet, a revolutionary change has been brought about. However, the power of traditional fields can never remain mighty in new areas. By using mathematical tools form the thinking mode of discrete mathematics and continuous mathematics, the second cross-boundary is a theoretical basis of cross-boundary economic management information system as well as a scientific method for realizing the integration between the optimal input-output planning model and Big data, new technologies of Cloud Computing and Internet of Things or new internet industry. With the second cross-boundary, area, scale, strength and efficiency of its application will be beyond our imagination. Based on modernisation of enterprise management, the cross-boundary economic management information system can be used to promote not only management of enterprises, but comprehensively enhance modern management quality and governance capacity. It is not only a scientific basis for establishing "One World", justice, mutual benefit and equal competition, it is also a method to completely eradicate the breeding ground of waste and corruption. In this paper, a brief description will be given based on real-time analysis of the optimal input-output planning model and timely analysis of input-output statistical model.

## Keywords

Optimal Input-Output Planning Model, Big Data, Cloud Computing, Internet of Things, Internet, Cross-Boundary

## 1. Real-Time Input-Output Tabulation

The scientific thought, theory and method of the real-time input-output tabulation are from the practice which is down to earth. By combining the micro input-output model with engineering design, manufacturing and management, a scientific basis can be built for realizing real-time analysis of planning model and timely analysis of statistical model. The real-time input-output tabulation can realise not only real-time analysis of the optimal micro input-output planning model and the optimal macro input-output planning model, but timely analysis of the micro input-output statistical model and the macro input-output statistical model. Thereinto, the part of the micro model sorts out the basic data according to a closely linked relationship between input and output during the process of production and operation activities. By using computer technology and based on certain orders, steps and programmed calculation procedure can complete tabulation. For the part of the macro model, the tabulation is completed based on combinations and connections between the optimal micro input-output planning model and the optimal macro input-output planning model. It must be pointed out that the basic data required for economic management information system which is based on modern enterprise management so that related to the "Nine-Must" linear model (Production Pioneer) **[*]** as well, can be precisely (variety and quantity of products) and accurately (the volume of variety and quantity of products) calculated in advance, and obtained immediately without collecting, processing and putting in order afterwards [1]. The relevant cases will be briefly described as following.

### 1.1. Scientific Thought, Theory and Method

How many substances are there in the world? What is the amount of each substance? It is difficult to answer the question. However, substances in the world consisted of 110 basic elements which have been known. Once variety and quantity of elements become certain, according to the two basic objective Laws-Information Conservation and Energy Conservation, the answer of what substance is required and the amount of each substance is easy to give. Taking variety and quantity of substances as input, the requirement of the substances and the amount of these substances as output, then the production process of intermediate products is a production process which is operated based on these two objective laws. It is not difficult to imagine, for every enterprise, according to product structure (component) or bill of materials (food, medicine and chemical industry which are referred as BOM) and based on the two basic objective Laws, once the variety and quantity of finished products and the corresponding volume are identified, during the progress of each intermediate product from raw materials to finished products, the variety and quantity of input and output of those intermediate products can be accurately calculated; so be the corresponding volume. These scientific thought, theory and method are the initial stage of the original concept of the real-time input-output tabulation. It must be pointed out that in a whole process from initial input to final output, if the

basic data of various input-output of the manufacturing and processing of each product can be tracked, monitored and analyzed based on "Information Conservation and Energy Conservation", not only will the waste of resources allocation as well as dishonesty and cheats be avoided, but a thorough control of minimum cost of production will be conducted. And as basic functions of management, supervising work and conducting work, they will be accordingly realized. Based on this understanding, it is clear with the reason for me to dedicate to the research of realizing combinations and connections between these different fields: input-output model and engineering design, manufacturing and operating management, input-output model and information technology management such as MRP (material requirement planning), closed loop MRP, MRP II (manufacturing resource planning), ERP (enterprise resource planning), input-output model and management of finance and supply-demand chain, input-output model and TFP (total factor productivity) theory along with target management.

### 1.2. Periodic Achievements

In 1974, I realised that the input-output model was a main tool to promote harmonious development between departments (products) and a necessary condition to optimize economic performance. It was not only an important tool for macro-control, but also a scientific method for overall governance, and because of my personal experience and work experience, I became very excited about the research. After nearly 10 years, the original ideas of "real-time input-output tabulation" were finally built up.

In 1990, I succeeded in a trial run with colleagues in cotton textile factory of Guiyang, social and economic benefits were obvious. After several years of data validation, it was proved excellent and technical and economic indicators met the requirements of provisions. The evaluation made by Enterprise Management Association of Guizhou was that the design was creative and worth promoting. And one of my research papers—"Realisation of Real-Time Analysis of Enterprise Input-Output Table" was affirmed and supported by Chinese authorities. Professor Ge Zhen, the former head of the expert group of Guizhou University of Industry and Input-Output Association of Guizhou, the chairman of Project Appraisal Committee, he pointed out in a summary according to the experts' reviews: "This is a meaningful attempt with an orientation. Hopefully a continuous study can be carried out in order to build the methods representing Chinese input-output industry".

In June 2011, the 19$^{th}$ International Input-Output Conference was held in the United States, and submission deadline was on December 31, 2010. In May 2011, my research paper and its presentation that I wrote later were approved by the Vice President of the Regional Council of Science of the United States, Professor Klaus and his expert group of University of Maryland. The conclusion was: "The outcome of my research is very novel with a great contribution." And they recommended it to the chairman of the conference. After examination and approval, my research paper was exceptionally accepted and at the same time, was fully

released on official website of International Input-Output Association.

In June 2012, the 20th International Input-Output Conference held in capital of Republic of Slovakia one year early provided me an excellent opportunity to bring forth my research outcome to the professions of the world. I submitted two papers and the presentations, examples and reference introduction as well as identified materials of the trial run in {cotton textile factory of Guiyang} and copies of relevant data. {With Professor Klaus's support, Professor Kuishuang Feng of University of Maryland was entrusted by International Input-Output Association to examine all the material.} After more than 7 hours of questioning and communicating vis-à-vis, {my research outcome was finally received unanimous approval from chairman of the academic committee, experts and delegates.} I had two special reports and two presentations at the meeting, and I gave one of each as the chairman. Personally, this was not about a big honour of mine but an affirmation of my achievements as well. It must be pointed out that through the whole communicating session of the both conferences, {Professor Kuishuang Feng was invited by International Input-Output Association to help me with the translation.} Herein, I would like to extend my grateful thanks to International Input-Output Association, the chairman of the academic committee, the reviewers and the delegates of the conferences. {And I would like to specially thank Professor Kuishuang Feng and all those who gave me helps.} In addition, during the meeting, the representatives of the United States, Britain, France, Japan and some other countries paid special attention to my work, and had comprehensive and in-depth exchanges with me.

In May 2013, according to the comments made by the officials of Guizhou, my series of research papers exchanged in the conferences, speeches, examples and introduction of references, as well as identified materials of the trial run in the cotton mill of Guiyang and relevant copies of relevant data were verified by the experts of "Guizhou Bureau of Statistics" after reporting to the party secretary and the governor of Guizhou. In particular, the identified materials of the trial run in Guiyang cotton mill were once again examined. During the examination, they visited the pilot in Guiyang cotton mill and the application software system of the first stage which was developed for the enterprise was shown to them as well. In order to understand the implementation process, they also witnessed the logical model of computer management information system that I completed later which was on basis of the content of "Nine-Must" linear model involved in modern enterprise management as a reference. At the end of examination, as they asked about my expectations and requirements, I immediately said: "Chinese is called the factory of the world, while India is named the office of the world. In India, software service outsourcing has been growing so fast to make its service industry take more than the half of GDP. If I could have an opportunity, by gathering the relevant talents from all over the world, and integrating some parts of 'the real-time input-output tabulation' and 'the application of cost based price model for enterprise management' into a 'commercial application software', then who knows how much foreign currency would be brought every

year to our country!" After the verification, the experts of "Guizhou Bureau of Statistics" made a decision, "In case of failing to further carry out the research, please ask provincial economic and trade department to contact Mr. Kang Ning and discuss the possible way to apply 'the real-time input-output tabulation' in enterprises." And "Please ask the relevant individuals of universities in Guizhou to discuss the 'the real-time input-output tabulation' with Mr. Kang Ning and further carry out the relevant research."They did not only introduce the outcome of my research to "China Input-Output Association" for expanding its influence and putting the outcome in application, but also publish my paper in "Statistics of Guizhou" which is sponsored by "Guizhou Bureau of Statistics", "The Input-Output Real-Time Tabulation and the Origin and Development of Scientific Theory of Modern Enterprise Management—'Input-output planning table first and input-output statistic table after' is the only way to solve the problem of 'being outdated' and 'being presumed' while analysing input-output". The publication of this paper indicated that again: the scientific thought, theory and method of "the input-output real-time tabulation" are not only approved in the two conferences, by the chairman of the academic committee, the reviewers and the delegates, but also once again affirmed by Chinese experts.

In July 2016, I was in Korea at the 24th International Input-Output Conference. After discussion, some contents of my papers such as "Input-Output Real-Time Tabulation and Origin and Development of Scientific Theory of Enterprise Modern Management—Input-output planning model first, input-output statistic model after—the only way to solve the problem of 'being outdated' and 'being presumed' in input-output analysis" were firstly affirmed and supported by Professor Satoshi Inomat—chairman of the academic committee of the conference. With his introduction, my paper was registered and fully published on official website of International Input-Output Association and was able to be discussed.

### 1.3. Research Papers

We believe that the problem of being "outdated" and "presumed" in input-output analysis is not because of its inherent defect but Leontief's own tabulating order and method. About how to solve this problem along with issues of a series of effects or changes after realizing the real-time analysis of the optimal input-output planning model and the timely analysis of input-output statistics model, they have been thoroughly discussed in the following papers: "Implementation of Enterprises' Input-Output Real-Time Analysis—Input-output real-time tabulation and design of MIS (management information system)" [2]; "Input-Output Real-Time Tabulation and Implementation of Maximum Profit and Minimum Cost—The data establishment of enterprises' internal operation-control mechanism and the basic methods of product cost budgeting and accounting" [3]; "Relationship Between Input-Output Real-Time Tabulation and Enterprise Modern Management—A suggestion for economic construction, reservation of resources, prevention of corruption and scientific and harmonious development of society, all matters that are of great concerns to the general public" [1];

"Input-Output Model and Realisation of Real-Time Analysis for Financial Management and Supply-Demand Chain Management—The basic connection between the enterprise's input-output model and the financial management along with the supply-demand chain management" [4]; "Input-Output Real-Time Tabulation and Scientific Basis for Enterprise Modern Management System—The realisation of the systems modelling for the financial management and the supply-demand chain management & the scientific methods to root out the causes of wastes and corruptions" [5]; "Origin, Development and Re-Development of Scientific Theory of Real-time Analysis of Enterprises' Input-Output Model—'Input-output planning model first, input-output statistic model after' is the only way to solve the problem of 'being outdated' and 'being presumed' in input-output analysis" [6]. All these six papers and three speeches are related to the papers that were thoroughly discussed in "Description of Examples and Reference" such as "Input-Output Real-Time Tabulation and Enterprise Modern Management—The input-output model and the realisation of the real-time analysis for the financial management and the supply-demand chain management & Design of CMIS (Computer Management Information System)". And it was submitted to the 20th International Input-Output Conference as well. The first two papers were affirmed by China Input-Output Association, experts of the academic committee—CMIS Expert Group of 863 Program of China, and published respectively in Journal of Guizhou University of Finance and Economics in 1955 and 1998. The rest of four papers were approved by chairmen of the academic committee, reviewers and delegates of the 19th, the 20th and the 24th International Input-Output Conference. All these four papers were approved again by experts of the publishing and editorial department of National Academy of Sciences and were fully published respectively in Journal of American Economics.

The content of input-output real-time tabulation indicates that it has been more than 80 years since the input-output analysis method was proposed in 1936 by Mr. Vasily Leontief—the Nobel prize winner, American economist and professor of Harvard University. For more than 80 years, the problem of "being outdated and presumed" was considered the inherent vice of the input-output analysis method that was actually a misunderstanding. The scientific thought, theory and method of the input-output real-time tabulation began with the original concept through a long period of time, the misunderstanding was finally cleared up. In addition, with the combination of automation and information and its development, calculus—as a representative of continuous mathematics during the industrial revolution, its mainstream status has been changed and the importance of discrete mathematics has been gradually recognised. Discrete mathematics is the theoretical foundation of computer science, and it has been widely applied in many fields of computer science and technology as well as some related professions. For example, from scientific computing to information processing, from computer science theory to computer application technology, from computer software to hardware, from human intelligence to cognitive system, everything is closely related to discrete mathematics. Similarly, the reason of the achievement of

real-time analysis of the optimal input-output planning model and timely analysis of input-output statistical model along with the establishment of cross-boundary economic management information system and its implementation method is based on the scientific thought, theory and method of the input-output real-time tabulation which is closely related to discrete mathematics as well.

## 2. Problems of Current Economic Management Information System

Problems of current economic management information system are mainly related to "isolated island" and "fault" as well as "being outdated and presumed". Without exception, these problems exist universally in both micro and macro-economy management information system or between these two systems. If these problems cannot be thoroughly solved, no matter for Industry 3.0 (automated production) or Industry 4.0 (customized production), the great harm and negative influence will be brought to construction and development of national economy and macro-control. In order to facilitate description and understanding, examples will be given in terms of the most typical and representative problems existing in current economic management information system and summarized as following.

### 2.1. The Problems of Micro-Economy

The problems of micro-economic are mainly about "isolated island". For example, management information technology began in 1960s, by marking the first time in the United States that computers were applied to inventory management, it has gone through four different phases: MRP, closed loop MRP, MRP II and ERP. None of them has a mathematical model. In terms of the important parts of EPR system, although MRP II takes the advantage of modern computers simulating the status quo of enterprises through timely process of mass amount of data during the whole process of production and operation, activities as engineering design, manufacturing and operating management have developed their own separate and computerized system, each system owns high automation of internal information and material processing. However, it acts exactly like an automatic "isolated island" [1]. The problem of connection and coordination still remains to be solved.

### 2.2. The Problems of Macro-Economy

The issues in macro field are mainly related to "being outdated and presumed". Leontief proposed his input-output analysis method in 1936. However, for example, due to long time of collecting, processing and reorganizing accurate and reliable statistical data for the calculation of input-output statistical models in terms of national economy, there is a great shortcoming of that the models are already "outdated" when they have been made. By using those models in the mathematical model $[X = (I - A)^{-1}Y]$ to compile the input-output planning models for national economic budgeting (planning), due to the "presumption",

the direct consumption coefficient A of the input-output statistical models remains same in the planning period, but this direct consumption coefficient A in the reporting period changes along with changes of objective factors such as variety and price of products, technological progress and management quality. Therefore, it is considerably difficult to reflect the actual situation of the process of social reproduction according to this input-output planning model. Despite the fact that the direct consumption coefficient A can be corrected by using the method of technical and economic analysis, Delphi, RAS and regression analysis and other scientific methods, but as all these methods themselves also have some limitations, it is still very difficult to solve the problem that after all the correction, the consistence between the "presumption" and the actual situation in the input-output planning model [1].

### 2.3. The Problems between Micro-Economy and Macro-Economy

The problems between micro-economic field and macro-economic field are mainly related to "fault". For example, the order and method of input-output tabulation put forward by Leontief which are not able to establish combinations and connections between micro and macro input-output model will become a primary cause of "fault" economic information and the separation between the two systems. The problem of the input-output analysis method being "outdated and presumed" is caused by Leontief's tabulation order and method as well.

According to Leontief: an input-output statistical model goes first, then an input-output planning model is made by using the mathematical formula [$X = (I - A)^{-1}Y$] of the statistical model. It is clear to see, if the order and method of input-output tabulation do not change, the problem of "being outdated and presumed" will not be solved while establishing micro input-output model or macro input-output model [6].

The problems of the current economic management information system indicates that no matter for micro or macro-economic information system management themselves or between these two systems, in terms of solving the problems of "isolated island" and "fault" as well as "being outdated and presumed", it is absolutely impossible by simply using the method of traditional continuous mathematics. In fact, the combination of micro input-output model and information management technology as well as some other methods become scientific methods to solve these problems. Firstly, the real-time analysis of micro input-output model needs to be realized; secondly, combinations and connections between macro and micro input-output model should be established based on the first step.

## 3. Optimal Input-Output Planning Model, New Technology and New Industry

After more than 80 year hard work, the scope of input-output model application, from macro to micro, from economic problems to gradually involving in other social fields, its wide-ranging impact has attracted worldwide attention. However, how to use the objective law of coordination between departments (products)

and allocated resources? It is clear that the result before and after the implementation of the real-time analysis of the optimal input-output planning model and the timely analysis of the input-output statistics model is completely different. Currently, Big data, Cloud Computing and Internet of Things or internet and such words attract a great attention, the main reason is to be based on internet, Big data represents informative layers of internet (a massive amount of data) which is the foundation of intelligence and consciousness of internet; Cloud Computing is a cluster of hardware layer core and software layer core of internet which is the basis of central nervous system budding in internet; Internet of Things is corresponding to sensory and motor of internet. Therefore, the relationship of Big Data, new Cloud Computing technologies and Internet of Things or new internet industry is like the relationship of body, soul and mind. Now, the basic knowledge is summarized as following.

### 3.1. The Optimal Input-Output Planning Model

The input-output model mainly solves the problem of coordinated development between departments (products) which is necessary for enterprises to obtain the best economic results. If it can be combined with linear programming method to establish the optimal input-output planning model, the maximum economic benefits can be obtained for enterprises with the minimum input. The input-output model is not only an important tool of macro-control, but the scientific method of comprehensive governance. An originality of the input-output model is: it can provide three different tools for national economy, namely accounting framework, method of policy analysis and budgeting (planning) [7]. It must be pointed out that the preparation of regional or national macro input-output model is to develop a reasonable economic policy, and the establishment of micro input-output model of enterprises is to strengthen internal management and improve economic efficiency.

### 3.2. Big Data and New Cloud Computing Technologies

Big data: Big data is the collection of huge data sets, these data sets are produced in a variety of analog or digital resources, Internet of Things, Internet of Humans(IoH), they are transferred with different speed, capacity and protocol. Usually, it is impossible to implement meaningful storage and processing of Big Data through traditional information technology and information architecture. Big data includes human data and equipment data. Human data is the machine data produced by shopping, browsing, downloading and watching videos on Internet of Things or internet; equipment data is the machine data generated through communication process by connecting one equipment to another. For example, according to the industries covered by the three major industries (agriculture, industry and services) and the objects to which they belong, on the basis of automation, information and intelligence, along with the application of Internet of Things or internet, all aspects of relevant machinery, equipment and other means of labor will generate the massive data, this huge amount of data is

the data source of Big data [8]. It must be pointed out that Big Data is completely different to physical infrastructure. Big data does not have any problem due to depreciation and devaluation. Therefore, Big Data will gradually become an important part of the infrastructure of modern society. In terms of Cloud Computing, its occurrence was not an accidence. In the 60s of the last century, it was put forward by McCarthy which was to provide computing as a utility like water and electricity. This concept became the origin of Cloud Computing. Cloud Computing came after personal computer revolution and internet revolution, it was considered as the third wave of IT which became an important part of strategic emerging industry of nations. By bringing fundamental changes to the mode of life, production and business, it has attracted the attention from the whole society. Between new Cloud Computing technologies and Big Data, like two sides of a coin, the relationship is interrelated and interactive. Big data cannot work without Cloud Computing while Cloud Computing provides relevant services respectively based on the classification of Big Data. For example: to provide IT services, internet services and storage services for enterprises or individuals.

### 3.3. Internet of Things and New Internet Industry

What is Internet of Things (IoT)? It is known as a sensor network, and it is another wave of information industry after computer, internet and mobile communication network. To take product electronic code researched by Auto-ID Center of Massachusetts Institute of Technology, with technologies such as sensor, radio frequency identification, wireless data communication and so on, Internet of Things becomes a kind of physical network based on computer internet. Basically, it is the inevitable outcome of social production development and intelligent development as well as the combination of modern information network technology and traditional commodity market. This kind of creation can greatly promote not only social productivity development, but also change people's lifestyles [9]. With sensors, radio frequency technology, global positioning system and other technologies, Internet of Things can be real-time collector for the information of interactive objects, and through any possible network to build the connection between different objects and well objects and services. Machine to machine (M2M) communication refers to the data exchange between terminal equipments. In future, a variety of products and services will become these kind of things and services—they actually are equipped with an IP address and connected with each other through the network protocol, and also connected with people. Internet of Things clearly describes the connection between physical objects, these objects contact with each other through this connection, thus obtain an extension and create additional value for customers. This interaction occurs between machine and machine, object and object. Generally speaking, everything of this world, from as small as a watch or a key to as big as a car or a building, by embedding a micro sensor chip, making those objects intelligent, they can automatically send out relevant information. With the help of wireless network technology, "dialogues" becomes possible between people and

objects so is the communication between objects. By firstly making objects intelligent through radio frequency identification technology, infrared sensor, GPS, laser scanner and various information sensing equipment, then connecting these objects on internet with agreements of information exchange and communication, objects recognizing, positioning, tracking, monitoring and managing can be realised. Obviously, smart objects are the basic part of Internet of Things which are generated from combined actions of mechanical, electronics and software. Internet of Things is an important part of a new generation of information technology. It is a huge network which is extended and expanded based on internet industry, and it is also an upgraded version of this industry. As an additional income, its formation has opened a new dimension of innovation, product features and process of value-added benefits. Through Internet of Things, the data can be collected from the bottom of devices for analyzing and processing. It provides people with the service which is faster and more convenient. For example, the most popular things nowadays, Industry 4.0, intelligent plant, smart city and intelligent traffic are all based on Internet of Things. It must be pointed out that between Internet of Things or new internet industry, apart from a closely linked relationship, by combining internet, market (demand), factory (capacity) and other factors, they generate a new production or new sales model. In addition, the nature of internet +is about connecting factors of production in order to improve production efficiency, sales efficiency, and thus output value. It can be seen that the relationship between them is that by comparing the future network to human brain, Internet of Things will be the sensory nerve while internet+ will be the motor nerve.

### 3.4. The Basic Relationship between Big Data, New Cloud Computing Technologies and Internet of Things or New Internet Industry

We know that Big Data is about how to solve the problem of massive data analysis while new Cloud Computing technologies solve actual operation problems based on Big Data. Internet of Things or new internet industry works on the integration of equipment and software. The Big data of Internet of Things or new internet industry is from equipment data. Collection, control and service of this huge amount of equipment data relies on new Cloud Computing technologies; the analysis of equipment data and product data relies on Big data; collection and analysis of Big data also rely on new Cloud Computing technologies, and in turn, Internet of Things or new internet industry provide equipment and product information services and so on for new Cloud Computing technologies; Big data analysis provides suggestions to analysis and definition of the operation data which is generated from new Cloud Computing technologies. Obviously, without Internet of Things or new internet industry bringing a huge amount of data, Big Data is no longer Big Data, without interconnection of networks, what is the use of new Cloud Computing technologies. Therefore, the relationship between Big Data, new Cloud Computing technologies and Internet of Things or new internet industry should be a relationship which is interrelated, interactive

and interdependent. These fields can be regarded as a whole and developed and promoted altogether.

### 3.5. Implementation Methods

The methods of realizing combinations between the optimal input-output planning model and new technology and new industry, please see to the reference [8]. It is described in that part of the content about how to realize combinations and connections between the optimal input-output planning model and Big Data, new Cloud Computing technologies through encoding method. However, Internet of Things or new internet industry are the main source of Big Data and new Cloud Computing technologies, by recognizing the data sources of Big data and new Cloud Computing technologies, it becomes easy to recognize combinations of the optimal input-output planning model and Internet of Things or new internet industry. For example, on the basis of realizing automation, information and intelligence, along with the application of Internet of Things or internet, means of labor of each link will produce a massive amount of data, this massive data is the source of Big data. Moreover, according to the classification and code of means of labor, not only the flow and transfer of products and corresponding logistics, information flow and capital flow can be accurately observed, the objects and industries to which they belong can be revealed as well and so is the massive amount of data. By using Big Data, new Cloud Computing technologies, the basic data will be easily gained. It shows that the data of Big Data and new Cloud Computing technologies which are related to the optimal input-output planning model are basically the equipment data generated from Internet of Things, or the machine data generated from communication process by connecting equipments together. Therefore, the method of realizing combinations between the optimal input-output planning model and new technology and new industry: either an encoding content can be added between Internet of Things or new internet industry and Big data along with new Cloud Computing technologies based on the relevant data sources of Big data and new Cloud Computing technologies; or to copy the relevant encoding method of realising combinations and connections between the optimal input-output planning model and Big data and new Cloud Computing technologies through re-encoding.

The combinations of the optimal input-output planning model and new technology as well as new industry indicate that by combining with Big Data, new Cloud Computing technologies along with Internet of Things or new internet industry, the model becomes an important way for better serving national economy. Its theoretical and practical significance is mainly about to strengthen management of national economy and improve economic benefits. Imagine, if effective combinations between the optimal input-output planning model and new technology and new industry cannot be achieved, and important functions of Big data, Cloud Computing and Internet of Things or internet [based on the objective law, to collect data in accordance with the coordinated development of departments (products)] cannot be used to guide the actual operation of national

economy, then the two basic functions of management (supervision and guidance) will not be realized at the same time! It may well be asked—What is exactly the purpose of developing Big data, Cloud Computing and Internet of Things? What is the meaning in there? It's worth rethinking!

## 4. The Second Cross-Boundary

The second cross-boundary is to combine the optimal input-output planning model with new technology and new industry and put comprehensive advantages and abilities to full play. Speaking of cross-boundary, since the input-output analysis method was proposed in 1936 by Leontief, it could provide not only a quantitative analysis to technical and economic association of the social reproduction process between various fields (production, distribution, exchange and consumption), departments of national economy, regions and nations, but also effectively integrate all kinds of system resources and personnel such as supply, production, sale and labor, finance and material, etc. It was not only a revolution in economics, it also illustrated that the cross-boundary in fact objectively exists. However, the significance of cross-boundary seems more prominent nowadays under the situation of globalized market competition.

### 4.1. The Second Cross-Boundary

The second cross-boundary is about implementing combinations and connections between the optimal planning model of micro input-output and the optimal planning model of macro input-output based on the realization of combining them with new technology and new industry respectively. It must be pointed out that from reality of the optimal planning model of macro input-output which is involved in each field and object of micro-economy, between each internal system of each field and object of micro-economy (such as engineering design, manufacturing, operation management and other systems), each external field and object of micro-economy and each internal system of each field of macro-economy, each internal system of each field of macro-economy as well as each external field of macro-economy and each external system of each field of macro-economy of other countries, the issues of "isolated island" and "fault" as well as "being outdated and presumed" are almost everywhere. After the second cross-boundary, the relationship between them should be interrelated, interconnected and interacted. Thus, according to the optimal planning model of macro input-output involved in each field and object of micro-economy, by following rules such as micro first and macro after, bottom-up and macro and micro combining, input-output planning table first and input-output statistics table after and with second cross-boundary, the realisation of the order and method of real-time analysis of the optimal input-output planning model and timely analysis of input-output statistics model can be achieved. It is not only a scientific method to solve the issues of "isolated island" and "fault" as well as "being outdated and presumed", it also will be, on a larger scale, bringing great influence and change to the current economic set-up, system, structure and management which are

related to economic operation mechanism.

### 4.2. Core Competitiveness

First of all, the core competitiveness changes with the progress of science and technology as well as social development. For example, manufacturing industry of Industry 3.0, the production method was emphasized on standardization, scale and low cost. However, in Industry 4.0, manufacturing industry will be individualized, customized, intelligent mode of production. Because of the different competition method, the core competitiveness of manufacturing industry for Industry 3.0 and Industry 4.0 is essentially different. Obviously, in Industry 4.0, AI (artificial intelligence) will be increasingly applied and by combining with comprehensive abilities of economic management information system of cross-boundary after the second cross-boundary, it will be the core competitiveness. This kind of core competitiveness will not be substituted in any other way. Once the real-time analysis of the optimal macro and micro input-output planning model and timely analysis of macro and micro input-output statistics model can be realized, because the combinations between micro-economy and production process as well as macro-economy and micro-economy, from macro-economy to micro-economy then to production process, the basic relationship of them is naturally combined and closely connected. It must be pointed out that the basic relationship of such which is closely linked from bottom to top, macro-economy to micro-economy or vice versa is the key technology to solve the problems of "isolated island" and "fault" and "being outdated and presumed" in the current economic management information system. Moreover, in the cross-boundary economic management information system, the economic information (such as logistics information, cash flow information, information flow information and other economic information) is fully guaranteed to be real-time and timely, accurate and precise [4]. Therefore, it is not only a scientific management method of Industry 3.0 for the time being, it is also an important management tool of Industry 4.0. It is not difficult to see that with the second cross-boundary, decisions of finance management which are made by senior managers or decision makers can be carried out to the end or completely implemented without any intermediate links and immediate effects can be received as well. On the contrary, without the second cross-boundary, not only the economic development of Industry 3.0, but the economic takeoff of Industry 4.0 will be affected as well.

The second cross-boundary indicates that it does not only mean survival, it also means starting from beginning. For example, the legend of Apple and Face book, the tycoons deeply appreciate rapid changes of industry, that is to say, the ability of integration must be developed and the overall coordination must be learned along with superior resources of cross-boundary, it is the path to success in the future or it will lead to a dead end. Certainly, in order to implement combinations of the optimal input-output planning model and new technology and new industry, past success must be dropped, new way of thinking must be taken from beginning, and enter to a new field of comprehensive perspective. This is

the true meaning of cross-boundary!

## 5. Cross-Boundary Economic Management Information System

In terms of the industries covered by the three major industries (agriculture, industry and services) and the objects to which they belong, the optimal micro input-output planning model can integrate each field and object of the relevant industries respectively into separate small systems; the optimal macro input-output planning model can combine not only those small systems into independent subsystems according to basic requirements of industry, but also combine these subsystems into an independent large-scale system. Through computer network (Internet of Things or internet), it is possible to combine small systems and subsystems into a unified, integrated economic management information system and that is the cross-boundary economic management information system. The core of the cross-boundary economic management information system is the implementation of combinations between the optimal input-output planning model and the new technology and new industry. As the scientific basis of the combinations, the real-time analysis of the optimal input-output model and the timely analysis of input-output statistical model must be realized. It must be pointed out that according to the optimal macro input-output planning model involved in each object and field of micro-economy, based on actual need, the cross-boundary economic management information system can be sorted into different levels or grades based on enterprises, regions and countries etc. through encoding method and realize the real-time analysis of the optimal input-output planning model and the timely analysis of input-output statistical model on different levels or different grades with consistency. In addition, regardless of Industry 3.0 or Industry 4.0, the core reform is about business restructuring and social changes as well as the redefinition of global retailsales method. They are closely related to the structure of the optimal input-output planning model and the basic data. Thus it can be seen that in order to meet expectation and requirement of combinations between the optimal input-output planning model and new technology and new industry, as the keys, lone-term planning, design and development, business restructuring and social changes of the cross-boundary economic management information system as well as the redefinition of global retailsales method have become particularly important. The relevant contents will be briefly described as following.

### 5.1. Long-Term Planning, Design and Development

Generally speaking, the implementation of long-term planning, design and development discussed here is the implementation of long-term planning, design and development in the cross-boundary economic management information system: firstly, the structure of macro input-output model needs to be determined; secondly, according to macro first and micro after, top-down principle and combinations of macro and micro, the development of cross-border eco-

nomic management information system can be carried out; thirdly, based on the structure of macro input-output model, according to micro first and macro after, bottom-up principle and combinations of macro and micro, the relevant tabulation can be accomplished. It must be pointed out that in order to implement long-term planning, design and development of the cross-boundary economic management information system, the optimal macro input-output planning model involved in each field and object of micro-economy must be taken as an inseparable and organic unity which is the precondition to realize combinations of the optimal input-output planning model and new technology and new industry. In other words, the optimal macro input-output planning model involved each field and object of micro-economy has to be incorporated into an accounting framework of the optimal macro input-output planning model for long-term planning, design and development of the system and that is a scientific method. This method is not only the scientific basis of the realization of combinations between the optimal input-output planning model and new technology and new industry, it is also the basic principle and requirement of long-term planning, design and development of cross-border economic management information system. The basic principle and requirement are not only goal and direction of the implementation of long-term planning, design and development for the requirement of establishing a new system of each field and object of micro-economy from now on, but also for the requirement of upgrading or rebuilding this system. It is not difficult to see that, as the scientific method, it is also the basic requirement for realizing the real-time analysis of the optimal input-output planning model and the timely analysis of input-output statistical model. It must be pointed out that as long as all kinds of economic management information system is built departing from the basic principles and requirements of the system, even though with a large amount of manpower, material and financial resources, because of lack of economic laws and contents, internal relations and necessary basic functions, each part of this system will be isolated from each other. It might look nice but fails eventually.

### 5.2. Business Restructuring and Social Changes

In Industry 4.0, complex, intelligent, networked technology system will force people to find new business models. This challenge relates to whole manufacturing industry and the whole life cycle of products [10]. It is not difficult to imagine, in Industry 4.0, according to new ideas of cross-boundary of intelligent global supply chain to business restructuring, all fields and objects of micro-economy will be involved. Results of business restructuring will bring great changes to the whole world and all fields of macro-economy will be the part of it. Therefore, either business restructuring or social changes, the connection between the two, as such between micro input-output model and macro input-output model, is inseparable. The results of the whole process of business restructuring and social changes can be reflected through the real time analysis method of the optimal macro and micro input-output planning model. The next thing is to list the input vertically

and the output horizontally in each department of the macro input-output planning model, and make the material (input) and products (output) accurately delivered to right places at right time. This is vitally important to ensure the smooth operation of national economy as well as production, distribution, exchange and consumption of business restructuring and social changes. Since the vertical part of the macro input-output planning model shows the material (input) and its consuming quantity and volume of each department and the horizontal part shows the products (output) and its quantity and volume of each department. Therefore, once the real-time analysis of the optimal macro input-output planning model is realized, the basic data which is listed vertically such as the data of logistics, information and capital of production for consumption or investment can be obtained, the sources of the basic data of subordinate enterprises or companies can be tracked and controlled as well as the locations of these enterprises or companies. Obviously, comparing with the regular transport routes and cost, with the basic data which is obtained, by using the optimal transport model according to the relevant content of Operational Research, better transport routes and lower transport cost will be made.

### 5.3. Redefining Global Retail Sales Approach

It is known from what is stated above, the progress of business restructuring and social changes, is the progress of solving the issue of transport routes and cost of overall social production which can achieve its optimization by using the basic data of input and output based on the optimal input-output planning model and relevant information. Social machinery of internal socialized media is a part of production chains, the software made based on the combination between localized intelligent products and intelligent tools as well as means of production let them operate altogether in modern factories and connect to intelligent global supply chain. It is not difficult to imagine, by speaking of social progress and development in the future, according to the intelligence global supply chain stated above as a new concept of cross-boundary, the global retail sales approach can be redefined based on the basic data of input and output and relevant information after the realization of real-time analysis of the optimal macro input-output planning model which becomes very necessary. For example, the global retail sales approach of Amazon and Alibaba is basically the same. Even by removing all intermediate links, does it make the best retail sales approach? It is worth further discussing! It is believed that the process of business restructuring and social changes requires a solution to the problem of transport routes and cost so does re-defining the global retail sales approach. The difference between the two is that the former's problem is controllable while the latter's is not and the former's problem can be much more difficult and complicated. For example, for redefining TV products (or similar products) in terms of global retail sales methods, those products are greatly demanded, the demands thus can be not only changeable, but highly uncertain and the difficulty of choosing transport routes and controlling transport cost in-

creases. However, based on the solution to transport routes and cost of the whole process of business restructuring and social changes, by enhancing statistical methods to find an answer and make best sales plans. For social progress and development, the global retail sales approach can be redefined because it is on the basis of combinations of the optimal input-output planning model with new technology and new industry, it is very important and extremely beneficial no matter for individual or public, Amazon and Alibaba or any other similar enterprises or companies, is not it obvious where it goes?

The cross-boundary economic management information system shows that the input-output model mainly solves the problem of coordinated development between departments (products) which is a necessary condition to obtain the best economic benefits. As an objective law, it is not only the theoretical basis of carrying out long-term planning, design and development in cross-boundary economic management information system, but the scientific method of realizing combinations of the optimal input-output planning model with new technology and new industry. It must be pointed out that with the discussion of the long-term planning, design and development in cross-boundary economic management information system, business restructuring and social changes and the redefinition of global retail sales approach, it is not difficult to see that economic base and superstructure, fair trade and free competition, economic interests and value pursuit which are highly unified in a social environment [6], when a government needs to solve the problems of market economy operation with macro-economic control, the system can be used for corresponding problems with policy simulation and provide the scientific basis for the decision-making of the government. The cross-boundary economic management information system introduced above is the only method to put economic functions, goals, expectations and requirements of macro-economic management in place.

## 6. System Reviews

In Industry 4.0, the cross-boundary will become a normality when automation and information deeply integrate with one another. The cross-boundary in future will be not only involved in industry and daily life, its extension is too wide to define its boundary. However, it is certain that it is related to the field that can be as big as the world or as small as every aspect of life [11]. In spite of all, as management methods of Industry 3.0, fortunately, combinations of the optimal input-output planning model with new technology and new industry can better reflect the characteristics of Industry 4.0. Especially, after Industry 4.0 being brought to effectiveness, the strike of the cross-boundary will be hundred times stronger to industrial enterprises than internet companies. During this progress, huge development and essential change of foundations of politics, sociology and science of management will take place. By reshaping the entire commercial society, value system, knowledge system and lifestyle will be also affected or changed [11]. It must be pointed out that in the process of reshaping the entire commercial society, some fixed social production mode is changed. However,

the necessity of resources distributing with a certain proportion will never disappear, it will be changed only with the change of production mode. That is to say, the theoretical and practical significance of combinations of the optimal input-output planning model with new technology and new industry will never be shaken, neither the historical status and role of formulating plans of national economy and predicting trends of national economy development. The conclusions are made as follows.

1) As it is known, modern management is often called system management because it reflects the main characteristics of modern management. Those main characteristics are: modernized concept, systematic organisation, quantitative method, automatic and means as well as integration supply, production and sales. The input-output model is a scientific method of management system. Therefore, it can comprehensively and objectively reflect the main features of modern management. Obviously, by speaking of strengthening management of micro-economy and macro-economy and improving economic efficiency, in terms of combinations of the optimal input-output planning model and new technology and new industry, its theoretical and practical significance is not only the scientific method of economic management for Industry 3.0 and Industry 4.0, but also reconstruction of new international economic order and scientific basis to create a new civilisation.

2) The foundation of micro-economy is citizens and enterprises of national economy operation. The transformation of resource allocation means that the effectiveness of macro-economic control will depend on main bodies' independence of micro-economic foundation, perfection of market system, integrity of market mechanism and other factors, and these factors will determine the actual operation of macro control. The macro-economic control focuses on various indirect mechanisms which influence economy unnaturally. The macro-economic control is an overall control of entire national economy. However, it must start from behaviours of relevant main bodies of micro-economic foundation as a research point. Obviously, the combinations of the optimal input-output planning model with new technology and new industry are firstly implemented on an independent micro-economic foundation. Because of those behaviours of relevant main bodies are the basis of the implementation of long-term planning, design and development in terms of the cross-boundary economic management information system. Therefore, in the process of macro-economic control, they will entirely depend on the micro-economic basis and directly determine the effect of macro-control.

3) Macro-economic management is the management of the process of macro-economic operation. The macro-economic operation process is actually the process of social reproduction. The process of social reproduction consists of production, distribution, exchange and consumption. Those four areas are rather interdependent and interactive. The process of social reproduction starts from production, after distribution, exchange and consumption, it comes back to production which forms a continuous cycle. In order to complete this process, the percentage of each part should be maintained in a coordinated way through

the entire process. The percentage of each part is not spontaneously formed but through the macro-economic management. Therefore, by combining the optimal input-output planning model with new technology and new industry and realising the real-time analysis of the optimal input-output planning model and the timely analysis of input-output statistics model as a scientific foundation to realise macro-economic operation and management, firstly, it keeps the percentage of each part in coordination throughout the entire process of social reproduction; secondly, it is also the key to realise coordination.

4) Macro-economic management is the overall guidance and regulation based on the laws of nature and economy, with economy, legislation and other necessary administrative means and from systematic, comprehensive and global perspective for operation and development of modern market economy. Macro-economic management is different from special industries and particular products which are specifically regulated by government as well as industrial or regional economic management of departments or local governments, and it is much different from the internal economic management of individuals, enterprises and other micro-economic main bodies. Macro-economic management is not a simple sum of the individual management or the economic management of departments and regions. It is the overall plan and coordination involved in the cross-boundary economic management information system which is formed on the basis of interconnection, interdependence and interaction of micro-economic entities and the economy of departments and regions. Obviously, combinations between the optimal input-output planning model and new technology along with new industry as well as the real-time analysis of the optimal input-output planning model and the timely analysis of input-output statistics model, they do not reflect only in goals of the cross-boundary economic management information system and the content of those goals, they are also important tools for government to progress overall plan and coordination while facing operation and development of modern market economy.

5) In the modern market economy, between market mechanism and government intervention, the relationship should be complementary which means one should not edge another out. For example, governmental decisions deviate from public interests; governmental interventions in economic activities are obstacles to achieving expected goals; external negative effects are derived from governmental act; reform of political system delays economic reform; governmental act brings a negative impact; governmental functions are dislocated, unqualified public staff cannot carry out their duties; oversights of government are not fully implemented, overwhelming governments and so on. These problems are unfavourable and harmful to the market mechanism of modern market economy. Obviously, with combinations between the optimal input-output planning model and new technology and new industry, the market mechanism can be carried out based on expectations and requirements of the real-time analysis of the optimal input-output planning model and the timely analysis of input-output statistics model. Accordingly, the cost of governmental intervention can be covered

so can the insufficiency of market mechanism.

6) Economists predict that the industry value brought by Internet of Things will be 30 times larger than internet, and Internet of Things will become the next information industry that is worth some trillion Chinese Yuan because the emergence of the concept of Internet of Things will have broken a conventional way of thinking. According to the conventional way of thinking, physical infrastructures are separated from IT facilities, while an organic entity by connecting those two is what people believe nowadays. For example, on the one side, there are airports, ports, highways, railways, hydro-power and buildings, on the other side, there are data centre, computers, broadband and other IT facilities, and there is no direct link between them. At the time of Internet of Things, the physical infrastructures will be connected to chips, computers, broadband and other IT facilities and integrated together as a unified infrastructure. It is not difficult to imagine, in this sense, the infrastructure will be more like a new earth, the world will be running above and production and operation, economic management, social management and personal life will be involved [9]. Internet of Things can improve economic efficiency and greatly reduce cost as well as be widely used in intelligent transportation, intrusion prevention, environmental protection, governmental operation, public security, smart power grid, intelligent home furnishing, intelligent fire control, industry monitoring, individual health care and other fields. Obviously, based on combinations between the optimal input-output planning model and new technology and new industry, the change of logistics flow, information flow, capital flow and so on based on the change of information of Internet of Things. Therefore, in the progress of long-term planning, design and development of the cross-boundary economic management information system, how to meet the requirement of Internet of Things is the key.

7) At present, there are various fixed orders and rules and those of production and management are only a very small part. The orders and rules on a larger scale are also about different classes caused by hierarchy, wealth, etc., and became solidified. However, there are methods to change this situation, Internet of Things or new internet industry! Internet began to change the world from changing the information asymmetry. For example, because of limited cost, manufacturers frequently apply "one-size-fits-all policy". According to this policy, the product functions that are the most demanded are combined together and accordingly fabricated as products. For example, there is no need for the manufacturers to know about the shoe size of any customer's. What they can do is after collecting various sizes, the standardised sizes are set on basis of the most frequent sizes and sorted with numbers, for instance. However, it is inevitable that the sizes of some customers cannot perfectly match any of those standardised sizes. The situation of clothing industry is the same. Internet makes the situation changed. Between different individuals as well as individuals and manufacturers, even with low cost, personal needs can be met. People start to love individualised products. However, the demand for individualised products cannot be very big which requires enterprises to achieve rapid production of small batches. Internet changes the way of

traditional production and operation. That is to say, small batches of customised goods can be produced in a considerably short time to meet all consumers' needs. Obviously, based on combinations between the optimal input-output planning model and new technology and new industry, by implementing the method of long-term planning, design and development of the system based on the basic data of information technology management, not only the demands of small batches of customized products can be produced in a short time, but the various fixed order and rules will be changed based on this theoretical basis.

8) Combinations between automation and information is like from one stage to another so is the impact of Industry 4.0. It is known that Industry 4.0 is about the production depending on the consumption rather than any other factors. That is to say, before the implementation of production, each product has been individualised by its consumer, more individualised products can better meet consumers' needs and expectations. At that time, all orders will be made first and the production will be accordingly conducted. Therefore, there will not be inventory in Industry 4.0. However, Radio Frequency Identification Technology (RFID) which is equivalent to a two-dimensional code will be needed, it brings its own identity information and controls the production relying on sensors. For example, in a hat factory, while three hats continuously come along from the production line, each hat comes with a two-dimensional code which contains the personal information of the customer. This is a small batch of customised products with varieties. Products will be customised from the moment that on-line orders are made. All features of the products are in line with requests of customers' which will be appreciated when they reach customers. What does this result rely on? It relies on Big Data, Cloud Computing, sensors, Internet of Things, mobile internet and so on. Industry 4.0 is the comprehensive effect of these techniques developing to a certain level. Obviously, based on combinations between the optimal input-output planning model and new technology and new industry, the micro production process objectively reflects characteristics and demands of the customised productions of Industry 4.0. It can promote not only development and prosperity of society in the future, but enhance management and improve economic efficiency through the coordinated development as well.

9) During the time that automation and information deeply integrate with each other, the whole process of Industry 4.0 is the process of the constant integration of automation and information as well as the redefinition of the world. The world is changing very fast, an entire age will be missed with even a little inattention. In the future, variety will become the reality in a virtual world, a real world will correspond to numerous virtual worlds. By changing the real world, the virtual world will be changed and vice versa. Everything is precisely controlled based on data, most of the physical and mental labor will be replaced by machines and AI and all of today's economics principles will no longer be applied. However, the progress of science and technology as well as the internet revolution will keep providing services to human [11]. Obviously, with the progress of science and technology of Industry 4.0, new technology and new industry will be

improved as well. The combinations between the optimal input-output planning model and new technology along with new industry will also be accordingly improved, the core competitiveness will be changed with the progress of science and technology which fully indicates that in the cross-boundary economic management information system, the method of long-term planning, design and development will completely adapt to the development and requirements of time.

10) The main reason for the rapid development of the internet industry is that entrepreneurs only need to focus on innovation of products and models. Instead of buying a server, they can direct rent cloud services. So far, those entrepreneurs constantly struggle between OEM and self-built factory, and it greatly limits the innovation of industry. After the realisation of cloud factory, the world industry may be a wave of innovation and entrepreneurship which will be hundred times more than the internet. By the time, the whole society will be profoundly changed. When carrying out long-term planning, design and developing, the combinations between the optimal input-output planning model and new technology along with new industry should be viewed as a closed cross-boundary economic management information system which cannot be interrupted because it is related to the stable, private and secured operation of entire national economy. However, for new technology and new industry, apart from combining with the optimal input-output planning model, it can provide service to public management and service market as well as to enterprises, industry, app stores, and individuals. Especially some special industries like aerospace industry, for instance, which often carries out the task for maintaining those extremely complex devices and systems. Without any technical means which are preventive and predictive, this maintenance could be impossible. For example, in Boeing company, the business was accomplished by selling. However, at present, the data will be continually sent back to the factory during the process of operation, in this case, the operation condition and overhaul will be immediately known. What did Boeing do before? With "one-size-fits-all policy", once the time was set, the airplanes had to be sent back to the factory for the maintenance regardless of necessity. It needed to be done anyway for as large as an entire airplane or as small as a lock. Nowadays, Boeing receives the real-time information about overhaul or maintenance of its products and the payment of course will be made for the information. What is the most important factor for intelligent production? It is Big Data. The constant collection of relevant data is uploaded to the internet, such as which production lines of which factories are running at full capacity and which are left unused, the instant information of such can be observed. In this case, those vacant factories are able to offer the production capacity to other factories which need more capacity; as return, the formers will benefit as well. Obviously, with the combinations between the optimal input-output planning model and new technology and new industry, apart from the completion of one's own tasks (national economy budgeting (planning), policy analysis means and accounting), additional service platforms can be provided to entrepreneurs by using new technology and new industry. Either combining together or

being divided from each other, with the right balance maintenance, they will be the key to long-term planning, design and development of the cross-boundary economic management information system.

11) The production needs to be improved in spite of the repetition of human nature. The progress of productivity is not about providing goods more than the requirement of society, but about making some certain products multifunctional for customers to reduce the needs of other products because those products are enough for daily use. Accordingly, the excess material becomes a burden because the ultimate solution is found [11]. Imagine, because of constant differentiation and diversity of the requirements, once standardised production becomes outdated, and the time of customised production comes up, those competitions of old mode will no longer exist. In the time of traditional industry, people are always after social class and wealth, the main reasons are that the relation of production brings hierarchy, and the productivity level determines that the products cannot meet people's needs. However, in the time of internet, when the relation of production is adjusted to be collaborative work, the productivity level is developed to meet needs of individuals, and labor becomes demand. At that time, minimalism will be the mainstream of product design because garish things become redundant and no longer needed, and the highest value is one's own self. Obviously, based on the combinations between the optimal input-output planning model and new technology and new industry, and the real-time analysis of the optimal input-output planning model and the timely analysis of input-output statistics model, not only can human nature or individualisation be taken care of, the production can be improved as well.

12) The standardisation of system of Internet of Things is a process that gradually develops and matures, and its trend will show the progress from mature application plan to industry standards refining and forming, from industry standards to key technical standards and eventually to standardised system. It is almost impossible to develop a universal standard [9] because the concept of Internet of Things is related to many fields such as technology and industry. The standard of this industry will be the standard system covering a wide area and gradually develop with market development and become mature. During the progress of its development, the progressiveness of a single technology does not necessarily guarantee vigour or vitality of the standard, instead, the openness and market size are the keys to the core problem of sustainable development. With the gradual expansion Internet of Things application and the maturity of market, what application takes more market share, the relevant standards which are derived from their application will be more likely to become factual standards and be widely accepted. With the gradually mature industrial applications, a new universal technology platform of Internet of Things will appear. The innovation of Internet of Things is an integrative application innovation, and a complete solution cannot be achieved independently by a single enterprise. An application with mature technology, perfect service, various types and friendly interface is the result of the cooperation of equipment providers, technology so-

lution providers, operators and service providers. As the industry matures, the common platform which supports different device interfaces, internet protocols and integrative services will be the results of development of this industry. In the time of Internet of Things, mobile devices, embedded equipments, internet service platform will become mainstream. With the mature industrial applications, there will be a large public platform and common technology platform. Regardless terminal manufacturers, network operators, software manufacturers, integrative system providers or application service providers, they need to re-locate themselves in a new round of competition. In terms of the innovation of business model for Internet of Things, a full integration of technology and the mode of human behaviours will be the outcome. Speaking of the connection between Internet of Things and robots, as the outcome of the new business model, it is a full integration of Internet of Things related technology with the mode of human behaviours. Obviously, the combinations between the optimal input-output planning model and new technology along with new industry are public platform and common technology platform too large to keep growing. Certainly, these two platforms are currently looked for or will be looked for. This is because, on the one hand, the structure of macro input-output model will be change with certain changes in the future; on the other hand, in the vertical structure of macro input-output model, each field and object of micro-economy are covered, while the corresponding horizontal structure of macro input-output model objectively reflects the relations of technology and economy between each department of micro-economy and each department of the vertical structure. This feature does not exist anywhere else but on these two platforms. Therefore, with the structure of macro input-output model, relations of technology and economy and coordinated development, etc. as well as the relevant economic content and significance, the standardised system can be established based on the two platforms and meet their requirements. It can establish not only industry standards, but promote key technical standards through industry standards, and enhance the trend of standard system formation. It is not difficult to imagine, without macro input-output model as public platform and common technology platform to guide the establishment of industry standards, what will happen to the effort of promoting keys technical standards through the establishment of industry standards? It will be absolutely predictable. In addition, either for current Industry 3.0 or future Industry 4.0, due to the lack of real-time analysis before the test of plans implementation and timely analysis after for establishing balanced relations between each field of national economy and, the macro-economic management will not be easily carried out, guided and macro-controlled with accuracy and precision. As the consequences of current social situation, the problems of economic management cannot be fundamentally solved.

13) The so-called overall management is in fact about macro-economic management and proceeding from the overall interests of national economy and making it guaranteed. That is to say, the partial interests (such as interest of every enterprise and nation) should be subordinated to the overall interests. In

market economy, interest subjects become diverse in the pursuit of their own interests and put their own interests in the first place. The economic activities of the subjects tend to be self-interested without considering others and overall situation. However, the national economy is an organic entity, its economic activities of each subject (such as departments, nations, units) cannot be only involved in its own interests and benefits, the cooperation is required. In this way, the national economy can develop in a healthy and sustainable way. In order to solve the problems, the macro-economic management is the only method. The so-called long-term is that the macro-economic management should focus on long-term development and interests of the national economy, and combine short-term development with long-term development to prevent and correct short-sighted issues. In market economy, most behaviours of stakeholders are short-term, the projects which have long-term significance for the development of the national economy do not interest them. For example, infrastructure, basic farmland construction, large and medium-sized water conservancy construction, scientific research, basic education and so on. It is impossible or very difficult to solve these problems by simply relying on market mechanism. The so-called plans of macro-economic management are: the national economic needs to be kept balanced while conducting the social development and automatic adjustments of the national economy and the social development need to be taken care beforehand. In market economy, micro-economic activities are controlled by market mechanism and the plans are not excluded from the scope of its business activities. In terms of regular development, the business activities must be planned for every enterprise. However, the plans of micro-economy do not constitute the plans of macro-economy, they are often on the opposite side, and causing disorder and blindness for social production. Therefore, between them, macro-economy plays a guiding role because it is the only way to ensure the healthy and sustainable development of the national economy. In other words, the economic development of society needs to build on the plans of macro-economic management. The so-called plan is that by planning, comprehensive and systematic arrangements become the guides for macro-economy to healthily and sustainably develop. Obviously, the combinations between the optimal input-output planning model and new technology along with new industry, it builds not only a global view but also long-term and planned macro-economic management. This is because the macro input-output model itself is to focus on starting from the overall interests of national economy. It maintains not only the overall interests of national economy by letting all partial interests subordinate and coordinating the economic activities of different subjects together, but also completely avoids self-interests. In addition, because the micro input-output model is tabulated according to the structure of macro input-output model, the problem of short-sighted benefits can be prevented and corrected. Because the macro input-output model is tabulated on basis of micro input-output model as well, the contradictory situation between micro-economy and macro-economy can be overcome. It is not difficult to imagine, without the realisation of the real-time analysis of the optimal input-output plan-

ning model and the timely analysis of input-output statistical model, the problems mentioned above cannot be resolved at all.

14) As believed that in order to achieve a significant breakthrough for the scientific application of economics, politics, sociology and many other fields by promoting new technology and new industry, the best strategy is to start from the development and implementation of the combinations between the optimal input-output planning model and new technology along with new industry which is entirely and fundamentally related to national economy and people's life. This is because, with the realisation of the real-time analysis of the optimal input-output planning model and the timely analysis of input-output statistical model, multiplied effects can be obtained while ensuring the national economy in a smooth operation and the economic structure in the best state. In this case, the development and implementation in other fields can also be accordingly conducted. It must be pointed out that for the long-term planning, design and development of the cross-boundary economic management information system, there are two points that need to be clarified: firstly, from macro perspective, the core content of Industry 4.0 is about an overall cross penetration of industry, industrial products and services; secondly, from micro perspective, it is about an overall cross penetration of industrial engineering design, production and operation management. Regardless macro reform or micro reform, this kind of penetration is based on the software and is realised by making products and services available on internet and other networks. Micro reform is the foundation of macro reform, as long as problems of micro reform can be solved, it will be easier to solve the macro reform problems. Therefore, in order to plan, design and develop in long-term for the reform which is related to core content of Industry 4.0, based on the combinations of the micro input-output model and engineering design, production and operation management, the objective law of the input-output model which mainly solves the problem of coordinated development can be used as a theoretical basis. It is conducive for applying more standardised methods as well as realising the overall cross penetration for micro reform related core content of Industry 4.0 through the combinations between the optimal micro input-output planning model and new technology along with new industry. On this basis, based on the combinations, the overall cross penetration for macro reform related core content of Industry 4.0 can be also realised. Certainly, the realisation of the reform related core content of Industry 4.0 is not only a pure technical issue but it depends more on these so-called soft criteria which are formed with factors such as corporate culture, quality of personnel and social environment. In this regard, an appeal needs to be made to International Input-Output Association: firstly, for the heads of governments around the world to understand the theoretical and practical significance of using the optimal input-output planning model to conduct long-term plan, design and development for reform related core content of Industry 4.0; secondly, it is about building a professional team. The professional and skilled personnel from all over the world need to be trained in order to implement the long-term planning,

design and development for reform related core content of Industry 4.0. Once they understand real-time and timely analysis of input-output real-time tabulation as well as the method and essence of the combinations between the optimal input-output planning model and new technology along with new industry, they will be able to accomplish tasks based on the objective law of coordinated development of the input-output model and properly carry out relevant research and development; thirdly, providing training for personnel who are involved in management, technology and operation and willing to be engaged in application of the cross-boundary economic management information system. Based on their understanding of reform related core content of Industry 4.0, prospect and significance of Industry 4.0 as well as basic structure, work principle, operation sequence, operation maintenance and so on in the cross-boundary economic management information system, their responsibilities and obligations will be clarified and their work will be accomplished smoothly. Obviously, the comprehensive theory related training on different levels is very important for success! From as big as a country to as small as an industry, if the core content of Industry 4.0 cannot be aware or the preparation of the reform cannot be conducted, the replacement will be made by other countries or industries which already obtain the new technologies and take a leading position. The prospect of the application of input-output model is the same, in order to take the leading position, the only way is following the reform of Industry 4.0, keeping updating the method of tabulations and combining with new technology and new industry which is likely to become commanders to direct production, distribution, exchange and consumption. Now, human being is in a crossroad, either seizing this new technology opportunity and translating it into new production to reach economic success or taking the risk of long-term economic recession. It must be specified that for the implementation of cross-boundary economic management information system, the micro-economic management can provide not only the basic data for the real-time analysis of the optimal macro input-output planning model and the timely analysis of macro input-output statistical model, but what is more important is how to use system or model to strengthen management and improve economic benefits as well as work efficiency and service level and quality. In terms of macro-economic management, apart from using system or method to strengthen management and improve economic benefits as well as work efficiency, service level and quality, it also needs to provide service information to the society as well as the objects which are involved.

In the end, I would love to sincerely thank International Input-Output Association, chairmen of the academic committee, experts and delegates for their attention, guidance and help that can date from 2011. In order to foster and train a group of high-quality R & D personnel who are creative and versatile in economics, accounting, management, computer science, automatic factory of the future, Big data, new Cloud Computing technologies along with Internet of Things or new internet industry and other areas, I am willing to do my best! In case of any in-depth understanding of the relevant basic cross-boundary eco-

nomic management information system, by visiting the pilot in cotton textile factory of Guiyang and the application software system of the first stage of development, then the implementation process can be learned. Moreover, the logical model of computer management information system that I completed later which is based on the content of the "Nine-Must" linear model, and it is available in the reference.

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Due to my limitation, mistakes and shortcomings in this article are inevitably, any criticism and correction are more than welcome!

## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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## Note

For convenience, the shorter forms which are mentioned in this paper: cross-boundary economic management information system, short for the optimal input-output planning model and cross-boundary economic management information system; input-output model, short for input-output planning model and input-output statistical model; the optimal input-output planning model, short for the optimal micro input-output planning model and the optimal macro input-output planning model; input-output statistical model, short for micro input-output statistical model and macro input-output statistical model; real-time analysis of the optimal micro input-output planning model, short for real-time analysis of the optimal micro input-output planning model and timely analysis of micro input-output statistical model; real-time analysis of the optimal macro input-output planning model, short for real-time analysis of the optimal macro input-output planning model and timely analysis of macro input-output statistical model; real-time analysis of the optimal input-output planning model and timely analysis of input-output statistical model, short for real-time analysis of the optimal micro input-output planning model and timely analysis of micro input-output statistical model as well as real-time analysis of the optimal macro input-output planning model and timely analysis of macro input-output statistical model; combinations and connections between the optimal macro input-output planning model and the optimal micro input-output planning model, short for combinations and connections between the optimal macro input-output planning model and the optimal micro input-output planning model as well as macro input-output statistics model and micro input-output statistics model; new technology, short for Big data and new Cloud Computing technologies; new industry, short for Internet of Things or new internet industry; combinations between the optimal input-output planning model and new technology and new industry, short for combinations of the optimal micro input-output planning model and new technology and new industry as well as the optimal macro input-output planning model and "new technology" and "new industry"; engineering design is referred to product structure design and process design; manufacturing is referred to combinations of these three elements: objects of labor, labor force, means of labor and relevant progresses; operation management is referred to market management and finance management.

## [*] The Basic Content of the "Nine-Must"—Production Pioneer of Linear Model in Enterprise Modern Management

1) Why must it be necessary to draw up the production and management plans with the optimal input-output planning model?

2) Why must it be necessary to draw up inventory strategies with the input-occupancy-output model?

3) Why must it be necessary to establish the grey input-output model to study the connection between input and output of grey factor?

4) Why must it be necessary to establish the dynamic input-output model to carry out dynamic analysis?

5) Why must it be necessary to realize the combination and connection between the optimal input-output planning model and the enterprise resource planning (ERP), lean production, agile manufacturing, etc.?

6) Why must it be necessary to realize the combination and connection between the optimal input-output planning model and the total-factor productivity (TFP), target management and other modern management methods?

7) Why must it be necessary to realize the real-time analysis for the optimal input-output planning model and the finance management?

8) Why must it be necessary to realize the real-time analysis for the optimal input-output planning model and the supply-demand chain management?

9) Why must it be necessary to use the optimal input-output planning model to conduct the analysis of policy?