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[Field Research]

## Research on the Polarization Effects of the Shandong Processing Trade and Strategy to Coordinate Its Development

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### Abstract

**Purpose** - This dissertation is based on previous research, and analyzes processing trade, which constitutes a major section of foreign trade in Shandong Province.

**Research design, data, and methodology** - The study uses the survey data on polarization, which is a vital index reflecting the unbalanced growth of regional economic development. The article introduces the processing trade polarization index, and the processing trade polarization fluctuation rate, to predict the geographical polarization posture and development trends in Shandong Province.

**Results** -The development of processing trade in Shandong Province shows the level of gradient from east to west. The first-line growth pole has been formed and developed, and the initial formation of the diffusion mechanism has taken place. However, coordination problems in accompanying regional development have become increasingly prominent.

**Conclusions** - This study focuses on the development of processing trade strategy and suggests overall coordination of development objectives, using non-balanced development goals. According to regional characteristics and development objectives of the processing trade in Shandong Province, the region around the city is divided into innovation diffusion region, enhanced growth areas, areas expected to undertake development, and areas to upgrade in four levels, given the different policy proposals.

**Keywords** : Processing Trade, Polarization Posture, Shandong.

**JEL Classifications** : E3, E5, F4.

### 1. Introduction

Processing Trade consists of a major section of foreign trade in Shandong Province. Taking the resource endowments, geographical location and other aspects of non-homogeneous characteristics into consideration, the Shandong provincial government makes a decision of implementing differentiated policy on the processing trade respect to the different regions. The general idea bases on that the processing trade industry spread among the eastern coastal cities will take the orientation and priority in growth seeking so as to develop into the strongest increase incentive; thereafter through the demonstration and diffusion effect the above area may bring with, the development of processing trade and related industry will be affected and stimulated, with the ultimate blueprint of achieving the general progressiveness of processing trade in the entire province. Over the past 30 years, the implementation of non-equilibrium strategy has generated obvious effect and the internal & external environment have been correspondingly improved. With the coming of new period of time, it is of great necessity for us to reconsider and revise the non-equilibrium policy in processing trade.

### 2. Literature Review

It is generally agreed that the gradient transfer theory, growth pole theory, Myrdal – the Hirschman mode, "inverted U"font theory and point - axis development theory together constitute the theoretical system of non-balanced development of the regional economy. The core ideology of this theory considers that the generation of Growth Pole is an important feature of the coordinated development of regional economy, and the appearance of a Growth Pole will result in the birth of new ones; this multi level increasing mode involves the cross-pole contact in between with the achievement of sharing the information and resources and performing the chains effect to promote the overall development of economy. In addition, with the economic development, the production cost as well as dealing cost of the first-line growth pole located area will be inevitably increased, in opposite, the effects of scale economy will be gradually weakened. To pursue more marginal income, the factors of production such as human resources and capital move towards the

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second-line growth pole and the neighbor area, along with which the related industries also cater to the trend of transferring and extending to the countryside in form of gradient transferring. The entity is showing a push-forward trend.

Unbalanced development theory has provided the important theoretical support for many nations and regions to make regional economic development policies. (Li & Gao, 2012; Li & Zhang, 2012). But the practice proves that the development mode that the advanced spurs the backward may not be necessarily realized following the idealistic path. On the one hand, the high profitability rate of growth pole has strong attractions to the resources, capital, human resources and information these superb factors of production; as for the regions at backward, the resources and factor are constantly exported, which brings about the wider gap in between. So the generation of growth pole may deprive the developing opportunity of other regions and also increase the difficulty of developing the regions at backward. On the other hand, the realization of diffusion effect is the key to decide the success of the unbalanced development policy. Under the assumption of market economy, only if the profit is enough low and the cost is enough high in the area of growth pole, the liquidity to the backward regions will happen in the market diffusion. The requirement for much time-consuming and the goal of coordinated development of all regions are contradicted. (An, 1997; Hong, 2001; Liu, 2004).

Therefore, the government intervention at the appropriate time with proper policy is the key for the success of the non-equilibrium strategy workout. By observing and supervising the polarization posture and development trend of regional economy, government thus picks up the appropriate time to give necessary instructions and re-corrections. At the stage of economy prosperity, government accelerates the polarization posture of advantaged region so as to form the growth pole; when the growth pole develops to a certain stage, government will perform its coordination reverting to the market to strengthen the diffusion function of growth pole, encourage the backward regions to catch up and achieve the common development.

The non-equilibrium theory has been widely applied in china, and many scholars have used his theory to conduct researches on the china economic development status. Zhou (2000) has did research on the responsive strategies to the regional economic differentiation and development in Hunan Province; Zhao (2003) did analysis on the economic differentiation among the villages in Guangdong province and came up with the strategies of promoting the coordinating development; Lu & Gu (2004) did the quantitative analysis on the regional economic polarization status and motives mechanics in Jiangsu Province; Sun (2003), Li (2005), Mu (2006), Shi (2010) had research and discussion on the regional economic development of Shandong Province. There are also many other scholars doing the research on the sustainable development paths of processing trade in China (Yuan & Yu, 2003; Li, 2005; Zhang, 2004). But if applying the non-equilibrium strategies in the assigned industries especially

the processing trade industry to analyze its development, the sustainable fruits are still very limited. This article analyzes the polarization posture and structure of Shandong processing trade development and discusses on the existing problem and solutions with the aim of promoting the sustainable development of Shandong processing trade industry development.

### 3. Methodology

Polarization is a vital index reflecting the unbalanced growth of regional economic development. The article introduces the processing trade polarization index and processing trade polarization fluctuation rate to predict the geographical polarization posture and development trend of Shandong Province. The introduction of processing trade value-added index to evaluate the polarization posture and trend at the capital accumulation speed of Shandong processing trade.

#### 3.1. The polarization index of processing trade

$$W_i = \frac{(X_i + I_i) \cdot n}{\sum_{i=1}^n (X_i + I_i)}$$

$$a_i = W_i(2011) / W_i(2005)$$

In the above equation,  $W_i$  is the regional polarization index of processing trade,  $X_i$  is the total value of export of regional processing trade,  $I_i$  is the total value of import of regional processing trade,  $n$  is the total amount of regions.  $a_i$  is the fluctuation rate of processing trade polarization in  $i$  regions from 2005 to 2011. The polarization index of processing trade evaluates the ratio of total foreign trade amount of regional processing trade to the average level of the entire region, reflecting the geographical gathering status of processing trade. If the polarization index of processing trade is over 1, which means the regional total processing trade development is better than the regional average level in amount. The bigger the polarization index of processing trade is, the higher the degree to which the regional processing trade polarization is.

#### 3.2. The polarization index of processing trade product

The polarization index of processing trade product mainly reflects the polarization status of grouped products in processing trade.

$$K_a = \frac{X_a \cdot m}{\sum_{a=1}^m X_a}$$

$$a = 1$$

In the above equation,  $K_a$  is the polarization index of "group a" processing trade product,  $X_a$  is the export value of "group

a" processing trade product. m is the amount of processing trade product grouping. The polarization index of processing trade product reflects the polarization posture of processing trade development in product structure. If K is over 1, that means the export of this group of products is better than the average provincial level; the bigger the K is, the more advantages the export of this product has in the processing trade export in Shandong Province.

### 3.3. The value-added index of processing trade

$$P_i = \frac{\sum_{i=1}^n (X_i - l_i) / X_i}{\sum_{i=1}^n (X_i - l_i) / \sum X_i}$$

P<sub>i</sub> is the value-added index of processing trade, reflecting the value-added status of the local processing trade. The bigger the index is, the added value through processing could be achieved for product export, the faster the capital accumulation is for processing trade industry.

## 4. Experiment Results

### 4.1. The polarization index of processing trade

Collect the staged data of processing trade in each year in each region from Shandong Commerce Department and calculate the polarization index of processing trade & fluctuation rate of polarization index in many regions of Shandong province from 2005-2012.

<Table 1> The polarization index of processing trade in regions of Shandong Province

	2005	2006	2007	2008	2009	2010	2011	2012	ai
Jinan	0.28925	0.20799	0.22370	0.21046	0.21954	0.16418	0.16726	0.17649	-38.98%
Qingdao	7.87281	7.59697	6.72433	5.67190	5.31758	5.04268	5.21327	4.85788	-38.30%
Zibo	0.62304	0.55255	0.46477	0.40077	0.37008	0.39558	0.44059	0.46022	-26.13%
Zaozhuang	0.02219	0.03988	0.03739	0.03953	0.03342	0.04748	0.05235	0.05123	130.90%
Dongying	0.33204	0.32221	0.36306	0.34883	0.38594	0.56703	0.87623	0.96856	191.70%
Yantai	2.84781	3.41295	4.91245	6.37691	6.91084	6.79190	5.81737	5.68375	99.58%
Weifang	0.75174	0.75031	0.66636	0.61288	0.57483	0.6286	0.832719	1.20371	60.12%
Jining	0.15994	0.14957	0.15869	0.19811	0.18835	0.18253	0.252089	0.32141	100.954
Taian	0.10149	0.09552	0.08174	0.06993	0.06154	0.05747	0.060087	0.07385	-27.24%
Weihai	2.51609	2.64489	2.28884	2.04829	2.01677	2.07067	2.086631	2.06116	-18.08%
Rizhao	0.22650	0.21066	0.22250	0.21544	0.21219	0.19906	0.362976	0.29320	29.45%
Binzhou	0.71500	0.61160	0.46102	0.46055	0.40943	0.48373	0.45639	0.37049	-48.18%
Dezhou	0.09631	0.08593	0.07424	0.05730	0.06383	0.06763	0.07441	0.07868	-18.30%
Liaocheng	0.09966	0.06748	0.07821	0.07715	0.06500	0.11018	0.11137	0.19971	100.39%

Linyi	0.16634	0.14929	0.16531	0.15897	0.12541	0.09896	0.11468	0.12992	-21.89%
Heze	0.02322	0.03429	0.02848	0.02441	0.02377	0.02782	0.03468	0.04265	83.69%
Lai	0.15657	0.06793	0.04893	0.02857	0.02148	0.02451	0.03023	0.01358	-91.33%

Resources from: Calculation based on the "Shandong International Commerce website- Technology department- Processing Trade Page- Statistics data of processing trade- The import & Export of Processing trade in various regions of Shandong Province.

<http://www.shandongbusiness.gov.cn/zz/index/zz/kjc/itemid/554>

### 4.2. The polarization index of grouped products in processing trade

Collect the staged data of processing trade in each year in each region from Shandong Commerce Department and calculate the polarization index of grouped products in processing trade in many regions of Shandong province from 2009-2012.

<Table 2> The polarization index of grouped products in processing trade

No.	Grouped Products	2009	2010	2011	2012	2009-2012 increasing rate of polarization index
a	Mechanics& devices	4.5	4.84	3.78	3.06	-0.32
b	Electronic appliances	3.56	3.26	2.78	3.04	-0.15
c	New inflatable rubber tire	1.54	1.76	2.4	2.8	0.82
d	Transportation Vehicles	1.08	1.64	2.28	1.64	0.52
e	Textile composite and products	1.5	1.68	1.42	1.44	-0.04
f	Clothing and its raw materials	1.4	1.12	1.18	1.16	-0.17
g	Gamer	1.44	1.18	1.16	1.76	0.22
h	Seafood	0.96	0.86	0.92	0.9	-0.06
i	Metal Products	0.6	0.56	0.54	0.6	0
j	Devices & equipments	0.16	0.22	0.32	0.28	0.75
k	Shoes	0.4	0.3	0.28	0.28	-0.30
l	Plastic products	0.3	0.24	0.26	0.32	0.07
m	Paper and paper mold (not processed)	0.14	0.14	0.22	0.28	1.00
n	Boxing products	0.22	0.16	0.16	0.18	-0.18
o	Pearl, gemstone, half-gemstone	0.1	0.08	0.12	0.12	0.20
p	Furnitures and composites	0.16	0.12	0.1	0.1	-0.38
q	Gymnastic facilities	0.06	0.06	0.06	0.06	0
r	Vegetables	0.06	0.04	0.04	0.04	-0.33
s	Noble metal and its processed Jewel	0.06	0.04	0.04	0.04	-0.33
t	Others	0.06	-	-	0.04	-0.33

### 4.3. The value-adding index of regional processing trade

Collect the staged data of processing trade in each year in each region from Shandong Commerce Department and calculate the value-adding index of regional processing trade in many regions of Shandong province from 2005-2012.

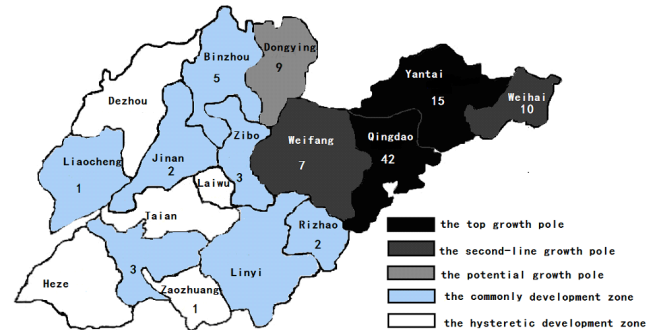
<Table 3> The value-adding index of regional processing trade

	2005	2006	2007	2008	2009	20102011
Jinan	2012	1.448231	1.501073	1.206834	1.433588	1.5726751 .339442
Qingdao	1.248415	1.048942	1.125645	1.149924	1.202523	1.1670471 .153375
Zibo	1.525689	1.147504	1.204604	1.332647	1.301012	1.1545621 .130534
Zaozhuang	1.029075	1.717628	1.242038	1.018277	1.232757	1.4590211 .505629
Dongying	1.155495	1.562965	1.314405	1.482719	1.590344	1.2020731 .178626
Yantai	1.157249	0.65843	0.639722	0.774742	0.730201	0.8232070 .857738
Weifang	1.133872	1.357202	1.33671	1.368286	1.32538	1.2519311 .069627
Jining	1.561025	1.053567	1.419925	1.226325	1.0727	0.8503891 .1026
Taian	1.456039	1.692357	1.658763	1.70067	1.639293	1.6486531 .527452
Weihai	1.468856	0.796261	0.771281	0.754965	0.818832	0.85830.9 17799
Rizhao	1.305406	1.152977	1.172431	1.26812	1.197677	0.9773320 .910513
Binzhou	0.753722	1.189249	1.365426	0.795173	0.929963	0.8477170 .273572
Dezhou	0.768887	1.47287	1.597792	1.632684	1.460145	1.356661. 372139
Liaocheng	2.041449	1.66745	1.811088	1.881758	1.436097	1.0710670 .188159
Linyi	0.990746	1.14229	1.177884	1.236587	1.167908	1.0988350 .937047
Heze	1.641174	1.78757	1.876296	1.708409	1.493851	1.4872231 .213523
Laiwu	1.208197	1.728832	1.668687	1.451644	1.55279	1.3918380 .913344
	1.546939					
	1.556632					
	0.772018					
	1.00277					
	1.102387					
	1.050426					
	0.776136					
	0.555651					
	1.378059					
	1.186216					
	1.973748					
	-0.03928					
	0.967407					
	1.008056					
	1.677506					
	1.223204					
	1.353276					
	1.582186					

## 5. Discussion & Analysis

### 5.1. The regional coordinating analysis on the whole polarization level

From the polarization index, the regional processing trade development of Shandong Province is in mode of east to west gradient level. The growth pole of processing trade represented by Yantai and Qingdao has been formed; Weifang and Weihai sequently followed, consisting of the second-line growth pole; The polarization index of processing trade in Dongying comes near to 1. The processing trade industry development in Yantai and weifang has formed the feature of polarization, pioneering the processing trade development in Shandong province. Also, from 2005-2012, the polarization level of processing trade in two places continue to rise up with strong increasing incentive.



<Figure 1> polarization index of processing trade and regional distribution of the top 100 enterprises

Furthermore, the regions such as Dongying, Rizhao, Liaocheng, Heze, Jining, Zaozhuang remain at low processing trade development level but have tremendous increasing potential. The proportion of potential processing trade keeps constant increasing. There are also regions such as Dezhou, Jinan, Taian, Laiwu, Linyi, Zibo and Binzhou where the regional processing trade level remain not high, whose polarization level keeps depressing have unpromising overview. The polarization index of processing trade in Qingdao and Weihai is high representing the typical growth pole of processing trade development which grows very mature. But the incentive of further development is decreasing and the polarization level is gradually degrading.

The distribution of top 100 enterprises of processing export forms the same feature as advantaged in east and weak in west. Qingdao has obvious strengths as possessing 42 enterprises among the top 100; Yantai and Weihai respectively have 15 and 10; Dongying has 9, Weifang has 7 and Binzhou has 5. Zibo and Jining each has 3; Jinan and Rizhao each has 2; Liaocheng and Zaozhuag each has 1.

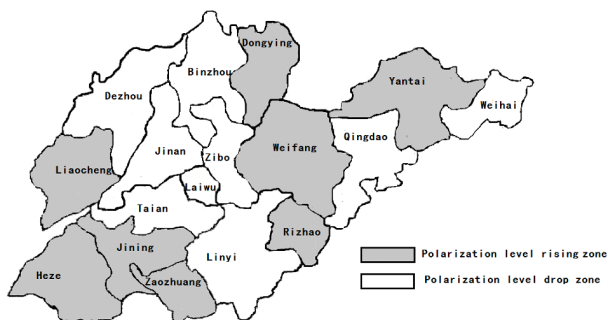
At the meanwhile, it's not hard to discover that the regional processing trade development of Shandong province is com-

paratively at backward with obvious gap in between. Making full use of the prominent geographical conditions and development opportunities, Qingdao and Yantai achieve the rapid increasing in processing trade with the respective polarization index of 4.86 and 5.68. However, in the middle west areas, the polarization index of processing trade in 12 regions is all below 0.5. The big differentiation must weaken the coordination of processing trade development.

### 5.2. Analysis on the polarization level fluctuation of regional coordination: obvious soaring-up increasing feature

Comparing the polarization index of processing trade in years, the polarization level of Shandong regional processing trade has changed tremendously from 2005-2012. Qingdao and Yantai as the first-line growth pole of processing trade industry perform totally different developing trend. The polarization index of processing trade in Qingdao is in trend of sharp decreasing, from 7.87 in 2005 to 4.86 in 2012. In opposite, the polarization index of processing trade in Yantai has soared from 2.85 in 2005 to 5.68 in 2012, ranking the top in Shandong province. Weifang among the cities with the second-line growth pole has achieved the increasing from 0.75 in 2005 to 1.20 in 2012. Weihai remains at a comparatively level. Besides, Liaocheng, Heze, Jining and Zaozhuang such cities in west also stay with "up" trend.

With the geographical advantages as well as its good processing trade status, East regions could match with the West regions with its cost saving and flexibility so as to become the domain region of seeking for processing trade prosperity. This trend is the compulsory result by market choice, which also initially performing the region-divided trend in promoting the development of processing trend.



<Figure 2> The change trend of polarization level of processing trade

### 5.3. The analysis on the region coordination of polarized structure: from the pyramid to the spindle.

The polarized structure of Shandong processing trade shows

the harmonious graph of pyramid in 2005. The cities with typical growth poles are Qingdao, Yantai and Weihai. In 2012, the structure has been transformed to the spindle form, developing unhealthily. Weifang was added to the growth pole category of processing trade. The polarization level of Dongying also came near to 1. The first-line and second-line growth poles of processing trade have been increased, whereas the potential cities for developing into growth poles have been limited in shortage of the middle power for processing trade industry upgrading. This gap polarized structure is apparently unsteady, which will bring bad influence on the coordinating development of Shandong processing trade development.

### 5.4. The analysis on the product coordination of polarized structure

The polarization index and increasing index of new pneumatic rubber tires and transportation vehicles are very high, showing that the proportion of the export of such products not only remains at a high proportion but also increases at a rate higher than the increasing rate of average. It is the growth pole of processing export product and has strong developing incentive and potential. The growth index of seafood, instrumentation, plastic products, pearl, precious stones and semi-precious stones, paper and paperboard (not cut to shape) is high but the polarization index is comparatively low. That means that such kinds of products consist of a low proportion in the processing export, however, it has a strong increasing potential and is expected to grow up to be the growth pole of processing export trade. The growth index and polarization index of metal products, shoes, handbags and similar contains, precious metal or metal clad with precious jewelry, sporting goods and equipment, vegetables, furniture and parts thereof is very low. This shows that this part of products remains at a low level, which means the proportion of products export and increasing speed are both below the average criteria. Machinery and equipment, electrical and electronic products, textile yarn, fabrics and products, clothing and accessories, game consoles grew slower than average, but the polarization index is relatively high, in a large proportion of the province's economic processing trade exports. It is the mature industry of processing trade, and there is an urgent need to upgrade.

### 5.5. The regional coordination analysis on the value-adding level

Qingdao not only dominates the leading position in the import and export volume of processing trade, but also its value-adding rate which is above the provincial average level. As for Tai'an, Zaozhuang, Jinan, Dongying, Texas, Zibo, Heze, Jining, Rizhao, Weihai, Linyi, Laiwu and such other regions, although the total import and export of processing trade in the province's proportion is not high, but the value-adding status keeps in good

condition; The proportion of import and export of processing trade in Binzhou, Liaocheng and Weifang is not high, the same does in the value-adding situation. Yantai has a relatively high proportion of processing trade but its value-adding status is not optimistic.

## 6. Conclusion

As you can see from the above analysis, the development of processing trade in Shandong Province shows the level of gradient from east to west. First-line growth pole has been formed and developed as well as the initial formation of the diffusion mechanism. The problems of accompanying regional development in incoordination also become increasingly prominent. Such as agglomeration effects apparent lack of diffusion polarization trap early; development of processing trade polarization, lack of industry to undertake intermediate level; Next, Shandong Province, the development of processing trade strategy development, it is necessary to the overall coordination of development objectives into by a non-balanced development goals. According to regional characteristics and development objectives of the development of processing trade in Shandong Province, around the city is divided into innovation diffusion region, enhance growth areas, development to undertake area, and upgrading four levels, given the different policy proposals.

**Innovation Diffusion: Qingdao and Weihai.** The priorities of the innovation diffusion policy are to encourage innovation and strengthen the diffusion effect play. Qingdao, Weihai as mature development of processing trade growth pole, focused on the best talent in the area, state-of-the-art equipment, with the most innovative conditions. The region's development encourages the processing trade enterprises to improve self-development capacity, increase processing aspects of the technology and knowledge content, and enhance deep and fine processing capacity of resource-based products, increase product added value; also play to the exemplary role of the growth pole, diffusion, large enterprises as the leading decomposition process for further processing trade, control the high-end portion of the product value chain, the lower end of the value chain transfer and spread to the surrounding areas, the eastern drive west, drive around the center, to promote processing trade overall co-ordination.

**Rapid growing areas: Yantai, Dongying and Weifang.** The degree of polarization of the processing trade in these three regions has been relatively high, and the development of processing trade steps in a rising channel with strong growth momentum. Measures can be taken to strengthen the agglomeration effect, enhance the degree of industrial linkage and spill-over effects to promote the accelerated growth of processing trade in order to gradually form a set of manufacturing, trade, shipping, financial and high-tech development as a whole with the technical level and the degree of internationalization of high-

er processing trade industry group.

**Undertaking development area: Binzhou, Rizhao, Zibo, Liaocheng, Heze, Jining, and Zaozhuang.** The development of processing trade level in these regions is not very highly pitched, but the eastern cities represented by Binzhou, Rizhao, Zibo have to undertake the transferring of processing trade industry under the geographic advantage, western cities such as Liaocheng, Heze, Jining, and Zaozhuang have elements like the cost advantages with the development of processing trade have the potential. What should be encouraged in these areas play a traditional advantages of natural resources, geographical location and cheap labor to undertake the transfer of the eastern region over the processing trade at the same time, play to the strengths, learn from the experience of the development of processing trade in the eastern coastal areas, with sound policies, quality service, combined with dynamic comparative advantage and competitive advantage, the selective introduction of industry leading project and its accompanying upstream and downstream projects.

**Upgrading and restructuring areas: Texas, Jinan, Tai'an, Laiwu, and Linyi.** The five regions located in central Shandong Province, which neither have the geopolitical conditions of the development of processing trade, nor the labor and other basic elements of lack of cost advantage. Therefore, the development of processing trade is lagged behind the proportion reduced year by year in the province. Five cities should focus on the transformation and upgrading, to avoid the cost and geographical defects, enhance the level of elements in the international division of labor, participate in the knowledge-intensive factors of production, focus on the development of high technology content at high level of processing trade, or to breakthrough manufacturing sectors, from tangible products to intangible services development.

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