

# Research on Manufacturing Industry Linkages in Province Y

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## Abstract

Province Y is a large manufacturing province in China, and its scale has ranked among the top 5 in the country for 10 consecutive years, but there are still problems such as insufficient attention, insufficient investment, lack of high-level talents and unreasonable industrial structure. This paper analyzes the external and internal direct and complete correlations of manufacturing industry in Y province by applying the theory of industrial correlation, in order to provide reference for Y province to grasp the development direction of manufacturing industry, optimize the industrial structure of manufacturing industry and formulate the policy of manufacturing industry development.

## Keywords

Manufacturing Industry, Direct Industrial Association, Indirect Industrial Association, External Industrial Association, Internal Industrial Association

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## 1. Introduction

As an important part of the real economy, manufacturing industry is the most important “stabilizer” and “gas pedal” of the world economy, and is the foundation of the country and the basis of a strong country. In 2020, the proportion of strategic emerging industries and high-tech industries will reach 37% and 46.8% respectively, and a total of 1307 provincial-level demonstration smart workshops will be created, and the scale of intelligent manufacturing equipment industry will exceed 500 billion yuan, making it a national smart manufacturing demonstration area (Xiong, Song, & Cui, 2021). In the process of high-quality development of manufacturing industry in Y province, although resources, capital and other factors keep gathering to key core technologies, manufacturing equipment transformation at the provincial level, etc., there are still problems such as

insufficient attention, insufficient investment, lack of high-level talents and unreasonable industrial structure. Deepen the integration of industry and education, is to promote the priority development of education, talent-led development, industrial innovation and development of strategic initiatives. At present, the global economy continues to be in the doldrums, to promote the economic transformation and upgrading of Y province, the focus is on the manufacturing industry, the difficulty is in the manufacturing industry, and the way out is also in the manufacturing industry (Zhang & Zhu, 2021). In this paper, we apply theories related to industrial association to analyze the external and internal association of manufacturing industry in Y province, in order to provide reference for Y province to grasp the development direction of manufacturing industry, optimize the industrial structure of manufacturing industry and formulate the policy of manufacturing industry development.

## 2. Analysis of External Industry Linkages in Manufacturing

In this paper, the industrial sectors in the input-output table of province Y in 2020 are combined into six major sectors, namely, primary industry, extractive industry, manufacturing industry, water and electricity production and supply industry, construction industry, and tertiary industry.

### 2.1. External Direct Industry Linkages

The external direct industrial association is analyzed by the direct consumption factor, the combined direct consumption factor, and the mixed direct consumption factor.

**Definition 1.** The direct consumption coefficient, also known as the input coefficient, denoted as  $a_{ij}$  ( $i, j = 1, 2, 3, \dots, n$ ), refers to the value of goods or services of the  $i$ -th industry directly consumed by the total output of the  $j$ -th industry per unit in the production and operation process, and the direct consumption coefficients of each industry form the direct consumption coefficient matrix  $A$ .

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix} \quad (1)$$

The larger the  $a_{ij}$ , the stronger the direct dependence of the  $j$ -th industry on the  $i$ -th industry; the smaller the  $a_{ij}$ . The weaker the direct dependence of the  $j$ -th industry on the  $i$ -th industry.  $a_{ij} = 0$  means that there is no direct dependence of the  $j$ -th industry and the  $i$ -th industry, and the specific direct consumption coefficients are shown in **Table 1**.

As can be seen from **Table 1**, in terms of the direct dependence of other industries on manufacturing, manufacturing and construction are the largest, at 0.5849 and 0.5509 respectively, followed by extractive industries, primary industries, tertiary industries, and water and electricity production and supply, at 0.2956, 0.2179, 0.1939, and 0.1716 respectively, and their direct dependence on

**Table 1.** Table of external direct consumption factors.

Inputs	Output	Primary Industry	Extractive industry	Manufacturing	Water and electricity production and supply industry	Construction	Tertiary Industry
Primary Industry		0.1235	0.0033	0.0370	0.0000	0.0039	0.0118
Extractive industry		0.0007	0.0906	0.0466	0.1478	0.0136	0.0018
Manufacturing		0.2179	0.2956	0.5849	0.1716	0.5509	0.1939
Water and electricity production and supply industry		0.0037	0.0798	0.0235	0.3156	0.0041	0.0129
Construction		0.0002	0.0010	0.0003	0.0004	0.0091	0.0054
Tertiary Industry		0.0614	0.1313	0.0790	0.1034	0.1437	0.1742

manufacturing is relatively large, indicating that manufacturing The driving effect on other industries is strong. In terms of the direct dependence of the manufacturing industry on other industries, it mainly relies on itself, followed by the tertiary industry, the extractive industry and the primary industry, with 0.0790, 0.0466 and 0.0370 respectively, and the direct dependence of the manufacturing industry on them all is relatively small, and the dependence on the construction industry is the smallest, with only 0.0003.

**Definition 2.** The integrated direct consumption coefficient, which reflects the direct dependence of the  $j$ th industry on all industries.  $b_{ij}$  The larger the value of the coefficient, the higher the degree of physical consumption and capital intensity of the  $j$ th industry, and **Table 2** is arranged in  $b_{ij}$  from the largest to the smallest.

$$b_{ij} = \sum_{i=1}^n a_{ij} \quad (i = 1, 2, 3, \dots, n) \quad (2)$$

As seen in **Table 2**, all other sectors have the highest intensity of direct dependence on manufacturing, exceeding the tertiary sector by more than a factor of one, indicating that manufacturing has the highest degree of material consumption and capital intensity, followed by construction and water and electricity production and supply.

**Definition 3.** The mixed direct consumption coefficient expresses the degree of direct induction of  $i$  on the production of all sectors of society.  $c_{ij}$  The higher the value of the coefficient, the stronger the degree of direct induction. In  $c_{ij}$  ascending order, see **Table 3**.

$$c_{ij} = \sum_{j=1}^n a_{ij} \quad (j = 1, 2, 3, \dots, n) \quad (3)$$

As can be seen from **Table 3**, the manufacturing industry has the strongest inductivity, exceeding the construction industry by more than 200 times. When the supply is not enough, the priority is to develop the industry with large  $c_{ij}$  and then the manufacturing industry becomes the “bottleneck” industry. In the case of insufficient demand, priority is given to the development of industries with small  $c_{ij}$ , when the construction industry becomes the “bottleneck” industry.

**Table 2.** External integrated direct consumption factor ranking.

Department	Manufacturing	Construction	Water and electricity production and supply industry	Extractive industry	Primary Industry	Tertiary Industry
Integrated direct consumption factor	2.5205	2.3391	2.2864	1.8540	1.1834	1.1476
$b_j$	2.1963	2.0383	1.9924	1.6155	1.1834	1

**Table 3.** Ranking of external mixing direct consumption coefficients.

Department	Manufacturing	Tertiary Industry	Water and electricity production and supply industry	Extractive industry	Primary Industry	Construction
Mixed direct consumption factor	7.06	1.82	1.02	0.86	0.530	0.03
$c_{ij}$	239.88	61.99	34.74	29.34	18.03	1

**Definition 4.** The depth of direct association value is calculated as the size of the direct consumption between industries as a proportion of the total direct consumption, and the depth of association value  $c_{ij}$ . The greater the value of depth of association, the deeper the association between the  $j$ th industry and the  $i$ . The higher the value of depth of association, the deeper the association between the  $j$ th industry and the first industry. It is expressed in the formula, in descending order  $r_{ij}$ , as shown in **Table 4**.

$$d_{ij} = \frac{a_{ij}}{\sum_{i=1}^n a_{ij}} \quad (i = 1, 2, 3, \dots, n) \quad (4)$$

As seen in **Table 4**, the manufacturing industry has the deepest and closest direct correlation with itself, and the shallowest direct correlation with the construction industry. The depth of direct correlation with the tertiary industry, extractive industry, primary industry, and water and electricity production and supply industry is average.

## 2.2. External Full Industry Affiliation

External complete industrial association includes direct and indirect association, which is analyzed by complete consumption coefficient, influence coefficient, and inductance coefficient.

**Definition 5.** The complete consumption factor is the sum of the direct and indirect consumption of goods or services in product sector  $i$  for each unit of end use provided by product sector  $j$ . The complete consumption coefficient of each product sector is expressed in the form of a table, which is the complete consumption coefficient table or complete consumption coefficient matrix, usually denoted by the letter  $E$ .  $(I - A)^{-1}$  is the Leontief matrix, and the specific complete consumption coefficients are shown in **Table 5**.

$$E = (I - A)^{-1} - I \quad (i, j = 1, 2, 3, \dots, n) \quad (5)$$

**Table 4.** External direct correlation depth value ranking.

Department	Manufacturing	Tertiary Industry	Extractive industry	Primary Industry	Water and electricity production and supply industry	Construction
Direct correlation of depth values	0.76	0.10	0.06	0.05	0.03	0.0003
$d_{ij}$	2339.36	316.02	186.42	148.04	93.94	1

**Table 5.** Table of external complete consumption factors.

Inputs	Output	Primary Industry	Extractive industry	Manufacturing	Water and electricity production and supply industry	Construction	Tertiary Industry
Primary Industry		0.1750	0.0554	0.1228	0.0499	0.0807	0.0470
Extractive industry		0.0462	0.1866	0.1636	0.3044	0.1155	0.0472
Manufacturing		0.7486	1.1041	1.7920	1.0445	1.6755	0.6957
Water and electricity production and supply industry		0.0406	0.1827	0.1216	0.5392	0.0844	0.0541
Construction		0.0014	0.0033	0.0027	0.0030	0.0118	0.0073
Tertiary Industry		0.1716	0.3219	0.3179	0.3453	0.3713	0.2965

As can be seen from **Table 5**, in terms of the degree of complete dependence of other industries on manufacturing, manufacturing itself and construction are the largest, at 1.7920 and 1.6755 respectively, followed by extractive industry, water and electricity production and supply, primary industry and tertiary industry, at 1.1041, 1.0445, 0.7486 and 0.6957 respectively, and their complete dependence on manufacturing is relatively large. In terms of the degree of external complete dependence of the manufacturing industry on other industries, it mainly relies on itself, followed by the tertiary industry, the extractive industry and the primary industry with 0.3179, 0.1636 and 0.1228 respectively, all of them have a relatively small degree of complete dependence of the manufacturing industry on them, and the smallest dependence on the construction industry with only 0.0033.

**Definition 6.** The coefficient of influence is the degree of ripple effect of production demand on various sectors of the national economy when one unit of final product is added in one industry of the national economy. The larger the impact coefficient, the greater the pulling effect of that sector on other sectors. In order of  $f_{ij}$  **Table 6**, from the largest to the smallest.

$$f_{ij} = \frac{\sum_{i=1}^n e_{ij}}{\frac{1}{n} \sum_{j=1}^n \sum_{i=1}^n e_{ij}} \quad (i = 1, 2, 3, \dots, n) \quad (6)$$

As can be seen from **Table 6**, the manufacturing industry has the greatest influence, exceeding the average social impact level, and the pulling effect is obvious, followed by the construction industry and the water and electricity production

**Table 6.** External influence coefficient ranking table.

Department	Manufacturing	Construction	Water and electricity production and supply industry	Extractive industry	Primary Industry	Tertiary Industry
Impact factor	1.3346	1.2386	1.2107	0.9817	0.6266	0.6077
$f_{ij}$	2.1963	2.0383	1.9924	1.6155	1.0312	1

and supply industry, and the extractive industry is close to the average social impact level, and the primary and tertiary industries are a little weaker. Such as expanding domestic demand, should be manufacturing, construction, water and electricity production and supply industry to increase investment to stimulate domestic demand, pull the entire national economy, stable, healthy and sustainable development.

**Definition 7.** The coefficient of responsiveness is the degree of demand induction that a sector receives as a result of each additional unit of end use in each sector of the national economy, that is, the amount of output that the sector is required to produce for other sectors. A large coefficient indicates that the sector has a strong sense of demand for economic development, and conversely, a weak sense of demand for economic development. In order of  $g_{ij}$  **Table 7**, from largest to smallest.

$$g_{ij} = \frac{\sum_{j=1}^n e_{ij}}{\frac{1}{n} \sum_{i=1}^n \sum_{j=1}^n e_{ij}} \quad (i = 1, 2, 3, \dots, n) \quad (7)$$

As seen from **Table 7**, the manufacturing industry has the strongest induction, exceeding the average level of social demand for each sector by a lot, indicating that the manufacturing industry is an important sector for expanding domestic demand, stimulating consumption and prompting the national economy to develop at a high speed, and investment should be increased. Under the economic downturn, especially the weak domestic demand, manufacturing is the key sector to promote the recovery of the national economy.

**Definition 8.** The depth of complete association value is a calculation of the magnitude of the share of complete consumption between industries in the total complete consumption. The larger the depth of association value  $s_{ij}$ , the deeper the association between industry  $j$  and industry  $i$ . Expressed in the formula, in descending order  $s_{ij}$ , see **Table 8**.

$$h_{ij} = \frac{e_{ij}}{\sum_{i=1}^n e_{ij}} \quad (i = 1, 2, 3, \dots, n) \quad (8)$$

As seen in **Table 8**, the manufacturing industry has the deepest and closest complete correlation with itself, and the shallowest complete correlation with the construction industry. The depth of direct association with tertiary industry, extractive industry, primary industry, and water and electricity production and supply industry is average. The ranking of the depth of complete association is consistent with the ranking of the depth of direct association, but the gap is narrowed.

**Table 7.** External inductance coefficient ranking table.

Department	Manufacturing	Tertiary Industry	Water and electricity production and supply industry	Extractive industry	Primary Industry	Construction
Inductance factor	3.74	0.97	0.54	0.46	0.28	0.02
$g_{ij}$	239.88	61.99	34.74	29.34	18.04	1

**Table 8.** Ranking table of external complete correlation depth values.

Department	Manufacturing	Tertiary Industry	Extractive industry	Primary Industry	Water and electricity production and supply industry	Construction
Fully correlated depth values	0.7110	0.1261	0.0649	0.0487	0.0482	0.0011
$h_{ij}$	674.4488	119.6583	61.5727	46.2136	45.7490	1

### 3. Analysis of Industry Linkages within the Manufacturing Industry

This paper calculates and analyzes the data of 17 sectors belonging to the manufacturing category among 42 industrial sectors in the input-output table of province Y in 2020.

#### 3.1. Internal Intermediate Input Industry Linkage

##### 3.1.1. Direct Industry Affiliation

The internal intermediate input direct industry linkage is analyzed by the intermediate demand rate and intermediate input rate.

**Definition 9.** The intermediate demand rate is the ratio of the sum of the intermediate demand for an industry's product by industry to the total demand for that sector's product by the national economy as a whole.

$$P_i = \frac{\sum_{j=1}^n x_{ij}}{\sum_{j=1}^n x_{ij} + Y_i} \quad (j = 1, 2, 3, \dots, n) \quad (9)$$

**Definition 10.** The intermediate input rate is the ratio of intermediate inputs to total inputs in the production process of the industry sector in a given period (usually one year).

$$Q_i = \frac{\sum_{i=1}^n x_{ij}}{\sum_{i=1}^n x_{ij} + Y_j} \quad (i = 1, 2, 3, \dots, n) \quad (10)$$

According to the theory of industrial economics, the sector is divided into four different industry groups according to the difference between the intermediate demand rate and the intermediate input rate, which is above or below 50%, as shown in **Table 9**.

The calculation of input-output tables for 2015 and 2020 for Province Y gives the intermediate demand rate and intermediate input rate for 17 sectors of manufacturing, as shown in **Table 10**.

As seen in **Table 10**.

**Table 9.** Industry type classification table.

Classification	Intermediate demand rate less than 50%	Intermediate demand rate greater than 50%
Intermediate input rate greater than 50%	Final demand-based industries	Intermediate product-based industries
Intermediate input rate less than 50%	Final demand-based basic industries	Intermediate product-based basic industries

**Table 10.** Table of internal industry intermediate demand rate and intermediate input rate.

Industry	Coefficient	Intermediate demand rate		Intermediate input rate		2020 Year Type of Industry
		2015	2020	2015	2020	
Food manufacturing and tobacco processing industry	39.58%	48.68%	79.81%	72.75%	Final demand-based industries	
Textile industry	64.79%	55.85%	80.69%	78.65%	Intermediate product-based industries	
Textile, clothing, shoes, hats, leather and down and its products industry	16.99%	23.63%	69.01%	77.47%	Final demand-based industries	
Wood processing and furniture manufacturing	55.21%	53.88%	80.16%	81.76%	Intermediate product-based industries	
Paper, printing and stationery and sporting goods manufacturing	70.07%	63.14%	77.55%	72.74%	Intermediate product-based industries	
Petroleum processing, coking and nuclear fuel processing industry	71.89%	97.34%	84.11%	84.08%	Intermediate product-based industries	
Chemical Industry	82.65%	68.25%	76.18%	76.64%	Intermediate product-based industries	
Non-metallic mineral products industry	81.47%	86.53%	76.12%	74.81%	Intermediate product-based industries	
Metal smelting and rolling processing industry	88.62%	79.13%	83.34%	80.88%	Intermediate product-based industries	
Metal products industry	57.59%	54.24%	80.55%	81.72%	Intermediate product-based industries	
General and special equipment manufacturing	47.10%	42.41%	78.48%	77.97%	Final demand-based industries	
Transportation equipment manufacturing	45.87%	47.41%	79.22%	73.94%	Final demand-based industries	
Electrical machinery and equipment manufacturing	53.77%	37.17%	80.63%	77.14%	Final demand-based industries	
Communications equipment computer and other electronic equipment manufacturing	41.87%	33.86%	78.91%	78.16%	Final demand-based industries	
Instrumentation and cultural office machinery manufacturing	61.40%	43.04%	82.80%	76.88%	Final demand-based industries	
Craft and other manufacturing industries	73.58%	72.70%	82.34%	74.98%	Intermediate product-based industries	
Scrap waste	78.58%	95.37%	0.00%	8.93%	Intermediate product-based basic industries	
Average value	60.65%	58.98%	74.70%	73.50%		
Maximum value	88.62%	97.34%	84.11%	84.08%		
Minimum value	16.99%	23.63%	0.00%	8.93%		



First, the average value of intermediate demand rate of manufacturing industry in province Y in 2020 is 58.98%, indicating that manufacturing industry provides 58.98% of production materials for intermediate use and 41.02% for final use such as consumption, investment, and export. The average value of intermediate input rate is 73.5%, which indicates that 73.5% of total manufacturing output comes from intermediate inputs and 26.5% from value added. According to the 50% cut-off point, manufacturing industries in province Y can be divided into three major categories: first, final demand-based industries with high intermediate input rate and low intermediate demand rate, second, intermediate product-based industries with high intermediate input rate and high intermediate demand rate, and third, basic intermediate product-based industries with low intermediate input rate and high intermediate demand rate, and the ratio of the three categories is 7:9:1.

Second, the final demand-based industries include food manufacturing and tobacco processing industry, textile, clothing, shoes, hats, leather and down products, general special equipment manufacturing, transportation equipment manufacturing, electrical machinery and equipment manufacturing, communication equipment, computer and other electronic equipment manufacturing, instrumentation and cultural office machinery manufacturing and other seven industries, they provide products are mostly final consumer goods, mainly to meet People's living needs, less as factors of production re-invested in the social reproduction process of various sectors of the national economy. Comparing the data of 2015 and 2020, the intermediate demand rate of electrical machinery and equipment manufacturing industry and instrumentation and cultural and office machinery manufacturing industry decreased by 16 and 18 percentage points respectively, changing from intermediate product type to final demand type, indicating that people's final consumption of their products is increasing.

Third, the intermediate product industries include wood processing and furniture manufacturing, metal products, textiles, paper printing and sporting goods manufacturing, chemical industry, handicrafts and other manufacturing, metal smelting and calendering, non-metallic mineral products, petroleum processing and coking and nuclear fuel processing industries and other nine industries, they provide most of the products sold in the market for production materials, participate in the social reproduction process. Comparing the two data sets of 2015 and 2020, the petroleum processing, coking and nuclear fuel processing industry increased by 25 percentage points to 97.34%, indicating that the industry has been applied to all production fields and relies on energy to drive significantly; the intermediate demand rates of other product-based industries have all decreased to varying degrees.

Fourth, the only intermediate product-based industry is the scrap and waste sector, with an intermediate demand rate of 95.37%, indicating that the products of this sector are almost entirely used for intermediate use of production materials. The intermediate input rate increases from 0% in 2015 to 8.93% in 2020, indicating that most of the total output of the sector comes from value added.

### 3.1.2. Complete Internal Industry Linkage

Internal intermediate input complete industry association includes direct and indirect association, which is analyzed by influence coefficient and inducance coefficient. Internal influence coefficient.

$$f'_{ij} = \frac{\sum_{i=1}^n x_{ij}}{\frac{1}{n} \sum_{j=1}^n \sum_{i=1}^n x_{ij}} \quad (i = 1, 2, 3, \dots, n) \quad (11)$$

Internal inducance coefficient.

$$g'_{ij} = \frac{\sum_{j=1}^n x_{ij}}{\frac{1}{n} \sum_{i=1}^n \sum_{j=1}^n x_{ij}} \quad (i = 1, 2, 3, \dots, n) \quad (12)$$

The calculation of the input-output tables for 2015 and 2020 for Province Y gives the internal influence and inducance coefficients for the 17 sectors of manufacturing, as shown in **Table 11**.

**Table 11.** Table of internal influence and inducance coefficients.

Industry	Coefficient	Impact		Sensitivity		2020 Year Type of Industry
		2015	2020	2015	2020	
Food manufacturing and tobacco processing industry	1.1640	0.9548	0.8907	1.3034	Basic Industries	
Textile industry	1.3852	1.2841	1.9420	1.2710	Pillar Industries	
Textile, clothing, shoes, hats, leather and down and its products industry	1.2008	1.3442	0.2075	0.3744	Dominant Industries	
Wood processing and furniture manufacturing	1.3488	1.3422	0.3353	0.6181	Dominant Industries	
Paper, printing and stationery and sporting goods manufacturing	1.2748	1.1799	1.3936	1.0053	Pillar Industries	
Petroleum processing, coking and nuclear fuel processing industry	0.9935	1.2790	0.8397	1.9412	Pillar Industries	
Chemical Industry	1.3242	1.3292	7.0695	4.6733	Pillar Industries	
Non-metallic mineral products industry	1.3012	1.2566	0.5832	0.8152	Dominant Industries	
Metal smelting and rolling processing industry	1.4672	1.4360	3.3925	5.1200	Pillar Industries	
Metal products industry	1.4875	1.5287	0.8759	1.0278	Pillar Industries	
General and special equipment manufacturing	1.4977	1.4458	1.9356	1.9590	Pillar Industries	
Transportation equipment manufacturing	1.4802	1.3705	0.9140	1.1210	Pillar Industries	
Electrical machinery and equipment manufacturing	1.5563	1.4391	1.0074	1.2199	Pillar Industries	
Communications equipment computer and other electronic equipment manufacturing	1.5069	1.4696	2.3500	2.0790	Pillar Industries	
Instruments and cultural office machinery manufacturing	1.5766	1.4423	0.3649	0.5048	Dominant Industries	
Craft and other manufacturing industries	1.5601	1.2618	0.8206	0.2097	Dominant Industries	
Scrap waste	0.0000	0.0886	0.3017	0.4425	Supporting Industries	
Average value	1.3015	1.2619	1.4838	1.5109		
Maximum value	1.5766	1.5287	7.0695	5.1200		
Minimum value	0.0000	0.0886	0.2075	0.2097		

As seen from **Table 11**.

First, the average influence coefficient of manufacturing in province Y in 2020 is 1.2619, indicating that the production demand generated for all sectors of the national economy increases by 1.2619 units for each additional unit of final product, with a clear backward correlation to the national economy. The average inductance coefficient is 1.5109, indicating that for each additional unit of end use in the national economy, 1.5109 units of output are required from manufacturing for other production sectors, which is clearly associated with the national economy in the forward direction.

Second, according to the cut-off point, manufacturing industries in Y province can be divided into four categories, the first category is the pillar industries with high influence and high induction, the second category is the leading industries with high influence and low induction, the third category is the basic industries with low influence and high induction, and the fourth category is the supporting industries with low influence and low induction, and the ratio of the four categories is 10:5:1:1.

Third, the pillar industries include 10 sectors such as metal products industry, communication equipment computer and other electronic equipment manufacturing, general special equipment manufacturing, electrical machinery and equipment manufacturing, metal smelting and rolling processing industry, transportation equipment manufacturing, chemical industry, textile industry, petroleum processing, coking and nuclear fuel processing industry, paper printing and stationery and sporting goods manufacturing. Pillar industries have a pivotal role in the development of the national economy, directly determine the overall quality of the national economy, which is the government to focus on supporting the key industries.

Fourth, the leading industries include non-metallic mineral products, handicrafts and other manufacturing industries, wood processing and furniture manufacturing, textile, clothing, shoes, hats, leather and down and its products, instruments and cultural office machinery manufacturing and other five sectors. The leading industries have a greater induced effect on other industries, influence and pulling power is strong, is an important driving force of the national economy, when the rapid development of these sectors, it can drive the rapid development of the whole economy, the leading industries induction degree is low, the final product is the main.

Fifth, the basic industries are only 1 sector of food manufacturing and tobacco processing industry, which has an important basic role in the economic system, providing intermediate consumption products or services for economic growth, and a more significant support role for other industries. If the development of basic industries is neglected, they will become the bottleneck of the economic system and hinder the pace of economic growth.

Sixth, the support industry only scrap waste 1 sector, this type of industry itself neither drive the development of other industries, nor easily affected by the

development of other industries, is the industry with the lowest correlation effect. Although the economic drive of the support industry is not strong, but is an important part of the national economy, is a necessary factor to promote the overall socio-economic progress, and therefore must be supported.

### 3.2. Internal End-Use Associations

End use is divided into final consumption expenditure, gross capital formation, and outflows. The internal end-use association is analyzed using the consumption allocation factor, the investment allocation factor, and the outflow allocation factor. These three coefficients are calculated by dividing the flows by the total output of the corresponding sector, respectively, and the results are shown in **Table 12**.

As seen from **Table 12**.

First, the top 3 consumption allocation coefficients are food manufacturing and tobacco processing industry (0.5001), handicraft and other manufacturing industry (0.2623), textile, clothing, shoes, hats, leather and down and their products industry (0.1829), while the consumption allocation coefficients of other sectors are lower, indicating that the demand driver of manufacturing industry in Y province is not mainly from the local market.

**Table 12.** Consumption allocation, investment allocation, transfer out allocation coefficient table.

Department	Consumption distribution coefficient	Investment allocation factor	Call out allocation factor
Food manufacturing and tobacco processing industry	0.5001	0.0171	0.1762
Textile industry	0.0070	0.0102	0.4639
Textile, clothing, shoes, hats, leather and down and its products industry	0.1829	0.0075	0.6012
Wood processing and furniture manufacturing	0.0496	0.0336	0.5414
Paper, printing and stationery and sporting goods manufacturing	0.0231	0.0103	0.4381
Petroleum processing, coking and nuclear fuel processing industry	0.0574	-0.0229	0.0218
Chemical Industry	0.0191	0.0250	0.3104
Non-metallic mineral products industry	0.0140	0.0059	0.1638
Metal smelting and rolling processing industry	0.0000	0.0139	0.2748
Metal products industry	0.0135	0.3920	0.1485
General special equipment manufacturing	0.0009	0.4082	0.2531
Transportation equipment manufacturing	0.0627	0.2933	0.2027
Electrical machinery and equipment manufacturing	0.0331	0.1488	0.5187
Communications equipment computer and other electronic equipment manufacturing	0.0178	0.0913	1.0637
Instrumentation and cultural office machinery manufacturing	0.0160	0.2490	0.4253
Craft and other manufacturing industries	0.2623	0.0118	0.0502
Scrap waste	0.0000	0.0000	0.0486

Second, the top 5 investment allocation coefficients are general special equipment manufacturing (0.4082), metal products industry (0.3920), transportation equipment manufacturing (0.2933), instrumentation and cultural office machinery manufacturing (0.2490), electrical machinery and equipment manufacturing (0.1488), and the other sectors have lower investment allocation coefficients, indicating that the equipment The capital accumulation capacity of the manufacturing industry is stronger.

Thirdly, the allocation coefficient of transfer out is at a high level for all sectors except handicraft and other manufacturing industries and scrap and waste sectors, indicating that manufacturing industries in Y province mainly face the external market.

### **3.3. Gross Output Linkage within Manufacturing**

#### **3.3.1. High Concentration**

In this paper, the proportion of sectoral output to total manufacturing output is used to measure the concentration of manufacturing industry. 8.65%, the sectoral concentration of 57.95%, in 2020, the top 5 ranked in order for the chemical industry, communications equipment, computer and other electronic equipment manufacturing, metal smelting and rolling processing industry, general special equipment manufacturing, textile industry, accounting for 16.86%, 14.85%, 13.48%, 9.57%, 8.82%, the sectoral concentration of 63.58%. 63.58%. The top 5 sectors are completely consistent, including communications equipment computer and other electronic equipment manufacturing and metal smelting and rolling processing industry is developing rapidly.

#### **3.3.2. High Technical Degree**

Compared with 2015, the top 5 ranking of the rise in the output ratio in 2020 are metal smelting and rolling processing industry, communication equipment computer and other electronic equipment manufacturing, electrical machinery and equipment manufacturing, general special equipment manufacturing, instrumentation and cultural office machinery manufacturing, with an increase of 4.62, 3.97, 2.51, 0.92, and 0.51 percentage points, respectively, these sectors are technology-intensive industries, indicating that output is tilted toward the technology sector.

## **4. Recommendations**

Manufacturing industry is the most important force to promote the economic development of Y province, and the development of manufacturing industry in Y province should move towards three transformation goals, namely, transformation of manufacturing to creation, transformation of speed to quality, and transformation of product to brand.

### **4.1. High-End Clustering of Pillar Industries**

Pillar industries have a high degree of influence and feeling, at this stage of the

development of China's high-end equipment manufacturing industry focus on the direction of aviation equipment, satellites and applications, rail transportation equipment, marine engineering equipment, intelligent manufacturing equipment (Ding, 2020) (Yan & Lei, 2019). Y province should seize the opportunity to increase financial efforts to encourage research and development, guide technological transformation and innovation, enhance the intelligence of the supporting system, the formation of a number of high-end equipment products with intellectual property rights and Famous brands, training a number of leading scientific and technological talent with international vision, build a number of innovation capacity, distinctive high-end equipment manufacturing cluster, so that more and more "special, fine, special, new" specialized production enterprises gathered, and strive to master the key core technology, improve product and service standards (Peng, Zhang, Yang, & Ding, 2019) (Gan, Liu, & Shaya, 2018).

#### **4.2. Transformation and Upgrading of Leading Industries and Basic Industries**

Leading industries and basic industries from low value-added to high value-added transformation, from high energy consumption and high pollution to low energy consumption and low pollution transformation, from rough to intensive industrial transformation, strengthen the "Internet+" collaborative manufacturing, and actively develop intelligent and large-scale personalized customization, expand domestic demand, and accelerate the transformation of manufacturing services. The policy should strengthen the guidance, encourage enterprises to increase the investment in information technology, promote the development of e-commerce, pay attention to the construction of human resources, and strive to create an Internet ecosystem, forming a development pattern of "consumers - enterprises - projects - industrial chain - industrial clusters - industrial bases - partners - employees - communities", and establishing the brand belonging to enterprises and consumers (Chen & Zhu, 2018). At the same time, we must pay attention to the construction of consumer rights protection system, intellectual property protection system and enterprise credit system, and maintain the effective growth of independent innovation capacity of manufacturing industry (Sun, 2017).

### **5. Conclusion**

The following conclusions are obtained from the above analysis of external industry linkages in manufacturing: manufacturing and construction have the highest direct dependence on manufacturing, and manufacturing has the highest dependence on itself, so manufacturing has a strong driving effect on other industries and itself. The highest intensity of direct dependence of manufacturing in all other industries indicates the highest degree of material consumption and capital intensity of manufacturing. When the market supply is insufficient,

priority is given to the development of manufacturing industry, and when the market demand is insufficient, limited development of construction industry. The manufacturing industry has the deepest direct dependence on itself. The manufacturing industry itself and the construction industry are more completely dependent on the manufacturing industry. The manufacturing industry has the greatest influence, the strongest induction, and the greatest complete correlation with itself.

The following conclusions are obtained from the above analysis of industry correlation within the manufacturing industry: the manufacturing industry in Y province has the highest proportion of intermediate product-type industries with high intermediate input rate and high intermediate demand rate, and relies on energy to drive significantly. People's final consumption of electrical machinery and equipment manufacturing and instrumentation and cultural and office machinery manufacturing is increasing. The products of the scrap and waste industry are almost entirely used for intermediate use of production materials. Most of the total output of the manufacturing industry comes from added value. The forward and backward linkages between manufacturing and national economy are obvious. The highest proportion of high impact and high induction pillar industries is currently 58.8%. The food manufacturing and tobacco processing industries provide intermediate consumption products or services for economic growth and have a more significant supporting role for other industries. The top 3 consumption distribution coefficients are food manufacturing and tobacco processing industry (0.5001), handicraft and other manufacturing industries (0.2623), and textile, clothing, footwear, leather, feather and down products (0.1829). Investment allocation coefficient ranked in the top 5 is the general special equipment manufacturing (0.4082), metal products (0.3920), transportation equipment manufacturing (0.2933), instrumentation and cultural office machinery manufacturing (0.2490), electrical machinery and equipment manufacturing (0.1488). The distribution coefficients of most industries are at a high level, indicating that the manufacturing industry in Y Province mainly faces the external market. Communication equipment, computer and other electronic equipment manufacturing and metal smelting and rolling processing industries are developing rapidly. In the past five years, the top five ranking of the rise in metal smelting and rolling processing industry, communications equipment, computer and other electronic equipment manufacturing, electrical machinery and equipment manufacturing, general special equipment manufacturing, instrumentation and cultural office machinery manufacturing, these sectors are technology-intensive industries, indicating that the output to the technology sector.

Therefore, Y province should vigorously develop science and technology, and transform and apply the results of scientific and technological innovation to the manufacturing industry. Second, we should vigorously invest in the manufacturing industry, upgrade the intelligent equipment of the manufacturing indus-



try, and expand the production capacity of the manufacturing industry. Third, we should conscientiously implement industry-related policies, and make efforts to promote the transformation and upgrading of manufacturing industry in high-end, intelligent, characteristic and green. Fourth, we should vigorously cultivate manufacturing talents, including scientific and technological talents and management talents, expand the number of manufacturing talents and improve the quality of manufacturing talents. Fifth, we should form manufacturing alliances to form a closely linked industrial chain and share resources; sixth, we should study and track the manufacturing market, grasp the dynamic market data in real time, and adjust the manufacturing planning in time; seventh, we should protect the ecological environment, collect the relevant ecological data of the manufacturing industry, and assess and guide its environmental protection situation. Deeply practice the new development concept, accelerate the supply-side structural reform, firmly build a strong manufacturing province, and ensure the high-quality development of manufacturing industry in Y province.

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### Conflicts of Interest

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

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