

## FINANCING BEHAVIOR AND EXPORT VALUE CHAIN MODE SELECTION METHOD BASED ON CLUSTER COMPUTING

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**Abstract:** Embedded in the value chain mode selection method driven by buyers and the mode selection method "embedded" by "OEM", ignoring the impact of financing behavior differences on the governance mode of product export value chain, leading to inaccurate research results of competitiveness. In the face of this situation, this paper puts forward the financing behavior based on cluster computing and the mode selection method of product export value chain. According to the cluster optimization model, the deviation of financing behavior chain 1 and product export chain 2 is calculated to minimize the interference. From the perspective of cluster computing model classification, this paper studies the competitiveness of export products, and determines the revealed comparative advantage index and trade competitiveness index, so as to judge the export competitiveness of products under the background of value chain. According to the measurement results of product export competitiveness under financing behavior, the analysis results of product export competitiveness by this method are consistent with the actual value, and the error is 0.

Key Word: cluster computing; financing behavior; export of products; value chain; mode selection;

### 0 Introduction

Since the reform and opening up, with the advantages of good industrial base, low labor cost and scale production, China's manufacturing industry has gradually integrated into the global division of labor system dominated by multinational companies in the form of "OEM" or "Tiepai", and achieved rapid development [1]. In terms of total volume, China's export has continued to grow in recent years. In 2006, the proportion of manufactured goods export reached 10.84% of the world's manufactured goods export, of which clothing export accounted for 30.63% of the world's clothing export, textiles accounted for 22.27%, and office and communication equipment accounted for 19.80% [2]. Although China has become the most important world manufacturing base for many products, the technical knowledge content and added value of export products have not been rapidly improved to the same extent as the export trade volume. On the contrary, some indicators are still deteriorating. "Made in China" is at the end of the international vertical division system, which seriously restricts the development of China's manufacturing industry [3]. How to get rid of the dilemma of global low value-added module production in China's manufacturing industry chain and promote enterprise innovation and upgrading is a major problem to be solved for China's manufacturing export [4]. There are two different views on the relationship between the export

value chain of products and the upgrading of enterprises in developing countries: one is that in the process of embedding into the value chain driven by buyers, enterprises in developing countries will quickly and automatically integrate imported parts into the whole production process, then product design, and then sell their own brand products in regional or global markets The other holds that the upgrading of developing country enterprises "embedded" in the product export value chain in the way of "OEM" is limited to the improvement and innovation of products and processes according to the global strategic intention of the leading enterprises in developed countries, resulting in stronger path dependence and higher business risk [5]. From the above analysis, we can see that the research on industrial technology catch-up pays too much attention to the endogenous factor of technological mode differences of developing countries' technology catch-up industry differences, and ignores the huge opportunities that the reconstruction of product export value system may bring to the financing behavior of backward enterprises; while the product export value chain and financing behavior pay attention to the local enterprises of developing countries under the background of product export value chain Learning opportunities, the transformation of value chain governance model as the only factor affecting the upgrading of backward enterprises, ignoring the impact of financing behavior differences on the export value chain governance model. Combining the two, it is considered that the characteristics of the technology model of the industry should be considered in the study of the financing behavior of developing countries under the background of export value chain, and it should be considered as the endogenous factor of the financing behavior of developing countries under the background of export value chain.

### 1 Cluster optimization computing

This paper investigates the cluster financing behavior and product export value chain, and finds that the inventory system is composed of financing behavior and product export value chain. Each financing behavior and product export value chain includes a supplier, a manufacturer and a retailer respectively. It is assumed that they all operate homogeneous and completely replaceable products They compete with each other in the same market<sup>[6-8]</sup>. The long-term competition and cooperation game makes them realize that only necessary cooperation can enlarge the market share of the whole cluster, so as to achieve "win-win"<sup>[9]</sup>. In reality, the financing behavior and product export value chain establish a long-term cooperative relationship for the purpose of reducing the shortage rate and improving the service level, so as to enlarge the overall demand of the same industrial cluster<sup>[10-11]</sup>.

Suppose that the inventory model with inventory status as state variable is as follows:

$$x_{i,k+1} = x_{i,k} + u_{i,k} - \xi_{i,k} \quad (1)$$

In formula (1),  $x_{i,k}$  is the inventory level of the nodes on the two chains;  $u_{i,k}$  is the upstream required order quantity of the nodes on the two chains;  $\xi_{i,k}$  is the market demand of the two chains<sup>[12]</sup>.

Customer demand is divided into two parts: certainty and uncertainty:

$$\xi_{i,k} = d_{i,k} + \omega_{i,k} \quad (2)$$

In formula (2),  $d_{i,k}$  represents deterministic demand;  $\omega_{i,k}$  represents uncertain demand [13].

Suppose that the nominal values of financing behavior and product export in two clusters are  $xs$ 、 $us$  respectively, then the deviation of financing behavior and product export in two clusters is as follows:

$$\hat{g}_{i,k} = \begin{cases} \hat{g}_{1i,k} = x - xs \\ \hat{g}_{2i,k} = u - us \end{cases} \quad (3)$$

In formula (3),  $x$  is the actual value of financing behavior, and  $u$  is the actual value of product export:

$$\hat{x}_{i,k+1} = \hat{x}_{i,k} + \hat{u}_{i,k} - \hat{g}_{i,k} \quad (4)$$

For financing behavior, the first chain is as follows:

$$\hat{x}_{1i,k+1} = \hat{x}_{i,k} + \hat{u}_{1i,k} - \hat{g}_{1i,k} \quad (5)$$

For the export of products, the two chains are as follows:

$$\hat{x}_{2i,k+1} = \hat{x}_{2i,k} + \hat{u}_{2i,k} - \hat{g}_{2i,k} \quad (6)$$

The quantitative description of the bullwhip effect of financing behavior and product export value chain is mostly in the form of variance, which plays an important role in the quantitative analysis of the bullwhip effect [14]. However, it is difficult to use variance to describe the dynamic control of bullwhip effect in the case of complex structure, such as financing behavior and Multi Chain and multi node in the mode selection of export value chain. Bullwhip effect is the process that low-end demand fluctuation causes front-end order fluctuation to increase [15]. Here, the bullwhip effect is described by the ratio of the front-end inventory and order fluctuation to the end demand fluctuation in the cluster. Considering the cluster financing behavior and the whole product export value chain model, how to select an appropriate control sequence to minimize the bullwhip effect in the supply chain system is a  $H_\infty$  control problem [16] in terms of control theory system analysis.  $H_\infty$  control problem is actually a maximum minimization problem, that is, dynamic zero sum game problem. Its systematic significance is to choose control strategies to minimize the interference, that is, to optimize the "worst case". Using  $H_\infty$  control strategy, we can get the best pattern matching results of financing behavior and product export value chain [17].

## 2 The establishment of the logical framework of financing behavior and the choice of product export value chain model

For the logic framework of financing behavior and product export value chain mode selection based on cluster computing.

It can be seen from Figure 1 that the logical framework is composed of financial flexibility definition index, the relationship between financing behavior and financial flexibility reserve of product export, and the relationship between financing management and cash flow.

### 2.1 Clearly distinguish the definition of financial flexibility and scientifically construct the definition index of financial flexibility

At present, the mainstream view in China is to define financial flexibility from the perspective of the overall financial management system. This concept emphasizes the overall view and focuses on the concept, characteristics and role of financial flexibility. However, it is mostly limited to the preliminary theoretical discussion of financial flexibility, which more reflects the concept of flexible management. The concept of financial flexibility is difficult to quantify under this framework <sup>[18]</sup>. Since the overall financial management is a kind of management activity, it is necessary to stress the effect of the activity. The effectiveness of financial management means that the financial management system is sound, the measures are perfect and reasonable, and have been well implemented in the actual process, so as to fully realize the financial strategy, financial objectives, and achieve the purpose of controlling financial risks. To measure the effectiveness of a financial management work can not be simply described by such vague primary qualitative language as confusion or level. However, the real problem is that the standard of evaluating the effect of financial management activities is not clear and the method is improper. "Financial management confusion" and "low level of financial management" are still the most common, the most empty and the most lethal official definitions when people evaluate the effect of financial management activities.

Financial flexibility indicators include:

(1) Combination of scientificity and standardization

The scientificity of the evaluation index system of the effectiveness of financial management requires that the evaluation index must scientifically reflect the content and level of the enterprise's financial management. The concept of each index should be complete and accurate, with clear connotation and extension. It should reflect the essential characteristics of the enterprise's financial management as comprehensively, objectively and reasonably as possible. The composition of the whole index system is effective for financial management Abstract description of sex. Standardization requires comprehensive and systematic reflection of evaluation objectives, and the evaluation index system should be set up from the overall point of view. The index system should be composed of several homogeneous indexes and form a system structure. The standardization of the effectiveness evaluation index of financial management should conform to the provisions of financial management theory and general principles of enterprise finance, and fully reflect the scope and level standard of the effectiveness evaluation of financial management. The combination of scientificity and standardization requires that the establishment of various indicators must have theoretical basis, and the indicators without practical significance should not be selected; the attribute indicators and assessment indicators of evaluation should be strictly distinguished, so as to truly reflect the effectiveness of financial management.

(2) Combination of qualitative and quantitative analysis

Qualitative evaluation index can not be directly expressed by numerical value, but can be differentiated to a certain extent; quantitative evaluation index can be expressed by numerical value, including absolute number and relative number. In fact, these values are also a more accurate degree reflection. The effectiveness of financial management is the result of the comprehensive effect of all aspects, so it can't be fully quantified as the financial analysis index or enterprise

performance evaluation index, and it can't accurately evaluate the effectiveness of financial management. Therefore, those indexes that can't be quantitatively described need to be evaluated by qualitative analysis method. In this study, the qualitative index is given a certain weight to make it quantitative, which can avoid the arbitrariness or generalization of the evaluation and reduce the uncertainty of the evaluation.

The definition of financial flexibility draws lessons from the international mainstream view, defines the concept of financial flexibility clearly from the perspective of financing, and emphasizes that financial flexibility means that the export of products can quickly obtain and allocate financial resources at a fair price, so as to prevent and use uncertain events in the future and maximize the export value of products. The measurement index of financial flexibility is conducive to the export of products, and the empirical test of financial flexibility decision-making based on big data.

## **2.2 Analyzing the relationship between financing behavior and export financial flexible reserve**

It is our country's financing qualification management system that has seriously affected the financial decision-making of product export, thus making the financing mode of product export choice affected by the transmission effect of financial crisis, resulting in a large deviation between the selection result and expectation. From the perspective of equity refinancing and flexible holding, not all export products have the ability of post equity refinancing, so companies with the ability of export holding have the ability of refinancing, and can directly distinguish the quality of equity refinancing. After comprehensive analysis, equity financing and flexible reserve can more clearly distinguish the nature of preference between financing behavior and export flexible reserve.

## **2.3 Analysis of the relationship between financing management and cash flow from the perspective of transmission effect of financial crisis**

According to the relationship between financing management and cash flow, this paper analyzes the level of financing control and external uncertainty of export products to reserve appropriate financial flexibility. Firstly, export products with high degree of financing constraints will retain more financial flexibility, including cash flexibility and debt financing flexibility, and the financial flexibility of export products with high degree of financing constraints is more sensitive to internal cash flow; secondly, export products with high risk will maintain higher cash flexibility than those with low risk. However, the level of debt financing flexibility is relatively low, so the overall level of financial flexibility is relatively low. At the same time, the cash flexibility of export products with higher risk is more sensitive to cash flow<sup>[19]</sup>; thirdly, the relationship between the cash flow sensitivity of export products and financial flexibility reserves shows different relationships under the influence of the transmission effect of financial crisis. The investment of export companies with low financing ability is based on the negative correlation between cash flow and finance; the investment of export companies with high financing ability is based on the positive correlation between cash flow and finance; fourthly, from the perspective of financial crisis transmission effect, this paper reveals the positive role of financial flexible reserve in the financing of export companies. Before the financial crisis, there were many export products

with financial flexible reserves. In this crisis, we can avoid risks through flexible preparedness and relevant attributes, so as to ensure the export of products and seize the favorable financing opportunities<sup>[20-21]</sup>. Different ways of financial flexible reserve of export products have different forms in the financial crisis. In the outbreak of the financial crisis, we can raise more funds by increasing liabilities, and then grasp a good investment form. After the financial crisis, export product companies with good debt financing ability can have better financial resources through this process. It can also make good use of the financial flexibility to grasp the valuable growth opportunities brought by the financial crisis. At the same time, its investment cash flow sensitivity is relatively lower, which fully shows that the financial flexibility has a positive role in dealing with the adverse impact of the financial crisis.

### 3 Measurement of product export competitiveness under financing behavior

As the export of products involves the process, product and organizational innovation of enterprises under the fierce competition and financing behavior, which is the necessary condition to maintain and enhance the competitiveness of products, the study of the competitiveness of export products from the perspective of cluster computing model classification can better judge the export competitiveness of products under the background of value chain, and provide the basis for the choice of enterprise upgrading path.

#### 3.1 Data and indicators

According to the industrial model classification of cluster computing technology, this paper adopts the standard classification of international trade for China's manufacturing industry to measure the international competitiveness of related products in different industries by selecting clothing, footwear and leather products in the supplier LED industry.

##### 3.1.1 Revealed comparative advantage index

The explicit comparative advantage index is proposed by Balassa, which determines the comparative advantage of a country's products by calculating the ratio of the share of a country's export value in the country's total export value to the share of the world's total export value of that product in the world's total export value. It better reflects the strength and specialization advantage of a country's export trade of a certain product. The basic formula of revealed comparative advantage index is as follows:

$$RC_{ij} = (A_{ij} / A_{it}) / (A_{wj} / A_{mt}) \quad (7)$$

In formula (7),  $RC_{ij}$  refers to the revealed comparative advantage index of product  $j$  under type  $i$  financing behavior;  $A_{ij}$  refers to the export volume of product  $j$  under type  $i$  financing behavior;  $A_{it}$  refers to the total export volume of all products under type  $i$  financing behavior;  $A_{wj}$  refers to the export volume of product  $j$ ;  $A_{mt}$  refers to the total export volume of all commodities. Generally speaking,  $RC_{ij} \geq 2.5$  shows that  $j$  product has strong competitiveness under  $i$  financing behaviors;  $1.25 \leq RC_{ij} < 2.5$  shows strong competitiveness;  $0.8 \leq RC_{ij} < 1.25$  shows general competitiveness;  $RC_{ij} < 0.8$  shows weak competitiveness.

##### 3.1.2 Trade competitiveness index

Trade competitiveness index, also known as net export index, refers to the ratio of the balance between exports and imports of a certain kind of products to the total import and export of this kind of products. This index reflects whether a certain kind of product exported is superior or inferior to the same kind of products supplied by other countries in the world market in terms of efficiency and the degree of superiority and inferiority. The formula is as follows:

$$QC_{ij} = (A_{ij} - M_{ij}) / (A_{ij} + M_{ij}) \quad (8)$$

In formula (8),  $QC_{ij}$  is the trade competitiveness index of the  $j$ -th product under  $i$ -type financing behavior;  $M_{ij}$  is the total export volume of the  $j$ -th product under  $i$ -type financing behavior. It is generally believed that  $0.8 \leq QC_{ij} \leq 1$  means that product  $j$  has strong competitiveness;  $0.5 \leq QC_{ij} < 0.8$  means that product  $j$  has strong competitiveness;  $0 \leq QC_{ij} < 0.5$  means that product  $j$  has strong competitiveness;  $QC_{ij} = 0$  means that product  $j$  has general competitiveness;  $-0.5 \leq QC_{ij} < 0$  means that product  $j$  has low competitiveness;  $-0.8 < QC_{ij} < -0.5$  means that product  $j$  has low competitiveness;  $-1 \leq QC_{ij} < -0.8$  means that product  $j$  has very low competitiveness.

In the evaluation of product competitiveness,  $RC$  index and  $QC$  index are complementary.  $RC$  index can show the relationship between the proportion of the export volume of the product in the total export volume of goods and the proportion of the export volume of the product in the total export volume of goods in the world, so it can be used as an indicator of whether a country has a comparative advantage in the product. But in the context of global value chain, the high  $RC$  index of final product does not necessarily mean that a country can control the whole export process of the product. Because the  $QC$  index considers both exports and imports, it can be used as an evaluation of a country's dependence on imports. It can select a country's products with obvious competitive advantage but high import dependence, so it can measure a country's comparative advantage more accurately.

### 3.2 Measurement results and analysis

According to the standard of standard classification of international trade, the  $RC$  index and  $QC$  index of China's export products from 2013 to 2017 are investigated through the data provided by the United Nations Statistics Department in 2017, as shown in Table 1.

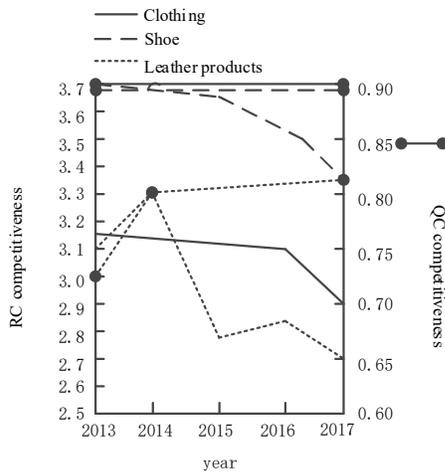
**Table 1 Competitiveness of export products in 2013-2017 /%**

particular year	index	clothing	Shoemaking	Leather products
2013	$RC$	3.1	3.7	2.9
	$QC$	0.9	0.9	0.7
2014	$RC$	3.1	3.7	3.3
	$QC$	0.9	0.9	0.8

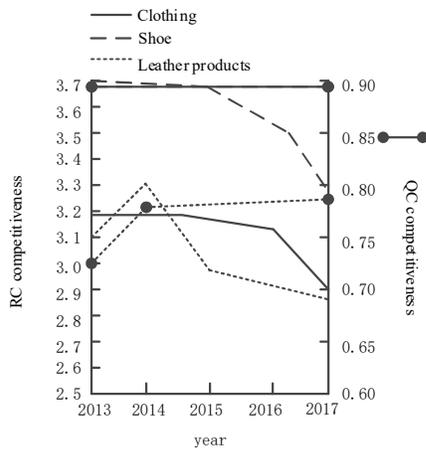
2015	<i>RC</i>	3.1	3.7	2.7
	<i>QC</i>	0.9	0.9	0.8
2016	<i>RC</i>	3.1	3.5	2.8
	<i>QC</i>	0.9	0.9	0.8
2017	<i>RC</i>	2.8	3.3	2.6
	<i>QC</i>	0.9	0.9	0.8

It can be seen from table 1 that the overall international competitiveness of products shows a trend from low to high, specifically as follows: the *RC* and *QC* indexes of clothing, shoemaking and leather products in the leading industries of suppliers exceed 2.5 and 0.8 respectively, showing strong competitiveness.

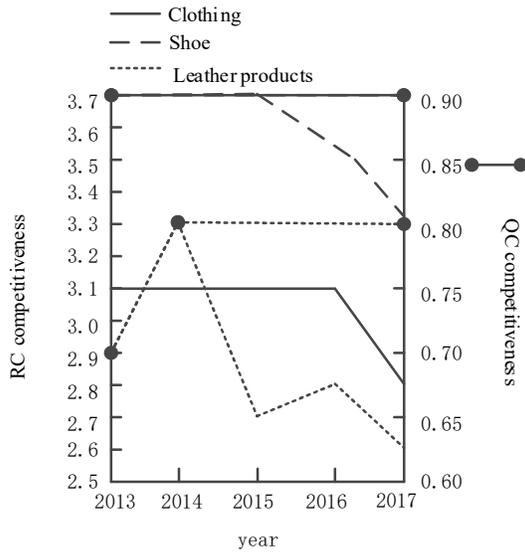
Based on the above actual situation, this paper uses the traditional mode selection method embedded into the value chain driven by buyers, the mode selection method "embedded" by "OEM" and the mode selection method based on cluster computing to make a comparative analysis of the analysis results of product export competitiveness, as shown in Figure 2.



(a) Mode selection method of buyer driven value chain mode



(b) Mode selection method of "embedding" in the way of "OEM"



(c) Cluster based computing mode selection method

**Fig.1 Comparative analysis of the export competitiveness of products with three mode selection methods**

It can be seen from Figure 2 that *RC* and *QC* of clothing, shoemaking and leather products use the traditional mode selection method of embedding into the value chain driven by buyers and the mode selection method of "embedding" in the way of "OEM". There is a certain deviation between the competitiveness and the actual value, but the cluster based computing mode selection method is consistent with the actual value, and the error is 0. Therefore, the cluster based computing mode selection method is more accurate in the analysis of product export competitiveness.

#### 4 Conclusion

Cluster computing technology is the basic factor that affects the financing behavior and the international competitiveness of product export, and then affects the upgrading path choice of enterprises. Therefore, in the context of the value chain, the export of products must consider the characteristics of the technology model of the industry, and the scientific design of industrial upgrading policies should be based on different industrial technology models. First, the main way for the supplier leading industry to maintain its competitiveness in the future is to shift from the low value-added value chain to the higher value-added value chain activities, that is, from the low-end manufacturing activities of the value chain to the high value-added activities such as brand, marketing and design, so as to realize the functional upgrading; second, in view of the fact that China's scale intensive enterprises are participating in the global value chain in the activities, the degree of technical support obtained from multinational companies is not high. The focus of upgrading is to establish its position in the global value chain through the development of the domestic market, and gradually realize its competitive advantage in the global market by establishing advantages in scale, product localization, service, brand and other aspects on the basis

of the advantages of domestic marketing network. Third, the focus of cluster computing technology is on the development of the global value chain. While encouraging the export of products, we should design reasonable financing behavior, and make use of the "window of opportunity" brought by cluster computing technology to establish our market position in the international product export competition.

## ACKNOWLEDGEMENT

1. Project of "Three Platforms and Two Bases" of Anhui Vocational College of Commerce and Technology: "Exploring the management system of financial integration based on the perspective of value creation". No. 2020ZDF11
2. Key Research Project of Natural Science in Anhui Province in 2020: "Research on Urban Economic Resilience Based on Information Network Technology Diffusion". No. KJ2020A1073

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