

# Social Manufacturing Development with Sino-Finnish Innovation Cooperation

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**Abstract**—Innovation is changing the world every day by offering new technical solutions for the society, and the technology development powered by innovation has been changing the operation and structure of traditional manufacturing. Social manufacturing is the new trend of manufacturing development, especially in the field of apparel industry. Social manufacturing can create opportunities for customers to participate in the produce process of tailoring, and to make more personalizing clothes, which will also benefit for the related companies' brand making process. With the assistance of internet technology and industry globalization, we can establish several modes about the trend of social manufacturing and new related technology, social manufacturing can also prompt the international division of labor by reducing the producing costs and enlarging the market capacity, we will analyze the advance of Sino-Finland cooperation in the field of innovation and apparel industry, the international cooperation in manufacturing industry will benefit both customers and industry revolution with the assistance of social manufacturing.

**Keywords**—social manufacturing, innovation, apparel industry, international cooperation.

## I. INTRODUCTION

Social manufacturing is an industry evolution which will change the traditional production mode. With the growing demand of personalized service and merchandise, enterprises need to be aware of customer's personal preference and affect it in their services or productions[1]. Thanks to the development of internet technology and the equipment of manufacturing, social manufacturing will be no longer a concept but a real industry system[2].

In the field of apparel industry, the service of production customizing has already been developed, many large companies offer chances for customers to choose their prefer color, size, or material of the clothes they will by.

In China, many apparel industry companies want to provide the production customizing service for their customers, but

they found they are lack of the ability of technology innovation and industry designation, it is necessary for Chinese apparel companies to find an international partner for establishing a social manufacturing platform.

Finland would be a good choice for China's apparel industry, not only because Finland owns a mature innovation industry and strong industrial design ability[3], but also Finland will be benefited through this cooperation by entering the huge market in China.

The propose of this paper is to analyze the industrial cooperation between Finland and China with the social manufactural platform mode, the paper is divided into three parts, the social manufacturing platform mode will be described firstly, and then the Finnish innovation and designation's advantages in the platform mode will be analyzed, and at the last part we will discuss the prospect of Sino-Finland innovation cooperation in the apparel industry.

## II. SOCIAL MANUFACTURING MODE IN APPAREL FIELD

### A. Demonds of Markets and Industry

The growing demand for personalized services and productions asks manufacturing companies find more ways to figure out different kinds of customer to fall in with the wishes of different customers(SoMa2010,2014).

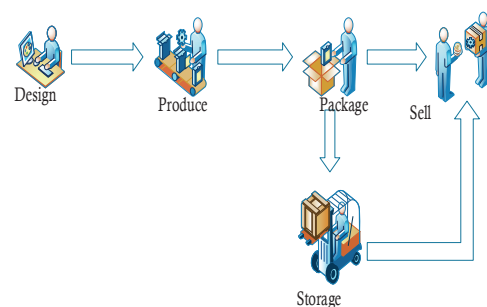


Figure 1. Traditional apparel industry mode

In apparel industry the demand of personalized production is often fastened on the individual performance of cloth style, color collocation, cloth material and cloth functions. In traditional apparel industry as Figure 1 shows, apparels are designed by professional designers, and customers do not participate in the process of producing, which cause that customers' choice is limited by the apparel enterprises, customers can only buy clothes which may not fit his or her individually though the competition between apparels gradually help customers expand their choice range. Maintaining the Integrity of the Specifications

In China, the traditional apparel industry is facing many challenges now for the fast industry structure transition. Chinese apparel industry are often recognized as a labor intensive industry, many enterprises lack the ability of innovation in product design and brand making [4], but future products of apparel industry should be high value added and well-known globally, it is a good choice for China to establish the social manufacturing structure for apparel industry and cooperate with Finland to get the aid of Finnish innovative industrial design.

### B. Social Manufacturing Mode

Social manufacturing will link up the manufacturing industry, social studying, large-scale social computing, and the normal customers with the social and manufacturing network created by the internet [5], the social manufacturing mode is established on the foundation of active involvement of customers in the process of production, from Figure 2, we can see that customers can design their personal style productions in the social manufacturing mode, in some situation, some of the costumers can even execute their own productions by 3D printer or other methods [6].

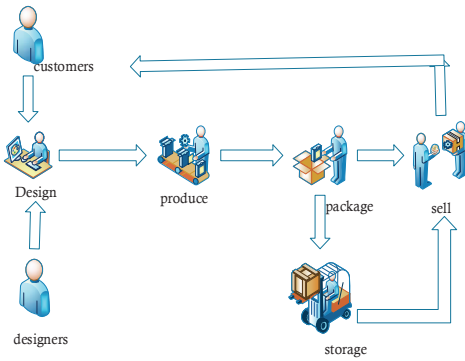


Figure 2. Social manufacturing apparel industry mode

But there is the question: how should we connect customers with the design department in enterprises?

Because of the achievement of internet and computer technology, now there are many new technologies and manufacturing equipment, such as cloud service and 3D printers [7], help us to realize the new manufacturing mode. And same technology also can be used in the apparel social

manufacturing mode under the influence of China-Finland innovation cooperation.

With the use of internet and related technologies, customers can involve the producing process in the apparel social manufacturing mode as Figure 3 showed. In Finland designation part, Finnish industry's advantages in the field of technology and industrial design will be putted into the use of the designing process, and in the part of China production, Chinese factories will help to produce the final production with the design from Finland and customers. First of all, designers will analyze basic functions of the product and make a prototype of the product. Secondly, customers can design the products on the foundation of prototype through the internet, to make products fit with their personality, or they can also design it with the assistance of professional designers. Thirdly, the design of productions will be sent to Chinese factories, these factories will organize the work flow on the basis of design, after the final step of producing, and productions will be stored or be sold to customers directly.

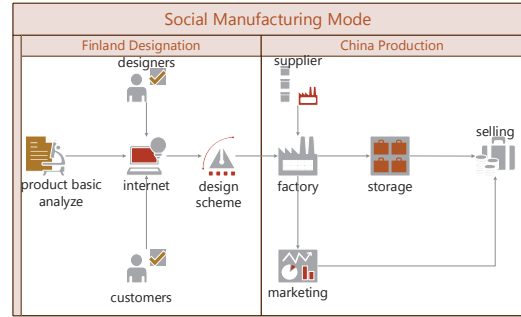


Figure 3. A social manufacturing mode under the innovation cooperation of Finland and China in apparel industry

Through the social manufacturing mode showed in Figure 3, anyone in the world is able to use the innovation and design sources of Finland to help them create the design of the productions fit with their personalization, then use the strong productivity of China to produce various productions they designed, everyone will be benefited with the system, and the manufacturing mode between China and Finland will drive world's manufacturing industry into a new age.

## III. FINNISH INNOVATION & DESIGN IN SOCIAL MANUFACTURING MODE

### A. Finnish Design

In the Finland designation part of Figure 3, the work of Finnish design industry includes: designing the prototype of production, helping designers or customers to design the production in the internet, and revising the design mistakes for getting the final design scheme. These works suggest the strong apparel design ability of Finland.

Smart regions idea is one of the efficient ways to improve innovation industry growth, smart region will gather innovation-relative departments such as universities, start-up companies, technical groups, into one place, it offers many opportunities for them to transfer information and trade

Most of Finnish apparel industry is located in the Helsinki-Uusimaa region, and this region is the center of Finnish economics and innovation industries [8].



Figure 4 shows the expending influence of Helsinki-Uusimaa region, and as an innovation industry region, Helsinki-Uusimaa's growing influence suggests the rise of Finnish innovation industry. The growing innovation industries in Finland prompt the development of industrial design ability because many high-tech innovation companies need to reflect their productions' innovativeness on the production's surface. And affected by the advance of industrial design, fashion design in apparel field also has been experiencing a rapid growth.

After the second world war, Scandinavian design presents the design idea of modernism and Functionalism, in the 1950s, Social democracy with strong Nordic characteristics and a large public welfare system supported by taxes began to develop, and in the mode of production, it is possible for the low prices in materials, and the large-scale mass production also became reality. Scandinavian design has also formed their design material by using plywood, plastic, aluminum, enameled aluminum and pressed steel.

Due to the Nordic special democratic environment, the Nordic design is usually considered to be democratic design, because its goal is through parity and friendly design products

Although the Nordic design is democratic and popular, but at the same time it retain its beauty and practicality, this balance is the most important characteristic of the Nordic design has always been. And because of such design idea, Nordic designation is one of world's most popular designation style.



Finnish design includes the design of building, furniture, dress and personal adornment, and industrial products, many famous design enterprises in Finland have rich experience in these design field these design fields and enjoy an international reputation, such as Marimekko in apparel design field (Figure 5) and ARTEK in the furniture design field. In the social manufacturing platform, each of these enterprises is very helpful because they are able to involve the customer design process to strengthen the design ability in the system.

During the last decades, Many Finnish companies or designers explored and extended their suited markets positively, and spread their design concept to the world successfully, today, not only the clothing design, but also the industrial and interior design, now reflecting the idea and style of Finnish design.

Due to the geographical location and the special culture, the development of Finnish design is different from the context of Europe center. Although the development of modern society is constantly tending to the integration of global civilization, the Finnish design maintain a critical attitude at the time of following the modernism, and constantly reflect it on their design style. Finnish design pays attention to the inheritance

and innovation of architectural culture, but also adhering to the location tradition at same time.

In this day, the Finnish design reminds users of the existence of "design", and the importance of "designer" with the Humanized elegance. In marketing, the Finnish marketing strategy is often limited to explore and meet the demands of consumers. For the Nordic design, the most important is not to sell, but to create the use of durable and cost-effective products, so, if the consumer demand for the product, they will naturally buy. And for the products which consumers do not need, for the ideal Nordic design market, it does not exist.

But the lack of marketing aware is the cause of economic crises, it is fine for design companies during the boom times, but when there is a decrease in economic, the market will be narrow and customers may give up the companies which they do not know or not satisfy the change of market.

#### B. Reasons of Finland's international cooperation

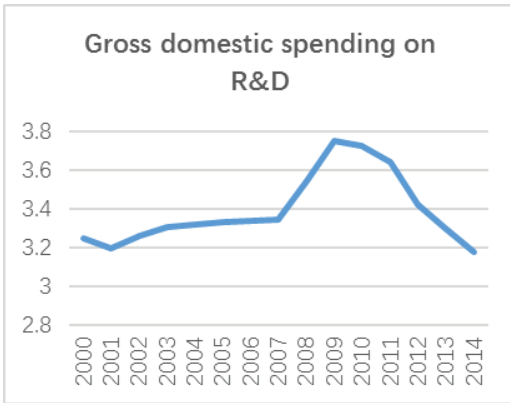


Figure 6. Gross domestic spending on R&D in Finland (research and development) 2000-2014 (OPEC 2016)

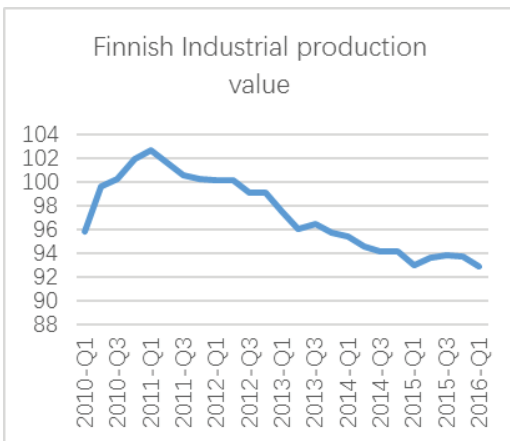


Figure 7. Industrial production value of Finland 2010-2016(OECD 2016)

Finnish innovation industry is not always keep on good performance, Figure 6 shows that the research costs begun decreasing in 2011, and according to Figure 7, the growing of industrial production value ended in the first season of 2011, and then the industrial production growth has kept on decline.

Both of Figure 6 and Figure 7 suggests a possible industrial crisis Finland have to face in recent years.

To boost industry growth, Finland have to find an international partner with large market to consume their products or innovation ideas and exchange resources.

China is a high quality international partner for Finland, firstly, China owns a huge population which is able to be transferred as a large market, secondly, China owns a mature and complete industry chain, which means China can produce almost every consumer commodity, but China is a bit lack the innovation ability and advanced design concepts, the innovation cooperation between China and Finland will be beneficial to each country.

#### IV. SOCIAL MANUFACTURING DEVELOPMENT

##### A. Social manufacturing with sort system and data center

In the apparel social manufacturing mode, China plays a role as an apparel producer, which means factories in China most face the incredible number of design scheme in different kinds, it is very hard to produce all of them by limits kinds of product line in one factory. It's necessary to classify the characteristic of every design scheme and find a suitable factory for it.

In order to conquer the product difficulties and improve product efficiency, the design scheme from Finland design part in original mode should be classified in to some basic types before submitting to product section. A sorting system (Figure 8) is designed between Finland part and China part. The function of the sorting system is note and classify different design scheme's characteristic and then search an appropriate factory to produce it in the database.

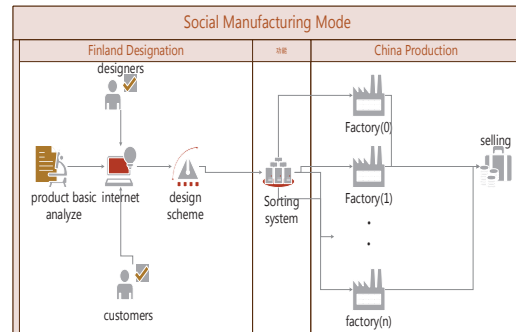


Figure 8. New social manufacturing mode with sorting system

This source data of the sorting system is from customers, database of Finnish design, and Chinese factories. This sorting system is running on the basement of a data-sharing environment.

To realize the sort system, data centers is supposed to be established to collect related data of apparel design and apparel produce, from Figure 9, we can infer that the data center will run as an information transfer station between customers and sort systems.



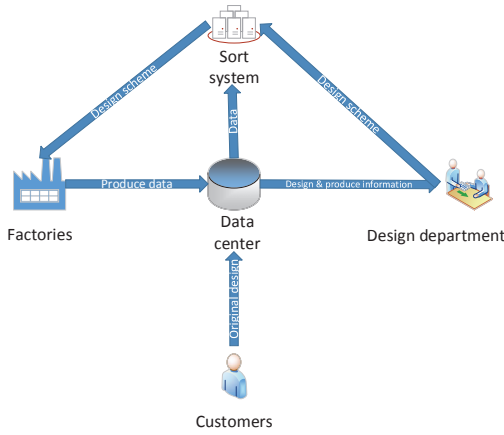


Figure 9. Relationship of data center and other parts

The data center (in Figure 9) will records customers' original design scheme and different factories' production ability, and then sent information to design departments in Finland and sort system in order to optimize the original design scheme and refurbish factories' production ability in sort system. The sort system records the final design scheme from Finland and new factories' information, then allocate the appropriate produce order to different factories after managing.

Data center is capable of relating with big data technology, many of such data centers can construct a big data cloud service platform, cloud service platform is able to storage large number of produce and design data and dispose these data with high efficiency, which is helpful for enlarging the social manufacturing mode and improving the service quality [9].

### B. Social Manufacturing with new Human-Body Shape Technology

In the design field of this social manufacturing mode, it is very important to affirm the design scheme is suitable for customers' body shape and skin color, but because of the separation between customers and design departments, it is hard to collect customers' body information directly. But the 3D-scanning and 3D-modeling technology solved the problem by providing new ways to present the dressing appearance.

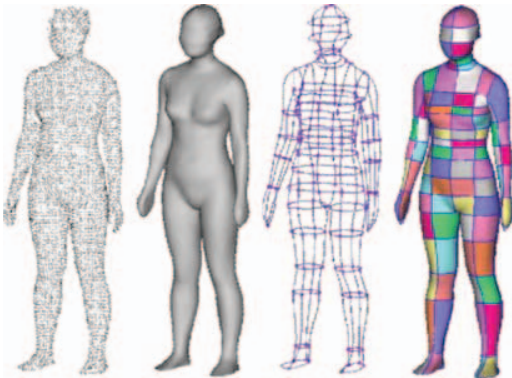


Figure 10. Human body shape modeling in four parameterization ways [10]

By reliable 3D scanning devices, customers', data of human body is able to be gathered. After gathering human body data, model structuring will be on process, in Figure 8, the we can see the 3D model of a man, the three dimensional human body presents the detail on our bodies. With this technology, customers can make their own body model in computer thereby, and customers can use the 3D models in computer as a virtual design test project in design process, to designers, the 3D models of customers will also help them to assure the design scheme in the internet rather than communicate with customers directly, which is impossible in the social manufacturing mode because of the huge numbers of design scheme [11].

3D modeling is formed by the coordinates in three directors, it is easy to store it in a digital store equipment, and the operation to the 3D model is also convenient in a digital way, besides, 3D model of human body provides a clothing fitting model, which means customers is able to try their clothes in a virtual platform at the same time they choose the cloth (Figure12), it will improve the convenience of customers while they are shopping.

What's more, customers' bodies models can be updated on the data center (Figure 9) or cloud service platform with their permission (Figure 11).

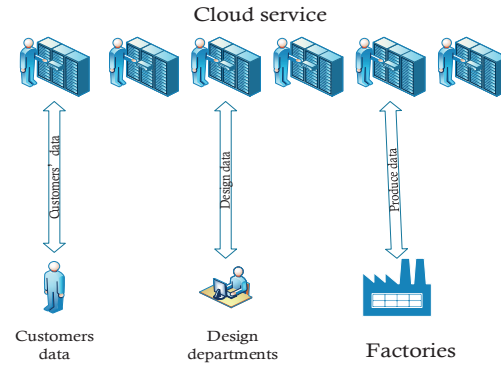


Figure 11. Cloud service structure for social manufacturing mode

The cloud service (Figure 9) will service all the parts of the social manufacturing mode, and the efficiency of the mode

Through the cloud service, we can organize the apparel produce on a virtual platform, by establishing the cloud service, the distance problem will be conquered, and everyone can enjoy the convenience of apparel social manufacture under Sino-Finland innovation cooperation only if he or she has an internet-connecting device, which is an improvement of consumer market.



Figure12. New customer dressing interface (Cisco: The Future of Shopping)

The 3D modelling technology for human body is able to improve many customers' shopping experience too in the internet, comparing with the traditional customer design interfaces, new customer interface (Figure 12) is more intuitional, succinctly, and user-friendly, customers can observe their design result directly on their virtual model, the 3D body modelling's advantages can also be used in a real-time dressing monitoring system, as Figure 12 shows, customers can design and select their prefer clothes while they are shopping or any other time and judge if the clothes is suited with their body in time with the assistance of 3D body model. it is very convenient for customers.

### C. Future of Social Manufacturing

In the future, customers will design prefer clothes all by themselves, the all they need to concern is their body shape and style performance, they are able to customize their own personal style products by using their own body or shopping data, the 3D body modeling equipment and cloud service will help to handle it, both of customers is allowed to establish their own database, their databases store the body data and consumer hobbies, every time they want to buy, they will get the best suited one.

Social manufacturing will also prompt the globalization and market integration, after the complete of new global customer market, all the world will share the global market as a whole, countries or regions is able to get the market profits through the industry division, different countries could use their own advantages to help customers get their favorite productions, any economic entity has the most fitted customer group, and the efficiency improvement brought by social manufacturing also help them improve their own industry level to fit the market in high quality.

## V. CONCLUSION

We analyzed how the Sino-Finland innovation cooperation influences the social manufacturing in apparel industry field. From our analization, Finland owns significant innovation and design industry but need new markets to digest it, and China needs to import advance innovation technology and design ideas from developed countries, Cooperating the advantages of China's manufacturing industry productivity and Finnish

innovative design creates active social manufacturing mode, we also discussed the possible advantages of the new 3D modeling technology in the field of apparel industry and modern markets, it can be inferred that this kind of new technology will improve publics' shopping quality rapidly.

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