

Scientific Foundation of Real-Time Input-Output Tabulation and AI

—Combinations and Connections between Optimal Input-Output Planning Model and AI

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Abstract

Be it the era of current Industry 3.0 (3D printing) or the era of Industry 4.0 (customised production) in the future, as far as globalisation is concerned, based on combinations of automation & information and intelligence, the application of Big Data, new Cloud Computing technologies, Internet of Things or new internet industry and AI will usher in a huge revolution to human beings, which will consequently rock foundations of modern economy, politics, social sciences, management and accounting, etc. and even bring about fundamentally changes and development, and hence an era for technology industry going novelty, *i.e.* customised production. Commercial re-group and the drastic society change will influence not only the overall ecological pattern around the world but also human beings' value system, knowledge system and life style. Many seeming probabilities today will become impossible while the impossible at the moment will go real in the future. Under such complicated, constantly changing and rapidly developing circumstance, only when the passive situation of tabulating and interpreting is completely changed, can national economy's smooth operation be directed by the objective law of coordinated development, and thus, to achieve the utmost economic efficiency. The scientific foundation of the real-time input-output tabulation method and AI is rightly designed on the basis of the above dreaming realisation. This thesis will take the real-time analysis of the optimal input-output planning model and a timely analysis of input-output statistical model as an example to illustrate how to realise the good wish.

Keywords

Big Data, New Cloud Computing Technologies, Internet of Things or New Internet Industry, AI (Artificial Intelligence), CAD (Computer Aided

1. "One World"

"One world" refers to an idea that human being will finally realise a beautiful vision of human society in the future. In spite of different description and understanding in politics, economy, culture, science and technology, according to its nature, the foundation of entire human society lies in economy, and that is the starting point and finishing point of human society. The economic foundation is related to the entire society and it is a great support which backs up nations for the strong competitiveness, how to make this foundation of human society (economy) be systematically managed and regulated and always kept in the best operation? Obviously, the real-time analysis of the optimal planning model of input-output and the timely analysis of the input-output statistical model become the key technology. Other problems which are related to the economic foundation will be solved as long as this critical problem can be properly dealt with.

For realising "One world", regardless of social form or system, as long as the real-time analysis of the optimal input-output planning model and the timely analysis of the input-output statistical model shall be implemented, the unification of economic foundation and superstructure, fair trade and free competition, economic benefit and value pursuit can be realised. It is crucial to make this point clear in this paper.

2. The Real-Time Input-Output Tabulation Method and the Scientific Basis of AI

Regardless of 3D printing (Industry 3.0) or customised production (Industry 4.0), in AI unmanned factories, all work can be done by computer-controlled robots, CNC machine tools, unmanned trolleys and automated warehouses. Instead of working directly, workers become commanders and doctors. During daytime, a small number of workers can handle the work such as checking and modifying orders; at nights, even fewer workers are left to monitor. It is summarised as following.

2.1. Background

All economic activities of International Standard Industrial Classification (ISIC) are published by United Nations Bureau of Statistics. According to the division of industrial sectors, agriculture belongs to the primary industry, industry belongs to the secondary and others belong to the tertiary. In the primary industry, products can be obtained directly from nature through human labor, including agriculture, forestry, animal husbandry and fishery; in the secondary industry, the products (raw materials) provided by the primary industry and the second-

ary industry itself are processed. According to the accounting budget (plan) and the degree of difficulty in accounting, the departments which are engaged in product structure (components) and bill of materials (food, medicine and chemical industry which are referred as BOM, hereinafter the same) are named manufacturing; the departments which are engaged in extractive industry, construction, public works, water, electricity, oil and gas are called other industries; the tertiary industry are the sectors other than the primary and the secondary that provide only final services to consumers and intermediate services to producers (including producers of the tertiary industry itself), including transportation, storage and postal service, information transmission, computer service and software, wholesale and retail, accommodation and catering, finance, real estate, leasing and business service, scientific research, technology service and geological exploration, water conservancy, environmental and public facilities management service, residential service and other services, education, health, social security and social welfare, culture, sports and entertainment, public administration and social or international organisations. For convenience, those which make profit are categorised as service industry while those do not are categorised as service offering organisations. The basic relation of the three major industries is to restrict and depend on each other. The primary lays the foundation for the secondary and the tertiary; the secondary is the core of the three industries and it brings along the primary; the primary and the secondary create opportunities for the tertiary; the development of the tertiary boosts the primary and the secondary.

According to the basic method of input-output statistical model tabulation all over the world, it can be seen that because of different accounting systems, the basic structure of the model is also different. For example, by applying SNA (System of National Accounts) as the accounting method, production and labor supply are included in the form of production and the monetary income from factors of production is included in the national income. By adopting MPS (System of Material Product Balances), the national economic activity can be divided into material production field and non-material production field, and only the material production field is considered the part of the production and included in the national income. Because theoretical basis, research field and basic flow of these two kinds of accounting systems are different, their basic structure of the input-output statistical model is also different. In addition, there is only value based input-output model in SNA. However, in MPS, both value based input-output model and material based input-output model exist. In order to solve the problem of the comparability of statistical data among different countries, the conversion of aggregate index can be carried out according to the difference of those two accounting systems. For example: the conversion between national income and added value, between total social products and material consumption along with total output and intermediate input, between personal consumption and household consumption, and between other corresponding indicators. The comparability can be accordingly realised [1].

According to the basic theory put forward by John McCarthy (the inventor of

AI), AI is about the science and engineering of making intelligent machines, the programme for making those machines particularly. By being programmed by human, the computer is able to think like human. Through the research of human brain and its capability of study and work, for instance, the result becomes the foundation of the development of intelligent software and system. AI is not human intelligence. However, it has the ability to imitate and might also exceed human intelligence one day. AI is a branch of computer science that attempts to understand the essence of intelligence and produce intelligent machines that can respond in a similar way to human intelligence. In general, one of the main goals of AI research is to enable machines to perform complex tasks that usually require human intelligence. It must be pointed out that different people of different time have various understanding of such kind of complex tasks. Therefore, as a science, the specific goal of AI will naturally be evolved according. From its birth, the theory and technology of AI have been getting matured, and its application has been expanding. It can be seen in the future, the technological products brought along by AI will become a container of human intelligence. On the one hand, it continues to make new progress. On the other hand, it starts to set goals that will be more meaningful though more difficult [2].

In terms of the ability of problems solving, AI can be divided into three categories: weak AI, strong AI and super AI. ANI (Artificial Narrow Intelligence) is also called Weak AI which is good enough for individual use, for example, smart bikes and cars. According to Professor Linda Gottfredson, AGI (Artificial General Intelligence) is “a comprehensively psychological ability regarding thinking, planning, problems solving (sometime even abstract issues and complex ideas), fast learning and learning based on experiences”. As strong AI, AGI is at human-level because it can be considered equal to human intelligence and used for doing everything that requires human intelligence. Creating AGI is much more difficult than creating ANI, this is beyond human’s capability so far. ASI (Artificial Super Intelligence) is defined by Professor Nick Bostrom (Oxford philosopher and thinker) as “intelligence that is much smarter than the smartest human in all fields such as scientific innovation, general knowledge and social skills”. In terms of ASI, no matter it could be a little stronger or much stronger than human intelligence, it has been brought to the sight and that is why these two words—immortality and extinction, have been paid close attention to.

According to the concept of computer network, it is built up with interchangeable and programmable hardware. However, hardware is not specifically used for any certain purpose (transmission of data or video signal). They can be used to transmit a variety of different types of data, and support a wide range of growing applications. According to this concept, the hardware which are connected to a computer network are not limited to ordinary computers, but also to smartphones; computer network is not specifically designed for data transmission, but for the support of a variety of applications (including the applications which will be used in the future). Programmable hardware means that it must be CPU (Central Processor Unit) involved [3]. It is obvious that the communica-

tion between computers can be realised through the interconnection, so that functions such as information, software and equipment resources sharing, and the ability of working together in computer systems can be greatly realised as well. Computer resources include computer hardware, software and data. Computer network can provide for both local and remote users network services; all computers in this network abide by a network protocol. Computer network architecture which is to unify the protocol around the world establishes software and hardware standards, and precisely defines the functions that the computer network and its components should perform. Therefore, different computers can do information docking with the same function. Computer network is based on a highly structured design method and applying the principle of functional stratification. In addition, regarding the range of action, network can be divided into four different types: PAN (Personal Area Network), LAN (Local Area Network), MAN (Metropolitan Area Network), and WAN (Wide Area Network). However, WAN is the core part of internet. Its main task is to transport the data which is sent by mainframes over long distances (across countries), and the link that connects the switches of all connecting points is generally high-speed link which has a large communication capacity.

According to the basic principle of CAD (Computer Aided Design), it is known that CAD software was first developed by Autodesk Company in 1982 which is useful for designing work by using computers and their graphics devices. CAD software can run on microcomputers and workstations which are supported by various operating systems. It can be used in two-dimensional drawing, detailed drawing, design documents and basic three-dimensional design; it provides a good user interface which is able to carry out various operations through interactive menus or command-lines. In the process of engineering design and product design, different schemes can be calculated, analysed and compared in order to determine the optimal schemes. All kinds of design information, such as digital, text or graphics, can be stored in computer memories or external storage and quickly retrieved. Designer usually start the work from sketches, then the heavy work for turning the sketches into engineering drawings can be done by computers. The engineering drawings are automatically produced by computers which can be quickly displayed, so that designers will be able to judge and modify the work in time. CAD applications include engineering drawing, architectural engineering, decorative design, environmental art design, hydro-power engineering and civil construction, etc. which have become popular drawing tools worldwide.

According to the basic principle of CAM (Computer Aided Manufacturing), it is known that CAM software was first developed by Massachusetts Institute of Technology in 1952 which is used to complete the entire production process from preparation to manufacturing with computer assistance. CAM software is able to directly or indirectly connect computers to manufacturing process and production equipment. With computer system, it is used to plan and manage manufacturing procedure, control and operate production equipment, process

data which is needed in the manufacturing procedure, control and process flow of materials (semi-finished products and components), as well as test and check finished products, etc. The core technology of CAM is numerical control (short for Computer Numerical Control) which is to generate NC code that machine tools can read by computer programming, so that the machine tools will be able to run more accurately and more efficiently for saving the cost.

According to the definition of basic functions of 3D printers which was put forward by two Americans, Professor Hod Lipson and Professor Melba Kurman, “3D printing is an opening”. A revolution of product manufacturing, design, material and intellectual property is about to be detonated by 3D printing and the great prospect of 3D printing is about to be unfolded. By crossing the gap between virtual world and real world, the iron law of scale economies is broken. 3D printing will bring AI from computers to elsewhere, the robot time will become history, and it turns out an outbreak of revolution in science, technology and innovation. The advantage of 3D printing is to bring models which are not only visible, but also touchable; it does not only transform creative ideas of designers in forms of in-kind, but also avoid the situation of disappointing objects coming out from qualified designs, since the objects made by 3D printing can be assembled, and the rationality of structure and installation can be intuitively observed. Thus, the relevant problems can be found and solved in early phases. The cost of traditional manufacturing is generally high and large moulds are extremely expensive, therefore, in such situation, if product structures are found unreasonable or there are other problems in the process of mould making, the loss can be huge. With 3D printing, not only can the loss be saved, risks can be even completely avoided as well. 3D printers integrate advanced technological knowledge, such as digital modelling technology, electromechanical control technology, information technology, material science and chemistry which are high technologies. Machines can not only be made, they can be also used to design, manufacture, repair and recycle even adjust and improve other machines as well as to themselves [4]. The rapid prototyping technology of 3D printing has been widely used in design and development of automobile, machinery, aerospace, household appliances, communication, electronics, architecture, medicine and toys. And this is very helpful to establishment of the optimal micro material based input-output planning model.

2.2. Scientific Foundation of AI

The scientific foundation of AI can be illustrated in two aspects—material basis and technological basis (hereinafter the same).

The material basis of AI is based on realising intensive automation, information and intelligence of the three major industries. According to the basic structure of the optimal macro input-output planning model, with interconnections among the system of computer networks (Internet of Things or internet), the formation of the material basis includes two contents: 1) according to the basic structure of the optimal micro input-output planning model, relevant industries

and their affiliated subjects can be combined into small individual systems, and these small systems are the material basis of the corresponding cross-boundary economic information system; 2) according to the basic structure of the optimal macro input-output planning model, not only can small systems be combined into independent subsystems according to hierarchies of industries, these subsystems can also be combined into an independent large-scale system. This independent large-scale system is the material basis of the cross-boundary economic information system [5].

The technological basis of AI is based on realising the material basis of AI: 1) based on the characteristics and specialities of the three major industries and their affiliates, to design and develop the cross-boundary economic management information system; 2) to start vertically from the basic data processing to by applying computer technology for the fundamental data required for the realisation of real-time analysis of the optimal input-output planning model and timely analysis of input-output statistical model, based on the theory and method of input-output planning model as well as some certain steps and computations to respectively establish database files which are based on the basic data. These database files are the strong support of AI to solve problems of tabulating and table using in the future.

2.3. Scientific Foundation of the Optimal Micro Input-Output Planning Model and AI

Real-time input-output tabulation can realise the real-time analysis of the optimal input-output planning model because the scientific method of obtaining the basic data which is required for the realisation of the real-time analysis of the optimal micro material based input-output planning model has been found, nothing can be achieved without this breakthrough. Therefore, as long as the database files which should be based on what kind of basic data for realising the real-time analysis of the model of such becoming clear, the rest of problems in this field will be solved accordingly. The manufacturing industry (components and BOM) is chosen from the three major industries as an example to better explain the application of AI.

According to the tabulation of real-time analysis of the optimal micro material based input-output planning model [6]: for skilled technicians engaged in production and operation, once the variety and quantity of final products and the corresponding volume are determined, the volume of every process of input (consumption) and output in each entire production cycle can be calculated through the technical manual of product standard, and the volume of purchased products that need to be input (consumed) in each process can also be calculated by consumption quota or man-hour quota. According to the balance established in rows, the total output of each production can be calculated. By combining with linear programming method, the optimal scheme of product structure can be laid down under the condition of limited resources without increasing investment and labor force. It can be seen that according to the scientific idea,

principle and method of real-time tabulation of input-output planning model, it is not difficult to manually build the optimal micro material based input-output planning model.

For ANI, in order to use computer technology to build the optimal micro material based input-output planning model, first of all, the steps and calculation methods of manually model building should be followed, and the database files based on basic data should be respectively established. For example, to establish database files based on the relationship between final products and processing lines, these database files should include name, specification, model, quantity, price and other basic information of final products as well as such information of intermediate products in each process. Thus, 1) the information such as the quantity of final products can be modified according to the demand of market; 2) according to the information of input and output in each process, with their corresponding database files based on technical parameter of product standard, the volume of input and output in each process can be respectively calculated; 3) the database files based on the ratio coefficient of the volume of input and output in each process, the basic data in the internal flow matrix table from right to left, top to bottom, final product to raw material can be calculated with program (algorithm); 4) according to the database files based on the information such as consumption quota or man-hour quota in each process of intermediate products, not only the volume of purchased products that need to be input (consumed) in each process can be calculated, the name, plan, model, price, supplier and other basic information of these purchased products can be shown; 5) according to the balance established in rows, the total output of each production can be calculated. The data above is the basic data for the micro material based input-output planning model. With the database files based on the basic data of the model and the fundamental data which is needed by the mathematical model that is combined with the linear programming method, the optimal product structure scheme can be laid out. By simulating steps and calculation methods of manual tabulation, the corresponding calculation programs can be respectively compiled, and by programming with human's logic and knowledge, the real-time analysis of the optimal micro material based input-output planning model can be realized with high speed computing and massive storage capacity of computers. It can be seen that according to the scientific idea, principle and method of real-time tabulation of input-output model, it is not difficult to use ANI technology to build the optimal micro material based input-output planning model.

It must be pointed out that with the change of market demand, enterprises need to adjust the output of the final product and other information; with the technical transformation or updating of machinery and equipment, the corresponding technical parameters will change, and so on. The modification of the information can be realized by passwords only when the ability of AI technology is equal to that of human's which is AGI. In such time, AI technology will reach the level of ASI and accomplish the work that cannot be done by human being.

2.4. Scientific Foundation of the Optimal Macro Input-Output Planning Model and AI

The realisation of combinations and connections between the optimal micro input-output planning model and the optimal macro input-output planning model is the key to realize the real-time analysis of the optimal macro input-output planning model. In the three major industries, the real-time analysis of the optimal macro value based input-output planning model is chosen as an example to understand the general conception of system design and software development. In order to facilitate the description of the structure of this model, please refer to the basic table (Table 3-1) of China's Value Table 1992 [1].

By using ANI, the difference of tabulation between the optimal macro value based input-output planning model and the optimal micro material based input-output optimal planning model is essential, however, according to the structure of input-output model as well as the economic significance, dependence and data source of each part, to simulate manual tabulation with ANI, the principle of following steps and calculation methods of manual tabulation is basically the same. Thus, a brief introduction to the principle only is made in this paper.

For example: 1) the database files designed according to the tabulation structure of the model are established based on the structure of the optimal macro value based input-output planning model. The direction of input shall include intermediate input, added value, total input of the major column, as well as name, specification, model, quantity, sum and other data of the specific objects to which they belong and the corresponding industry or department (product); the direction of output shall include use-in-process, use-at-the-end, other use, total output of the corresponding column, as well as name, specification, model, quantity, sum and other data of the specific objects to which they belong and the corresponding industry or department (product). Then, according to their quadrant and subordination from bottom to top in order to make them separately encoded and facilitate link and mergence; 2) according to industry or department (product) to which each specific object belongs and its corresponding name, specification, model, quantity, sum and other data, all the information can be respectively linked and merged from bottom to top based on the code. The result of the mergence can meet not only the requirements of basic data needed for the management of industry or department (product), but also the requirements of building the optimal macro value based input-output planning model. By linking and merging the relevant basic data again one by one after receiving it, for the internal flow matrix, according to the allocation direction and consumption source of products and services which are planned by the department (product) in this period, the data of the specific objects can be linked and merged according to their corresponding name, specification, model, quantity, sum and so on. For other projects, according to name, specification, model, quantity, sum and other data corresponding to specific objects, it is convenient to link and merge the added value in the major column as well as the use-at-the-end and other use in the corresponding column. Then the

total output can be calculated according to the balance established in rows, and the total input can be calculated by the balance established in columns. The basic data of such is the basic data of the macro value based input-output planning model; 3) the database files based on the fundamental data required for the mathematical model which is combined with the linear programming method by its basic data, the optimal structure scheme of product value can be laid out in order to realize the real-time analysis of the optimal macro value based input-output planning model. It can be seen that according to the scientific idea, principle and method of real-time tabulation of input-output model, as long as steps and calculation methods of manual tabulation are clarified, it is not difficult to use ANI technology to build the optimal macro value based input-output planning model.

It must be pointed out that the optimal macro value based input-output planning model is built on the basis of the optimal micro value based input-output planning model, and the optimal micro value based input-output planning model is built on the basis of the optimal micro material based input-output planning model, therefore, the operation of national economy loses its balance because the imbalance occurs between material products. At this time, by adjusting the output of relevant micro models, the optimal macro value based input-output planning model which is built on the basis of the new tabulation of the optimal micro material based input-output planning model and value based input-output planning model from the new level can have instructive effect. Otherwise, the ability of AI technology must be equal to that of human's and becomes AGI or even ASI in order to adjust national economy in time.

The scientific basis of AI indicates that the process of machine learning is a process of continuous training, and the process of model optimisation is a process of continuous adjustment which means more training data bringing models which are more precise. Human learning is not only about continuous learning, but also a jump-type study which is often told insight learning. However, it has not happened for machine learning. It is important to point out that in the basic structure of the optimal macro input-output planning model, not only are each field and its objects included vertically, but also the relationship between each field and its objects in horizontal line and vertical line is objectively shown, that is inter-interactive and interconnected. Because of interaction and interconnection of such between vertical line and horizontal line do not exist in any other public platform and common technology platform, on the basis of macro input-output model, technology file database which is established on its basic structure and the combination of technology and economy such as economy significance and substance not only can meet requirements of public platform, but also requirements of common technology platform; not only can technology file database of each industry be established, but also the establishment of critical technology file database can be accordingly brought along; not only can trend of standard system shaping be gradually evolved, but basic needs of protocols such as data exchange and communication can be met as well.

3. Combinations and Connections between Internal Information of the Optimal Input-Output Planning Model and AI

Combinations and connections between internal information of the optimal input-output planning model and AI are mainly about how to solve tabulation problem. Because the basic data of the model itself has characteristics of natural and social of management attributes, it can be regarded as an interface in which natural science and social science interact, interconnect and interpenetrate. In this interface, the data information of the model can be divided into internal information and external information. It must be pointed out that the concept of internal information is introduced to facilitate tabulation, and the concept of external information is introduced for tables using. In this paper, for both tabulations and tables using, MPS accounting system and its corresponding model structure are used for budget (planning), policy analysis and accounting of national economy. In addition, no matter for joint ventures or foreign enterprises, in the production, the tabulation of the optimal micro input-output planning model and micro input-output statistical model is not difficult. While the problem of merging the basic data of material volume and value volume one by one can be dealt with laws and regulations of nations and the scope of accounting contents. According to the scientific basis of AI, the internal information of the model is related to the starting point of in-depth development which is fundamental data; and file database is related to the starting point of future development. Therefore, the file database based on the fundamental data can be regarded as interfaces between internal information and AI technology. With these internal information interfaces, AI technology can be used to simulate artificial processing of fundamental data and provide accurate and reliable basic data for creating the model. In addition, in terms of the optimal material based input-output model, they do not only clarify economy significance and make actual work meet the needs, they become foundation of the optimal material based input-output model formation for worldwide use. Therefore, for realising combinations and connections between internal information of the optimal input-output planning model and AI, according to the characteristics and requirements of 3D printing of current Industry 3.0 or customised production of future Industry 4.0, the introduction of tabulation methods of the optimal micro material based input-output planning model and material based micro input-output statistical model is the important part of this paper. As long as tabulation methods of these two models are clear, problems of other input-output tabulations will be easily solved. It is elaborated as following.

3.1. Combinations and Connections between Internal Information of the Optimal Micro Material Based Input-Output Planning Model and AI

Although scientific thought, theory and method of “real-time tabulation of in-

put-output model” have avoided a rigid way of thinking of traditional tabulation that completely changed order of input-output statistics table first and input-output planning table after according to Leontief. As a main problem, the realisation of real-time analysis of the input-output planning table and timely analysis of input-output statistical table is thoroughly solved. However, in terms of the realisation of the real-time analysis of the optimal micro material based input-output planning model and the timely analysis of the micro material based input-output statistical model with the fundamental data, how to process the data is still the most difficult and complicated problem and it takes a heavy workload. In addition, in terms of the realisation of the real-time analysis of the optimal micro material based input-output planning model with the basic data. Because technology file database that produce the fundamental data which is related to the basic data can be regarded as interfaces between the optimal micro material based input-output planning model and AI technology. With these internal information interfaces, AI technology can be used to simulate the artificial processing of the fundamental data and obtain the basic data to realise the real-time analysis of the optimal material based micro input-output planning model.

To this point, to take the procedure of the product structure or BOM processing for the fundamental data interface which is based on the basic structure of the optimal micro input-output planning model as the example, basic methods of AI tabulation are summarised as following:

Method 1: The combination of manual tabulation and AI technology

Combinations and connections between the optimal micro material based input-output planning model and AI are realised through technology file database which is related to the fundamental data. Thus, in procedure of the fundamental data processing by using means of AI technology to simulate manual tabulation, it is necessary to accurately (referring to variety and quantity of products, the same as below) and precisely (referring to the volume of variety and quantity of products) generate the basic data with means of a unique algorithm (program) for realising the real-time analysis of the optimal micro material based input-output planning model. In terms of realising the combination between manual tabulation and AI technology, the method can be described as following: for any new product, once it is shaped and put into production, according to the information provided by the design of final product and the classification of enterprise accounting, as long as the procedure of product structure or BOM is taken as the fundamental data which is built on the basic structure of the optimal material based micro input-output planning model, technology file database of tabulation includes: variety and quantity of final product and its corresponding volume; technical data of industry standard and database files of product standard technical parameter; variety and quantity of intermediate product and its corresponding volume; fundamental data of consumption quota and man-hour of intermediate products in unit; in each procedure of the consumption (input) of purchased products (such as components, raw materials, materials, auxiliary materials, power

and so on), the technical data of names, specifications, models, volume and suppliers of these purchased products; the output of the previous procedure is the input of the current procedure and the output of the current procedure is the input of the succeeding one, and whether the shape and the structure have changed and external conditions as such. Therefore, method of combining manual tabulation and AI technology stated above is based on content, technical data and external conditions of technology file database which is related to tabulation, method of relevant fundamental data processing, unique algorithms (program) and principles of tabulation. For each product, with database files of relevant products, the variety and quantity of input and output and the corresponding volume of each process can be accurately calculated as well as the ratio of input and output. With the ratio of each process, the basic data for the realisation of the real-time analysis of the optimal micro material based input-output planning model can be accurately calculated.

It is important to point out that the input-output model cannot solve the problem that is related to optimisation, but by being combined with quantitative management technology (Operational Research), the optimal input-input-output planning model can be always built up. The optimal planning model that is used by enterprises will bring the best economic benefits to enterprises. It is not only an important part of the scientific foundation of AI, but also the important content of technology file database which is related to the fundamental data processing.

Method 2: The combination of CAD and AI technology

By using CAD which can be based on product structure, material table, technology requirements and other basic information provided from drawings. In the production, the basic function of relevant software can be increased according to basic requirements of realising real-time analysis of the optimal micro material based input-output planning model. For example, with industry standard technology file and the relevant product standard technical parameter database file, it is possible to accurately calculate variety and quantity of products and the corresponding volume of both input and output of each process. After the volume of input and output of each process is known, according to the quota of consumption and working hour in unit, the consumption (input) of varieties and the quantities of those purchased products and the corresponding volume of each process can also be accurately calculated. That is the basic data for the realisation of the real-time analysis of the optimal micro material based input-output planning model.

Method 3: The combination of CAM and AI technology

CAM system generally has two basic functions: By using CAM computer system to test and verify products during manufacturing process in order to increase basic functions of the relevant software according to basic requirements of real-time analysis of the optimal micro material based input-output planning model. For example, based on the data information provided at the time of testing and inspection of products, adoption of industry standard technical infor-

mation and relevant technical parameter database files of product standard, the variety and quantity of input and its corresponding volume as well as the variety and quantity of output and its corresponding volume quantity of each process can be accurately calculated. After the amount of input and output in each process becomes certain, according to the quota of consumption and working hour in unit, the consumption of varieties and the quantities of those purchased products and the corresponding volume of each process can also be accurately calculated. That is the basic data for the realisation of the real-time analysis of the optimal micro material based input-output planning model.

Method 4: The combination of 3D printing and AI technology

By using 3D printing for conceptual designing and printing, in the process of product structure or BOM, the basic function of relevant software can be increased according to basic requirements of realising real-time analysis of the optimal micro material based input-output planning model. For example, according to the correspondence between procedure of conceptual 3D designing and printing and the procedure of product structure or BOM processing, based on the data information provided from the design of physical products, with the database file of industry standard and the relevant product standard technical parameter database file, the data information of the whole procedure from raw material to final product can be calculated. Thus, the variety and quantity of input and output and the corresponding volume of intermediate products of each process which corresponds to conceptual products can be accurately calculated, so is the technical data such as names, specifications and models of input and output of those intermediate products. After the volume of input and output of each process becomes certain, according to the quota of consumption and working hour in unit, the consumption of varieties and the quantities of those purchased products and the corresponding volume of each process can also be accurately calculated. That is the basic data for the realisation of real-time analysis of the optimal micro material based input-output planning model. It must be noted that 3D printing can also make solid components based on method of layer-by-layer accumulation of material from AutoCAD data. The method is that the material is added by point-by-point accumulation to form a surface and surface-by-surface accumulation to form a body. This method provides a new opportunity for manufacturing development from the traditional structure which is “macro” to the integration of macro-micro structure.

Method 5: The combination of future factory and AI technology

Although 3D printing technology is “brilliant” in theory, however, it is difficult for it to replace mass production and become a primary production. Therefore, the study of the combination of future factory and AI has its great contemporary relevance. According to the official data provided by Siemens (German corporation), the so-called future factory is actually a digitalised factory. The characteristics of the digitalised factory can be summarised as following: the communication between products and production equipment; all processes have been optimised and implemented by IT control; during whole production, man con-

trolled work is little, for example, at the beginning of production, printed circuit boards are installed on production line, all work is automatically controlled by machines thereafter; all devices are connected to Internet which can exchange data in real time, important information can be observed through mobile terminals; scanners which are installed in the whole factory record all processes in real time, the details such as welding temperature, patch data and test results; distribution of raw materials is also automated and information based, when certain material is required, man controlled work is limited to, for example, to scan samples of materials and make bar code information transmitted to automated warehouses. Instructions issued by ERP system will let automated logistics system finish the rest of work or sometime to make changes for improvements. Therefore, the combination of future factories and AI technology is in fact, based on automation, information and intelligence, in the process of product structure or BOM, basic functions of relevant software can be increased according to basic requirements of realising the real-time analysis of the optimal micro material based input-output planning model. Technology file database of relevant tabulations can be established with the methods mentioned above. By using the algorithm (program), the basic data for realising the model can be accurately calculated.

Method 6: With the development of technology of control, computer, communication, network and other technologies, information exchange application rapidly covers from the area of all equipment to the area of supervision and management. In despite of the availability of the methods stated above, how to make those methods allow developing enterprises or even developing countries to benefit from the model management? To save time for tabulation as well as resources of labor, material and finance becomes the key to problems. For example, 1) for factories based on a large-scale manual production line (non-automated production line), regardless of the production period or process complexity, according to rules and regulations [7] which are matched with input-output model management, not only can the variety and quantity of the first product or the first batch of products of input and output and the corresponding volume along with the variety and quantity of those purchased products and the corresponding volume which are consumed (input) in each process of intermediate products be accurately calculated in advance, but the variety and quantity and the corresponding volume of those purchased products in each process of intermediate products can also be immediately obtained later. According to internal connection and distinction between statistical models and the optimal planning model of micro material based input-output [6], it shows that: by combining the variety and quantity of input and output and the corresponding volume of each process before to which of purchased products consumed (input) in each process of intermediate products after, the first product or the first batch of products can be created in the micro material based input-output statistical model. It can be seen that if the basic data of the first product or the first batch of products of the statistical models can be used as the basic data of the second product or the second

batch of products of the optimal micro material based input-output planning model as the guide of the enterprise operation and so on. In this case, not only can the basic data of the optimal micro material based input-output planning model be closer to actual data, but by doing half of the work, corresponding results can be doubled as well. 2) For the factories based on the manual production (non-production line), regardless of production period or the process complexity. According to rules and regulations which are matched with the input-output model management, any plan of production and operation that is prepared by using the idea of the optimal micro material based input-output planning model, same results can be obtained when the corresponding column of the basic structure of the optimal micro material based input-output planning model is seen as a special case in which $N = 1$. For example, once the variety and quantity of a small batch of products are determined, the variety and quantity the corresponding volume of intermediate products of each working procedure can be accurately calculated. Therefore, according to this basic data as well as the quota of consumption and working hour, the consumption (input) of varieties and quantity and the corresponding volume of those purchased products can also be accurately calculated. And this volume becomes the basic data of the basic structure of the optimal micro material based input-output model in which the corresponding column is regarded as $N = 1$. 3) For those processing enterprises, product drawings provide production information and it is the only basis for preparing a series of follow-up work such as production plan and financial plan, regardless of the production period or process complexity, according to rules and regulations which are matched with input-output model management. Any plan that is prepared by using the idea of the optimal micro material based input-output planning model, same results can be also obtained when the corresponding column of the basic structure of the model is seen as the special case in which $N = 1$. For example, based on the basic information provided on drawings, since the variety and quantity and the corresponding volume of intermediate products per working procedure can be accurately calculated. Therefore, according to this basic data as well as the quota of consumption and working hour, the consumption (input) of the variety and quantity and the corresponding volume of those purchased products can also be accurately calculated. And this volume becomes the basic data of the basic structure of the model in which the corresponding column is regarded as $N = 1$. 4) For enterprises that are able to meet requirements of 3D printing and customised production, it is suggested to comprehensively consider the methods above.

Special note: for industries of the primary industry, the production period is normally long and the changes during the process also take time; for those of the secondary industry, the production period and the changes are differed from one another; for the service industry of the tertiary, the inherent differences exist between service industry and service sectors, but it can be seen that when budget (plan), policy analysis and accounting are applied to these industries, apart from application of the methods stated above, the corresponding column of basic

structure of the optimal micro material based input-output planning model can be regarded as a special case in which $N = 1$. The processing method is the same as that of processing enterprises. The purpose of doing this is not only for meeting requirements of classification accounting, but also by applying basic structure, theory, economic content and significance, internal relation and management requirement of input-output model to regulate design and development of the micro economic management information system. At the same time of realising the real-time analysis of finance management and supply-demand chain management, the standardised data can be provided according to the basic requirements of industries as well as the basic requirements of establishing the optimal macro input-output planning model for worldwide use.

It is important to point out that for all industries, no matter which type of tabulation method is used, because product variety, technology progress, management and factors of such are constantly changing, as long as the relevant fundamental data can be modified, the basic data of the optimal micro material based input-output planning model can be changed accordingly.

3.2. Combinations and Connections between Internal Information of the Optimal Micro Value Based Input-Output Planning Model and AI

The basic data required for the optimal micro value based input-output planning model is based on the basic data of the optimal micro material based input-output planning model. The establishment of product cost is an initial investment which is transferred and accumulated during the process; and establishment of product value is initial investment and profit which are transferred and accumulated during the process. Therefore, not only can the price of products be calculated by using a direct or full consumption coefficient for parallel carry-over (the carry-over targets are the initial input and profit), but the composition of product price can be received as well. The product price is factory price of self-made products. In this price system, no matter semi-finished products or finished products, profit is generated. Thus, according to classification of enterprise accounting, technology file database of the tabulation includes: based on the basic data of the optimal material based input-output planning model, direct consumption coefficient and complete consumption coefficient in the matrix table of internal flow are calculated; based on the method of inventory management (first in-first out, last in-first out, moving weighted average and individual valuation, etc.), material volume in the flow matrix of the purchased products which are consumed by each production sector in the process of self-made products can be converted into value volume; based on the data of fixed assets, low-value easily-consumed goods, salary of management personnel and workers, the depreciation and repair costs of fixed assets, expenses of low-value easily-consumed goods and salary of management personnel and workers can be calculated separately; based on fixed assets, low-value easily-consumed goods and salary of managers which are allocated by management department, fixed assets

depreciation and repair cost, low-value easily-consumed goods cost and salary of management personnel can be calculated separately; based on cost of depreciation and repair of common parts of fixed assets, expense prepaid, accrued expense, other expenses and profits; based on price and quantity of relevant products and the balance between the vertical line and the horizontal line, material volume in the flow matrix of the internal enterprise can be converted into value volume; based on value volume of intermediate products of each production sector and the initial input and the profit, the total input of value volume in each production sector can be calculated; based on value volume of intermediate products and final products in each production sector, the total output of value volume of each production sector can be calculated. This is the optimal value based input-output planning model based on the basic data of the optimal material based input-output planning model. With its value volume, the actual situation of the environment of enterprises and production activities at the time of schedule making is observed. This technology file database can realise the real-time analysis of the optimal micro value based input-output planning model, gradually unify classifications according to basic requirements of industries, and provide the basic data for the optimal macro value based input-output planning model. In addition, in the tabulation methods mentioned above, when the column of the basic structure of the optimal micro material based input-output planning model is regarded as a special case in which $N = 1$ for the small scale production enterprises and the processing enterprises, according to the corresponding rules and regulations of the input-output model, it is shown that because 1) the total value of variety and quantity as well as the corresponding volume of related products of each production department is known; 2) the total value of variety and quantity as well as the corresponding volume of purchased products that need to be consumed (input) in process of intermediate products of each production department is known; 3) the cost of fixed assets depreciation and repair, low-value easily-consumed goods, as well as the salary of management personnel and workers are known; 4) the expense of fixed assets depreciation and repair, low-value easily-consumed goods and management personnel allocated by the management department is known; 5) the cost of depreciation and repair, the expense to be paid and accrued, other expenses as well as profits to be shared by each production department are also known. Therefore, according to the classification of enterprise accounting, these basic data can be not only merged one by one based on the basic requirements of the industry, but provide the basic data needed for the optimal macro value based input-output planning model.

It is important to note if the allocation method of common cost, such as expense to be prepaid, accrued expense, other expenses and common cost as supplementary production cost and manufacturing cost is scientific and satisfactory which will directly affect quality of the establishment of value based input-output planning model and value based input-output statistical model. In this regard, the matrix which is formed based on the cost of purchased products such as fuel, power and auxiliary materials, depreciation cost of fixed assets and

labor compensation cost often becomes a rectangular matrix. Therefore, the first step is to convert the rectangular matrix into a square one with elementary transformation. Then the weight coefficient which is based on the eigenvalue of the square matrix makes the common cost shared, and the scientific basis of distribution method can be better ensured. In addition, the basic data of this rectangular matrix can be directly used to calculate the cost of each column respectively, then the cost of each column will be added together to obtain the total amount, and the total amount of each column will be calculated as a percentage of the total amount. By taking this percentage as the weight coefficient to make the common cost shared is also a feasible method. To sum up, the scientific thought, theory and method of real-time tabulation of input-output model have been improved by overcoming disadvantages which are caused psychologically.

3.3. Combinations and Connections between Internal Information of the Micro Material Based Input-Output Statistical Model and AI

According to connections and distinctions of the basic data between the optimal micro material based input-output planning model and the micro material based input-output statistical model: apart from the basic data remains same in the first quadrant and the second quadrant, the basic data in the third quadrant is distinguished. This is because the former is a planned value and the latter is an actual value.

With continuous development and innovation of computer technology, wireless technology, field bus technology, industrial Ethernet technology, IT technology, sensor technology, robot technology and safety technology, after several important stages such as single machine automation, workshop automation, total automation of centralised control of whole plant (an integration of product design, quality monitoring, process control, supervisory control and factory management, etc.), the factory automation is now developing towards AI. Therefore, in terms of the basic data of the third quadrant of the statistical model, it does not matter the factory automation is on which phase, AI technology can make use of intelligent means of labour in every link of supply and demand chain, so that the basic data can be provided according to product structure or BOM processing based on the realisation of timely analysis of the statistical model. For example, for laying up: labor objects can be counted only by being labeled according to basic requirements of the tabulation which includes the basic information of source, name, quantity, volume, price and so on; in terms of intelligent means of labour, basic functions of software are added according to basic requirements of tabulation which should contain the basic information of source, name, quantity, volume, price and expiration to be effective. For delivery from storage: for the labor objects, name, application, quantity, price and other basic information need to be marked separately to become effective; the same applied to intelligent means of labour. For enterprises with zero inventory, even though the process of entering and leaving warehouse is simplified, but it is very important to attach

the basic information of related products in the process of purchase and consumption, accounts keeping and payment making. The purpose is not only to take the basic information for relevant use, but also keep the very clear description for each piece of original item. Not only can the description be checked according to actual needs of management, it also can meet basic requirements of data utilisation of Big Data, new Cloud Computing technologies, Internet of Things or new internet industry and AI technology, and this is the whole point.

It must be noted that regardless of manufacturing or other industries of the primary industry, industries of the secondary industry as well as service industries and service organisations of the tertiary industry, according to the basic information recorded at the time of entering and leaving warehouse, for production process or business management, the technology file database of tabulation for realising the combination of internal information of the micro material based input-output statistical model and AI can be summarised as following: for the input (consumption) labor objects, electronic labels should be affixed to indicate the identity, characteristics and attribute in accordance with basic requirements of tabulation; for intelligent means of labour, basic functions of software can be added according to basic requirements of tabulation to show identity, characteristics and attribute. Obviously, this kind of technology file database is basic work of realisation of AI. The so-called intelligence, for labor objects, it is able to reflect name, source, specification, model, quantity, price and other basic information of labor objects; for means of labour, according to basic requirements of tabulation, it can be used to record how long each process takes, what resources are consumed, and the information such as number and price of processed products as well as the same information of means of labor. Evidently, this basic information creates interfaces between internal information and AI. The interfaces are not only the scientific basis of AI, but also the database which forms the basic data in the third quadrant of the micro material based input-output statistical model; the basic data can be gradually unified one by one and provide the basic data for the macro material based input-output statistical model.

3.4. Combinations and Connections between Internal Information of the Micro Value Based Input-Output Statistical Model and AI

Because the basic data needed for the micro value based input-output statistical model is based on the basic data of the corresponding micro material based input-output statistical model. Moreover, format and name of the third quadrant in the micro value based input-output statistical model are identical to those of the optimal micro value based input-output planning model. The only difference is that while tabulating the micro value based input-output statistical model, collection and distribution of the cost between finished products and products should be considered. In addition, in tabulation method stated above, for enterprises of small scale manual production and processing enterprises, when the column of the basic structure of the micro material based input-output statistical

model is regarded as a special case in which $N = 1$, according to rules and regulations of the input-output model, it shows: as long as the total value of final product and its variety and quantity and the corresponding volume are certain, so are the total value of purchased products as the consumption (input) of intermediate products, its variety and quantity as well as the corresponding volume, fixed assets depreciation, repair expense, low value easily-consumed goods expense and salary of management personnel and worker, cost of depreciation and repair, prepaid expense, accrued expense, other expenses and profits to be shared by each production sector. According to classification of enterprise accounting, the basic data mentioned above can be gradually unified one by one according to basic requirements of industries and provide the basic data for the optimal macro value based input-output planning model.

It must be pointed out that because of different reasons, in terms of low value easily-consumed goods of each production sector and management departments as well as travel expense of management departments, between the budget (planned) and the accounting, there are generally discrepancies. In order to present truthfully an actual situation, either the data information of original technology file database which is related to tabulation needs to be modified or new technology file database needs to be created. In other words, apart from the expense of the low value easily-consumed goods and travel expense need to be modified or technology file database needs to be rebuilt, the technology file database used for the optimal micro value based input-output planning model can be called directly while tabulating the micro value based input-output statistical model. It can be seen that based on the basic data calculated from combinations and connections between internal information of the micro value based input-output statistical model and AI, the timely analysis of this statistical model can be realised. It can gradually unify different categories according to basic requirements of industries and provide the basic data needed for the macro value based input-output statistical model as well.

3.5. Combinations and Connections between Internal Information of the Optimal Macro Material Based Input-Output Planning Model and AI

According to basic structure, economic significance and content of the optimal macro material based input-output planning model: it is a product distribution flow table in the row of the first quadrant which is the quantity of products that are provided for themselves and other products as consumption (input). In the column, it is a production consumption (input) composition table which is the quantity of each product as consumption of itself and other listed products. In the row of the second quadrant, it is the table of final product distribution and use which reflects not only the distribution and use of all listed products in production cycle for final consumption, accumulation and export, but the proportion of listed products for consumption, accumulation and export. In the column, it is a final product composition table which reflects that each final de-

mand is composed by what listed products and an actual physical form of national income is social net products.

The real-time analysis of the optimal macro material based input-output planning model is based on the realisation of the real-time analysis of the optimal micro material based input-output planning model (including industries of the primary industry and the secondary industry and service industries and service organisations of the tertiary industry) as well as an equation [1] that is formed as a chessboard, in which *intermediate products + final products - import = total products*. Therefore, based on combinations and connections between internal information of the model and AI, for enterprises based on independent accounting, regardless of a single type or multiple types of products, according to the classification of enterprise accounting and basic requirements of industries, the basic data can be gradually unified with principles of bottom-up, top-down as well as a combination between macro and micro and be classified according to the basic structure of the optimal macro material based input-output planning model and specific requirements of tabulation (pure requirements of departments) to provide accurate and reliable basic data. Thus, it can be seen that technology file database of combinations and connections between internal information of the model and AI includes: a balance table of production and distribution of various products in the optimal micro material based input-output planning model; consumption of components, raw materials, auxiliary materials, power and other purchased products in each process during the production, purchased products consumption in service industries and service organisations as well as the data of import and export products and the corresponding material volume in international trades. They are the basic data needed to realise the real-time analysis of the optimal macro material based input-output planning model.

3.6. Combinations and Connections between Internal Information of the Optimal Macro Value Based Input-Output Planning Model and AI

Although the material based input-output model can accurately reflect physical connections between main products. However, due to measurement units, it cannot be summed up in the column, the forming process of product value therefore cannot be reflected. Because the value based input-output model takes currency as its measurement unit, its basic function has been further expanded comparing with the material based input-output model. Therefore, economic significance of the basic structure of the value based input-output model is similar to that of the material based input-output model. However, some differentiations are also there. The real-time analysis of the optimal macro value based input-output planning model is based on the realisation of the optimal micro value based input-output planning model (including industries of the primary and the secondary industry, and service industries and service organisations of the tertiary industry) as well as the equations [1], in which *net export = export - im-*

port, intermediate output + final output + other output = total output, intermediate input + added value = total input. Therefore, according to combinations and connections between internal information of the model and AI, the classification of enterprise accounting and basic requirements of industries, the basic data can be gradually unified with principles of bottom-up, top-down as well as the combination of macro and micro, it can also be classified according to the basic structure of the optimal macro value based input-output planning model and specific requirements of the tabulation (pure requirements of departments) to provide accurate and reliable basic data.

Thus, it can be seen that technology file database of combinations and connections between internal information of the model and AI include: the balance table of production and distribution of various products in the optimal micro value based input-output planning model; the value of purchased products in the third quadrant; depreciation and repair cost of fixed assets of production and management departments, low value easily-consumed goods cost of production and management departments, and salary of management personnel of production and management departments; salary of workers; depreciation and repair cost of fixed assets to be shared by each production department; prepaid expense, accrued expense, tax, other expenses and profits. In addition, they also include cost of depreciation and repair of fixed assets, low-value easily-consumed goods as well as salary of management personnel of overall management; the cost of depreciation and repair of fixed assets that should be apportioned among overall common parts; overall prepaid expense, accrued expense and other overall expenses as well as the data of import and export products and the corresponding value volume in international trades, etc. These expenses and profits are the basic data needed to realise the real-time analysis of the optimal macro value based input-output planning model.

3.7. Combinations and Connections between Internal Information of the Macro Material Based Input-Output Statistical Model and AI

The realisation of timely analysis of the macro material based input-output statistical model is based on timely analysis of the micro material based input-output statistical models (including industries of the primary industry and the secondary industry as well as service industries and service organisations of the tertiary industry) as well as the equation [1], in which *total products = intermediate products + final products – import*. Therefore, according to the basic method of combinations and connections between internal information of the micro material based input-output statistical model and AI, for enterprises based on independent accounting, regardless of a single type or multiple types of products, according to the classification of enterprise accounting and basic requirements of industries, the basic data can be gradually unified with principles of bottom-up, top-down as well as the combination of macro and micro, it can also be classified according to the basic structure of the macro material based

input-output statistical model and specific requirements of the tabulation (pure requirements of departments) to provide accurate and reliable basic data. Thus, it can be seen combinations and connections between internal information of the macro material based input-output statistical model and AI is similar to those between the internal information of the optimal macro material based input-output planning model and AI. The technology file database includes: balance tables of production and distribution of various products of the micro material based input-output statistical model; consumption of components, raw materials, auxiliary materials, power and other purchased products of each process, purchased products consumption of service industries and service organisations as well as the data of import and export products and the corresponding material volume in international trades. They are the basic data needed to realise timely analysis of the macro material based input-output statistical model.

3.8. Combinations and Connections between Internal Information of the Macro Value Based Input-Output Statistical Model and AI

Because timely analysis of the macro value based input-output statistical model is on the basis of the realisation of timely analysis of the micro value based input-output statistical models (including industries of the primary industry and the secondary industry as well as service industries and organisations of the tertiary industry) as well as the equations [1], in which $net\ export = export + import$, $total\ output = intermediate\ output + final\ output + other\ output$, $total\ input = intermediate\ input + added\ value$. Therefore, according to the basic method of combinations and connections between internal information of the macro value based input-output statistical model and AI as well as the classification of enterprise accounting, the basic data can be gradually unified with principles of bottom-up, top-down as well as the combination of macro and micro, it can also be classified according to the basic structure of the macro value based input-output statistical model and specific requirements of the tabulation (pure requirements of departments) to provide accurate and reliable basic data. Thus, it can be seen that combinations and connections between internal information of the macro value based input-output statistical model and AI is similar to those between internal information of the optimal macro value based input-output planning model and AI. The technology file database includes: balance tables of production and distribution of various products in the micro value based input-output statistical model; value of purchased products in the third quadrant; depreciation and repair cost of fixed assets of production and management departments; low value easily-consumed goods cost of production and management departments; salary of the management personnel of production and management departments, salary of workers; the cost of depreciation and repair of fixed assets to be shared by each production department; prepaid expense, accrued expense, tax, other expenses and profits. In addition, they also include

the expense of depreciation and repair of fixed assets, cost of low-value easily-consumed goods and salary of management personnel of the overall management; the cost of depreciation and repair of fixed assets that should be apportioned among overall common parts; overall prepaid expense, accrued expense and other expenses as well as the data of import and export products and the corresponding material volume in international trades. These expenses and profits are the basic data needed to realise timely analysis of the macro value based input-output statistical model.

Combinations and connections between internal information of the optimal input-output planning model and AI show that by realising combinations between internal information of the optimal micro material based input-output planning model and AI as well as combinations between internal information of the micro input-output statistical model and AI, combinations between internal information of other input-output planning models and AI as well as combinations between internal information of other input-output statistical models and AI can be accordingly realised. In addition, for the tabulation: on the one hand, based on the realisation of automation, information and intelligence of means of labour, as long as basic functions of corresponding software are added according to basic requirements of realising real-time analysis of the optimal micro material based input-output planning model and timely analysis of the micro material based input-output statistical model, the purpose of the tabulation can be also realised. On the other hand, for those enterprises that intend to realise automation, information and intelligence, they also put forward feasible plans of the tabulation to meet their requirements of development. In particular, to combine computer-aided design, drawing and manufacturing software and 3D printers altogether with AI, a principle which is similar to simulation technology can be taken as a basic method of data collecting and processing. It is the key technology to the tabulation of the optimal micro material based input-output planning model. It must be pointed out that according to the tabulation stated above, for those products with standard parts, based on technology file database of the product standard technical parameter, the volume of such products can be directly received; for those products with non-standard parts, the dimension of such products can be directly measured by scanning, and the volume can be calculated by specific gravity. The volume of the non-standard part products can be measured directly by electronic scale as well. Therefore, the basic data can be received.

4. Combinations and Connections between External Information of the Optimal Input-Output Planning Model and AI

How to use the tables is the solution of realising combinations and connections between external information of the optimal input-output planning model and AI. According to the scientific basis of AI: external information of the optimal

input-output planning model is based on real-time analysis of the optimal input-output planning model, and on the basis of the basic data of the model, technology file database becomes interfaces for combinations and connections between external information of the model and AI. It must be pointed out that MPS and SNA have their respective advantages, calibers of MPS can be adjusted to match those of SAN through conversion. It can be seen that after conversion, database files which are drawn up separately on the basis of the basic data of the model corresponding to SNA accounting system are also interfaces between external information of the model and AI. For using the tables, no matter which accounting system will be adopted, with these interfaces: on the one hand, they can be called directly for traditional or commonly use of research, analysis, forecasting (planning) of economy, policy research, economic accounting, etc. to obtain results which are basically consistent with actual situations. On the other hand, Big Data, new Cloud Computing technologies can be used to excavate the massive data information produced by means of labor of Internet of Things or new internet industry in order to track, supervise and analyse the actual operation of national economy. The summary is given as following.

4.1. Combinations and Connections between External Information of the Optimal Micro Material Based Input-Output Planning Model and AI

For the optimal micro material based input-output planning model (including industries of the primary industry and the secondary industry as well as service industries and organisations of the tertiary industry): because the basic structure of the model can objectively reflect the whole process of enterprises engaged in production and business activities in accordance with technology processes, it can also reflect balance of supply, production and sale of various products as well as quantity and direction of various products among various production departments; the basic data of the optimal micro material based input-output planning model is a guide for future work such as plans of production, purchase, finance, progress and so on. Therefore, no matter what stage the automation is in, combinations and connections between external information of the optimal micro material based input-output planning model and AI is aimed at the basic data of the model. On the basis of realising the intellectualisation of means of labor, each procedure of product structure (parts) processing or BOM processing can produce not only a large amount of real-time data of the variety and quantity of input and output and their corresponding volume, it can also produce a large amount of real-time data information of the variety and quantity of purchased products which need to be consumed (input) and the corresponding volume. This shows that by using Big data, new Cloud Computing technologies, Internet of Things or new internet industry and AI: on the one hand, based on basic requirements of the optimal micro material based input-output planning model, this vast amount of data can be automatically exca-

vated in order to track, monitor, and analyse real-time situation from internal management such as purchase, inventory, plan, production and sale to logistics, collaborative processing and distribution service as well as each link of external management such as commercial circulation which makes production and business activities generate a tight link from supply to demand and the flow of resources which is related to supply and demand chain in order to ensure consumption of material, human resources, finance, equipment and so on in the best state; on the other hand, it can precisely lock resources needed in production to ensure that all aspects of enterprises engaged in production and business activities can proceed smoothly in accordance with the law of coordination developments as well.

4.2. Combinations and Connections between External Information of the Optimal Micro Value Based Input-Output Planning Model and AI

The optimal micro value based input-output planning model (including industries of the primary industry and the secondary industry as well as service industries and organisations of the tertiary industry) is created on the basis of real-time analysis of the optimal micro material based input-output planning model. Therefore, combinations and connections between external information of the optimal micro value based input-output planning model and AI are based on the basic data of the model. Through the volume of value to track, supervise and analyse enterprises which are engaged in production and business activities. For example, by using Big data, new Cloud Computing technologies, Internet of Things or new industry of internet and AI: on the one hand, the basic data of the optimal micro material based input-output planning model can be converted into the corresponding value volume to track, monitor and analyse in order to ensure tight connections between the optimal micro material based input-output planning model and the optimal micro value based input-output planning model. On the other hand, it can also start with supplier and warehouse, then follow the links of process (from raw materials to semi-finished products, finished products and products for sale) till a whole business procedure is complete. According to basic requirements of the optimal micro value based input-output planning model, through the data information that is generated from means of labor of each working procedure and each link to track, supervise and analyse whether production and business activities are in accordance with the law of coordination development. This is the key technology for avoiding waste of resources and fraud. At the same time, the cost of depreciation and repair of fixed assets and low-value easily-consumed goods; salary; prepaid expense, accrued expense, other expense and profit, etc. can be better track, supervise and analyse. According to the classification of enterprise accounting, tracking, supervising and analysing respectively is a scientific method to strengthen enterprise management, control cost and improve economic efficiency.

4.3. Combinations and Connections between External Information of the Micro Material Based Input-Output Statistical Model and AI

The micro material based input-output statistical model (including the industries of the primary industry and the secondary industry as well as service industries and service organisations of the tertiary industry) is created on the basis of realising the real-time analysis of the optimal micro material based input-output planning model. The only difference between the two is that in the third quadrant, the basic data of purchased products is different. The basic data of the former is an actual value, and that of the latter is a planned value. It can be seen that no matter what stage of automation is in, combinations and connections between external information of the micro material based input-output statistical model and AI are based on the basic data of the third quadrant of the optimal micro material based input-output planning model. By comparing and analysing the basic data of the third quadrant from the both models one by one, the method for solving the problems which exist in production and management can be found. Since the purpose of establishing the micro material based input-output statistical model is no longer to provide data to support the establishment of the optimal micro material based input-output planning model, it becomes a method of comprehensive accounting (making an inventory, the following is the same) and audit. For example, based on the basic data in the optimal micro material based input-output planning model to check if the balance is there between the data and the actual situation such as consumption, inventory, accounting and purchase, and this is the scientific method to control the quantity. In addition, from the process of generating the basic data needed for the third quadrant and sources of the data information, it is shown that by using Big data, new Cloud Computing technologies, Internet of Things or new industry of internet and AI: on the one hand, the consumption (input) of the variety and quantity of purchased products and the corresponding volume can be comprehensively calculated and audited. On the other hand, the internal management can be expanded from purchase, inventory, plan, production and sale to logistics supply, collaborative processing, distribution service as well as commercial circulation and other external management. In this case, production and business activities are formed a tight link from supply to demand, and comprehensive accounting and auditing can be conducted to this supply and demand chain. This scientific method is for improving accounting and audit.

4.4. Combinations and Connections between External Information of the Micro Value Based Input-Output Statistical Model and AI

The micro value based input-output statistical model (including the industries of the primary industry and the secondary industry and service industries and organisations of the tertiary industry) is created on the basis of realising the timely analysis of the micro material based input-output statistical model. Therefore,

combinations and connections between external information of the model and AI are based on the basic data of the model itself, and by applying the volume of value to conduct comprehensive accounting and auditing for production and business. The purpose of establishing micro value based input-output statistical model is not about providing data for accounting anymore, it is about a comprehensive accounting and auditing. Therefore, the content of accounting and auditing of the micro value based input-output statistical model and that of the micro material based input-output statistical model is basically the same. The method of using Big Data, new Cloud Computing technologies, Internet of Things or new internet industry, is not again given here.

4.5. Combinations and Connections between External Information of the Optimal Macro Material Based Input-Output Planning Model and AI

The optimal macro material based input-output planning model is created after realising the real-time analysis of the optimal micro material based input-output planning model (including industries of the primary industry and the secondary industry and service industries and service organisations of the tertiary industry). Combinations and connections between external information of the model and AI is based on the basic data of the model itself to track, supervise and analyse all aspects involved in the macro-economic operation through the volume of material. For example, by taking advantage of Big data, new Cloud Computing technologies, Internet of Things or new industry of internet and AI: on the one hand, according to the basic structure and economic significance and content of the model and principles such as bottom-up, top-down and the combination of micro and macro, as results, all types of the optimal micro material based input-output planning models must be unified one by one according to a transitive relation between them and departments (products) of the optimal macro material based input-output planning model. On the basis of the basic of the optimal micro material based input-output planning model to track, supervise and analyse microservice industries, by applying the basic data of the optimal macro value based input-output planning model to track, supervise and analyse whether the macro-economy operation is in accordance with the objective law of coordinated development or measurements will be taken. On the other hand, according to rules and regulations associated with the input-output model management, the classification of enterprise accounting and basic requirements of macro-economy management as well as the actual situation of macro-economy operation, the implementation of rules and regulations in different levels can also be tracked, supervised and analysed to ensure the smooth operation of macro national economy.

4.6. Combinations and Connections between External Information of the Optimal Macro Value Based Input-Output Planning Model and AI

The optimal macro value based input-output planning model is created on the

basis of realising the real-time of the optimal micro value based input-output planning model (including industries of the primary industry and the secondary industry and service industries and organisations of the tertiary industry). Therefore, combinations and connections between external information of the model and AI is based on the basic data of the model itself to track, supervise and analyse all aspects involved in the macro-economic operation through the volume of value. The basic data of the optimal macro value based input-output planning model includes not only the basic data of the optimal micro value based input-output planning model, but also expenses of macro management departments and macro management organisations. It can be seen that by using Big data, new Cloud Computing technologies, Internet of Things or new industry of internet and AI: on the one hand, according to the basic structure of the optimal macro value based input-output planning model and principles such as bottom-up, top-down and the combination of micro and macro. As results, all types of the optimal micro value based input-output planning models must be unified one by one according to the transitive relation between them and departments (products) of the optimal macro value based input-output planning model. Based on the basic data of the optimal micro value based input-output planning model to track, supervise and analyse micro-economy operation, by applying the basic data of the optimal macro value based input-output planning model to track, supervise and analyse whether the macro-economy operation is in accordance with the objective law of coordinated development or measurements will be taken. On the other hand, according to rules and regulations which are associated with the input-output model management, the classification of enterprise accounting and basic requirements of macro-economy management as well as the actual situation of macro-economy operation, the implementation of rules and regulations in different levels can also be tracked, supervised and analysed to ensure the smooth operation of macro national economy.

4.7. Combinations and Connections between External Information of the Macro Material Based Input-Output Statistical Model and AI

The macro material based input-output statistical model is created on the basis of realising the timely analysis of the micro material based input-output statistical model (including industries of the primary industry and the secondary industry and service industries organisations of the tertiary industry). Therefore, combinations and connections between external information of the model and AI are based on the basic data of the model and by applying the volume of material to conduct comprehensive accounting and auditing for the macro-economy operation. For example, by using Big Data, new Cloud Computing technologies, Internet of Things or new industry of internet and AI: on the one hand, according to the basic structure of the macro material based input-output statistical model and principles such as bottom-up, top-down and the combination of micro and macro. As results, all types of the micro material based input-output statistical

models must be unified one by one according to the transitive relation between them and departments (products) of the macro material based input-output statistical model. On the basis of the basic data of the micro material based input-output statistical model for accounting and auditing, the macro-economy operation can be respectively and comprehensively calculated and audited according to the basic data of the macro material based input-output statistical model. On the other hand, according to rules and regulations associated with the input-output model management, the classification of enterprise accounting and basic requirements of macro-economy management as well as the actual situation of national economy operation, by comparing the basic data of the macro material based input-output statistical model and that of the optimal macro material based input-output planning model one by one, implementation problems can be revealed in each management level, and solutions will be found accordingly.

4.8. Combinations and Connections between External Information of the Macro Value Based Input-Output Statistical Model and AI

The macro value based input-output statistical model is created on the basis of realising the timely analysis of the micro value based input-output statistical model (including industries of the primary industry and the secondary industry as well as service industries and organisations of the tertiary industry). Therefore, combinations and connections between external information of the model and AI are based on the basic data of the model and by applying the value volume to conduct comprehensive accounting and auditing for the macro-economy operation. For example, by using Big Data, new Cloud Computing technologies, Internet of Things or new industry of internet and AI: on the one hand, according to the basic structure of the macro value based input-output statistical model and principles such as bottom-up, top-down and the combination of micro and macro. As results, all types of the micro value based input-output statistical models must be unified one by one according to the transitive relation between them and departments (products) of the macro value based input-output statistical model. On the basis of the basic data of the micro value based input-output statistical model for accounting and auditing, the macro-economy operation can be respectively and comprehensively calculated and audited according to the basic data of the macro value based input-output statistical model or measurements will be taken. On the other hand, according to rules and regulations associated with the input-output model management, the classification of enterprise accounting and basic requirements of macro-economy management as well as the actual situation of national economy operation, by comparing the basic data of the macro value based input-output statistical model and that of the optimal macro value based input-output planning model one by one, implementation problems can be revealed in each management level, and solutions will be found accordingly.

Combinations and connections between external information of the optimal input-output planning model and AI show that the external information changes with changes of the internal information, and the external information is determined after confirmation of the internal information. Therefore, for management personnel, they can modify neither the internal information, nor the external information. For table using, since the accuracy of the basic data in the optimal input-output planning model or that of the cross-boundary economic management information system is fully guaranteed. Therefore, problems of waste of resources and fraud can be thoroughly solved.

5. System Reviews

At present, another round of industrial revolution with intelligent manufacturing as the main content is set off around the world. A deep integration of the new generation of information technology and manufacturing industry brings profound industrial changes and forms a new mode of production, new form of industry and business as well as a new economy growth point. Among them, enhancing the ability of IT management will become a focus of enterprises. At present, humans have accomplished mastering the scientific method of applying ANI. In fact, ANI is involved in our daily life. AI revolution starts from ANI through AGI and will reach ASI eventually. Humans might not see that happen but the world will be in any case completely different. Thus, it can be seen that the scientific basis of input-output real-time tabulation method and AI needs to adapt to development and change of the coming social industry structure as well as development and change of future social economy management. Everything is difficult at the beginning but with great efforts! In 1991, a pilot project was conducted in Cotton Textile Factory of Guiyang, scientific research results of the first stage were received. Although it was merely a preliminary attempt of tabulation by using AI technology and it was far from reaching the level of ANI application, however, once the first step was taken and a good start was made, that would be at least half of the success. What is the next thing to do will become much clearer and easier. In this regard, it is not difficult to draw following conclusions:

- 1) The idea of solving the problem of tabulating and table using with AI (computers) may seem like a myth. However, it is actually the most promising solution. This is because by making computers that can study AI and modify their own code improving not only their own structure, but also turn the computers directly into computer scientists. How to improve the intelligence of computers becomes the task of the computers themselves. In terms of calculating speed of a human brain, the maximum speed is 200 hertz, and a micro-processor can operate at 2G hertz which is 10 million times faster. The information processing speed of a human brain is 120 meters per second, while the speed of computers is the speed of light, the difference is rather large which is several orders of magnitude. In terms of capacity, the human brain capacity cannot be

made any bigger, even if it could, its limited speed would have become a huge drawback. The physical size of computers can be very adjustable, with more hardware, larger memory, long-term effective storage medium, they can be much more capable and accurate than the human brain. In terms of reliability and durability, the human brain easily tends to fatigue. However, computers can operate at peak speed 24 hours a day. The storage capacity of computers is stronger because their transistors are more accurate than human brain, and these transistors can be repaired or even replaced. In terms of software, it is editable, upgradable and other possibilities to be made more effective. Computers can be as good as human brain in terms of visual elements as well as engineering elements that can be strengthened and optimised. In terms of collectivity intelligence, from early language and formation of large communities to the invention of written language, printing and internet, human being becomes overwhelming because of the collectivity of intelligence. However, computers can do much better. An AI network that runs specific programs can easily synchronise itself around the world, whatever one of those computers learns will be immediately available to all other computers, and computer clusters can perform a same task together because characteristics such as divergence, motivation, self-interest which are unique to humans do not happen to computers. By creating powerful AI computers that are comparable to human intelligence, a harmonious human society might not be far away because the computers will be used to manage and regulate the foundation of economy and society according to human's pre-set. This shows that human level intelligence will be an important milestone while AI will be able to create itself as AGI through self-improvement. Fortunately, it will not stop moving forward. Considering that AGI needs to be greater than human brain, it will quickly pass through the human level and head towards ASI.

2) In the three major industries, technology file database which are built based on the technology files of the industry standard and the technical parameter of product standard are used as the starting point for the future development. If relevant research, analysis, accounting and forecasting (planning) of economy, policy research and other functions can be classified and numbered in advance, and the database files can be organised, then all requirements will be met through a man-made command. In addition, using Big data, new Cloud Computing technologies, Internet of Things or new industry of internet and AI, under the circumstance of combinations and connections between internal information and external information of the optimal input-output planning model and AI, regardless of of micro-economy operation or macro-economy operation, while the operation of national economy is in an imbalanced situation which is caused by natural disasters or man-made disasters and the imbalance is beyond the scope of remediation, by using a vast amount of data that is generated by means of labor and on the basis of realisation of tracking, supervising and analysing the operation of national economy, AI can be used to analyse possibilities with the law of coordinated development. If it is beyond the range that can be remedied, AI can automatically simulate artificial analysis and process and carry out corres-

ponding procedures in order to achieve the expected goal.

3) According to the basic data of the optimal macro input-output planning model, by using the material volume information of relevant products of Internet of Things or new internet industry, the balance of supply and demand can be tracked, monitored and analysed through Big data and the new Cloud Computing technologies. In case of the existence of discrepancies, the basic data such as reason, location and cost of these discrepancies will provide decision makers with a theoretical basis. In other words, to create alternatives with certain technology or method that imitates human thinking and behaving to help human in certain fields. In addition, the objects which are involved in the realisation of real-time analysis of the optimal input-output planning model and a massive amount of data generated by means of labor from these objects in the process of production are based on products and the logistics, information flow and capital flow. Therefore, according to classification and code of these means of labor, the products and the corresponding logistics, information and capital flow can be accurately received as well as based on what object and which industry, the massive data are generated from. In this regard, with Big data, new Cloud Computing technologies, Internet of Things or new internet industry and AI, based on monthly production cycle, the massive amount of data of these products and the associated logistics, flow of information and capital will be analysed for not only tracking, monitoring and analysing the actual operation of national economy, but supervising functional departments to implement rules and regulations according to the objective law of coordinated development. This is the only way for the optimal input-output planning model to play a leading role in construction and development of national economy.

4) As methods, based on Internet of Things or new internet industry and AI and according to the traditional operation process, Big Data and new Cloud Computing technologies can be used for the following tasks: with correlation analysis, customers, users and products will be connected together, user preference and customer relationship can be individualised for user-driven products and customer-oriented services. In such process, each type of resource digging mode, actual situation and reserves distribution can be searched, analysed and formed a visual map of resource distribution for enterprises. It is like using electronic map to digitalise and visualise all kinds of virtual advantages point to point, with thorough management, managers can take existing and potential resources for use more effectively; by using the data provided by Big data and new Cloud Computing technologies to plan production structure and processing in order of helping enterprises to explore an unknown value combination of traditional data as well as a one-to-one solution to detailed problems of the combination which will provide a guarantee to production; with the analysis of Big data and new Cloud Computing technologies, according to different brands intersecting and overlapping in the market data, the operation direction of the business will be intuitively and easily identified. And brand promoting, location choosing, strategy planning and other works can be more ensured. By using Big

Data and new Cloud Computing technologies to dig the data of social and customer interaction, it can help enterprises to carry out the work which is related to balance design and fragmentation expansion for brand information. Richard H. Thaler, the economist argued that “small and apparently insignificant details can have major impacts on people’s behaviour”, in the context of these major impacts, enterprises must pay attention to every small flow of information in order to meet requirements of customers, every detail is a key to success.

5) According to requirements of future factory automation, the high automation and integration of product design, manufacturing, processing and sale should be realised. In terms of the technology support of future factory automation, it cannot be separated from management engineering, system engineering, information technology, automation technology, market economics, etc.; based on the application of Big data, new Cloud Computing technologies, Internet of Things or new internet industry and AI technology, resource sharing can be implemented, and efficiency and effectiveness of production can be improved. It can be seen that for giving full play to their comprehensive roles in construction and development of national economy, to combine them with the optimal input-output planning model is the only way. Therefore, in the process of combining, the basic data of tabulation should be regarded as one of key contents of research and development from now. To realise connections between these methods and the optimal input-output planning model is not only the best approach, in terms of progress and improvement of human society and its technology, as well as productivity, the maximum efficiency can also be made with half of the work. The future factory will become a smart factory, a high efficiency will be made accordingly, substandard products, downtime, waste and laying-off and falsification, for example, will be eliminated. By effectively working together, managers and employees ensure that data and production, IT and manufacturing are seamlessly integrated to make every rotation of each machine, every cutting of each tool and every transport of every department in the global delivery chain clear and unambiguous.

6) The basic functions of real-time tabulation of input-output model: for International Input-Output Association, the problems of being “out-dated” and “presumed” existing in the analysis of the optimal micro material based and value based input-output planning model which is related to production model have been thoroughly solved. However, in the optimal macro input-output planning model applied by regions and nations, agriculture, forestry, animal husbandry, fish industry, other sectors of the secondary industry, as well as the service industry in the third industry are also included, it is thus difficult to predict (plan) accurately. It must be pointed out that whether it is 3D printing in the current Industry 3.0 or customized production in the future Industry 4.0, once the real-time tabulation input-output model and cross-boundary economic management information system can be realized, the basic data in the national macro input-output statistical model applied by regions and nations will be au-

tomatically merged, generated and collected from fundamental data on the bottom, thus it is more accurate and reliable than the basic data in the optimal macro input-output planning model of regional or national level. For International Accounting Association, enterprises that realize the real-time analysis of the optimal micro material based input-output planning model and the optimal micro value based input-output planning model can completely solve the problem of how to model the financial management system and supply-demand chain management system. This is because on the basis of the common basic data (product structure or BOM, process routes, consumption quotas, man-hour quotas, capacity resources and inventory data, etc.) and in a unified data environment (a unified data environment such as the basic data of optimal micro input-output planning model and micro input-output statistical model, etc.), not only can combinations and connections between those two models be established, but the basic structure of the optimal micro input-output planning model can be used to plan accounting subjects and establish accounting systems as well. By making real-time analysis of the optimal micro input-output planning model and timely analysis of the micro input-output statistical model as basis and core to establish accounting theory, principles, standards and methods as well as management methods [8]. For International Management Association, the problem of how management can involve at the same time in two different fields which are natural science and social science as well as the interface which is interlinked, influenced and permeated one another [7]. This interface is not only the scientific basis for enterprises, regions and countries that are in different social forms and social systems to formulate relevant rules and regulations, but also a necessary and sufficient condition for obtaining the best economy benefits. In terms of CAD, CAM, 3D printers as well as Big Data, new Cloud Computing technologies, Internet of Things or new internet industry and AI technology, they have become internationally popular and important tools. However, how to adjust the industrial structure according to basic requirements of realising real-time analysis of the optimal micro input-output planning model and timely analysis of the micro input-output statistical model, and what kind of design and research needs to be done to better serve national economy, the real-time tabulation input-output model can be used to respectively point out a way forward.

7) According to Einstein: "Imaginations are more important than knowledge". He put forward a simple hypothesis: "A creative mode of thinking is equal to knowledge multiplying curiosity and imagination". In terms of original ideas of input-output real-time tabulation method which date back to when I was just a "Red Guard" college student who had taken only two years of basic courses, and I was merely very much curious and interested in the ideas of such while I did not have any special talent. In 1974, when I started to realise that input-output statistical model could solve principal problems of coordinated development and it could be useful for enterprises to achieve the best economic benefits as long as it could be combined with linear programming. It was not only an important

tool of macro-control, but also a scientific method of overall governance. On the one hand, I was very interested in this research because of my personal experience and work experience. However, on the other hand, in order to promote achievements of this scientific research, a social environment which needs to be fair and impersonal is crucial, and management talents who hold no prejudice are required as well as recommendations of the authorities. I chose to carry the research forward until now when I was very close to make an important decision (yet difficult) to give up because of all the difficulties and obstructions. In terms of the knowledge of future factory automation, information, intelligence, Big Data, new Cloud Computing technologies, Internet of Things or new internet industry and AI, I am still studying, thinking and researching. Changes and effects of AI technology for tabulation and the application of tables have not yet been seen. Considering AI is about machine learning, and a very important part of machine learning is image recognition which is to accumulate a large amount of recognition and memory of existing knowledge. According to this we can be sure that eventually, AI technology of the future will be able to completely replace, even surpass human brain at least in terms of tabulation and the application of tables.

8) In terms of material basis of the intelligence, starting with single equipment automation and smart products, material basis of the intelligence is to keep the intellectualisation of key procedures, replace key positions with robots and realise improvements of both production efficiency and product efficiency. Internet of Things or new internet industry should not only cover objects of labor and means of labor as well as the integration of automation products, software and services to boost profitability and efficiency of enterprises and promote digitalised transformation of business in order to realize digitalised economy, but also be opened to the information of industry market, and extend client-side connecting between objects for information exchange and communication. In general, the application of such information will present a trend of integration, mobility and intelligence. The integration of applications breaks down the "isolated island" information and makes the information system become an organic entirety, the application of mobile technology breaks the limitation of time and space, and multi-terminals can make access to systems anytime and anywhere which will significantly improve efficiency of the cooperation. Intelligence technology is largely adopted to make the application system operation more human-oriented with better experience. Finally, with aid of information transmission, the whole production process from orders to completion of products is optimised and managed between enterprises and supply chains. In this case, plan, production and resources are closely combined together in a form of two-way interaction to reduce value-free activities and effectively guide the operation process of the production and improve timely delivery capacity.

9) As a new generation of information technology, it will present a series of far-reaching effects of innovation and development for enterprises. The compe-

tion among enterprises in the future will be the competition based on the information technology which will determine the critical competence of future enterprises. For developed countries, for example, the United States, on the basis of the three major industries which are highly modernised (automation, information, intelligence), it should not be difficult to establish the scientific basis of AI to achieve intelligence. It is believed that under direct leadership and guidance of International Input-Output Association, firstly, some relevant training should be carried out for personnel of high executive levels in order to make them pay more attention to corresponding research and development and participate in such work. Secondly, skilled workers or engineers who are engaged in ERP system development, IT industry, Big data, new Cloud Computing technologies, Internet of Things or new internet industry and AI, etc., the relevant training should be taken by them as well. On the basis of mastering the basic principle of input-output model, by combining their specialties, the relevant research and development can be carried out. Thirdly, during the training, specialists of economics, accounting, management, future factory automation, Big data, new Cloud Computing technologies, Internet of Things or new internet industry and AI technology should gather together to form a high-grade and multi-skilled research and development team, or schools such as International Input-Output Real-time analysis Institute should be established in order to dedicate publishing multilingual textbooks for all grades according to the design of the cross-boundary economic management information system and provide services of using and maintaining this information system as well as its relevant theory training and product development to universities, managers and individual users, and integrate this research result into a commercialised system application software. Fourthly, to cooperate with input-output associations of other countries to carry out practical training and promotion in those countries and regions. By realising application technology of ANI, problems of tabulation and table using will be completely solved in developed countries within approximately five years. After the realisation of AGI, the work which is normally done by human will be done by AI so that tabulation and table using will be excellently accomplished as well. In terms of ASI, overall it is much greater than human intelligence. Therefore, not only can tabulation and table using be automatically carried out according to purpose of human, but actual tabulation and table using will be much better than it has been ever expected. Finally, I will be more than glad if I will be able to make all this happen.

It must be pointed out that the scientific research project of input-output real-time tabulation method which has been completed is a self-funded project of mine right from the beginning. Therefore, it is a completely individual project. My wish is: as the basic content of modernised management, the “Nine Must”【*】 linear model (it is also called Production Pioneer) will become indication, standard and measurement to observe, examine and judge whether an economy society meets the qualification of modernized management. I sincerely hope that by combining the optimal input-output planning model with automation, in-

formation, intelligence, Big Data, new Cloud Computing technologies, Internet of Things or new internet industry and AI technology, the cross-boundary economy management information system which is constructed will become an important tool in different fields such as production, distribution, exchange and consumption in the process of reproduction. In this regard, I respectfully invite International Input-Output Association to advise the heads of governments around the world that the foundation of human society (economic basis) should be comprehensively governed and regulated and in order to do that, as the achievement of this scientific research, input-output table real-time tabulation method must be brought into productivity as soon as possible. It is not difficult to imagine, for those manufacturers that produce all kinds of means of labours such as machines and equipment as well as those enterprises which are engaged in Big data, new Cloud Computing technologies, Internet of Things or new internet industry, AI technology, CAD, CAM and 3D printers, etc., for their own survival and development, based on the basic requirements of real-time analysis of the optimal material based input-output planning model, the functions of their respective products will be extended in order to participate the competition of market and take it over. I could not have the opportunity to participate in the development of macro input-output model, nor could I use the basic data from the input-output model doing any analysis although I used to work in an enterprise for a long time. I never studied English when I was a student, but I learned some basic rules of grammar in English training for adults for more than three months after taking part in my work. For many reasons, I did not have time to carry out the study any further. In terms of my English skill, I was unable to communicate with people coming from different countries in the conferences of International Input-Output Association. I am fully aware of my language incapability. However, I strongly feel publishing some of my ideas to share with people who carry out the same undertaking as references. I have always believed that coming results will be much better than I think under the direct leadership and guidance of International Input-Output Association in terms of economic construction, resource conservation, prevention of corruption, scientific development and harmonious society establishment which are of common concern to mankind.

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Conflicts of Interest

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

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Note

The shorter forms which are mentioned in this paper: the optimal micro input-output planning model, short for the optimal micro material based input-output planning model and the optimal micro value based input-output planning model; the micro input-output statistical model, short for the micro material based input-output statistical model and the micro value based input-output statistical model; the optimal macro input-output planning model, short for the optimal macro material based input-output planning model and the optimal macro value based input-output planning model; the macro input-output statistical model, short for the macro material based input-output statistical model and the macro value based 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; real-time analysis of the optimal input-output planning model, short for real-time analysis of the optimal micro input-output planning model and timely analysis of the micro input-output statistical model as well as real-time analysis of the optimal macro input-output planning model and timely analysis of the macro input-output statistical model; the scientific foundation of the optimal input-output planning model and AI, short for the scientific foundation of the optimal micro input-output planning model along with the micro input-output statistical model and AI as well as of the optimal macro input-output planning model along with the macro input-output statistical model and AI; the scientific foundation of AI, short for the scientific foundation of real-time input-output tabulation and AI; cross-boundary economic management information system, short for real-time input-output tabulation and cross-boundary economic management information system.

【*】 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 connections between input and output of grey factors?
- 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 realise combinations and connections between the optimal input-output planning model and enterprise resource planning (ERP), lean production, agile manufacturing, etc.?
- 6) Why must it be necessary to realise combinations and connections between the optimal input-output planning model and total-factor productivity (TFP), target management and other modern management methods?
- 7) Why must it be necessary to realise the real-time analysis for the optimal input-output planning model and finance management?
- 8) Why must it be necessary to realise the real-time analysis for the optimal input-output planning model and supply-demand chain management?
- 9) Why must it be necessary to use the optimal input-output planning model to conduct analysis of policies?