Productivity and Performance of Thai Industry Report 2018

present

The Office of Industrial Economic

by

Fiscal Policy Research Institute

Table of contents

Table of contents (Cont.)

1 Preface

The Office of Industrial Economics has assigned the Fiscal Policy Research Institute Foundation (FPRI), Ministry of Industry, to survey business operators' data, and produce the Industrial Productivity and Performance Report for 2018. This report serves as essential material that is useful in forming policies, measures, and governmental planning, as well as business planning for the private sector.

In collecting field data, surveys were conducted among a sample of 2,619 business operators. The data gathered from the sample will be used to analyze the industrial economic situation by establishing productivity indicators, namely Total Factor Productivity (TFP) and studying the changes of TFP (TFP Growth: TFPG) at the industrial, production and corporate levels. The results from the analysis will be compiled and synthesized for the Industrial Productivity and Performance Report for 2018.

The analysis of industrial productivity and performance takes consideration of Value-Added (VA), which means the economic value that has increased from the input of production factors (such as labor and machinery) into the production or service process until it appears as a finished product or service. Calculations use the Growth Accounting Model to calculate the source of growth or the rate of increase in Value-Added, from the rise in the vital production factors, which are labor and capital, including the Total Factor Productivity Growth (TFPG).

TFPG or the expansion of this overall productivity is a measure of the Value-Added growth caused by other factors aside from the quantity of labor and capital factors used in production. It most often reflects the expansion of Value-Added due to quality factors such as the quality of labor and capital used in production and the efficiency of using existing production factors. It further reflects technological advantages, management ability, level of research and development, brand confidence, and other various marketing factors that may affect the Value-Added, whether it is a change in demand or the market supply, which causes the product price to increase or decrease. The details of the study will be the overall manufacturing industry at the national level, and analysis classified by various dimensions, namely the size of the business (large, medium and small), the ownership dimension (Thai, joint-venture and foreign), the regional dimension (Bangkok and vicinity, the northern, northeastern, central, western, and southern regions) and a dimension by production.

2 Field Survey Results

2.1 Structure of the Sample from the Field Survey

The survey of 2,619 samples has a sample structure that can be divided according to the following main dimensions, including production and size, area, and ownership type, as follows (see details in Table 2.1).

- The sample group covers the sales value of the corporate population in the manufacturing sector from an average of 73.8 percent of the industry census, especially in the manufacturing industry that has economic importance as one of the top 10 industries. The sample group covers the sales value of the population in each branch, exceeding 50 percent. In addition, the sample group consists of all branches in the TSIC 2 framework, covering a total of 24 branches. The top three branches with the highest proportion of samples were the food, automotive, and rubber and plastic branches, with 383, 262, and 224 samples, respectively. Most of the businesses in the sample group were large enterprises (L) with a total of 1,955 samples (74.6 percent of the total number of samples), followed by 444 medium-sized businesses (17.0 percent of the total number of samples) and 220 samples of small companies (8.4 percent of whole samples).
- Most of the firms in this sample are in Bangkok and metropolitan areas with 1,272 samples (48.6 percent of the total number of samples) followed by the eastern and central regions.
- Business ownership in this sample is 1,420 Thai businesses (54.2 percent of total samples) and 512 foreign businesses (19.6 percent of all samples)[1].

[1] Businesses with a 100 percent proportion of Thai shareholders are designated as a Thai business and businesses with a 100 percent proportion of foreign shareholders are considered a foreign business.

Table 2.1: Sample structure from field survey

(A) Categorized by production branch and size

TSIC		Proportion of Value-Added to the Industry Value-Added (%)	Proportion of sales coverage (%)	Size of business (business)							
				L	Proportion (%)	M	Proportion (%)	S	Proportion (%)	Total	Proportion (%)
29	Motor Vehicles	16.0	89.2	239	9.1	19	0.7	4	0.2	262	10.0
10	Food Products	15.8	55.8	319	12.2	42	1.6	22	0.8	383	14.6
26	Electronic	12.1	70.7	177	6.8	37	1.4	5	0.2	219	8.4
22	Rubber and Plastics Products	7.4	52.9	190	7.3	22	0.8	12	0.5	224	8.6
20	Chemicals	7.1	57.3	132	5.0	46	1.8	16	0.6	194	7.4
19	Petroleum Products	5.3	99.8	31	1.2	18	0.7	21	0.8	70	2.7
25	Fabricated Metal Products	4.6	57.1	86	3.3	22	0.8	27	1.0	135	5.2
28	Machinery	4.6	60.2	91	3.5	14	0.5	9	0.3	114	4.4
24	Basic Metals	4.5	74.7	112	4.3	14	0.5			126	4.8
23	Non-Metallic Mineral Products	3.6	54.7	98	3.7	19	0.7	9	0.3	126	4.8
27	Electrical Equipment	3.5	91.5	62	2.4	17	0.6	4	0.2	83	3.2
11	Beverages	2.7	88.7	62	2.4	5	0.2	3	0.1	70	2.7
13	Textiles	2.1	24.9	60	2.3	9	0.3	1	0.04	70	2.7
17	Paper and Paper Products	2.1	45.0	40	1.5	9	0.3	2	0.1	51	1.9
32	Other Manufacturing	1.6	99.6	38	1.5	11	0.4	18	0.7	67	2.6
14	Wearing Apparel	1.4	23.6	58	2.2	13	0.5	14	0.5	85	3.2
30	Other Transport Equipment	1.3	71.9	37	1.4	6	0.2	2	0.1	45	1.7
16	Wood and Products of Wood	0.8	24.9	17	0.6	31	1.2	8	0.3	56	2.1
31	Furniture	0.8	31.4	32	1.2	12	0.5	8	0.3	52	2.0
12	Tobacco Products	0.6	95.8	2	0.1	2	0.1	1	0.04	5	0.2
15	Leather and Related Products	0.6	49.8	24	0.9	21	0.8	4	0.2	49	1.9
18	Printing	0.6	24.6	12	0.5	27	1.0	11	0.4	50	1.9
21	Pharmaceuticals	0.6	36.8	21	0.8	12	0.5	2	0.1	35	1.3
33	Repair and Installation	0.6	48.9	15	0.6	16	0.6	17	0.6	48	1.8
Total		**100**	**73.8**	**1,955**	**74.6**	**444**	**17.0**	**220**	**8.4**	**2,619**	**100.0**

(B) Classified by area

Area	Amount (business)	Proportion (%)
Bangkok and vicinity	1,272	48.6
Central	228	8.7
Western	71	2.7
Eastern	700	26.7
Northeastern	126	4.8
Southern	112	4.3
Northern	110	4.2
Total	**2,619**	**100.0**

(C) Classified by ownership

Ownership	Amount (business)	Proportion (%)
Thai	1,420	54.2
Joint venture	687	26.2
Foreign	512	19.6
Total	2,619	100.0

Source: Fiscal Policy Research Institute Foundation (FPRI)

2.2 Income and Production

The data operating mode, sales channels, and the income of the business can reflect the ability level and the business operating situation of the company during the year 2017-2018, as shown in Table 2.2.

- The operating business model is OEM, which is considered the least developed, slightly increased from 41.1 percent in 2017 to 41.7 percent in 2018. Meanwhile, the ODM and OBM formats decreased.
- Most of the sales channels of the business are still regular sales. Only 6.84 percent of all transactions are from sales through electronic channels (E-Commerce).
- The average income of companies in the sample group has continuously increased throughout the year 2016-2018, with an average income of 4,133 million Baht per year and income growth of 3.2 percent in 2018.
- The average income of most businesses in the sample comes from domestic sales. The proportion of revenue from exports of these businesses is approximately 7.2 - 7.3 percent per year.
- The average capacity utilization rate of companies in the sample group is relatively stable at approximately 70 percent.

Table 2.2: Income and production of the sample

(A) The proportion of sales classified by operating model and distribution channel (average).

Operating model	Proportion to total sales (%)	
	2017	2018
OBM	35.1	34.8
ODM	23.8	23.5
OEM	41.1	41.7
E-Commerce	n.a.	6.4

(B) Income and capacity utilization rate (average)

Ownership	2016	2017	2018
Revenue (million Baht)	3,913	4,176	4,311
Exports (%)	7.3	7.2	7.2
Capacity utilization rate (%)	69.7	70.1	70.0

Source: Fiscal Policy Research Institute Foundation (FPRI)

Note: OEM— Original Equipment Manufacturer
ODM— Original Design Manufacturer
OBM— Original Brand Manufacturer

2.3 Structure of production factors of samples

Important production factors for factories are capital factors that comprise machinery, equipment, factory buildings and land, and labor factors from unskilled workers to executives. Table 2.3 shows the structure of capital and labor factors of the sample.

- The measurement of capital factors uses the net fixed assets value from the financial statements of the business. Businesses in the sample group had slightly fewer net assets, which show that in the general overview, there was an ongoing investment to maintain capital levels. This is consistent with the investment data in new machinery, which indicates that the proportion of machinery and equipment under the age of 5 years gradually increased from 2.5 percent in 2016 to 2.6 percent in 2018. Also, the new investments were in automatic or semi-automatic machinery and equipment, whereby the proportion of automatic or semi-automatic machinery and equipment increased from 33.8 percent in 2016 to 34.9 percent in 2018.

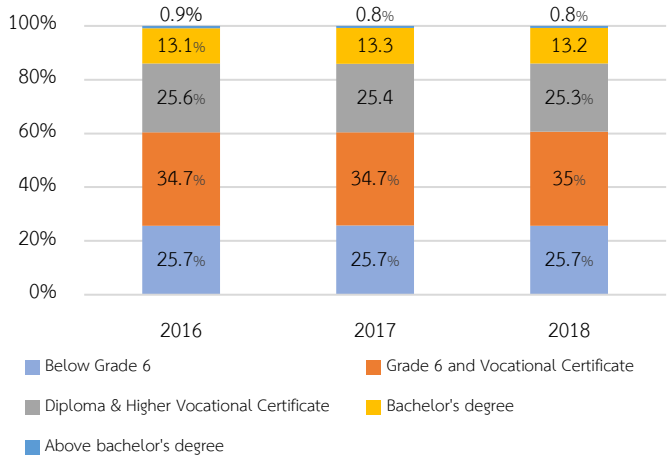
- The level of education is an indicator that reflects the quality and ability of personnel in the sample group had a relatively low level of education. The largest populations were graduates of secondary school and vocational certificates. Over 86 percent of the workforce were Thai nationals. The number of working hours gradually increased from 8.02 hours per day in 2016 to 8.05 in 2018.
- The average age of workers in the sample group increased from 37.0 years in 2016 to 38.0 years in 2018, which shows that businesses employed fewer new employees. The data is consistent with the investment in new machinery that reduced manual work.
- When considering the necessary skills and training for personnel in the sample group, 46 percent were skilled workers. Still, the level of English and technology competence of the staff was relatively low, with an average score of 2.2 and 2.3 out of a total of 4 points. These businesses also emphasized the development of personnel skills, training on average 107 people per year (accounting for 28.5 percent of the total workforce), and the average hour of training was 7.8 hours per person.

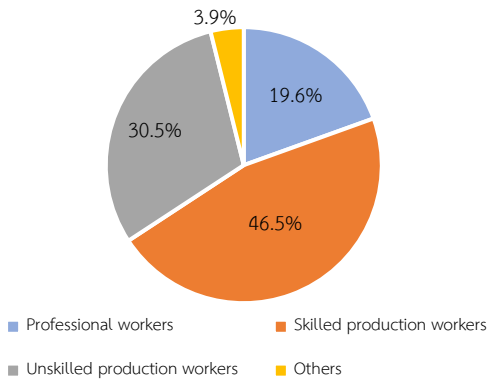
Table 2.3: The structure of production factors of the sample

(A) Capital factors (average)

Capital factors	2016	2017	2018
Net fixed asset value (million Baht)	1,536	1,529	1,532
Machinery and equipment not older than five years (%)	2.5	2.6	2.6
Automatic/semi-automatic machinery and equipment (%)	33.8	34.0	34.9

(B) Labor factors (average)





Labor factors	2016	2017	2018
Total labor force (person)	376	374	376
Number of working hours per day (hours)	8.02	8.05	8.05
Average age (years)	37.0	37.6	38.0
The proportion of Thai workers (%)	n.a.	n.a.	86.4
- Language ability (full score of 4)	n.a.	n.a.	2.2
- Technology competency (total score of 4)	n.a.	n.a.	2.3
- Number of trained workers (persons/year)	n.a.	n.a.	107
- Number of training hours (hours/year)	n.a.	n.a.	7.8

Source: Fiscal Policy Research Institute Foundation (FPRI)

2.4 The Business Cost Structure in the Sample Group

The costs of the business consist of two main parts, which are production costs and other expenses.

- Most of the samples' costs were from production costs, which increased from 3,110 million Baht in 2016 to 3,426 million Baht in 2018, which corresponds to the increased income. Production costs with the most significant proportion were raw material costs with an average value of 1,979.99 million Baht (60.3% of total production costs) during 2016-2018, as detailed in Table 2.4.
- The majority of sales and administrative expenses came from office labor and transportation costs. The average proportion in the year 2016-2018 was equal to the average value of 69.8 million Baht (representing 23.7 percent of the total sales and administrative expenses) and 44.6 million Baht (accounting for 15.2 percent of total sales and administrative costs respectively. Meanwhile, research and development, and information technology expenses were relatively low, indicating that business operators also have the technology to help manage and that investment in innovations was relatively little. This shows that not much has changed, even though there has been more emphasis on information technology investment, as shown in the details in Table 2.4.

Table 2.4: The business cost structure in the sample group

(A) Production cost (average)

Production cost (million Baht)	2016	2017	2018
Total production costs (including production labor costs)	3,109.7	3,318.7	3,426.0
Total raw material costs	1,853.9	2,006.4	2,079.4
Depreciation of fixed assets	199.0	206.5	208.0
Fuel and energy costs used in production	172.5	215.6	204.2
Compensation for labor in the production	158.5	159.0	170.1
Cost of materials used to package products	103.2	125.0	119.0

Production cost (million Baht)	2016	2017	2018
Expenses for repairs and maintenance of machinery and equipment	79.1	74.7	76.9
Cost of raw water/tap water used in production	15.8	16.3	24.0
Costs of purchasing finished goods for reselling	18.1	20.7	19.0
Cost of sub-contractor fees paid to other operators in which the employer procures raw materials	4.5	6.1	5.7
Expenses paid for contracted labor	0.2	0.4	0.3

(B) Other expenses (average)

Expenses (million Baht)	2016	2017	2018
Total sales and administrative expenses (including sales and administration labor costs)	308.2	282.1	291.3
Compensation for labor in sales and administration	73.1	66.4	69.7
Transportation costs	44.8	43.2	45.6
Rental fees (land, buildings, warehouses, machinery, and equipment)	18.7	16.4	15.9
Marketing expenses (advertising and brokerage fees)	3.0	2.8	3.2
Information and technology expenses	0.4	0.4	0.4
Research and development expenses	0.4	0.3	0.2
Interest expenses	69.8	53.5	53.6

Source: Fiscal Policy Research Institute Foundation (FPRI)

2.5 The Business Financial Structure in the Sample Group

The structure of the financial statements of the sample in the balance sheets will help to identify the direction of the businesses' investments and access to capital.

- Data from the balance sheet shows an increase in assets, mainly from increased current assets from 1,807 million Baht in 2017 to 1,936 million Baht in 2018 (45.9 percent of total assets). The rest is an increase in fixed assets that reflects investments that did not increase much.
- Businesses used both loans (increase in debt) and their own retained earnings (utilizing their own capital) to increase the assets of the company. The sample group's liabilities increased from the value of 1,816 million Baht in 2017 to 1,897 million Baht in 2018, earning over 80 million Baht in 2018. As a result, the debt to asset ratio decreased slightly from 45.5 percent to 45.0 percent of total assets. Meanwhile, interest expenses and the principal to be repaid in 1 year increased, as shown in Table 2.5.

Table 2.5: The business financial structure in the sample group (average)

Financial Statement (million Baht)	2017	2018
Total assets	3,991.5	4,216.7
Current assets	1,806.8	1,936.2
Total liabilities	1,816.4	1,897.9
Current liabilities	1,087.7	1,155.8
Shareholders' equity	2,173.6	2,317.8
Net profit before tax, interest expenses, and depreciation	716.4	797.0
Interest expense + principal that must be repaid within 1 year	200.8	258.4

Source: Fiscal Policy Research Institute Foundation (FPRI)

2.6 Technology and Innovation Operations

The use and creation of technology and innovation are at the heart of the business's competitiveness. The technological and innovation operations of the samples are shown in Table 2.6.

- Overall investment in technology within the sample group slowed down due to less investment in automation and robotics, from 312.7 million Baht (60.7 percent of the total investment in machinery and equipment) in 2017, to 226.7 million Baht (50.0 percent of the total investment in machinery and equipment) in 2018. At the same time, the purchase and/or request for rights to use technology decreased in value as well, which may affect the competitiveness of the sample group in the future.
- The ability to create innovation of businesses in the sample group is still low, based on the data of the proportion of the value of an investment in machinery and equipment. The average percentage of sales of innovative products was less than 1.0 percent, including the quantity of innovative and newly developed products and the number of patents/copyrights/trademarks. However, this group of companies has more innovative products both in terms of value and types of products, although still at a low level.

Table 2.6: Technology and innovation operations (average)

Items	2017	2018
Value of investment in production machinery (million Baht)	514.8	453.7
Automation and robotics (million Baht)	312.7	226.7
Others, please specify (million Baht)	202.1	227.0
Purchase/request rights to use technology (million Baht)	259.0	249.2
The proportion of the value of tools and machinery that the factory has invented by themself (%)	0.03	0.02
Number of innovative products that are newly invented/newly developed (items)	0.4	0.7
Sales value of innovative products (million Baht)	39.4	50.0
Number of patents / copyrights / trademarks (editions)	0.02	0.02

Source: Fiscal Policy Research Institute Foundation (FPRI)

2.7 Action Plans and Obstacles in the Sample Group

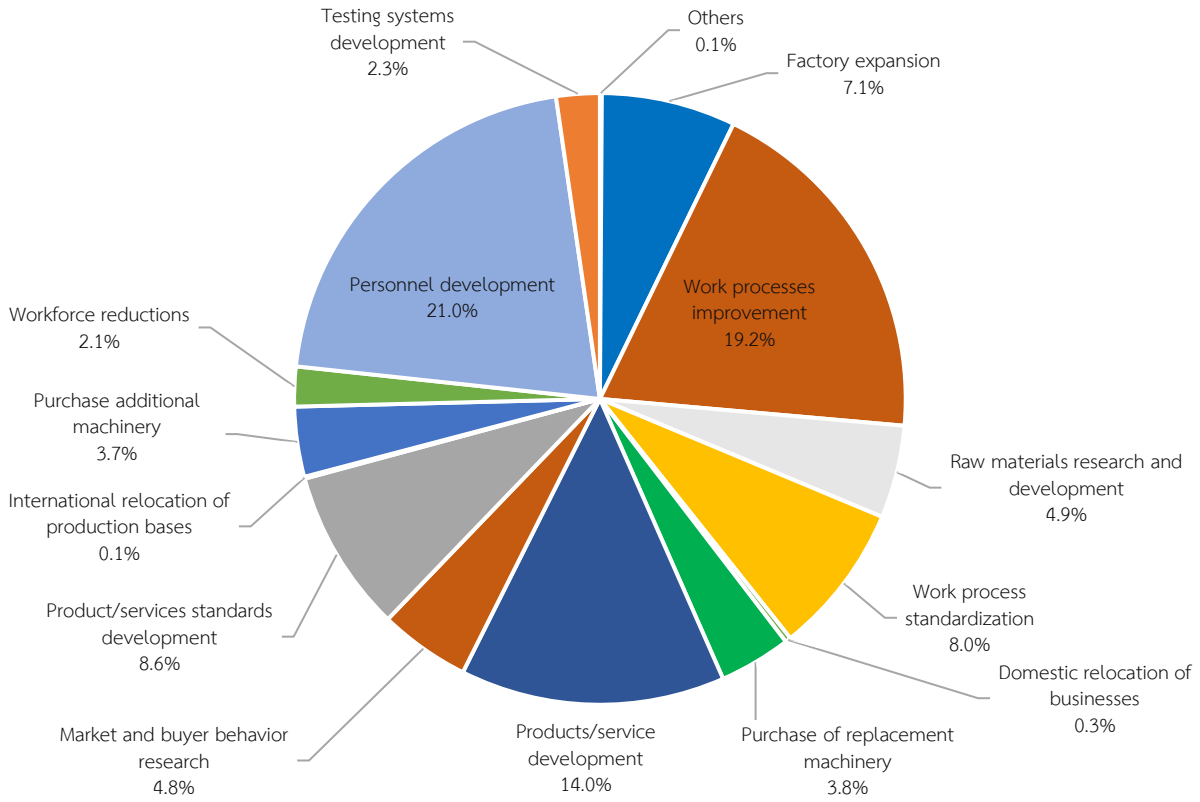
In addition to collecting current business data from businesses in the sample group, the survey also inquiries about action plans and obstacles in business operations for these businesses as well (see details in Diagram 2.1).

- The top three action plans that the firms in the sample group focused on were personnel development, work process improvement, and product/service development. Firms with the aforementioned action plans accounted for 21.0 percent, 19.2 percent, and 14.0 percent, respectively. Therefore, business operators in the sample group placed both direct and indirect importance on labor. Direct approaches included skills development to increase the efficiency of labor following rising labor costs, and indirect methods included improved work processes.

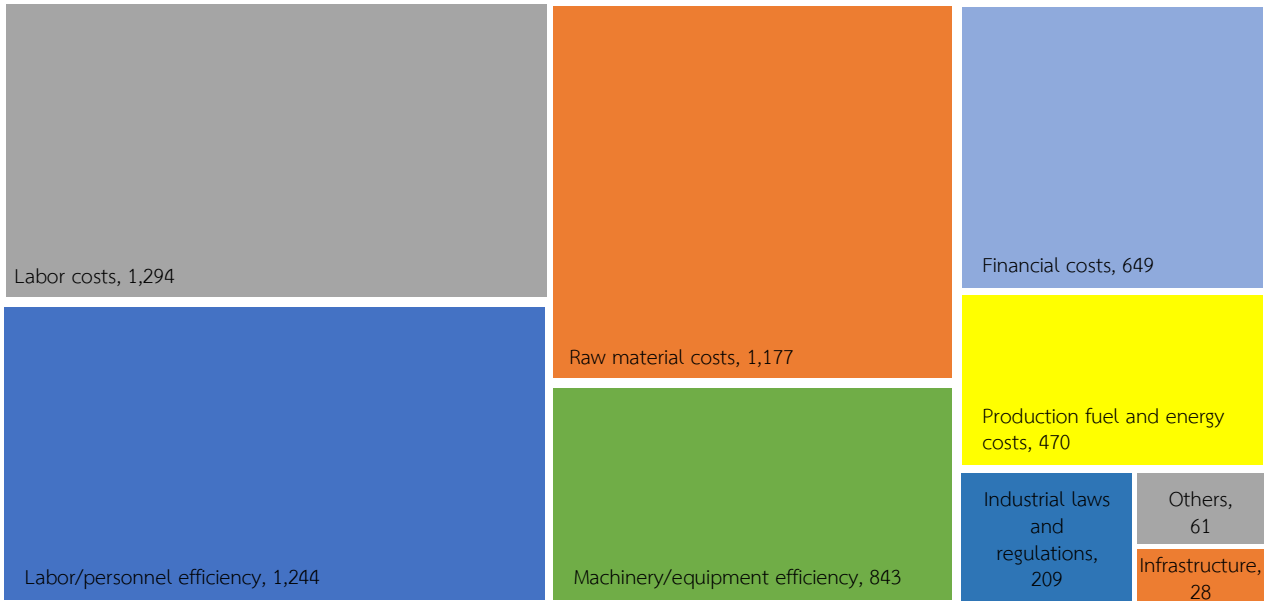
- The top three problems and obstacles that the businesses from the sample group found were labor cost, labor/personnel efficiency, and raw material costs, in line with the current elderly population structure problem, which causes labor shortages. Furthermore, existing workers still lacked new labor skills.

Diagram 2.1 Action plans and obstacles in the sample group

(A) Action Plan



(B) Obstacles



Source: Fiscal Policy Research Institute Foundation (FPRI)

3 Analysis of Production Productivity and Performance

Analysis of production productivity and industry performance is a consideration of the elements of Value-Added and factors that create Value-Added. The Value-Added here means the economic value that has increased by using inputs into production processes or services until they are finished products or services that are ready for users. The analysis of production productivity is based on the concept of Growth Accounting, which is the calculation of the source of growth or the rate of increase in Value-Added. As a result of the rate of increase of the main production factors, which are labor and capital (such as machinery, equipment, and buildings, etc.) and Total Factor Productivity (TFP).

TFPG or the expansion of overall productivity is a measure of the growth of Value-Added caused by other factors aside from the labor and capital factors used in production. It most often reflects the growth of Value-Added in terms of quality factors such as the quality of labor and capital factors used in production, the efficiency of using existing production factors, technological advantages, management capabilities, level of research and development, brand confidence and various marketing factors that may affect Value-Added whether it is a change in demand or the market supply, which can increase or decrease the product price. The results of the analysis of production productivity and the performance of the industrial sector are as follows.

3.1 Summary of Analysis

In 2018, the manufacturing industry as a whole had a decelerated growth in value from the previous year. The Value-Added grew at a slower pace from 3.3 percent in 2017 to 2.5 percent in 2018. The decline in Value-Added was due to the Total Factor Productivity Growth (TFPG) or production capability and less investment. TFPG dropped to 1.6 percent in 2018, as well as capital factors (investment and machinery utilization) grew slower to 0.2 percen/t in the same period. Meanwhile, employment increased in 2018, as detailed in Table 3.1.

The change in TFP also reflects changes in labor and capital productivity. The change of TFP follows the same direction as the sum of changes in labor and capital productivity during 2017-2018. The TFP value slowdown is due to labor productivity, which slowed to 0.8 percent in 2018 from employment, which grew more than before.

In addition, other indicators that influence Value-Added signals were positive, even though the TFP had a slower growth rate. More experienced workers and machinery with automated systems had a higher proportion. Also, costs reduced, with good financial positions, including investment in research and development.

Table 3.1: Account of Business Growth Indicators in the Sample Group

(A) The Account of Growth in the Manufacturing Industry (percentage)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	**3.3**	**0.1**	**0.5**	**2.6**	**1.8**	**0.8**	**2.5**	**0.7**	**0.2**	**1.6**	**0.8**	**0.8**

(B) Key Indicators

Indicators	2016	2017
Quality of Production Factors		
The proportion of skilled labor to total labor (%)	n.a.	65.1
The average number of years of education among workers (years)	12.2	12.2
Average age (years)	36.1	36.5
Percentage of training among workers (%)	n.a.	28.0
The proportion of machinery and equipment under the age of 5 years (%)	3.7	3.7
Percentage of the value of automatic or semi-automatic machinery and equipment (%)	31.5	32.0
Management		
Capital		
Percentage of cost to sales (%)	88.4	88.3
Percentage of Value-Added to sales (%)	19.8	19.7
Finance		
Working capital ratio (times)	1.55	1.62
Debt to assets ratio (times)	0.43	0.44
Debt to equity ratio (times)	0.83	0.87
Innovation		
The proportion of investment in research and development (%)	0.0022	0.0024

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

3.2 Analysis of the Manufacturing Industry as a Whole

3.2.1 Sample Structure

The analysis of production productivity and business performance in the manufacturing industry in 2018, is based on data from a survey of 2,619 fieldwork samples. The sample groups were classified according to the size and nature of ownership. Sorted by business size following the definition of the Office of Small and Medium Enterprises Promotion (OSMEP), the sample consisted of 1,955 large enterprises (74.6 percent of the total number of samples) and with Value-Added up to 2.0 trillion Baht (accounting for 99.1 percent of the Value-Added from the whole sample), followed by small and medium-sized enterprises.

Organized by the ownership of the business, most businesses from the sample group were owned by Thai people, with 1,420 companies (accounting for 54.2 percent of the total number of samples) and with a Value-Added of 0.5 trillion Baht (25.4 percent of the total Value-Added from the whole group) as detailed in Table 3.2.

Table 3.2: Sample Group Structure

Business Size	Item	Ownership			Total
		Foreign	Joint-Venture	Thai	
Large	Number (companies)	455	594	906	1,955
		(17.4)	(22.7)	(34.6)	(74.6)
	Value-Added (million Baht)	295,790	1,189,695	496,436	1,981,921
		(14.8)	(59.5)	(24.8)	(99.1)
Medium	Number (companies)	52	72	320	444
		(2.0)	(2.7)	(12.2)	(17.0)
	Value-Added (million Baht)	2,740	2,786	10,974	16,501
		(0.1)	(0.1)	(0.5)	0.8
Small	Number (companies)	5	21	194	220
		(0.2)	(0.8)	(7.4)	(8.4)
	Value-Added (million Baht)	11	188	1,322	1,521
		(0.0)	(0.0)	(0.1)	(0.1)
Total	Number (companies)	**512**	**687**	**1,420**	**2,619**
		(19.5)	(26.2)	(54.2)	(100.0)
	Value-Added (million Baht)	298,541	1,192,668	508,732	1,999,942
		(14.9)	(59.6)	(25.4)	(100.0)

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

3.2.2 Overview of Industrial Economics for Manufacturing and Productivity

The Thai economy in 2018 continuously grew but at a slower rate. The growth rate of the Current Price[1]. The decreased from 6.2 percent in 2017 to 5.6 percent in 2018. The source of economic growth came from demand for domestic goods and services, such as private consumption and investment, and government spending, which expanded. Meanwhile, the demand for products and services from foreign countries continued to recover, but the impact of the trade war between the United States and China caused exports to decrease.

Various economic sectors expanded well, in line with the overall economy. The agricultural sector had the lowest growth, with a decrease from 4.6 percent in 2017 to 3.0 percent in 2018. The industrial sector (consisting of mining, manufacturing, including electricity and water), whose growth was 5.3 percent in 2017, decreased to 4.8 percent in 2018, mainly caused by the manufacturing industry, with a slowdown from 6.0 percent to 4.1 percent during 2017-2018. The trade and service sectors had the best growth rates compared to other economic areas; the trade sector slowed down from 9.6 percent in 2017 to 8.5 percent in 2018, whereas the service sector slowed down from 5.9 percent in 2017 to 5.7 percent in 2018.

Analysis of the sources of growth of the manufacturing industry considered the results of the production and productivity of a sample of businesses in the manufacturing industry. The report is divided into six areas which are (1) Structure of Production and Sales (2) Productivity (3) Input Quality (4) Cost Structure (5) Financial Ratio and (6) Technology & Innovation. The analysis includes the consideration of the business group, which is divided into three groups comprising business size, ownership, and the region where the business is located, detailed as follows:

- **Structure of Production and Sales**

The structure of production and sales considers the proportion of exports, business model, and the concentration of machinery to labor, which shows the production and sales ability of business operators. Businesses with a high proportion of exports and the ability to design and have their brand, and used a high percentage of machinery, tended to have higher production and sales capabilities.

The sample data from Table 3.3 shows that the overall situation in foreign markets has not changed much. The proportion of exports increased slightly from 7.67 percent to total revenue (valued at 277.0 billion Baht) in 2017, to 7.70 percent of total revenue (valued at 281.3 billion Baht) in 2018. The largest group of companies were OEMs that were engaged in manufacturing. The proportion of this group increased from 40.01 percent to 41.18 percent. Meanwhile, operators used less machinery per worker. The ratio of

[1] This study does not use real growth rates that subtract the effects of inflation, as inflation cannot be found at the industrial level by sector.

capital to labor slightly reduced from 2.13 million Baht/person in 2017 to 2.11 million Baht/person in 2018, indicating the reliance on labor factors as a critical factor among business operators. This is because labor as a short-term investment cost was cheaper than investments in machinery. However, business operators started to focus more on the use of machinery and equipment for production operations and management.

The large companies had the highest production and sales capabilities. Large business groups were highly linked to the world value chain and had the highest proportion of OBMs with their brands, and the potential to invest in machinery and equipment. Therefore, the companies had a higher percentage of exports and used more labor-intensive machinery than medium and small businesses. Therefore, small businesses had the lowest production and sales potential.

Most foreign and joint ventures were large-scale enterprises that relied on international chains and mainly used technology. This resulted in greater access to foreign markets, and the use of machinery to labor was higher than Thai business owners. Most foreign companies that came into Thailand were both OBM and OEM, reflecting the move of the production chain to Thailand for both the brand owner company and the related supplier companies. Meanwhile, Thai OBM groups were able to compete in the market. For the joint venture group, companies were mostly OBM, indicating the need to use Thailand as a production base and reliance on Thai entrepreneurs for production and sales.

Dividing the business groups by area, businesses in the southern, western, and northern regions had the highest proportion of exports. The south, central, metropolitan Bangkok regions, and the eastern region were high in OEMs, which reflects the foreign production bases in these areas. Meanwhile, the northern, western, and eastern regions were mostly OBM groups. The east, central, and Bangkok and its suburbs use machinery the most. Businesses in the eastern region were foreign-owned primarily and joint ventures were promoted under the Eastern Economic Corridor (EEC), and therefore have production structures that use capital to labor the most. The central region and the Bangkok and metropolitan regions, which are production bases of high-tech industries, also had a high proportion of machinery usage.

Table 3.3: Production and Sales Structure of Businesses in the Sample Group

Item	The proportion of exports (%)		Operating Model						Fixed Assets per Labor (million Baht/Person)	
			OEM		ODM		OBM			
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Total	7.67	7.70	40.01	41.18	23.87	21.91	36.12	36.91	2.13	2.11
Business Size										
Large	6.91	6.79	22.10	23.69	21.14	17.92	56.76	58.39	2.38	2.40
Medium	4.67	4.48	46.59	51.55	32.06	29.94	21.36	18.51	0.80	0.81
Small	6.93	5.69	67.35	65.93	26.27	27.46	6.38	6.61	0.28	0.30
Ownership										
Foreigner	7.59	7.16	32.00	35.34	28.06	25.78	39.94	38.87	2.55	2.65
Joint venture	7.10	7.17	17.14	18.46	20.32	16.45	62.54	65.09	2.24	2.21
Thai	5.67	5.64	36.62	38.22	18.43	17.47	44.95	44.31	2.17	2.18
Region										
Northern	9.25	11.86	14.88	1.96	0.83	8.80	84.29	89.24	1.86	1.83
Southern	13.95	14.75	69.39	70.73	30.61	29.27	0.00	0.00	1.01	0.97
Bangkok and vicinity	7.01	6.85	22.82	25.06	29.71	24.54	47.47	50.40	2.02	2.05
Central	1.80	1.98	33.34	30.14	19.78	19.13	46.88	50.72	2.63	2.69
Western	12.54	11.13	2.49	1.64	28.54	22.57	68.97	75.78	1.70	1.68
Eastern	7.11	6.88	18.84	20.77	10.44	8.94	70.72	70.29	3.14	3.12
Northeastern	6.97	6.65	0.00	0.00	100.00	100.00	0.00	0.00	2.59	2.84

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

- **Growth Accounting and TPF**

Analysis of the Growth Accounting and Total Factor Productivity (TFP) can provide an understanding of the role of labor and investment in machinery and equipment to create Value-Added. If it is Value-Added can be created by using a small amount of labor, and the investment value is not high, this will show a high TFP and a high level of competitiveness.

In 2018, the overall business in the manufacturing industry grew at a slower rate due to less use of machinery and equipment or capital factors. The growth rate was only 0.2 percent in 2018, although the workforce grew by 0.7 percent during the same period, resulting in the company's decreased production capability. Details are shown in Table 3.4.

For large corporations and SMEs with Value-Added that expanded in 2018, there are sources of growth both in terms of production factors and TFP. However, large corporations start to add value at a slower pace. This is due to the lower growth rate of TFP. On the other hand, small and medium-sized businesses had accelerated Value-Added, whereby TFP increased considerably in 2018.

When considering business ownership, businesses with foreign owners and joint ventures grew in Value-Added in 2018, mainly as foreign-owned companies increase investments, and TFP increased. Joint ventures were a result of the continuously expanding TFP while Thai businesses contracted in Value-Added. This was mainly due to the decrease in the TFP despite increased employment and investment.

Comparing the businesses in different regions, it was found that in 2018, almost all sectors had Value-Added, mainly based on the growth of TFP. However, for businesses in the eastern region, the growth rate of Value-Added and TFP increased. Areas with Value-Added that shrank in 2018 were businesses in the central and northeastern regions. This was mainly due to the contraction of the TFP; however, investment in this group increased.

Table 3.4: Account of Business Growth in the Sample Group

Item	2017 (%)				2018 (%)			
	Value-Added	Source			Value-Added	Source		
		Labor	Investment	TFPG		Labor	Investment	TFPG
Total	3.3	0.1	0.5	2.6	2.5	0.7	0.2	1.6
Business Size								
Large	4.45	-0.18	0.40	4.24	2.83	0.09	0.69	2.06
Medium	-9.39	-0.63	-0.87	-7.89	7.68	0.24	0.89	6.55
Small	-6.52	-0.80	1.10	-6.82	9.46	1.07	3.07	5.32
Ownership								
Foreigner	-5.35	-0.30	0.18	-5.23	2.36	-0.17	1.95	0.59
Joint venture	12.06	0.00	0.67	11.39	5.45	-0.16	-0.49	6.09
Thai	3.55	-0.34	0.14	3.75	-0.26	0.62	0.70	-1.58
Region								
Northern	19.97	-0.04	2.57	17.45	4.71	0.82	0.39	3.50
Southern	25.33	-0.72	5.80	20.26	10.14	1.06	-2.02	11.10
Bangkok and vicinity	7.54	-0.61	1.73	6.43	3.03	-0.14	0.72	2.45
Central	6.52	1.98	-1.29	5.84	-2.02	-0.08	1.76	-3.69
Western	-2.87	-0.22	0.85	-3.50	6.17	1.08	0.72	4.37
Eastern	0.07	-0.06	-0.58	0.71	3.32	0.42	-0.01	2.91
Northeastern	-8.74	0.13	4.02	-12.90	-0.80	0.29	6.39	-7.48

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

The rate of change of TFP or TFPG can show the rate of change in labor productivity and capital productivity. TFPG in the overall picture of the industry expanded at a slower pace, caused by labor productivity, which had a slowed growth rate decreased from 1.8 percent in 2017 to 0.8 percent in 2018. Meanwhile, capital productivity grew at a constant rate of 0.8 percent, as shown in Table 3.5.

Large scale businesses were faced with the ability to reduce their production due to reduced labor and machinery efficiency. Meanwhile, small and medium-sized businesses were able to upgrade the development of labor and the use of machinery and equipment, which is in line with the improved TFPG.

Foreign-owned businesses were the only businesses that had improved TFPG, in line with the direction of labor and machinery and equipment that recovered again. On the other hand, the development of joint ventures and Thai businesses took the opposite direction.

Businesses in the north, south, Bangkok, and the metropolitan region, and the central region had a declining production capacity or decreased TFPG. For most of the businesses in these regions, labor productivity and capital productivity also worsened (except in the case of the central part). Businesses in the remaining areas had increased production capability, along with improved labor and capital productivity.

Table 3.5: The Productivity Structure of Businesses in the Sample Group

Item	2017 (%)			2018 (%)		
	TFPG	Source		TFPG	Source	
		Labor	Capital		Labor	Capital
Total	2.6	1.8	0.8	1.6	0.8	0.8
Business Size						
Large	4.24	2.73	1.51	2.06	1.57	0.49
Medium	-7.89	-5.39	-2.50	6.55	4.67	1.88
Small	-6.82	-3.38	-3.44	5.32	5.07	0.25
Ownership						
Foreigner	-5.23	-2.87	-2.35	0.59	1.59	-1.00
Joint venture	11.39	6.74	4.65	6.09	3.33	2.77
Thai	3.75	2.37	1.38	-1.58	-0.77	-0.81
Region						
Northern	17.45	10.37	7.08	3.50	1.63	1.87
Southern	20.26	16.14	4.11	11.10	4.84	6.25
Bangkok and vicinity	6.43	5.02	1.40	2.45	1.91	0.54
Central	5.84	1.95	3.89	-3.69	-1.13	-2.56
Western	-3.50	-1.44	-2.06	4.37	2.69	1.68

Item	2017 (%)			2018 (%)		
	TFPG	Source		TFPG	Source	
		Labor	Capital		Labor	Capital
Eastern	0.71	0.10	0.61	2.91	1.51	1.40
Northeastern	-12.90	-5.31	-7.58	-7.48	-0.77	-6.71

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

- **Quality of Production Factors**

Important production factors in this study are labor and capital (such as machinery and equipment). The quality of labor is measured by the knowledge gained from education and work experience. The quality of the capital is assessed from the technology of machinery and equipment and the condition of machinery and equipment. Excellent quality of labor and machinery and equipment will also affect the ability for sound production.

Overall, businesses in the manufacturing industry from the sample group had improved the quality of labor and for most machinery. Workers in this group experienced a slight increase in work experience to 36.48 in 2018. The proportion of machinery in operations with automated or semi-automated systems, combined with new machinery, increased to 32.04 percent and 3.69% percent in 2018, respectively. Therefore, the manufacturing industry pays more attention to the quality of machinery.

The quality of labor and machinery in large enterprises tended to develop gradually, in the same direction as in the case of small and medium enterprises. The labor quality of businesses of various sizes did not vary significantly; however, large-sized companies had a higher proportion of automatic and semi-automatic machinery and have a percentage of machinery that is less than five years old.

Foreign-owned businesses, joint ventures, and Thai businesses had a better quality of labor and machinery. Foreign-owned companies and joint ventures used more automatic and semi-automatic machinery and newer machinery than Thai companies.

Businesses in regions that were production bases of multinational companies, such as the southern region, Bangkok, and metropolitan regions, the central and eastern areas, had a higher proportion of automatic and semi-automatic machinery and machinery not older than five years, than those in other sectors. Meanwhile, the differences in labor quality between the regions remained unclear.

Table 3.6: The Quality of Production Factors from the Sample Group

Item	Average of Number of Educational Year (Years)		Average Age (Years)		The proportion of Automatic/Semi-Automatic Machinery (%)		Percentage of Machinery Not Over 5 Years (%)	
	2017	2018	2017	2018	2017	2018	2017	2018
Overall	12.17	12.17	36.08	36.48	31.52	32.04	3.66	3.69
Business Size								
Large	12.18	12.19	35.53	36.08	28.04	28.64	2.06	2.13
Medium	12.29	12.28	34.19	34.58	22.91	24.55	1.46	1.81
Small	12.41	12.41	35.79	36.26	26.02	26.99	1.00	0.97
Ownership								
Foreigner	12.15	12.14	35.39	35.86	34.92	35.69	1.90	1.86
Joint venture	12.16	12.19	34.93	35.63	30.22	30.80	2.94	3.31
Thai	12.25	12.26	36.20	36.63	17.87	18.28	1.13	0.99
Region								
Northern	12.35	12.37	36.47	36.79	15.55	16.44	1.54	1.62
Southern	11.89	11.89	37.67	38.48	28.98	28.75	2.54	2.60
Bangkok and vicinity	12.12	12.14	35.21	35.76	24.72	25.48	2.08	2.13
Central	12.18	12.21	35.94	36.47	29.75	31.05	1.73	1.89
Western	12.72	12.72	36.24	36.97	6.60	6.79	0.80	0.77
Eastern	12.33	12.31	35.29	35.79	35.43	35.98	2.33	2.42
Northeastern	12.41	12.40	37.39	38.16	9.36	8.61	0.01	0.01

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

- **Cost Structure**

The total cost of a business indicates the productivity of the company. The entire cost structure of the business consists of production costs and sales and administration expenses. Businesses with lower total costs can create more value and are more competitive.

The cost structure of the business in the sample group slightly decreased in total cost from 88.4 percent in 2017 to 88.3 percent in 2018, as a result of reduced sales and administration expenses from 8.8 percent of sales in 2017 to 8.7 percent of sales in 2018. Meanwhile, the cost of production remained relatively stable, as shown in Table 3.7.

In 2018, total capital expenditures for large businesses increased due to higher production costs, although it reduced sales and administration costs. Medium and small companies were able to better control costs, especially in terms of production costs. In addition, large enterprises had higher production costs, but lower sales and administration costs than medium and small businesses.

The total cost for foreign-owned businesses, joint ventures, and Thai businesses did not differ significantly. However, the cost structures were distinctly different. The production costs of foreign companies and joint ventures were higher than those of Thai businesses. At the same time, both groups had lower sales and administration expenses than Thai companies. In addition, joint ventures had the best ability to control costs.

At the regional level, the total cost of businesses in the northern region was most different from the other areas due to the production cost, which was much lower than other areas (57.30 percent in 2018); the businesses could also control costs the best. The total cost of other regions increased slightly. Businesses in Bangkok and surrounding vicinities and the western part had higher sales and administration expenses than those in other regions.

Table 3.7: Total Cost Structure of Businesses in the Sample Group

Item	Ratio of Total Cost to Sales (%)		Ratio of Production Cost to Sales (%)		Ratio of Sales and Administration Costs to Sales (%)	
	2017	**2018**	**2017**	**2018**	**2017**	**2018**
Overall	88.4	88.3	79.6	79.6	8.8	8.7
Business Size						
Large	90.9	91.1	82.6	83.1	8.3	8.0
Medium	91.5	90.3	78.5	77.6	13.0	12.7
Small	89.6	88.1	73.7	72.0	15.9	16.1
Ownership						
Foreigner	90.7	91.3	85.0	85.7	5.7	5.6
Joint venture	90.4	90.0	82.3	82.3	8.1	7.8
Thai	91.9	92.2	79.7	80.3	12.2	11.9
Region						
Northern	70.2	65.1	60.9	57.3	9.3	7.8
Southern	93.5	92.1	86.2	84.6	7.3	7.5
Bangkok and vicinity	91.9	91.9	81.5	82.0	10.4	9.9
Central	93.4	94.0	86.5	86.5	7.0	7.4

Item	Ratio of Total Cost to Sales (%)		Ratio of Production Cost to Sales (%)		Ratio of Sales and Administration Costs to Sales (%)	
Western	96.9	96.4	86.5	85.1	10.4	11.3
Eastern	89.7	90.1	84.3	84.8	5.5	5.3
Northeastern	94.9	95.5	88.5	88.6	6.4	6.8

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

The analysis on Value-Added[2] It provides understanding about the ability to create Value-Added and the structure of Value-Added, which consists of wages from labor factors and depreciation from capital factors. The ability to develop Value-Added reflects the manufacturing capability of the business.

Table 3.8 shows that in the overall picture, the sample group had a slightly decreased ability to create Value-Added. The proportion of Value-Added to sales fell from 19.8 percent in 2017 to 19.7 percent in 2018, and almost half of the return to production factors was labor compensation and depreciation. The proportion of labor compensation of the business as a whole increased to 14.4 percent in 2018, and the depreciation ratio decreased to 23.6 percent in 2018; therefore, the overall manufacturing industry had higher labor costs than capital or machinery and equipment, which had increased investment.

The ability to create Value-Added of all sized businesses did not change much between 2017 and 2018. Large-sized businesses had fewer rates of creating Value-Added than small and medium-sized enterprises. In addition, large companies had the highest proportion of machinery to labor in production.

Foreign businesses had a higher value-to-sales ratio and the lowest Value-Added due to the use of labor and capital, which differed from joint ventures and Thai companies. Therefore, foreign businesses are likely to import more raw materials and had a Value-Added that is profitable, with indirect taxes and higher rental fees.

Businesses in each region had unique features. Companies in the north had distinct characteristics from the other areas, including a high Value-Added to sales ratio and a small proportion of Value-Added arising from labor and machinery and equipment. Meanwhile, businesses in the western and northeastern regions have the least Value-Added, but the highest Value-Added resulting from the use of machinery. Therefore, industries in this region are likely to be less profitable than in other regions.

[2]Value added means the value of goods and services that increased in each production process. It can be calculated from the difference between production values and intermediate costs used in the production process or from the sum of primary production factors such as labor compensation, depreciation, profit, interest rates, rent, and indirect taxes.

Table 3.8: Total Cost Structure of Businesses in the Sample Group

Item	Ratio of Total Cost to Sales (%)		Ratio of Production Cost to Sales (%)		Ratio of Sales and Administration Costs to Sales (%)	
	2017	2018	2017	2018	2017	2018
Overall	19.8	19.7	14.1	14.4	24.2	23.6
Business Size						
Large	15.7	15.7	11.9	12.1	24.5	24.1
Medium	23.7	23.9	33.7	32.0	21.5	20.4
Small	35.4	34.8	54.2	52.0	11.1	10.0
Ownership						
Foreigner	14.5	14.3	10.5	11.0	23.5	23.9
Joint venture	17.5	17.4	13.1	13.0	23.2	21.9
Thai	15.4	15.5	13.2	13.6	27.6	27.8
Region						
Northern	35.0	42.0	5.8	5.7	9.7	9.3
Southern	14.3	16.8	23.4	23.2	23.5	21.2
Bangkok and vicinity	15.0	14.9	13.9	14.1	24.7	24.1
Central	16.0	15.5	9.9	10.4	33.0	34.4
Western	12.1	13.0	27.4	25.9	38.1	35.7
Eastern	16.3	16.0	10.5	10.6	23.6	23.2
Northeastern	11.5	11.7	13.4	13.7	36.8	41.1

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

- **Financial Ratio**

Liquidity and the ability to pay off debt can be used to assess the strength of the business and production capability. Businesses with good liquidity and a small proportion of debt will have the ability to operate and be more stable, making the business secure. It also reflects the production capability of the company.

When considering financial business ratios in the manufacturing industry, the current ratio decreased, but the risk of debt increased. Table 3.9 shows the liquidity potential of the business. Overall, the working capital ratio increased to 1.62 times in 2018. Indicators of debt serviceability, including the debt-to-asset ratio and the debt-to-equity ratio, rose to 0.44 times, and 0.87 times in 2018, respectively. In this regard, the economy continued to grow. As a result, the income of businesses continued to increase. However, the companies continued to invest, causing business operators to have external capital loans as well, as detailed in Table 3.9.

In the small business group, liquidity and ability to pay off the debt was higher than medium and large businesses, which reflects small businesses' ability to access the funding, that is lower than large and medium-sized enterprises, resulting in an inability to obtain long-term debt. Therefore, small businesses have to rely on themselves and short-term debt more. Companies of all sizes improved liquidity, but large-sized businesses incurred high levels of debt for investment.

Foreign businesses and joint ventures had higher liquidity and more debt than Thai businesses, causing Thai companies to be less concerned about liquidity and be less financially stable.

Businesses in Bangkok and its vicinity, central and eastern regions, had more liquidity than firms in the other areas; Bangkok and perimeter provinces, and the central part had better liquidity. At the same time, businesses in the southern region are at the highest risk of debt. However, the northern, eastern, and northeastern areas must be monitored due to decreased liquidity and more debt.

Table 3.9: Financial Ratios of Businesses in the Sample Group

Item	Current Ratio (times)		Debt to Assets Ratio (times)		Debt to Equity Ratio (times)	
	2017	2018	2017	2018	2017	2018
Overall	1.55	1.62	0.43	0.44	0.83	0.87
Business Size						
Large	1.54	1.57	0.46	0.47	0.86	0.88
Medium	1.52	1.58	0.49	0.48	0.95	0.92
Small	2.04	2.21	0.42	0.40	0.72	0.67
Ownership						
Foreigner	1.66	1.58	0.43	0.44	0.74	0.78
Joint venture	1.71	1.78	0.43	0.44	0.74	0.78
Thai	1.23	1.30	0.55	0.54	1.22	1.18
Region						
Northern	1.18	1.16	0.44	0.46	0.77	0.85
Southern	1.12	1.06	0.60	0.56	1.50	1.25
Bangkok and vicinity	1.46	1.49	0.52	0.51	1.07	1.05
Central	1.81	2.01	0.38	0.41	0.60	0.70
Western	1.07	1.14	0.521	0.518	1.09	1.07
Eastern	1.72	1.68	0.39	0.41	0.65	0.70
Northeastern	1.27	1.25	0.45	0.47	0.82	0.88

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

- **Technology and Innovation**

In the long run, an enterprise's production capability will depend on its ability to create technology and innovation. The proportion of investment in research and development (R&D) to sales, reflects the importance of knowledge creation and investment potential in the innovation of the business, through comparisons on revenue that is generated. Therefore, investment in research and development is essential to the development of the business.

Table 3.10 shows that the overall manufacturing industry has a very low investment in research and development. However, the proportion of investment in research and development increased from 0.0022% of total sales in 2017 to 0.0024% of total sales in 2018.

Large businesses were most interested in research and development investment, with the proportion of research and development investment to sales increasing in 2018. Investments in small companies were the most volatile.

Investment in research and development correlates with ownership. Joint ventures and Thai businesses were more interested in investing domestically than in foreign-owned companies, which most likely had research and development conducted in the country of the parent company.

Businesses in Bangkok and its vicinity, the western and eastern regions, had much higher research and development investment than those in other areas. There was an increased internal investment from 2017, which makes this group of businesses more likely to have the potential for excellent long-term production capabilities.

Table 3.10: Innovation Activities within the Sample Group

Item	Proportion of Investment in Research and Development (%)	
	2017	**2018**
Overall	0.0022	0.0024
Business Size		
Large	0.0015	0.0028
Medium	0.0368	0.0330
Small	0.0499	0.0076
Ownership		
Foreigner	0.0006	0.0006
Joint venture	0.0025	0.0055
Thai	0.0028	0.0031
Region		
Northern	0.0000	0.0000
Southern	0.0000	0.0000
Bangkok and vicinity	0.0028	0.0049
Central	0.0001	0.0001
Western	0.0020	0.0030

Item	Proportion of Investment in Research and Development (%)	
	2017	2018
Eastern	0.0012	0.0013
Northeastern	0.0000	0.0000

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

3.2.3 Production Productivity Comparison by Sector

Overall, most industries and production branches increased production capability (TFPG), especially in the medium to high technology group; low technology groups encountered more problems. In some manufacturing sectors, TFPG contracted continuously, such as electrical appliances, beverages, tobacco, publications, and textiles. Most of these production sectors were low technology. They were affected by policies such as tax collection and increased tax measures, including the business impact from technological changes or consumption behavior. It is, therefore, necessary to closely monitor these. In addition, there is a group of production branches where TFPG worsened, namely pharmaceuticals, and repair and installations, as shown in Table 3.11.

Table 3.11: Total Factor Productivity from the Sample Group

Manufacturing sectors	Total Factor Productivity Growth (TFPG) (%)		TFP index (Average Total Factor Productivity)		
	2017	2018	2016	2017	2018
Manufacturing Industry Overview	2.6	1.7	100.0	102.6	104.3
High and Medium-High Technology Groups	3.6	3.9	93.2	96.7	100.6
Electronics	4.07	6.54	98.08	102.07	108.76
Machinery	11.60	5.16	94.99	106.01	111.49
Chemicals	7.91	6.61	180.98	195.30	208.21
Automotive	7.95	6.19	94.43	101.93	108.25
Pharmaceuticals	2.74	-0.37	93.94	96.52	96.16
Other Automotive Parts	10.87	12.10	75.50	83.71	93.83
Electrical Equipment	-3.79	-3.86	64.05	61.62	59.25
Medium Technology Groups	1.98	1.12	84.99	86.66	87.33
Repair and Installations	7.46	-0.42	100.90	108.43	107.97
Basic Metals	1.13	0.15	105.43	106.62	106.78
Rubber	0.37	0.87	103.60	103.98	104.89
Plastics	-1.18	0.33	84.73	83.73	84.01

Manufacturing sectors	Total Factor Productivity Growth (TFPG) (%)		TFP index (Average Total Factor Productivity)		
	2017	2018	2016	2017	2018
Non-Minerals	0.09	1.56	68.97	69.03	70.11
Other Products	4.01	4.25	46.30	48.16	50.20
Low Technology Groups	-2.13	-6.84	127.44	118.05	104.48
Petroleum	6.13	5.14	433.58	460.13	483.76
Beverages	-1.92	-0.61	122.98	120.61	119.87
Tobacco	-40.46	-89.16	346.34	206.22	22.35
Paper	3.72	-0.35	65.35	67.79	67.55
Fabricated Metals	5.04	1.49	76.24	80.08	81.27
Foods	0.80	0.78	72.72	73.30	73.87
Publications	-2.40	-4.39	134.83	131.59	125.82
Furniture	5.32	1.80	45.72	48.15	49.02
Textiles	-1.46	-0.36	83.25	82.03	81.73
Leather articles	3.96	3.05	50.27	52.27	53.86
Wood and of products of wood	-6.21	0.18	67.35	63.17	63.28
Wearing apparel	1.88	0.35	30.64	31.22	31.33

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: The level of technology in each manufacturing branch is based on the UNIDO classification of technology levels, by considering the concentration of investment in research and development (R&D) on production value and towards Value-Added.

3.2.4 Industrial Sector Status Classified by Growth in Value-Added and Production Productivity

The assessment of the status of an enterprise in the manufacturing sector uses the growth of Value-Added and production productivity of that manufacturing sector compared with the average of the entire manufacturing industry. Industries in good standing will have more Value-Added growth and above-average production productivity. Industries in a bad state will have the opposite nature. Industries are likely to be good if the production productivity is higher than the average, even if the Value-Added growth is lower than the average. On the other hand, industries will tend to be worse off if the increase in production productivity is below average, and the Value-Added growth is higher than average.

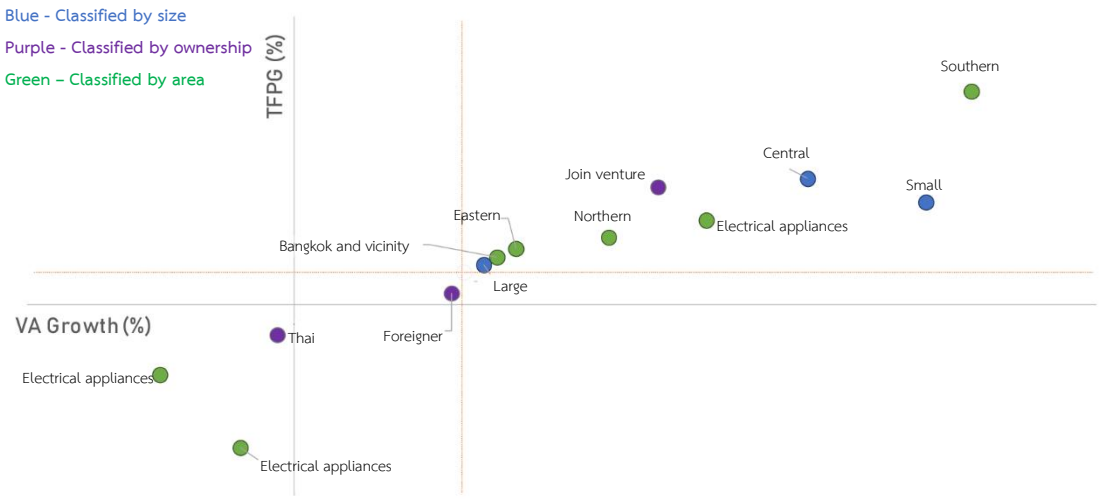
The majority of low-tech industries have a worrisome situation: their TFP shrank or increased, but at a slower rate than the industry average. In particular, labor-intensive sectors, including textiles, clothing, and wood. Meanwhile, almost all high-tech industries have Value-Added and production capability, which increased more than the average, except for products in the field of electrical appliances and pharmaceuticals, as detailed in Figure 3.1.

As for the overall picture of the industry in terms of size of the business and spatial data, SMEs and joint ventures were in a good position with Value-Added and production capability above the average. Thai-owned companies were worrying where both Value-Added and TFP decreased. In the case of an almost total spatial overview, the status was better than average for both Value-Added and TFP. The areas that were in a state of concern were the central and northeastern regions, as shown in Figure 3.1.

Figure 3.1: Status of Industrial Sectors Classified by Growth in Value-Added and Production Productivity

(A) Industrial Field

(B) Business Groups by Size, Ownership, and Area



Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Table 3.12: Account of Industry Growth by Industry Sector (%)

Account of Growth (%)		2017						2018					
		Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
						Source of TFPG						Source of TFPG	
TSIC	Sectors		Labor	Capital	TFPG	Labor Productivity	Capital Productivity		Labor	Capital	TFPG	Labor Productivity	Capital Productivity
10	Food	2.64	0.35	1.49	0.80	1.17	-0.37	3.13	0.72	1.63	0.78	1.08	-0.30
11	Beverages	-4.40	0.14	-2.61	-1.93	-2.01	0.08	-6.50	-0.05	-5.84	-0.61	-2.71	2.10
12	Tobacco	4.93	-2.45	47.87	-40.50	4.37	44.87	-71.17	0.02	17.97	-89.16	-28.01	-61.16
13	Textiles	-2.56	0.08	-1.18	-1.46	-1.95	0.49	-2.33	-0.08	-1.89	-0.36	-1.62	1.26
14	Apparel	3.79	1.02	0.86	1.91	1.98	-0.07	4.14	2.13	1.66	0.35	1.14	-0.78
15	Leather	4.16	-0.18	0.37	3.97	2.70	1.27	4.06	-0.77	1.78	3.05	3.23	-0.17
16	Wood	1.84	4.47	3.57	-6.20	-3.13	-3.08	4.04	1.52	2.34	0.18	1.44	-1.26
17	Paper	6.60	0.72	2.20	3.68	1.96	1.72	4.36	1.79	2.93	-0.35	-0.02	-0.34
18	Printing	1.07	0.27	3.27	-2.47	0.36	-2.84	1.22	1.76	3.85	-4.39	-1.02	-3.36
19	Petroleum	5.84	-0.60	0.31	6.13	3.61	2.52	3.56	-1.85	0.28	5.14	3.69	1.45
20	Chemicals	8.48	0.44	0.13	7.91	5.10	2.81	6.85	0.17	0.07	6.61	4.30	2.31
21	Pharmaceuticals	5.03	0.63	1.65	2.74	2.71	0.03	4.76	1.73	3.40	-0.37	1.43	-1.80
221	Rubber	3.90	1.07	2.45	0.37	1.35	-0.98	1.41	0.35	0.19	0.87	0.53	0.34
222	Plastics	-2.20	0.45	-1.49	-1.17	-1.82	0.66	0.22	-0.01	-0.11	0.33	0.14	0.19
23	Non-metallic minerals	-0.32	-0.66	0.26	0.09	0.52	-0.44	2.86	0.17	1.12	1.56	1.08	0.48
24	Basic metals	2.18	-0.78	1.83	1.14	1.90	-0.76	2.15	0.76	1.24	0.15	0.35	-0.19
241	Iron	4.09	-0.68	1.60	3.17	2.78	0.39	2.22	0.81	-0.03	1.44	0.33	1.11
25	Fabricated metal products	4.65	1.51	-1.90	5.04	1.59	3.45	4.74	0.68	2.58	1.49	2.48	-1.00
26	Electronics	5.66	-0.09	1.67	4.07	3.71	0.36	5.99	-0.91	0.35	6.54	4.74	1.81
27	Electrical equipment	-3.67	-0.22	0.34	-3.79	-2.32	-1.48	-6.01	0.56	-2.71	-3.86	-4.70	0.85
28	Machinery	7.56	-1.80	-2.24	11.61	5.81	5.79	6.60	-1.74	3.18	5.16	5.24	-0.08
29	Motor vehicles	5.07	-1.23	-1.65	7.95	3.93	4.02	6.55	0.03	0.32	6.19	3.45	2.74

Account of Growth (%)		2017						2018					
		Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
						Source of TFPG						Source of TFPG	
TSIC	Sectors		Labor	Capital	TFPG	Labor Productivity	Capital Productivity		Labor	Capital	TFPG	Labor Productivity	Capital Productivity
30	Other transport equipment	11.90	0.15	0.84	10.91	5.18	5.73	13.50	0.44	0.96	12.10	5.61	6.48
31	Furniture	3.86	-2.66	1.24	5.28	5.21	0.07	3.73	2.31	-0.38	1.80	0.17	1.63
32	Other manufacturing	1.53	-1.04	-1.31	3.89	2.30	1.59	4.65	2.80	-2.39	4.25	1.00	3.25
33	Repair	1.64	-2.38	-3.54	7.57	3.34	4.23	3.46	3.49	0.39	-0.42	-1.39	0.97
Total	Manufacturing industry	3.30	0.10	0.50	2.60	1.80	0.80	2.50	0.70	0.20	2.00	0.80	0.80

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

3.3 TSIC 10: Manufacture of food products

3.3.1 Industrial Structure

Food products manufacturing (TSIC 10) is an economic activity in the category of food production, which is in the form of intermediate processed foods that are produced as ready-to-eat foods. The group consists of ready-to-eat foods for consumption, including the processing and preservation of meats and seafood, fruits and vegetables, including the production of oils and fats from plants and animals, milk, milled products, cereals, starches, and starch products, and other food products and animal feed.

According to the 2017 Industrial Census, there were 4,977 establishments in this category of enterprises in Thailand, which comprised 949 large, 1,154 medium-sized, and 2,874 small companies. The total workforce amounted to 587,232 people with a product sales value of 1,776,304 million Baht, representing a Value-Added of 440,391 million Baht. The ratio of foreign shareholders is 48 percent, and the average proportion of exports was 52 percent, with 35.75 percent on the value of imported raw materials.

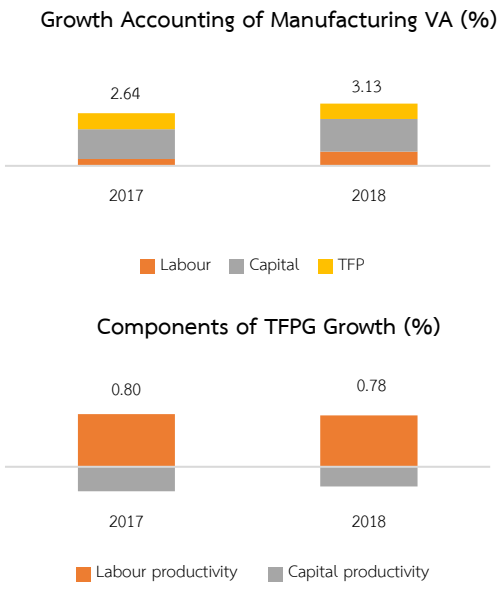
Thailand's food industry today, mostly produces primary processed food products such as processed meat, frozen processed seafood, and fresh and processed fruit and vegetables, which is considered a commodity accepted by the importing countries for the relatively good quality standards. According to Thai food export data for 2018, food exports valued 1,031,956 million Baht or 32,190 million USD, a growth by 1.6 percent and 7.3 percent in Baht and USD, respectively. Thailand ranked as the 12th largest food exporter in the world, an improvement from its 14th global rank in 2018. Thailand has slightly increased the global market share to 2.36 percent from 2.34 percent in the previous year, while the major exporters such as the United States, Brazil, and China have decreased in global market share. Furthermore, the major food-exporting countries in the region, such as India and Vietnam, had a decreased global market share. The top 5 export products in Thailand were rice, chicken, sugar, tuna fish, and shrimp. The main export markets of Thailand were Japan, China, and ASEAN countries. A critical supporting factor for the growth of the Thai food industry is the unlocking of the yellow card status in the Thai fishing sector by the European Union. This made trading partners more confident in Thai fishery products. Thai food products are still in demand in the ASEAN market, especially the CLMV. The risk factors that may have an impact include the volatility of international politics and the trade war between the United States and China, and the strengthening of the Baht. Furthermore, the United States' disqualification of GSP food products consisting of fresh durian, dried papaya, processed papaya, dried tamarind, flavored corn, and crystallized fruit. The main reason is that Thai products in that group have a market share of more than 50 percent in the United States.

3.3.2 Results of Production Productivity Analysis and Key Indicators

In the 2018 survey, the number of samples of food products manufacturing companies totaled 251 companies, divided into 213 large enterprises, 27 medium enterprises, and 11 small enterprises. The sample covered the proportion of the sales value of the products at approximately 55.8 percent of the whole TSIC 10. The types of products surveyed included poultry meat, frozen fish and seafood products, frozen and canned seafood products, processed and dried fruits, prepared food for livestock, sugar, vegetable oil, sauces, and condiments tapioca flour for example.

According to the data processed from the survey, it was found that in 2018, the Value-Added of the food industry increased by 3.13 percent from the previous year, mainly due to an increase in capital factors by 1.63 percent. This was followed by TFP factors by 0.78 percent and labor factors by 0.72 percent, respectively, as detailed in Figure 3.2.

Figure 3.2: The rate of change of Value-Added and labor, capital, and TFP factors in the food products manufacturing industry.



Group of Improved Indicators

- Increased automatic machinery
- Increased new machinery proportion
- Proportion of skilled labor: 61%
- Increased Value-Added to sales
- Decreased production costs per sales
- Increased liquidity
- Increased research investment

Group of Worsened Indicators

- Increased selling and administration expenses to sales
- Increased liabilities to equity

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis results of the key indicators of the food products manufacturing industry in 2018 from Table 3.12, shows that the ratio of capital to labor is not different from the previous year, which is equal to 2.99 million Baht per person. The quality of labor is considered to be at a medium level, according to the proportion of skilled labor to the total labor force at 61 percent. Meanwhile, the average number of years of study is close to that of previous years at 12.26 years. The quality of machinery improved from the prior year, from the proportion of machinery and equipment under the age of 5 years at 1.07 percent. It increased from 0.98 percent from the previous year. The increase reflects that the industry has the same quality of labor factor as the last year, while the capital factors have improved due to the use of automation in the production process. When considering the cost-to-sales ratio, it was found that production costs were slightly lower than the previous year, at 85.66 percent compared to 85.85 percent in the last year. However, sales and administrative expenses increased from 9.49 percent to 9.74 percent. Sales increased from 13.69 percent to 14.10 percent, including investment in research and development, which increased from 0.56 percent in 2016 to 0.61 percent per sales in 2017. Liquidity has increased as the working capital ratio increased from 1.20 to 1.35 times. The debt to assets ratio slightly increased from 0.56 times to 0.57 times, including the debt to equity ratio, which increased from 1.27 to 1.32 times.

In summary, the survey found that in 2018, the value of the food products manufacturing industry increased due to the growth in TFP capital use and labor, respectively. The proportion of Value-Added to sales increased partly due to reduced production costs. Also, manufacturers switched to use modern automation machines in the production process, which increased production efficiency. The production of quality or Value-Added food products will help add value to the businesses in the future. Also, the ability to better manage the liquidity of the industry will help the company continue.

3.3.3 Problems/Obstacles

The top three problems and obstacles encountered by the sample group are raw material costs, labor costs, and machinery/equipment efficiency. It can be seen that the operators in the sample group place the highest direct cost on raw material costs as they are vital components of the total production cost. The second most crucial issue is the cost of labor. The food industry still requires a lot of labor to produce particular foods, such as the frozen seafood industry. Labor efficiency, therefore, affects labor costs. Also, manufacturers in the sample focused on the efficiency of machinery and equipment with the intent to increase production efficiency, including maintaining and expanding the quality of food products to meet standards, therefore required modern machinery and equipment

3.3.4 Policy Recommendations

The food production industry increased efficiencies of machinery by using modern machinery in the production process. They also emphasized the development of skilled labor to create quality labor to control the production process using advanced technology to help manage the cost of production in the long run. In addition, better technology of machinery and the expertise and knowledge of the people will help create more value for the food industry. Following the needs of the market where consumers have turned to pay more attention to health, consumers are increasingly demanding food products that are of standard quality and can be conveniently and quickly consumed. Therefore, manufacturers in the food industry need to develop in the following areas:

1. Investment in research and development of products from essential processed foods to processed foods with Value-Added such as the production of concentrated extracts that are components in food production. In addition, it is the production of food that is valuable in various nutrients to enhance health and food products that are free from trans fats or allergens.
2. The application of new technology to the food industry from the production process to the distribution will increase production and distribution efficiency. Machinery or automation can be used to control production from the selection of quality raw materials, manufacturing, and packaging to reduce contamination. It also allows for convenient consumption and preservation to maintain nutritional value.
3. The production of food products that meet pesticide-free standards following international standards such as GMP HACCP, including the importance of quality development to meet the specific criteria of importing countries, increasing the opportunity to export to target markets.
4. Expanding export markets to new target groups such as the Middle East and South Africa and collaborating with countries that have networks to gather products from Thailand to export to other countries like India. This includes the development of distribution channels that can reach target groups or consumer groups requiring convenience via the internet.

Table 3.13: Growth accounting and indicators of food products manufacturing industry

(A) Growth Accounting of the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	2.64	0.35	1.49	0.80	1.17	-0.37	3.13	0.72	1.63	0.78	1.08	-0.30

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million bath/person)		2.99	2.99
Skilled labor-to-total labor proportion of (%)		n.a.	61.61
The average number of years of education received by labor (years)		12.27	12.26
On-the-job training proportion (%)		n.a.	39.26
The proportion of machinery and equipment under 5 years (%)		0.98	1.07
Automatic machinery proportion (%)		0.85	0.87
Management			
Capital			
Production cost-to-sales ratio (%)		85.85	85.66
Selling and administration expense to sales proportion (%)		9.49	9.74
Value-Added to sales ratio (%)		13.69	14.10
Raw material cost to production cost ratio (%)		38.91	38.89
Labor cost to total cost ratio		1.68	1.69
Finance			
Working capital ratio (times)		1.20	1.35
Debt to assets ratio (times)		0.56	0.57
Debt to equity ratio (times)		1.27	1.32
Innovation			
The proportion of investment in research and development to sales* (%)	0.56	0.61	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.4 TSIC 11: Manufacture of beverages

3.4.1 Industrial structure

The definition of the beverage production subcategory (TSIC 11), according to the Bureau of Statistics, covers the production of beverages such as non-alcoholic beverages and mineral water, fermented alcoholic beverages (such as beer and wine) and distilled alcoholic beverages (such as distilled liquor and mixed spirits). This category excludes fruit and vegetable juices, milk-based drinks, and products from coffee, tea, and tea, which are classified in another subcategory.

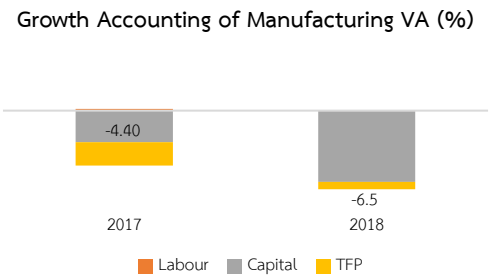
There are 914 firms in the beverage production industry in Thailand (according to the 2017 Census data), with over 85 percent of all businesses being small enterprises (779 firms), while there are 53 medium-sized firms and 81 large firms. This industry employs a total of 47,446 people, which are concentrated in large enterprises (39,209 people). The total value of this subcategory is 315,318 million Baht, which creates a total of 73,574 million Baht in Value-Added. Most of the products are consumed domestically (79 percent). The top 4 products with high production values are beer, distilled spirits, soft drinks and soda water, and energy drinks, including electrolyte drinks, which account for 83 percent of the value of this industry.

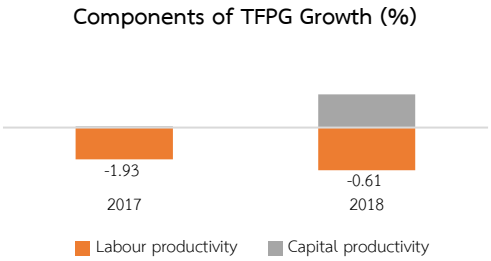
In the past, the beverage manufacturing industry experienced changes from two main factors: demand or demand for beverages and government tax measures. Domestic consumers tend to be more health-conscious in every age group, due to better access to information, whereas older people tend to pay more attention to health. The economy is growing slowly, and the low price of agricultural products caused low-income groups to have less purchasing power. Meanwhile, beverage exports to the CLMV countries continued to grow following the high economic growth rates of these countries. In 2017, the beverage industry's newly-adjusted excise tax followed the trend of consumer consciousness for more quality products. This was coupled with the adjustment of alcohol tax calculation based on alcohol content and retail prices. Taxes were collected according to the sweetness or sugar content of the drink. The new excise tax will increase the price of alcoholic beverages by 10-25 percent. All sugary drinks will increase 1-5 Baht per liter, depending on the amount of sugar in the beverage. The sugar tax will gradually increase from 2017 until the year 2023, which will have the most significant impact. Therefore, the overall domestic market of beer and distilled spirits will be affected by higher tax measures than soft drinks and soda water, as well as sweetened beverages in the first phase of the sweetness tax. At the same time, demand for beverages for low-income consumers (e.g., alcoholic beverages, white spirits, and energy drinks), especially among farmers and laborer have not recovered. However, healthy beverages and bottled water are expected to grow.

3.4.2 Results of Production Productivity Analysis and Key Indicators

A sample of 66 beverage production companies was used in the 2018survey, covering the production of liquor, beer, soft drinks and soda water, energy drinks, and bottled water. This represents approximately 88.7 percent of the total production value of this industry. Value-Added of this industry continued to decline during 2017 and 2018 at the rate of 4.40 percent and 6.00 percent, respectively. The decrease in Value-Added in 2018 was due to the decline, mainly due to capital factors (-5.84 percent). The net fixed asset value of this industry decreased by 10.15 percent, reflecting that the beverage manufacturing sector had no additional investment. Total Factor Productivity (TFP) and labor factors had little to no Value-Added, especially in 2018. Considering the components of TFP, labor capability was the main factor causing the decline of TFP in this industry.

Figure 3.3: The rate of change of Value-Added and labor, capital, and TFP factors in the beverages industry





Group of Improved Indicators

- Reduced debt burden. The debts to assets ratio and the debt to equity ratio improved.
- Increased Value-Added to Sales.
- Decreased production cost-to-sales ratio.

Group of Worsened Indicators

- The average number of years of study among workers decreased.
- Decreased capital-to-labor proportions
- Decreased current capital ratio

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

Considering the indicators that reflect the production productivity of beverage production in 2018, there is still no clear signal. The average number of academic years decreased to 12.20 years. The ratio of capital to labor decreased from 4.46 to 4.42 million Baht per person, and the current ratio of capital (Current Ratio) began to decline to 1.71 times. These three indicators reflect the decline in possible production productivity due to a lack of additional investment. It also requires more marketing expenses. The liquidity began to decrease due to the sales volume that dropped. However, this industry was able to slightly reduce the cost of production to sales to 87.46 percent. The ratio of sales and administrative expenses to sales decreased to 8.63 percent, increasing the Value-Added to sales ratio to 8.85 percent. The financial status improved from the Debt Ratio and the Debt to Equity Ratio (D / E Ratio) to 0.29 and 0.42 times, respectively, which is considered very low. These positive signal indicators show that beverage production is trying to adapt by improving production efficiency. Meanwhile, by not expanding production resulted in an improved financial status.

The analysis results show that the beverage manufacturing industry has faced many challenges in the past two years, with the Value-Added continually decreasing, in line with the MPI of the beverage production industry at 120.56, the lowest in 5 years. The contraction is a result of excise tax measures, reduced purchasing power, and changing consumer behavior trends. As a result, there were no additional investments in this industry, causing the value of capital to decrease by 10.17 percent. However, the sector adjusted to reduce production costs and had a better financial status and reduced debt. The beverage industry trend, alcoholic beverages, and sweet beverages are still worrisome as consumers become increasingly health-conscious. This saturates the market of this group of products, which starts to decline. Therefore, the beverage industry began to adjust by launching new products with a reduced sugar formula, reducing the amount of alcohol, adding new flavors, and improving the packaging size to be smaller.

3.4.3 Problems/Obstacles

The survey results found that raw material costs are the core problem for operators in this industry, followed by labor, in terms of both the cost and efficiency of labor and or personnel. Furthermore, the machinery/equipment's effectiveness corresponds to most beverage production, especially liquor and beer, which rely on domestic agricultural raw materials. Therefore, raw material costs are high. Meanwhile, wages increased, making it essential to focus on the efficiency of labor and personnel. Also, the beverage manufacturing industry uses a lot of machinery and, therefore, must continuously improve machinery and equipment efficiency. At this time, firms have chosen to delay their investments to adjust to the deteriorating market situation.

3.4.4 Policy Recommendations

The beverage manufacturing industry is divided into two groups, following the characteristics of products that are beneficial to health and those that are harmful. The behavior of Thai consumers that have changed to pay more attention to health and government policies that support this new behavior of consumers will reduce the burden of government medical expenses in the future. Therefore, alcoholic and sweet beverages will not be supported by the government and will be taxed to make it more expensive. Meanwhile, healthy drinks will have more opportunities to grow in the market. Also, energy drinks will not be able to penetrate this market as the drinks are still linked as beverages for laborer, causing the domestic market to grow very little. Therefore, businesses in the beverage manufacturing industry should adjust as follows:

1. Business operators in crucial product groups today must upgrade their product to have higher value and modify products to comply with government measures (such as reducing alcohol intake, reducing sugar, or use other sweeteners). They can also move to new businesses with more opportunities in the future when there is a clear trend that the original beverage market can no longer expand, and the tax rate steadily increases.
2. Businesses in the health beverage group should have increased innovation and marketing so that consumers are aware of health care and better products.
3. All beverage manufacturing operators must increase the efficiency of production cost management and business operations to increase profits and add value to the business.
4. Business operators in the current major product groups (such as beer, spirits, soft drinks and soda, and energy drinks) have to find more overseas markets than at present, whether it is exporting or investing in beverage production abroad. The domestic market of these products will see less growth in the future

Table 3.14 Account of Business Growth and Indicators of Beverage Manufacturing Industry

(A) The Account of Growth in the Beverage Manufacturing Industry

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	-4.40	0.14	-2.61	1.93	-2.01	0.08	-6.50	-0.05	-5.84	-0.61	-2.71	2.10

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		4.66	4.42
Skilled labor-to-total labor proportion (%)			67.79
The average number of years of education received by labor (years)		12.24	12.20
Proportion of machinery and equipment under 5 years (%)		0.92	0.34
Management			
Capital			
Production cost-to-sales ratio (%)		87.48	87.46
Selling and administration expense to sales proportion (%)		8.74	8.63
Value-Added to sales ratio (%)		8.33	8.85
Raw material cost to production cost ratio (%)		69.72	68.52
Labor cost to total cost ratio		0.83	0.94

Indicators	2016	2017	2018
Finance			
Working capital ratio (times)		1.72	1.71
Debt to assets ratio (times)		0.31	0.29
Debt to equity ratio (times)		0.45	0.42
Innovation			
The proportion of investment in research and development to sales* (%)	n.a.	n.a.	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: *Data from Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.5 TSIC 12: Manufacture of tobacco products

3.5.1 Industrial Structure

Tobacco product manufacturing (TSIC 12) is a subcategory of industries according to economic activities, whereby the production of tobacco products is appropriate for final consumption. This includes curing and incubating tobacco leaves, the manufacture of cigarettes and cigars, as well as the production of tobacco products and products that replace other tobacco (except cigarettes and cigars).

Data from the 2017 Industrial Census shows that this subcategory has a total of 31 enterprises in the Kingdom, consisting of four large firms, six medium firms, and 21 small firms. The companies employ a total of 6,097 people, with a total sales value of 68,216 million Baht, representing a Value-Added of 9,967 million Baht. Specific information on the curing and incubation of tobacco leaves shows 45 percent of foreign ownership and 82 percent of exports, with a 48 percent proportion of imported raw materials for the production of cigarettes and cigars, only. The Tobacco Authority of Thailand (TAT)[3]There is the only state enterprise that has a monopoly on tobacco production in the country. It accounts for over 99 percent of domestic sales.

[3] As announced in the Government Gazette on May 13, 2018, to close tobacco factories, which is a state enterprise in the category of a government-owned business unit but not a juristic person, caused limitations in operations. The Tobacco Authority of Thailand was established following the Tobacco Act of Thailand B.E. 2561, which is a juristic person that came into effect on May 14, 2018, by accepting the transfer of all business, cash, assets, rights, duties, liabilities and the responsibilities of the Ministry of Finance about the tobacco factory. The Ministry of Finance has the objective of producing cigarettes, which are state monopolies under the law on excise taxes and other activities.

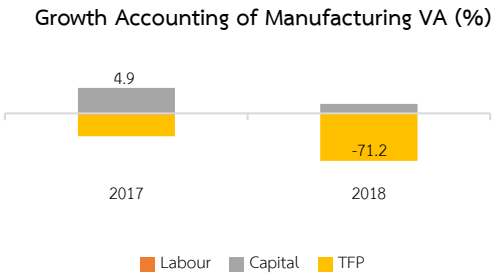
The Thai tobacco industry was profoundly affected by the Excise Tax Act 2017, which adjusted the method of calculations. The new excise tax rate became effective from September 16, 2017, increasing the prices of all domestic types of cigarettes, while some imported cigarettes decreased, causing the TAT to lose a significant share of the market for imported cigarettes. The market share of TAT decreased from 75.71 percent in 2017 to only 44.49 percent in 2018, resulting in 2018 having a decreased net profit by over 90 percent compared to the prior year, with no residual income to deliver to the state like in the past (in 2016 and 2017 the TAT provided 6,853 and 4,963 million Baht in revenue to the government, respectively). Also, the issue of self-made cigarettes occurred, along with illegal cigarettes and increased marketing of foreign cigarettes, which resulted in increased consumption of imported cigarettes. The declining domestic production affected the tobacco growers in over 20,000 households, with over 100,000 people involved in the tobacco leaf production system, and over 500,000 different types of tobacco traders[4]. The impacts resulted in a meeting with all concerned parties to speed up the solution to the problem before the increase in cigarette tax according to the Act again, which was postponed another year from October 1, 2019, to October 1, 2020.

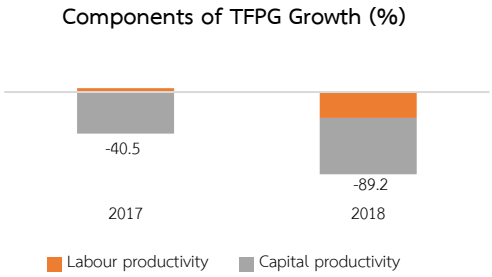
3.5.2 Results of Production Productivity Analysis and Key Indicators

In the survey data for the year 2018, the number of sample companies in tobacco production totaled five firms, including two large enterprises (including the Tobacco Authority of Thailand), two medium and one small firm. The survey sample covered 95.8 percent of the TSIC 12 category's product sales value. The surveyed products included curing and incubating tobacco, including tobacco, cigarettes, and cigars. Analysis of the survey data showed that in 2018, the Value-Added in the tobacco industry decreased by 71.17 percent from the previous year, due to the decrease of TFP by 89.16 percent. Although it received some positive results from the amount of labor and net fixed assets, which increased by 0.05 percent and 29.61 percent, overall, the Value-Added was still contracted significantly.

[4] information from the press release document "The Impact of the Excise Tax Act 2017" dated Monday, November 17, 2017, at Meeting Room 1, Administrative Building, Tobacco Authority of Thailand.

Figure 3.4: The rate of change of Value-Added and labor, capital, and TFP factors in the tobacco products manufacturing industry





Group of Improved Indicators

- Skilled labor proportion: 86%
- Increased the average number of years of education.
- Increased capital-to-sales proportion.
- Increased liquidity.

Group of Worsened Indicators

- Increased selling and administration expenses.
- Value-Added to sales decreased significantly.
- Decreased investment in research.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of the tobacco industry's key indicators in 2018 compared to the previous year showed that the ratio of capital to labor increased from 2.37 to 4.11 million Baht per person. A survey of the labor quality found that the ratio of skilled labor to total labor was 57.65 percent, while the average number of years of education was 12.91 years. Data on machinery quality was not available. When considering the cost-to-sales ratio, the trend of production cost decreased from 9.67 percent to 9.51 percent, while the sales and administrative expenses increased from 75.70 percent to 87.48 percent. The proportion of Value-Added to sales considerably reduced from 16.08 percent to 6.10 percent, reflecting the potential for Value-Added reduction. From critical financial ratios, this industry has the potential to increase liquidity and reduce debt. The working capital ratio increased from 9.03 to 14.82 times, while the debt to assets ratio decreased from 0.25 to 0.24 times, and the debt to equity ratio decreased from 0.34 to 0.32. Data from the Office of National Higher Education Science Research and innovation Policy Council (NXPO) found that the proportion of investment in research and development to sales of this industry in 2017 was 0.25 percent, down from 0.31 percent in the previous year.

In summary, the survey results showed that in 2018 the value of the tobacco products manufacturing industry decreased significantly. The leading cause was from the decrease in the TFP and the increase in the use of capital at a slower rate due to the contraction of Value-Added. This was mainly due to the tobacco sales value of the Tobacco Authority of Thailand in 2018, which decreased by 24.36 percent from the impact of the new calculation methods and excise tax. As a result, the growth rate of TFP was negative. Also, the proportion of Value-Added to sales trended negatively, reflecting the potential to create reduced Value-Added, resulting in contracted Value-Added. This was a result of increased competition in the tobacco industry and the trend of consumption of imported cigarettes, which increased. The ability to manage the production costs improved, but the cost of sales and management worsened. Meanwhile, the financial liquidity improved, and the trend of debt creation reduced. The proportion of investment in research and development in 2017 decreased from the previous year.

3.5.3 Problems/Obstacles

The problems and obstacles that the business from the sample group ranked highest in the top three were the cost of raw materials, labor costs, and industry-related laws and regulations. The Tobacco Authority of Thailand, which is a monopoly for cigarette production in Thailand, did not answer the question in this section; therefore, the answer belongs to the other two large manufacturers, which are significant producers of dried tobacco leaves, cigarette butts, and tipping paper. Thus, the responses emphasize direct costs in terms of both raw material and labor costs. The relevant legal and regulatory issues are also key obstacles. The current situation seems to be mainly related to the effects of the Excise Act of 2017.

3.5.4 Policy Recommendations

The analysis of the above tobacco product manufacturing industry shows improved production efficiency, cost management, product development, and market expansion. It is an important issue that will make this industry more competitive in the future. At present, the Thai tobacco industry is affected by the Excise Tax Act 2017, resulting in a decreased trend of tobacco production by the Tobacco Authority of Thailand. This has impacted relevant sectors in the supply chain, including tobacco growers, tobacco incubation and drying, cigarette filter manufacturers, and related products. However, since tobacco is a product that is harmful to human health, the increasing resistance and the tendency to maintain health will be the main pressure points to reduce the demand for this product. Furthermore, the trend of higher taxation will cause product prices to increase in the future. As a result, all relevant parties need to adjust as follows:

1. Tobacco growers may consider reducing tobacco planting areas and turn to grow other plants to comply with the tobacco market demand and still maintain income, ensuring it does not diminish.
2. Tobacco curing and incubation may require new marketing channels, especially exports because Thai tobacco leaves are of good quality and are needed in the world market.
3. Currently, the TAT has manufactured cigarettes mainly for domestic sales. There is a minimal amount of exports; therefore, they should consider planning for international market expansions. However, it is necessary to improve efficiency to compete with global cigarette manufacturing companies. Also, the improvement in cigarette taste quality and products that are less harmful to health to meet the needs of consumers may help increase the value of the products of TAT's products, and improve both domestic and international market share. Therefore, investment in research and development is necessary.
4. The TAT should consider expanding to other related businesses due to the advantage of existing production factors and potential in both the quality of labor and machinery. This would increase the opportunity to make money from new channels for the organization.
5. The government assists farmers affected by the reduction of tobacco cultivation quotas.

Table 3.15: Growth accounting and indicators of tobacco products manufacturing industry

(A) Growth Accounting of the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	4.93	-2.45	47.87	-40.50	4.37	-44.87	-71.17	0.02	17.97	-89.16	-28.01	-61.16

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		2.37	4.11
Skilled labor-to-total labor proportion (%)			5.65
The average number of years of education received by labor (years)		12.67	12.91
On-the-job training proportion (%)			65.77
Automatic machinery proportion (%)		0.17	0.10
Proportion of machinery and equipment under 5 years (%)		n.a.	n.a.
Management			
Capital			
Production cost-to-sales ratio (%)		9.67	9.51
Selling and administration expense to sales proportion (%)		75.70	87.48
Value-Added to sales ratio (%)		16.08	6.10
Raw material cost to production cost ratio (%)		n.a.	n.a.
Labor cost to total cost ratio		0.71	0.82
Finance			
Working capital ratio (times)		9.03	14.82
Debt to assets ratio (times)		0.25	0.24
Debt to equity ratio (times)		0.34	0.32
Innovation			
The proportion of investment in research and development to sales* (%)	0.31	0.25	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: *Data from Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.6 TSIC 13: Manufacture of textiles

3.6.1 Industrial Structure

The textile manufacturing industry (TSIC 13) covers manufacturing activities related to the preparation and spinning of textile fibers, textile weaving, finishing textiles, and clothing. It does not include activities in the cultivation of natural fibers, production of artificial fibers from chemical processes, and the production of clothing.

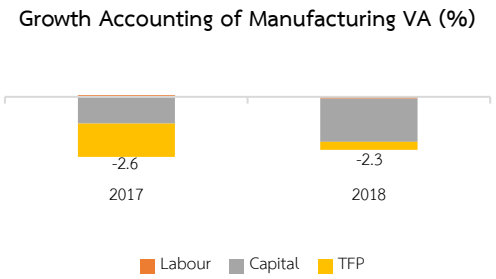
The textile industry structure from the 2017 Industrial Census Database found that there were 1,560 enterprises divided into 958 small companies, 388 medium companies, and 214 large companies, with 56.7 percent of the firms having foreign shareholders. This industry employs up to 133,701 people, with a total product value of 256,803 million Baht, creating a Value-Added of 60,623 million Baht. The domestic market is the primary market in this industry. Therefore, the proportion of exports is 39.8 percent, and the percentage of raw materials is 43.3 percent.

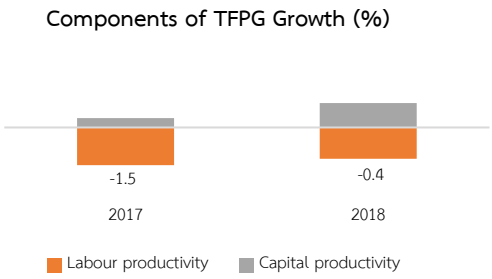
Although the Thai textile industry is traditional and has a robust supply chain, it faced labor shortages and rising labor costs, as well as losing the right to export benefits to significant markets of relevant industries, namely clothing. This resulted in the expansion and relocation of production to foreign countries. The overall situation in 2018 in the textile market continued to grow, with the main supporting factors from overseas markets. Meanwhile, the domestic market grew at a slower rate. Domestic consumption was affected by the slowdown in demand for clothing and garments that are more competitive due to more imported goods from abroad. Demand for natural textiles and fibers from domestic producers also reduced as business operators turned to import raw materials, fibers, and fabrics from China at a lower cost. The exports of textile products to foreign countries as a base and production source continued to expand well. Textile and synthetic fibers remained in demand, especially fiber products with unique properties such as collagen fibers and composite fibers, for example. There was a trend of continuous export growth.

3.6.2 Results of Production Productivity Analysis and Key Indicators

The field survey of 2018 had 33 samples of textile production enterprises, comprising 29 large companies, three medium and one small company. The sample group covers approximately 24.9 percent of the sales proportion of the TSIC 13 category. The surveyed product groups consisted of rope production and yarn spinning, knitted and woven fabrics, fabric products, including printed fabrics. The economic conditions of the sample continued to contract between 2017-2018. Still, the shrinkage rate reduced, meaning that Value-Added had a contraction rate equal to - 2.6 and -2.3, respectively, as a result of the diminished use of inputs and the ability to produce less. In 2018, the Value-Added contracted as sources from capital factors contracted by -1.89 percent, labor volume contracted by -0.1 percent, and the TFP contracted -0.4 percent, respectively.

Figure 3.5: The rate of change of Value-Added and labor, capital, and TFP factors in the textiles industry





Group of Improved Indicators

- Decreased total costs.
- Slightly increased in research investment.

Group of Worsened Indicators

- Skilled labor proportion: 55%
- Decreased Value-Added to sales.
- The use of machinery/equipment per worker reduced slightly.
- Decreased new machinery proportion.
- Liabilities decreased slightly.
- Debts increased slightly.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

Performance indicators and results show that business operators slowed down investment and did not expand capacity. They tried to reduce operating costs and had a slight increase in innovation operations. Only cost management, technology, and innovation improved. In 2018, the ratio of the total cost to sales decreased from 89.3 percent to 85.3 percent, a contraction in both production costs and sales and administrative expenses due to reduced labor costs following reduced production. Data from the Office of National Higher Education Science Research and innovation Policy Council (NXPO), the proportion of investment in research and development to sales in this industry in 2018, increased from 0.08 percent in the previous year to stand at 0.29 percent. However, while most other indicators indicate a decline in productivity, in terms of production, the ratio of capital to labor decreased from 1.1 to 1.0 million Baht/person.

Skilled labor accounted for 54.5 percent, which was lower than the average of 65.0 percent of the total labor force. The proportion of new machinery and automated machinery decreased in terms of management. The ability to create Value-Added decreased from 52.1 percent to 47.0 percent of sales, and raw material costs increased. As for financial management, the working capital ratio decreased from 1.9 to 1.8 times, and the debt to equity ratio increased from 0.60 and 0.62 times, respectively.

In general, the analysis results show that the textile industry has slowed down in the domestic market, which is affected by the import of textiles and fibers from foreign countries. Meanwhile, international markets continued to expand well, especially in the textile and synthetic fibers group. In 2018, business operators reduced production and did not invest in increasing or expanding production capacity. This resulted in a reduced overall cost. Businesses began to adapt by investing in research and development. However, the lack of adjustment and investment in machinery and equipment resulted in reduced production capabilities, while the competition in the market intensified.

3.6.3 Problems/Obstacles

The problems and obstacles that the business from the sample group ranked highest in the top three were labor costs, raw material costs, and the efficiency of labor/personnel. This reflects a heavy reliance on labor factors and labor and raw material costs as essential factors in the cost of the textile manufacturing industry. Furthermore, there were concerns about labor efficiency, in line with the training indicators that were relatively high in proportion.

3.6.4 Policy Recommendations

The textile manufacturing industry consists of products with primary value, namely textiles and yarns. These can be classified according to 2 types of raw materials, which are natural raw materials and synthetic raw materials. The two types have different trends that are natural textiles and yarns, most of which are raw materials from cotton, reduced in production continuously from 2012 to 2016, and imports of substitute products from China. Meanwhile, key synthetic textiles and yarn continued to grow from steadily increasing foreign demand. Business operators in the industry should adjust as follows:

1. Adding value to the product from investments and giving importance to the process of creating Value-Added in the research and design of products/raw materials. Also, creating organizational-level collaboration with various specialized agencies to benefit and be applied to existing knowledge from multiple studies to develop textile or related products for further commercialization.

2. Increasing production capacity from labor by developing skills and skilled workers, especially new workers entering the industry in terms of production such as machine control and modern production systems, including designs by collaborating and linking with educational institutions and professional institutions

3. Improvement and investment in machinery and equipment, both in terms of increasing production efficiency and replacing a more restrictive workforce, reduce production costs for products produced in large quantities, and focus on costs. Businesses should focus on production technology to help reduce pollution in the production process, including the use of information technology systems to manage production networks that have expanded bases and linked to foreign countries.

Table 3.16: Growth accounting and indicators of textile industry

(A) Growth Accounting of the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	-2.56	0.08	-1.18	-1.46	-1.95	0.49	-2.33	-0.08	-1.89	-0.36	-1.62	1.23

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		1.09	1.04
Skilled labor-to-total labor proportion (%)			54.54
The average number of years of education received by labor (years)		11.03	11.03
On-the-job training proportion (%)			60.05
Automatic machinery proportion (%)		9.93	9.44
Proportion of machinery and equipment under 5 years (%)		2.13	1.33
Management			
Capital			
Production cost-to-sales ratio (%)		80.99	77.58
Selling and administration expense to sales proportion (%)		8.27	7.74
Value-Added to sales ratio (%)		52.09	47.02
Raw material cost to production cost ratio (%)		60.43	60.51
Labor cost to total cost ratio		3.42	3.34

Indicators	2016	2017	2018
Finance			
Working capital ratio (times)		1.88	1.82
Debt to assets ratio (times)		0.38	0.38
Debt to equity ratio (times)		0.60	0.62
Innovation			
The proportion of investment in research and development to sales* (%)	0.08	0.29	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.7 TSIC 14: Manufacture of wearing apparel

3.7.1 Industrial Structure

The manufacturing industry of wearing apparel (TSIC 14) covers all tailoring, all types of clothing and accessories, including manufacture of articles of fur.

The textile industry structure from the 2017 Industrial Census Database found that there were 43 entrepreneurs producing apparel which consist of 1,761 small enterprises, 402 medium enterprises, and 191 large enterprises. The proportion of foreign shareholders was 47.0 percent. Employment in this industry reached 159,228 people, with a total output value of 177,664 million Baht and a value increase of 44,174 million Baht. The primary market for apparel is the international market, with the proportion of exports accounting for 59.3 percent of the total production value. The percentage of imported raw materials was 42.4 percent.

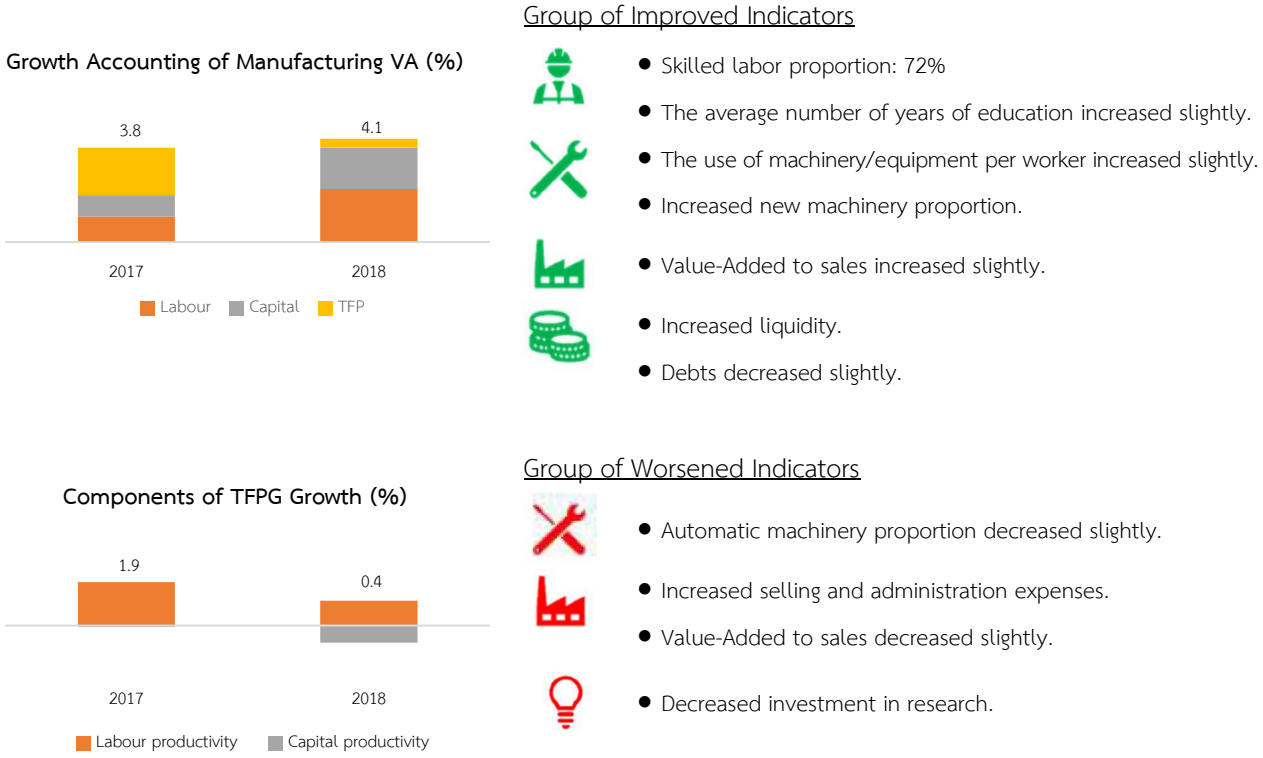
The wearing apparel industry is another industry that is old and has developed over a long period but still requires intense labor. This has resulted in a significant impact on the aging population structure and rising labor costs. It has also lost the rights to export to key markets, resulting in the relocation of production bases to foreign countries. However, in 2018, the overall apparel market grew with international markets as the main supporting factors. Demand for clothing products in key markets such as the United States, China, and Japan continued to grow, especially clothing in fashion, sports, and lingerie. Meanwhile, the domestic market slowed down, due to intensifying competition from increased imported clothing from abroad. However, Thai manufacturers have developed forms and brands, including production forms from production bases and raw materials from foreign countries, to control production costs and to support the development of E-Commerce distribution channels, which have become more active among Thai businesses, including international products as well. Additionally, macro factors that need to be followed are the direction of the Baht appreciation, including the suspension of the Generalized System of Preferences (GSP) of Thailand, which will affect the price competitiveness of Thai businesses.

3.7.2 Results of Production Productivity Analysis and Key Indicators

The sample of companies surveyed in the field in 2018, included 43 apparel manufacturers, comprising 36 large firms, two medium and five small firms. The survey sample covers approximately 23.6 percent of the sales value of the TSIC 14 category. The surveyed product group consists of clothing, uniforms, sportswear, socks, and underwear.

The Value-Added of the apparel industry continuously grew from 2017 to 2018 at a rate of 3.8 and 4.1 percent, respectively. The growth in 2018 was derived from the number of working hours that increased by 2.1 percent and the use of net fixed assets, which increased by 1.7 percent. Meanwhile, the value of fixed assets and production capacity or TFP began to slow down.

Figure 3.6: The rate of change of Value-Added and labor, capital, and TFP factors in the paper and paper products manufacturing industry



Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

When considering operational and performance indicators, it was found that business operators expanded production and increased investment in terms of workforce and machinery. In 2018, signs of quality and factors of production indicated workers with a better education. The proportion of skilled labor was quite high, equivalent to 72.4 percent, which is more than the industry average in general. Machinery and equipment increased in new investments, but automated work reduced. Meanwhile, the cost of management services found that the wearing apparel industry could create more value from 24.6 percent to 25.3 percent of sales but had to face rising costs from production costs. Financial indicators indicate improved financial status in terms of liquidity and debt risk. In addition, data from the Office of National Higher Education Science Research and innovation Policy Council (NXPO) showed that research and development activities decreased concentration. The proportion of investment in research and development to sales in this industry in 2018 was 0.09 percent, down from 0.06 percent in the previous year.

In general, the analysis results show that the wearing apparel industry continued to expand well. The export market continued to grow following the economies of major markets that are developed regularly. However, the domestic market imported more products and created more business channels, making the competition more intense. In 2018, business operators increased production both in the form of labor and machinery, creating more value but with increased cost, whereas the potential for innovation is reduced. As a result, production capability began to slow.

3.7.3 Problems/Obstacles

The problems and obstacles that the businesses from the sample group ranked highest in the top three were labor costs, raw material costs, and labor/personnel efficiency. This was consistent with the characteristics of this labor-intensive industry. Most of the Thailand manufacturers were OEMs; therefore, it is necessary to focus on low-cost production in the competition. The main cost factor is labor and raw materials; therefore, it is the priority of business operators. In addition, to upgrade production and the role of operators in the supply chain, it is necessary to rely on operational efficiency as a foundation and is something that operators need to consider.

3.7.4 Policy Recommendations

The wearing apparel industry relies heavily on labor for production. In connection with the global supply chain under leading brands, it is necessary to control and manage production costs. Thai entrepreneurs have moved their production bases to foreign countries with lower labor costs, in locations with export benefits. Thailand still has the potential for high-value products. Meanwhile, the domestic market is fierce in competition from both imported and various distribution channels to reach more consumers. Therefore, operators in the wearing apparel industry should adjust as follows:

1. Introduce more online distribution platforms, especially those that link to ASEAN and other regions' markets, and develop the ability to manage online marketing.
2. Develop supply chain management capabilities and product brand management, which is considered as an essential factor to upgrade from a contractor to a more Value-Added role and enable access to more of the global supply chain.
3. Increase the ability and skills of labor to support the development of more complex and higher-value products. Attach importance to educational institutions and professional institutions' links, especially in invention and design, to be able to play a more active role in the upstream supply chain.

Table 3.16 Growth accounting and indicators of textile industry

(A) Growth Accounting of the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	3.79	1.02	0.86	1.91	1.98	-0.07	4.14	2.13	1.66	0.35	1.14	-0.78

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		0.16	0.17
Skilled labor-to-total labor proportion (%)			72.44
The average number of years of education received by labor (years)		11.90	11.96
On-the-job training proportion (%)			15.18
Automatic machinery proportion (%)		8.57	8.40
Proportion of machinery and equipment under 5 years (%)		17.13	18.16
Management			
Capital			
Production cost-to-sales ratio (%)		66.67	67.39
Selling and administration expense to sales proportion (%)		19.39	18.89
Value-Added to sales ratio (%)		24.56	25.30
Raw material cost to production cost ratio (%)		68.52	69.93
Labor cost to total cost ratio		9.65	10.64
Finance			
Working capital ratio (times)		1.79	3.82
Debt to assets ratio (times)		0.37	0.36

Indicators	2016	2017	2018
Debt to equity ratio (times)		0.59	0.57
Innovation			
The proportion of investment in research and development to sales* (%)	0.09	0.06	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.8 TSIC 15: Manufacture of leather and related products

3.8.1 Industrial Structure

The leather and related products manufacturing industry (TSIC 15) covers manufacturing activities related to dressing and dyeing of fur and the transformation of hides into leather by tanning or curing and fabricating the leather into products for final consumption. The products made from leather substitutes are included here, since they are made in ways similar to those in which leather products are made (e.g. luggage) and are often produced in the same unit.

The leather industry structure from the 2017 Industrial Census Database found that there were 735 enterprises divided into 507 small, 154 medium, and 74 large enterprises, with 61.5 percent of the firms having foreign shareholders. This industry employed up to 57,060 people, with a total product value of 68,957 million Baht, creating a Value-Added of 19,452 million Baht. The overseas markets were the primary market for this industry. Therefore, the proportion of export value was 58.7 percent of the total production value, and the percentage of imported raw materials was 46.6 percent.

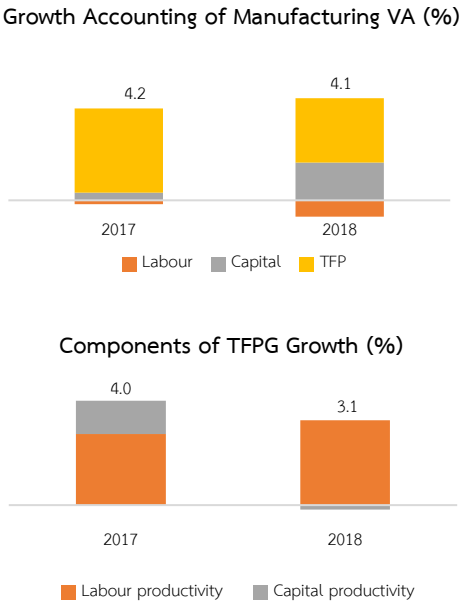
The leather production industry is another labor-intensive industry that lost competitiveness in labor costs and export benefits, resulting in the relocation of production to neighboring countries. In 2018, the overall leather market grew, supported by foreign markets, especially intermediate raw materials such as leather and finished leather. The domestic market, both Thai and foreign-owned brands, adjusted to import goods from production bases in neighboring countries with cheaper costs. There were also substitutes for domestic production, especially in footwear and luggage, causing domestic production to contract. However, leather and finished leather product groups continued to expand following downstream industries, the automotive industry, which continued to grow.

3.8.2 Results of Production Productivity Analysis and Key Indicators

The field survey of 2018 had 27 samples of leather production enterprises, comprising 14 large companies, 3 medium and 1 small company. The sample group covers approximately 49.8 percent of the sales proportion of the TSIC 15 category. The surveyed product groups consisted of production footwear, bags, including tanning and dressing of leather; dressing and dyeing of fur fabrics.

The sample group's growth rate of Value-Added was equivalent to 4.2 percent and 4.1 percent, respectively. In 2018, the growth of Value-Added, derived from the growth rate of the value of fixed assets, improved to 1.8 percent while TFP grew at a slower pace, as working hours continued to contract.

Figure 3.7: The rate of change of Value-Added and labor, capital, and TFP factors in the leather and related products manufacturing industry.



Group of Improved Indicators

- Skilled labor proportion: 71%
- The average number of years of study among workers increased slightly.
- The use of machinery/equipment per worker increased slightly.
- Increased value to sales.
- Increased production costs per sales.
- Liquidity Increased slightly.
- Debts decreased slightly.

Group of Worsened Indicators

- Automatic machinery proportion decreased slightly
- Decreased new machinery proportion
- Research investment decreased slightly

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

Performance indicators and results showed that entrepreneurs invested and expanded production capacity and used more machinery and equipment. The indicators of production factors, production cost, and financial status remained positive. In 2018, the ratio of capital to labor increased slightly from 0.47 to 0.48 million Baht per person. The average education among workers increased, and the proportion of skilled labor was 70.8 percent. In cost management, the percentage of total cost decreased from 96.1 percent to 94.8 percent of sales, with a significant portion of the production cost decreasing, resulting in an increase in value ratio of 15.5 percent to 17.0 percent of sales. The financial status improved in both liquidity and debt creation. However, risk factors that may slow production capability came from older machinery and equipment. The proportion of automated machinery decreased. Information from the Office of National Higher Education Science Research and innovation Policy Council (NXPO) reflected that the percentage of investment in research and development to sales in this industry in 2017 was 0.17 percent, down from 0.26 percent in the previous year.

In general, the analysis results reflect that the leather industry is still able to grow well, in line with the international market demand. The domestic market shrank as manufacturers' business models moved to neighboring countries, and the companies shifted to imports instead. In 2018, companies increased production and investments in production capacity, especially in the tanning and finishing of leather. This resulted in increased use of machinery and equipment and improved labor quality, which reduced costs and created Value-Added. It also improved the financial status. However, the industry had old machinery, postponed research, and was unable to generate more return on investment, resulting in slowed production.

3.8.3 Problems/Obstacles

The problems and obstacles faced by businesses from the sample group, ranked highest in the top three, were raw materials, labor costs, and the efficiency of labor/personnel. This reflects the importance of labor factors for the industry that determines the cost of production and operations, including value creation of the product. Also, the cost of raw materials was a concern to businesses, as they relied heavily on imports of raw materials from foreign countries.

3.8.4 Policy Recommendations

The leather production industry consists of products with primary value, classified according to 2 types of users, one of which is tanned and finished leather. This is an intermediate raw material that manufacturers will further process. This group has a good trend with growing demand from both domestic and international markets, from continuous industries that continued to grow, such as automobiles and parts. As for shoes and bags, which are a consumer product, manufacturers changed the pattern of operations by relocating to neighboring countries, then imported products to sell domestically. This caused domestic production to continue to decline during 2014-2018. However, industrial operators should adjust as follows:

1. Introduce more online distribution platforms, especially those that link to ASEAN and other regions' markets, and develop the ability to manage online marketing.
2. Creating trade partners and linking with regional production chains, including product brand development and management.
3. Skill development of workers in production, design, including research and development of products and raw materials, with the importance of linking with educational and professional institutions.
4. Improvement and investment in machinery and equipment to increase production to produce more value-added products.

Table 3.18: Growth accounting and indicators of textile manufacturing industry

(A) Growth accounting of the industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	4.16	-0.18	0.37	3.97	2.70	1.27	4.06	-0.77	1.78	3.05	3.23	-0.17

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		0.47	0.48
Skilled labor-to-total labor proportion (%)			70.84
The average number of years of education received by labor (years)		10.85	10.94
On-the-job training proportion (%)			31.56
Automatic machinery proportion (%)		11.178	10.75
Proportion of machinery and equipment under 5 years (%)		11.03	10.37
Management			
Capital			
Production cost-to-sales ratio (%)		83.97	82.06
Selling and administration expense to sales proportion (%)		12.10	12.75
Value-Added to sales ratio (%)		15.54	17.00
Raw material cost to production cost ratio (%)		64.40	64.82
Labor cost to total cost ratio		7.39	7.65
Finance			
Working capital ratio (times)		1.68	2.01
Debt to assets ratio (times)		0.46	0.43
Debt to equity ratio (times)		0.73	0.69
Innovation		0.84	0.74
The proportion of investment in research and development to sales* (%)	0.26	0.17	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.9 TSIC 16: Manufacture of wood and of products of wood and cork, except furniture

3.9.1 Industrial Structure

The production of wood and wood products (TSIC 16) is a subcategory of industries according to economic activities in the manufacture of wood, wooden and cork products, except furniture. The production of products from straw and weaved materials in an appropriate form for final consumption, including sawing and shaping of wood, and the production of wood products, cork, straw, and weaving materials, but not including furniture.

Data from the 2017 Industrial Census shows that this subcategory has a total of 1,069 establishments with juristic persons being manufacturers. There are 85 large firms, 269 medium firms, and 714 small firms, with a total workforce of 53,507 people and a total product value of 105,631.22 million Baht, representing a Value-Added of 12,939.27 million Baht. The proportion of foreign shareholders is equal to 50.77 percent, with the largest establishments having the most significant portion of foreign shareholders, accounting for 83.67 percent. This was followed by a small and medium firm which accounted for 47.60 percent and 46.85 percent, respectively. The average proportion of exports is 53.05 percent, with small companies having the highest percentage of exports accounting for 58.60 percent, followed by medium and large-sized companies, which accounted for 45.39 and 43.86 percent, respectively.

The manufacture of wood and of products of wood and cork (except furniture) industry was affected by the ongoing trade war between the United States and China[5], which directly impacted the exported lumber to China. From the statistics of international trade in Thailand from the Ministry of Commerce, the total export value in 2018 was 84,021.74 million Baht. Compared to 2017, the growth rate decreased, accounting for 13.46 percent, with the market share declining from 1.21 percent in 2017, which reduced by only 1.04 percent in 2018. Wooden ornaments had the highest export growth rate, followed by lumber and wood picture frame products. Although most industrial products had a declining growth rate, there were still some products that increased exports, namely veneer sheets with the highest growth rate, followed by fiberboard products and wooden construction equipment.

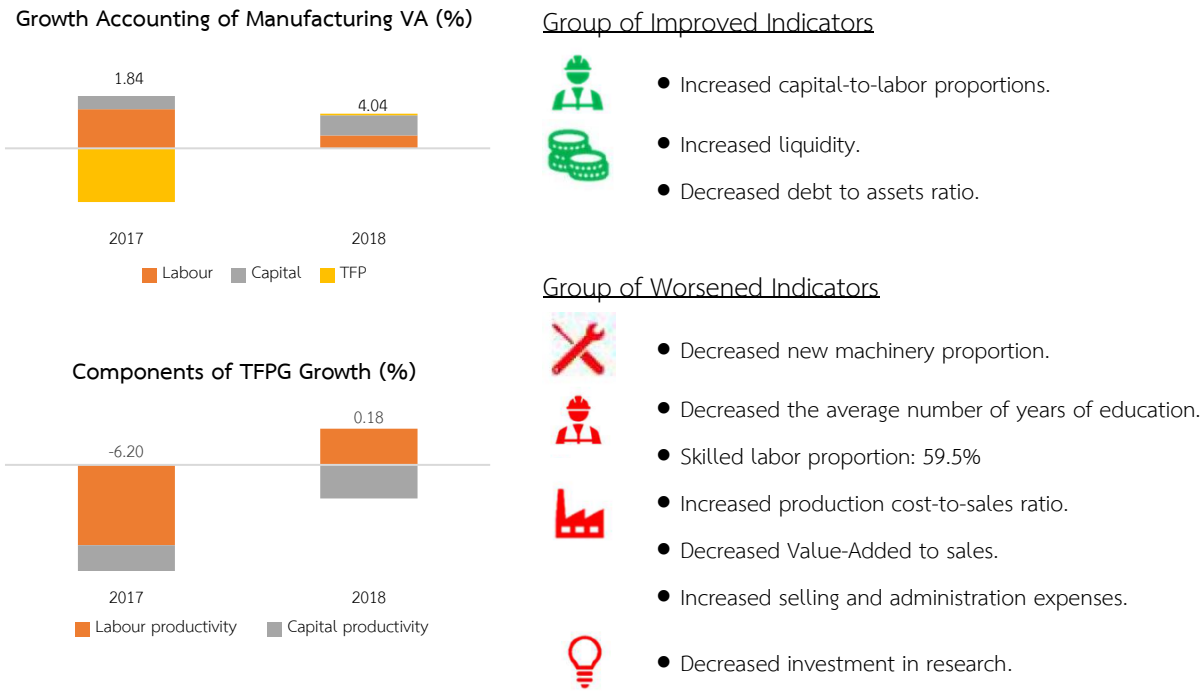
[5] Data from the document "Industry Economic Report 2018 and Outlook for 2019" for the Wood and wooden furniture industry from the Office of Industrial Economics

From the domestic market situation of the home building business in 2018, compared to 2017, there was a slight growth from the "Million House Project." From the market share, 82 percent were small houses and prefabricated houses (knock-down houses) with an estimated price range of 800,000-1,500,000 Baht, followed by homes in the 3,000,000-20,000,000 Baht price range, representing 12 percent. Larger homes with price ranges of 20,000,000-200,000,000 Baht, accounted for 6 percent, respectively. Most popular prefabricated houses were built with various types of wood, including pine, black rosewood, iron wood, teak, bamboo, and Shera wood. In 2019, the home building business will grow by an average of 7-8 percent, with the proportion in provincial regions expected to grow more than Bangkok and its vicinity, especially in the eastern and northeastern areas, which are expected to grow more than other regions.

3.9.2 Results of Production Productivity Analysis and Key Indicators

In the 2018 surveys, the sample number of companies in the manufacture of wood, wooden and cork products (except furniture) that can be used to assess the data, had a total of 26 companies. The total comprised 6 large firms, 17 medium and 3 small firms. The sales value of the products was approximately 24.9 percent of the whole of the TSIC 16 category. The products surveyed included the production and sales of processed wood, sawing, and the production of lumber and cork products. Survey data in 2018 of the wood, and wooden and cork products (except furniture) industry, increased in value by 4.04 percent from the previous year, which increased from TFP by 0.18 percent. Meanwhile, labor and capital factors caused the value to increase by 1.52 percent and 2.34 percent, respectively, due to the volume of labor and net fixed assets that decreased by 2.07 percent and 8.74 percent, respectively.

Figure 3.8: The rate of change of Value-Added and labor, capital, and TFP factors in the wood and of products of wood and cork (except furniture) industry



Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis results on essential indicators of wood and of products of wood and cork (except furniture) manufacturing industry in 2018, compared to the previous year, found that the proportion of capital to labor is likely to increase from 2.13 to 2.23 million Baht per person. The survey results on the workers' quality found that the ratio of skilled labor to total labor was 59.05 percent, while the average number of years of study was 13.01 years. The quality of machinery was 0.03 percent. Considering the cost-to-sales ratio, the trend of production costs increased from 83.68 percent to 84.12 percent, while sales and administrative expenses increased from 10.43 percent to 10.75 percent. The proportion of Value-Added to sales decreased considerably from 22.29 percent to 20.35 percent, reflecting the reduced potential to create value. From key financial ratios, the industry tended to increase liquidity and reduce debt. The working capital ratio increased from 0.83 to 0.86 times, while the debt to assets ratio decreased from 0.54 to 0.51 times, whereas the debt to equity ratio increased from 0.78 to 0.86. Information from the Office of National Higher Education Science Research and innovation Policy Council (NXPO) reflected that the proportion of investment in research and development to sales in this industry decreased slightly from 0.06 percent in 2017 to 0.05 percent in 2018.

In summary, the survey results showed that in 2018, the wood, and wooden and cork products (except furniture) industry, continued to increase in value. As a result, the growth rate of TFP was positive. The proportion of Value-Added to sales has a negative trend, reflecting the potential for creating Value-Added, which has decreased, resulting in Value-Added contraction, due to increased competition in the wood and wood products and cork (except furniture) industry. The ability to manage production costs improved, with improved sales and administrative expenses, as well as financial liquidity, with a tendency of less debt.

3.9.3 Problems/Obstacles

The top three problems and obstacles encountered by the sample group were the cost of raw materials, financial costs, and labor costs. It can be seen that the business operators in the sample placed a lot of importance on direct expenses, including the cost of raw materials, finances, and labor costs, which are essential in the process of wood processing and exports. In addition, the industry requires raw materials; therefore, raw material plays the most critical role in businesses. For indirect costs, business operators who attach importance to the next level will involve the enhancement of skilled labor in wood sawing and engraving, which can add value to the products.

3.9.4 Policy Recommendations

The analysis of the manufacturing of wood and of products of wood and cork (except furniture) industry shows that improving production efficiency, cost management, product development, and expanding the market more widely is an important issue that will make this industry more competitive in the future. The manufacturing of wood and wooden products and cork (except furniture) of Thailand was affected by the trade war between the United States and China, including the appreciation of the Baht over other currencies. This caused China to slow down the production of wood and reduce lumber purchases from Thailand, which affected sawmills in the country that need to delay the production of timber and impacts wood growers. This causes raw materials for plywood production to be a loss. As a result, all relevant parties need to adjust as follows:

1. Source other additional markets such as India, which is an exciting market as the trend of demand for rubberwood from India is positive, following the growth of the wood furniture industry. India is the top importer of unprocessed wood products (with cut bark or sapwood already, or made into rough, but not square shapes). Thailand is the third-largest exporter for such products and ships to India, which is ranked 68th. Therefore, it is Thailand's opportunity to expand the market to India.

2. Develop unskilled workers with skills in the carving and wood sawing processes through projects that assist in the development and training of labor. The government should play an essential role in supporting and helping the development of skilled labor, as the skills are scarce.

3. Business operators should increase the value of products by creating and designing products that are modern and useful in a variety of applications. Stories and history can be added to the product to make it more exciting and competitive in the world market. This can increase the market share of the wood industry, both domestically and internationally as well. Therefore, investment in research and development is necessary

Table 3.19: Growth accounting and indicators of manufacturing industry of wood and of products of wood and cork, except furniture

(A) Growth Accounting of the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	1.8	4.5	3.6	-6.2	-3.1	-3.08	4.04	1.5	2.3	0.2	1.4	-1.3

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		2.13	2.23
Skilled labor-to-total labor proportion (%)		n.a.	59.05
The average number of years of education received by labor (years)			13.01
Proportion of machinery and equipment under 5 years (%)			0.03
Management			
Capital			
Production cost-to-sales ratio (%)		83.68	84.12
Selling and administration expense to sales proportion (%)		10.43	10.75
Value-Added to sales ratio (%)		22.29	20.35
Raw material cost to production cost ratio (%)		36.14	33.79
Labor cost to total cost ratio		2.96	2.59
Finance			
Working capital ratio (times)		0.83	0.86
Debt to assets ratio (times)		0.54	0.51

Indicators	2016	2017	2018
Debt to equity ratio (times)		1.17	1.06
Innovation			
The proportion of investment in research and development to sales* (%)	0.06	0.05	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.10 TSIC 17: Manufacture of paper and paper products

3.10.1 Industrial Structure

The manufacture of paper and paper products (TSIC 17) is a subcategory of industries following economic activities in the category of producing paper and paper products in appropriate forms for final consumption. It consists of the production of pulp, paper and cardboard, corrugated paper and cardboard production, and boxes from paper and cardboard. It includes the production of other processed products made from paper and cardboard such as paper-processed products for household use, hygiene, and paper stationery.

Data from the 2017 Industrial Census shows that this industry has a total of 1,085 establishments with juristic person status acting as manufacturers. Of this number, there were 131 large, 283 medium, and 671 small enterprises, with a total workforce of 71,302 people and a total product value of 253,377.07 million Baht, representing a Value-Added of 60,681.37 million Baht. The proportion of foreign shareholders is equal to 53.08 percent, with the small establishments having the most significant portion of foreign shareholders, accounting for 56.82 percent. This was followed by a medium and large firm which accounted for 53.64 percent and 49.10 percent, respectively. The average proportion of exports is 35.96 percent, with small companies having the highest percentage of exports accounting for 43.88 percent, followed by medium and large-sized companies, which accounted for 39.95 and 25.88 percent, respectively.

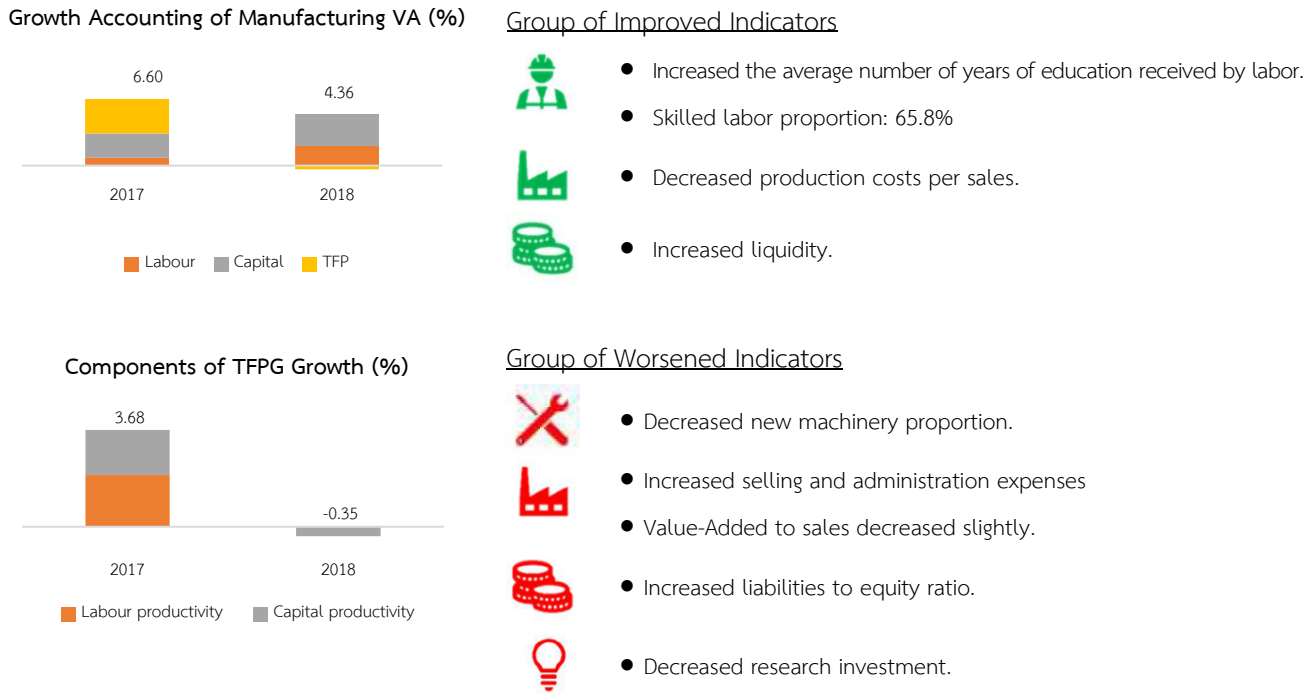
Thailand entered the digital economy era with the popularity of e-commerce and from consumer behavior, which shifted to convenience and speed, resulting in more product purchases through online channels. This resulted in increased demand for corrugated boxes and cardboard packaging for use in transportation. However, other products, such as paper products, were affected by the direction of the digital economy era and paper reduction policies within various organizations. Although some products were affected, in general, the data from the Office of Industrial Economics as a whole, found that in 2018, the industry's production increased by 2.30 percent from 2017. In 2018, the total sales value increased by 4.06 percent, whereby domestically, the growth rate was 1.49 percent.

Although the total domestic sales value increased, there were still products with a decreasing growth rate, namely the printing and writing paper industry. This is due to changing consumer behavior following modern technology, whereby consumers increasingly turned to read E-books, E-Magazines, and newspaper websites instead of reading books. Also, it has reduced the amount of recycled paper in the world, causing the price of wastepaper to increase, which increases costs for business operators who import waste paper as raw materials for the production of different paper products.

3.10.2 Results of Production Productivity Analysis and Key Indicators

In the survey data of 2018, the number of sample manufacturers of paper and paper products totaled 22 firms, divided into 16 large firms, 5 medium, and 1 small firm. The survey sample covers the sales value of the products at approximately 45 percent of the TSIC 17 category. Surveyed products included the production of pulp, corrugated paper, cardboard, and other products made from paper. According to the data from the survey, in 2018, the Value-Added of the paper and paper products industry decreased by 4.36 percent from the previous year. The TFP increased to 0.35 percent due to the increase in labor consumption by 4.40 percent. The net fixed assets value increased by 4.93 percent, while the labor and capital factors increased to 1.79 and 2.39 percent, respectively.

Figure 3.9: The rate of change of Value-Added and labor, capital, and TFP factors in the paper and paper products manufacturing industry.



Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis results on key indicators of the paper and paper products manufacturing industry in 2018, compared to the previous year, found that the proportion of capital to labor is likely to increase from 3.57 to 3.70 million Baht per person. The survey results on the workers' quality found that the ratio of skilled labor to total labor was 65.78 percent, while the average number of years of education received by labor was 11.88 years. The quality of machinery was 1.89 percent. Considering the cost-to-sales ratio, the trend of production costs decreased from 80.19 percent to 79.88 percent, while sales and administrative expenses increased from 8.99 percent to 9.72 percent. The proportion of Value-Added to sales decreased considerably from 20.32 percent to 19.89 percent, reflecting the decreased potential to create value. From key financial ratios, the industry tended to increase liquidity and debt. The working capital ratio increased from 1.02 to 1.04 times, while the debt to assets ratio increased from 0.39 to 0.42 times, and the debt to equity ratio increased from 0.65 to 0.73. Information from the Office of National Higher Education Science Research and innovation Policy Council (NXPO) reflected that the proportion of investment in research and development to sales in this industry decreased from 0.33 percent in 2017 to 0.12 percent in 2018.

In summary, the survey results show that in 2018, the paper and paper products industry's value continued to increase and expand. As a result, the TFP growth rate was negative. In addition, the proportion of Value-Added to sales decreased, showing a reduced potential to create Value-Added, resulting in shrinkage in value, due to increased competition in the paper and paper industry. The trend of importing pulp, paper, and paper products also increased. The ability to manage the cost of production decreased, and the cost of sales and administration decreased. Meanwhile, financial liquidity improved, but there was a trend toward increasing debt.

3.10.3 Problems/Obstacles

The top three problems and obstacles encountered by the sample group were cost-effective labor/personnel, cost efficiency of machinery/equipment, and financial costs. It can be seen that the operators in the sample place importance on direct costs, in terms of cost of labor/skilled personnel, cost capable machinery, and financial costs, which are essential for the process of using different types of paper production technology. In addition, being an industry that requires skilled personnel to use machines as a part of the production, both factors play an essential role for business operators. Meanwhile, financial costs are another equally important factor in investing in machinery and equipment.

3.10.4 Policy Recommendations

The analysis of the paper and paper products industry above shows that improved production efficiency, cost management, product development, and broader market expansions are essential issues that will make this industry more competitive. Although the Thai paper product manufacturing industry currently has increased demand from the growth of the E-Commerce business sector, the paper industry has also been impacted by electronic devices such as computers, tablets, and emails, for example. Organizations have also switched to electronic documents in their work setting to reduce paper use. As a result, all relevant parties need to adjust as follows

1. Skill development should be done among unskilled labor groups, to equip them with skills in the process of using technology and innovation in production. This is because today, technology and innovation are used to help produce products. Therefore, skilled and efficient personnel are essential to modern times and drive the paper and paper products industry.
2. There should be tax measures to reduce the costs of producing books. Moreover, these measures would encourage people to turn to love reading and help more people to purchase books.
3. Investments in research and development are essential for quality improvement, including product features, whether it is a property that can withstand the various weather conditions, or extend the shelf life of the product, including production that reduces costs.

4. Creativity is vital to increase the value of packaging, creating attractive, modern designs that are striking to consumers. It is one of the most critical factors in adding value to the package.

Table 3.20: Growth accounting and indicators of paper and paper products manufacturing industry

(A) Growth Accounting of the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	6.60	0.72	2.20	3.68	1.96	1.72	4.36	1.79	2.93	-0.35	-0.02	-0.34

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		3.57	3.70
Skilled labor-to-total labor proportion (%)		n.a.	65.78
The average number of years of education received by labor (years)		11.64	11.88
Proportion of value of machinery and equipment under 5 years (%)		2.16	1.89
Management			
Capital			
Production cost-to-sales ratio (%)		80.19	79.88
Selling and administration expense to sales proportion (%)		8.99	9.72
Value-Added to sales ratio (%)		20.32	19.89
Raw material cost to production cost ratio (%)		71.82	72.08
Labor cost to total cost ratio		2.16	2.04
Finance			
Working capital ratio (times)		1.02	1.04
Debt to assets ratio (times)		0.39	0.42
Debt to equity ratio (times)		0.65	0.73
Innovation			
The proportion of investment in research and development to sales* (%)	0.33	0.12	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.11 TSIC 18: Printing and reproduction of recorded media

3.11.1 Industrial Structure

The printing and reproduction of stored media (TSIC 18) is a subcategory of industries following economic activities on the printing and reproduction of storage media to be in appropriate forms for final consumption. This includes printing and printing-related services such as printing of newspapers, journals, labels, and other prints, including pre-printing and printing-related services, including the reproduction of various media.

Data from the 2017 Industrial Census shows that this subcategory had a total of 2,588 with juristic person status acting as manufacturers throughout the Kingdom. Of this number, there were 60 large, 234 medium, and 2,294 small enterprises, with a total workforce of 46,384 people and a total product value of 90,833.61 million Baht, representing a Value-Added of 24,444.57 million Baht. The proportion of foreign shareholders was equal to 51.95 percent, with the largest establishments having the most significant portion of foreign shareholders, accounting for 63.80 percent. This was followed by large and small enterprises which accounted for 55.17 percent and 44.82 percent, respectively. The average proportion of exports was 32.76 percent, with small companies having the highest percentage of exports accounting for 35.68 percent, followed by medium and large-sized companies, which accounted for 29.77 and 32.76 percent, respectively.

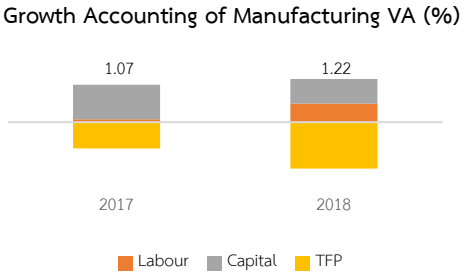
But because consumer behavior has changed following the times, the era of social media has become more active in print media, both in terms of advertising and sales. This has a significant impact on publications and has caused some small-scale businesses in the industry to disappear. Overall, data on exports from the Ministry of Commerce's Thailand's international trade statistics, it was found that overall books and publications products in 2018 reached a total export value of 2,644.97 million Baht. Compared to 2017, exports increased by 15.03 percent. Although exports increased in value, the market share remained stable at 0.03 percent. In 2018, countries with the highest publications exports from Thailand were the Philippines, followed by Hong Kong, Indonesia, and Japan. Other publications included printmaking, photos, and print media in books.

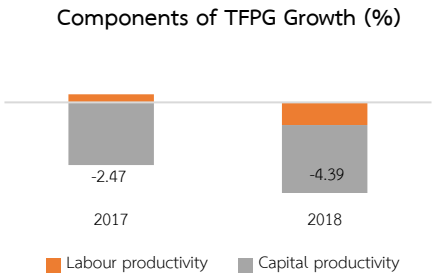
At present, the printing industry has a trend of continuous growth, which is a factor from the changes in the use of printing technology from the printing of books and magazines to the packaging industry that is growing from e-commerce businesses and government policies that aim to promote Thailand as a production center. Therefore, the food and beverage business sector remained a supporting factor in this industry. In 2018, the packaging industry had a domestic production capacity of 5.83 million tons, divided into printing on paper materials, which accounted for 37.74 percent, glass materials at 30.05 percent, and plastic materials at 24.34 metallic materials at 7.87 percent. According to the end-of-year forecast of 2019, government stimulus policies will increase the value in this industry by 10-20 percent.

3.11.2 Results of Production Productivity Analysis and Key Indicators

In the survey of data in 2018, the number of sample enterprises producing printing and reproduction of storage media totaled 18 enterprises, comprising 2 large, 11 medium and 5 small enterprises. The survey sample covered 24.6 percent of TSIC 18's total product category. The surveyed products included vinyl printing factories, advertisement boards, book printing, newspapers, journals, labels, and brochures. The data processed from the survey showed that in 2018, the printing and reproduction of stored media industry increased in value-added by 1.22 percent from the previous year due to the increase of labor and capital factors, causing the Value-Added to grow by 1.76 and 3.85 percent, respectively. The TFP declined by 4.39 percent from an increase in the amount of labor used by 2.91 percent and the value of net fixed assets, which increased by 9.75 percent.

Figure 3.10: The rate of change of Value-Added and labor, capital, and TFP factors in the printing and reproduction of recorded media





Group of Improved Indicators

- Proportion of new machinery increased slightly.
- Higher capital quality
- Increased the average number of years of education received by labor.
- Skilled labor proportion: 73.2%
- Decreased production costs per sales.

Group of Worsened Indicators

- Increased capital-to-sales proportion.
- Decreased Value-Added to sales proportion.
- Decreased liquidity.
- Increased liabilities to equity ratio.
- Decreased research investment.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis results on key indicators of the printing and reproduction of recorded media industry in 2018, compared to the previous year, found that the proportion of capital to labor is likely to increase from 1.21 to 1.37 million Baht per person. The survey results on the workers' quality found that the ratio of skilled labor to total labor was 73.21 percent, while the average number of years of education received by labor was 13.13 years. The quality of machinery was 1.89 percent. Considering the cost-to-sales ratio, the trend of production costs increased from 67.74 percent to 68.61 percent, while selling and administration expenses decreased from 12.66 percent to 11.86 percent. The proportion of Value-Added to sales decreased considerably from 42.69 percent to 39.52 percent, reflecting the reduced potential to create Value-Added. From key financial ratios, this industry tended to decrease liquidity and create more debts. The working capital ratio decreased from 1.97 to 1.42 times, while the debt to assets ratio increased from 0.31 to 0.39 times, whereas the debt to equity ratio increased from 0.45 to 0.65. Information from the Office of National Higher Education Science Research and innovation Policy Council (NXPO) reflected that the proportion of investment in research and development to sales in this industry decreased from 1.11 percent in 2017 to 0.06 percent in 2018.

In summary, the survey shows that in 2018, the printing and reproduction of stored media industry increased in value-added, causing the growth rate of the TFP to be negative. In addition, the proportion of Value-Added to sales decreased, reflecting the reduced potential to create value-added. This resulted in a contracted Value-Added due to increased competition in the printing and reproduction of stored media industries, for better ability to manage production costs. However, the cost of sales and administration decreased, while the financial liquidity declined, and the trend for debt increased.

3.11.3 Problems/Obstacles

The top four problems and obstacles encountered by the sample group were raw material costs, labor costs, efficient labor/personnel, and cost-effective machinery/equipment. It can be seen that the business operators in the sample placed importance on direct expenses, including the cost of raw materials, labor/personnel costs, and the cost of efficient machinery, which is vital for the use of printing technology. In addition, being an industry that requires raw materials and skilled personnel in using production technology for workpieces, both factors play the most important role to entrepreneurs.

3.11.4 Policy Recommendations

The analysis of the printing and reproduction of stored media industry sees that improving production efficiency, cost management, and product development is an important issue that will boost the industry’s competitiveness in the future. At present, the printing and reproduction of storage media industry in Thailand has been affected by the advent of digital technology and social media, both in terms of advertising and the increased use of electronic media in today's world, such as the introduction of e-books and electronic signage. However, it can still grow from the packaging industry. Therefore, the relevant parties should adjust as follows:

1. Some small firms in the industry have recently disappeared due to a lack of funds to adjust technology and innovation to meet the new printing needs. The government should, therefore, have funding measures for changing technology to enable small companies to adapt and survive in the modern era.
2. Investment in research and development is one component that is necessary to improve the quality, techniques, and properties of printing and printing inks. It also allows for printing in a broader variety of materials and adds value to the printing industry.
3. Businesses in the industry should have a precise analysis of target customers and the right selection of methods to reach consumers. Companies should look at building relationships with consumers through digital media to make marketing more successful, such as a website or social media marketing.

Table 3.21: Growth accounting and indicators of printing and reproduction of recorded media

(A) Growth Accounting of the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	1.07	0.27	3.27	-2.47	0.36	-2.84	1.22	1.76	3.85	-4.39	-1.02	-3.36

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		1.21	1.37
Skilled labor-to-total labor proportion (%)		n.a.	73.21
The average number of years of education received by labor (years)		13.05	13.13
Proportion of machinery and equipment under 5 years (%)		1.82	1.89
Management			
Capital			
Production cost-to-sales ratio (%)		67.74	68.61
Selling and administration expense to sales proportion (%)		12.66	11.86
Value-Added to sales ratio (%)		42.69	39.52
Raw material cost to production cost ratio (%)		55.14	54.32
Labor cost to total cost ratio		18.36	16.90
Finance			
Working capital ratio (times)		1.97	1.42
Debt to assets ratio (times)		0.31	0.39
Debt to equity ratio (times)		0.45	0.65
Innovation			
The proportion of investment in research and development to sales* (%)	1.11	0.06	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.12 TSIC 19: Manufacture of coke and refined petroleum products

3.12.1 Industrial Structure

The manufacture of coke and refined petroleum products (TSIC 19) is an economic activity to manufacture coke and refined petroleum products, which consists of 2 major groups, namely the production of coke and products from petroleum refining, including the creation of products from petroleum refining, biofuel production and the production of other products obtained from petroleum refining.

Data from the 2017 Industrial Census shows that this industry had juristic persons as manufacturers totaling 134 establishments throughout the kingdom. Of this number, there were 40 large, 38 medium, and 56 small enterprises, with a total labor force of 16,836 people. The product sales value was 590,218 million Baht, representing a Value-Added of 165,261 million Baht, which is more than 97 percent of the Value-Added from the manufacture of products from petroleum refineries or petroleum products. From the data, the proportion of foreign shareholders was 55 percent. The export ratio was 38 percent, and the percentage of raw materials imports was 64 percent.

The petroleum industry is likely to grow continuously as the refinery capacity utilization rate in 2018 increased to 96[6] percent and the domestic demand for petrol grew from 54,674 million liters in 2017[7] to 56,348 million liters in 2018. The Gross Refinery Margin (GRM)[8], which reflects the profitability of the industry, decreased from the previous year due to the increasing price trend of crude oil this year[9]. The GRM of this year remained at a good level of 5.8 USD per barrel, close to the five-year average of 5.9 USD per barrel. The supporting factors for the demand for petroleum products were domestic retail petrol prices, which were not high. Although the cost of crude oil was more volatile due to the conflict between the United States and Iran, the government still collected taxes and fuel oil funds from oil traders, to use in the reduction in the volatility of domestic refined petrol prices during the high or fluctuating oil prices in the world market. It is also used to support the use of certain types of petrol, such as E20 and E85. There were supporting factors from the growth of the domestic transportation sector, which grew from the increase of local industrial transportation from the utilization rate. Supporting factors including the growth of the tourism industry with total revenue in 2018, reached the target of 3.08 trillion Baht, including the growth of the automotive industry in 2018, with increased sales from returns to purchase cars in the first car buyer program group which had no debt. However, the above factors may be pressured by the tendency

[6] Data from Krungsri Research

[7] Data from EIC

[8] Gross Refinery Margin (GRM) is the average difference between the price of refined oil and the cost of crude oil

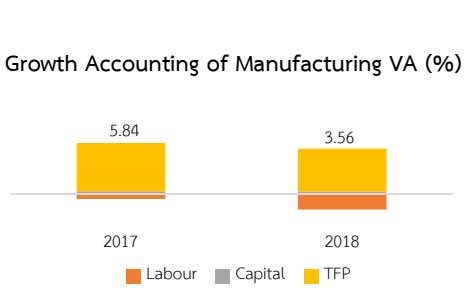
[9] The average Dubai crude oil price increased from 41.4 USD per barrel in 2016 to 53.1 USD per barrel in 2017 and 69.3 USD per barrel in 2018.

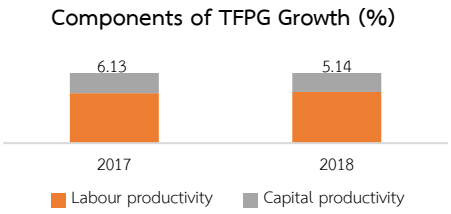
to use more environmentally-friendly electric vehicles, which may affect the demand for petroleum products in the future, including engine technology development with less capacity (engine downsizing) in lower fuel consumption.

3.12.2 Results of Production Productivity Analysis and Key Indicators

In the 2018 survey, the number of sample establishments producing coke and refined petroleum products was 29 establishments. Of this number, there were 14 large, 7 medium, and 8 small enterprise. The survey covered 99.8 percent of TSIC 19's total product sales. The types of products surveyed included coke, refined petroleum products, lubricants, biofuels, and other products obtained from petroleum refining, for example. According to data processed from the survey, in 2018, the industry producing coke and refined petroleum products had an increased Value-Added by 3.76 percent from the previous year, which grew from the TFP by 5.35 percent and the Value-Added from capital factors by 0.26 percent. Meanwhile, labor factors caused the value to decrease by 1.84 percent as the use of labor decreased by 3.58 percent.

Figure 3.11: The rate of change of Value-Added and labor, capital, and TFP factors in the manufacturing industry of coke and refined petroleum products





Group of Improved Indicators

- Skilled labor proportion: 84%
- Selling and administration expenses decreased.
- Increased research investment.

Group of Worsened Indicators

- Decreased proportion of automatic machinery.
- Production cost-to-sales ratio increased from interest Expenses.
- Decreased Value-Added to sales proportion.
- Decreased liquidity.
- Increased debts.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of key indicators for the coke and refined petroleum products industry in 2018 compared to the previous year, showed that the ratio of capital to labor increased from 6.18 to 6.23 million Baht per person. The results of the survey on the labor quality found that the ratio of skilled labor to total labor was 84.34 percent. In comparison, the average number of years of study was 12.79 years, and the proportion of labor training was 37.77 percent. The percentage of automated machinery was 8.33 percent. Considering the cost-to-sales ratio, the trend of production costs increased from 27.13 percent to 27.70 percent from the increase in raw material costs. Meanwhile, labor costs decreased as the sales and administrative expenses decreased from 7.79 percent to 7.42 percent. The proportion of Value-Added to sales decreased from 70.42 percent to 70.02 percent. The trend of liquidity contracted to cause increased debt. The working capital ratio declined from 1.50 to 1.31 times, while the debt to assets ratio increased from 0.34 times to 0.45 times, and the debt to equity ratio increased from 0.52 times and 0.80 times, respectively. Information from the Office of National Higher Education Science Research and innovation Policy Council (NXPO) reflected that the proportion of investment in research and development to sales in this industry in 2017 was 0.35 percent, up from 0.31 percent in the previous year.

In summary, the survey results show that in 2018, the manufacture of coke and refined petroleum products increased in value. Although the amount of labor reduced, capital usage continuously increased. The growth in Value-Added was mainly due to the higher capacity utilization rate from 86.2 percent in 2017 to 96 percent in 2018, following both domestic and international market demand. As a result, the growth rate of TFP was positive. However, the proportion of Value-Added to sales decreased, reflecting the reduced potential to create Value-Added as the trend of crude oil prices in the world market started to increase. The average Dubai crude oil price increased from 53.1 USD per barrel in 2017 to 69.3 USD per barrel in 2018, resulting in the GRM, which reflects reduced profitability, and also negatively impacts the ability to create Value-Added as crude oil accounts for up to 75-80 percent of the total variable cost in refining. The ability to manage production costs worsened, but the sales and administrative expenses improved. The financial liquidity deteriorated, whereas there is a trend of increased debt this year.

3.12.3 Problems/Obstacles

The top three problems and obstacles encountered by the sample group were financial costs, labor costs, and fuel and energy costs used in production. It can be seen that the operators in the sample placed importance on direct costs, in terms of the cost of capital factors, cost of labor and fuel, and energy costs, which are essential for the petroleum refining process. Also, being an investment-intensive industry, capital costs play the most crucial role for entrepreneurs. The issue that companies gave next level priority to was related to the enhancement of labor and machinery efficiencies.

3.12.4 Policy Recommendations

The production of coke and refined petroleum products in Thailand is currently affected by the change in crude oil prices, which has a significant impact on the ability of entrepreneurs to make a profit. Furthermore, there were challenges from changing product demand resulting from factors such as product prices, changes in technology or raw materials in downstream industries such as the use of electrical energy in the automotive industry and the use of biological raw materials in the chemical and plastics industries. Also, the amendments to the Fuel Oil Fund Act B.E. 2562, which will be enforced on September 24, 2019, has the critical issue of termination of biofuel subsidies within three years. It is expected to result in decreased biofuels demand and will continue to affect the cost competitiveness of biofuels. However, there are still factors that contribute to the growth of the industry, namely the Sulfur Control Measures in Maritime Fuels (IMO2020) of the International Maritime Organization (IMO), which established measures to control the sulfur emissions of fuels used in sea vessels to no more than 0.5 percent (previously 3.5 percent). The initiative will come into effect on January 1, 2020, and will result in increased demand for diesel fuel and low-sulfur fuel to replace fuel oil with high sulfur content. Therefore, this industry should adjust as follows:

1. Improve the efficiency of an oil refinery to allow the total GRM to increase, resulting in improved business performance.
2. Biofuel operators should speed up production efficiency improvements to lower costs and improve fuel quality. This will allow them to compete and survive in the future when the biofuels subsidy is lifted according to the Fuel Oil Fund Act B.E. 2562.
3. Support companies to develop more environmentally friendly petroleum products that can be used in downstream industries, more than those used in transportation, such as those used in the chemical, apparel, and consumer goods industries, for example.
4. Encourage operators to produce low-sulfur oil at low prices to support fleet operators and IMO measures that control the sulfur emission of fuels used in sea vessels.
5. Entrepreneurs should increase efficiency in business operations and control costs, especially raw material and financial costs, by reducing costs or improving efficiency in cost management.

Table 3.22: Growth accounting and indicators of coke and refined petroleum products industry

(A) Growth Accounting of the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	5.84	-0.60	0.31	6.13	3.61	2.52	3.56	-1.85	0.28	5.14	3.69	1.45

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		6.18	6.23
Skilled labor-to-total labor proportion (%)		n.a.	84.34
The average number of years of education received by labor (years)		12.81	12.79
On-the-job training proportion (%)		n.a.	37.77
Automatic machinery proportion (%)		8.67	8.33
proportion of machinery and equipment under the age of 5 years (%)		n.a.	n.a.
Management			
Capital			
Production cost-to-sales ratio (%)		27.13	27.70
Selling and administration expense to sales proportion (%)		7.79	7.42
Value-Added to sales ratio (%)		70.42	70.02
Raw material cost to production cost ratio (%)		64.55	64.98
Labor cost to total cost ratio		2.70	2.59
Finance			
Working capital ratio (times)		1.50	1.31
Debt to assets ratio (times)		0.34	0.45
Debt to equity ratio (times)		0.52	0.80
Innovation			
The proportion of investment in research and development to sales* (%)	0.31	0.35	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.13 TSIC 20: Manufacture of chemicals and chemical products

3.13.1 Industrial Structure

The manufacture of chemicals and chemical products (TSIC 20) is an economic activity producing chemicals and chemical products, which consists of 1) manufacture of basic chemical products, fertilizers and associated nitrogen compounds, as well as plastics and synthetic rubber in primary forms. 2) manufacture of other chemical products, including pesticides and other agrochemical products, paints, varnishes and similar coatings, printing ink and mastics, soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations, other chemical products not elsewhere classified (such as explosive, adhesive and gelatin, essential oil, photographic chemicals, etc.) and 3) manufacture of man-made fibers.

According to the 2017 Industrial Census, this industry had a total of 2,013 establishments with juristic person status acting as manufacturers throughout the Kingdom. Of this number, there were 320 large, 534 medium, and 1,159 small enterprises. The total workforce amounted to 134,666 people with a product sales value of 795,478 million Baht, representing a Value-Added of 189,427 million Baht. The manufacture of plastic pellets and upstream plastics, which are downstream petrochemical products, had a proportion of Value-Added as high as 40 percent of the Value-Added of the chemical and chemical product manufacturing industry. Other large industrial groups had a value-added ratio between 0.04-9.21 percent only. From the data, the percentage of foreign shareholders was 57 percent, the export ratio was 34 percent, and the proportion of raw materials imports was 43 percent.

The Chemical and chemical products industry had a grow growth trend following the growth of domestic and foreign demand. The rising prices of chemical products allowed operators in the industry to be able to create better profits. The value of chemical exports in 2018 increased by 12.47 percent from 248,763 million Baht in 2017 to 290,817 million Baht in 2018 (BOT), which comes from the aftermath of the trade war between the United States and China with increased clarity that the United States would apply more tax measures on Chinese products. As a result, the export of chemicals accelerated, becoming a product that Thailand began to have a role within China's supply chain before the increase in tariffs from China. Also, the current government has policies to support the chemical industry, by focusing on the production of bio-chemicals and bio-polymers that are environmentally friendly, using agricultural raw materials in production instead of raw materials from petroleum. However, for petrochemical products (chemicals produced from oil-based raw materials) such as plastic pellets, upstream plastics, and artificial fiber, the majority of costs at 60-70 percent were raw materials from petroleum industries such as natural gas, condensate, and naphtha. These products still faced the risk of fluctuation in crude oil prices caused by the conflict between the United States and Iran. Meanwhile, petrochemicals rely on oil-based raw

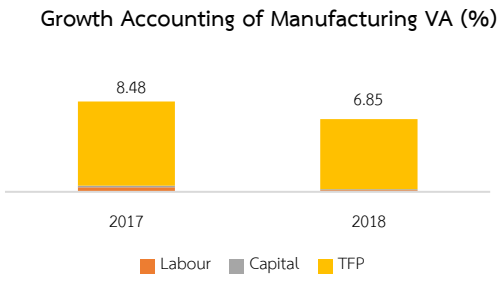
materials. The materials face the risk of fluctuations in crude oil prices. The industry also faced the effect of amendments of relevant laws, especially the new Chemical Act[10], which has issues related to complete chemical management to reduce the risks of chemical hazards to health and the environment. At present (October 2019), the act is considering feedback from all parties.

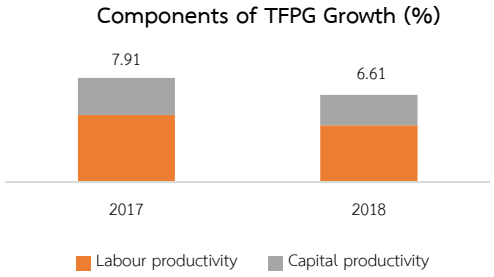
3.13.2 Results of Production Productivity Analysis and Key Indicators

In the 2018 survey, the number of sample establishments manufacturing chemicals and chemical products, of which data was processed, was 94 enterprises. Of this number, there were 74 large, 16 medium, and 4 small enterprises. The survey covered 57.3 percent of TSIC 20's total product sales. The types of products surveyed included organic chemical products, inorganic chemical products, other chemical products, cosmetics, soap, and detergents, chemical fertilizers, synthetic fibers, plastic pellets, and plastic in primary forms. According to data processed from the survey, in 2018, the industry producing chemicals and chemical products had a value-added decreasing from 8.48 percent in the previous year to 6.85 percent this year. The growth of value-added was from the increase of TFP by 6.61 percent. Meanwhile, labor and capital factors caused the value-added to increase by 0.17 percent and 0.07 percent, respectively, because the use of labor and the net value of fix assets increased by 0.26 percent and 0.20 percent respectively.

[10] The Chemical Act led to the termination of the Hazardous Substance Act B.E. 2535, the Hazardous Substance Act (2nd edition) B.E. 2544, the Hazardous Substance Act (3rd edition) B.E. 2551 and the Hazardous Substance Act (4th edition) B.E. 2562, to become the "Chemical Act B.E.....". It will be the first law in the country that covers the full management of chemicals, including production, import, export, bypass, re-import, re-export, to possess, sell, transport, use, treat, eliminate, destroy and reuse, including the return of the remains of containers or packages of chemicals for treatment, disposal, destruction or reuse

Figure 3.12: The rate of change of Value-Added and labor, capital, and TFP factors in the manufacture of chemicals and chemical products





Group of Improved Indicators

- Increased automation machinery.
- Increase the proportion of new machinery.
- Decreased total costs as material costs, labor costs, and selling and administration expenses reduced.
- Increased Value-Added to sales proportion.
- Increased research investment.

Group of Worsened Indicators

- Skilled labor-to-total labor proportion: 65%
- The average number of years of education received by labor decreased.
- Decreased liquidation.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of key indicators for the manufacturing industry of chemicals and chemical products in 2018 compared to the previous year, showed that the ratio of capital to labor projected to decreased from 4.07 to 4.02 million Baht per person. The results of the survey on the labor quality found that the ratio of skilled labor to total labor was 64.82 percent. In comparison, the average number of years of education received by the labor was 12.67 years, and the proportion of on-the-job training was 39.90 percent. Regarding the quality of machinery, it was found that the proportion of value of machinery and equipment under 5 years was 4.92 percent and the percentage of automated machinery was 51.74 percent. Considering the cost-to-sales ratio, the trend of production costs decreased from 78.45 percent to 77.94 percent. Meanwhile, selling and administration expenses tend to decrease from 9.80 percent to 9.58 percent. Value-Added to sales proportion increased from 18.39 percent to 18.73 percent. The liquidity tends to contracted and no additional debts were created. The working capital ratio declined from 1.72 to 1.65 times, while the debt to assets ratio remained at 0.35 times, and the debt to equity ratio decreased slightly from 0.54 times and 0.53 percent. Information from the Office of National Higher Education Science Research and innovation Policy Council (NXPO) reflected that the proportion of investment in research and development to sales in this industry in 2017 was 0.65 percent, up from 0.48 percent in the previous year.

In summary, the survey results show that in 2018, the manufacture of chemicals and chemical products had a higher Value-Added, mainly from rising prices of chemical products, which was beneficial to business performance within the industry. Demand for chemicals and chemical products increased in

both the domestic and foreign markets, especially the Chinese market. Business operators accelerated chemical exports; a product affected by the supply chain to China before the tariff increase on Chinese products to the United States. The TFP experienced growth with an increased workforce and capital as operators increased production at the end of the year to accelerate the export of products to the Chinese market. The Value-Added has the potential for continued growth; therefore, the ratio of Value-Added to sales has a positive trend. The ability to manage production costs improved while the financial liquidity worsened. There was no trend of increased debt this year.

3.13.3 Problems/Obstacles

The top three problems and obstacles encountered by the sample group were raw material costs, labor costs, and labor/personnel efficiency. The operators in the sample group gave the most important to the cost of raw materials as business operators in the industry producing chemicals and chemical products in Thailand in many businesses such as fertilizer, pesticides, and petrochemicals, continue to face restrictions on raw materials that cannot be produced locally or produced in a limited amount. Therefore, business operators must rely on imports resulting in a relatively high cost of raw materials. At the same time, operators also pay more attention to labor costs and seek to increase the efficiency of the workforce/personnel.

3.13.4 Policy Recommendations

The manufacture of chemicals and chemical products in Thailand is an industry that has been affected by the international trade war, such as the United States-China and United States-Iran trade wars, including changes in domestic legislation, especially the promulgation of the new Chemical Act. The new act is revised from the Hazardous Substance Act, which will be more stringent regarding the full range of chemical management. There are also risks of fluctuations in oil prices, which are key raw materials among petrochemical operators, including reliance on raw materials imported from foreign countries to produce certain chemicals such as fertilizer and pesticides. As a result, all relevant parties will need to adjust as follows:

1. Promote investment in technology research and development to increase the potential for the production of raw materials to replace imports, maintaining standard quality, and improving the ability of technological development.
2. Improve and increase the production efficiency of business operators in chemicals, especially upstream to intermediate chemicals, to have more potential and switch to bio-raw materials such as sugarcane, cassava, and palm oil. The switch will support the limitation of raw materials from natural gases that reduced and further reduce the impact of fluctuations in oil prices, which are the main raw material. It is also a response to the government policy that focuses on the development of the biochemical industry in being environmentally friendly.

3. The government should play a role in improving the ability of entrepreneurs in the downstream chemical industry, to be able to produce raw materials that are upstream to intermediate chemicals, substituting the import of raw materials from abroad. This can increase the ability to create Value-Added for the industry, especially in the production of downstream chemicals where raw materials cannot be produced domestically, such as pesticides.
4. Businesses must be aware of and monitor measures/regulations issued by domestic and foreign governments and prepare/handle changes that occur. The government sector may play a role in assisting business operators affected by the regulations or measures.

table 3.23: Growth accounting and indicators of the manufacturing industry of chemicals and chemical products

(A) growth accounting of the industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	8.48	0.44	0.13	7.91	5.10	2.81	6.85	0.17	0.07	6.61	4.30	2.31

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		4.07	4.02
Skilled labor-to-total labor proportion (%)		n.a.	64.82
The average number of years of education received by labor (years)		12.69	12.67
On-the-job training proportion (%)		n.a.	39.90
Proportion of automatic machinery (%)		51.40	51.74
Proportion of machinery and equipment under the age of 5 years (%)		4.50	4.92
Management			
Capital			
Production cost-to-sales ratio (%)		78.45	77.94
Selling and administration expense to sales proportion (%)		9.80	9.58
Value-Added to sales ratio (%)		18.39	18.73
Raw material cost to production cost ratio (%)		72.34	72.64
Labor cost to total cost ratio (%)		2.43	2.31
Finance			
Working capital ratio (times)		1.72	1.65

Indicators	2016	2017	2018
Debt to assets ratio (times)		0.35	0.35
Debt to equity ratio (times)		0.54	0.53
Innovation			
The proportion of investment in research and development to sales* (%)	0.48	0.65	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.14 TSIC 21: Manufacture of pharmaceuticals, medicinal chemical, botanical, and zoological products

3.14.1 Industrial Structure

The manufacture of pharmaceuticals, medicinal chemical, botanical, and zoological products (TSIC 21) is an economic activity in the production of pharmaceuticals, chemicals to treat diseases and products from plants and animals to treat diseases. Activities consist of the production of pharmaceuticals and chemicals used for treatment, such as the production of chemicals with pharmacological properties used in the production of medicines, the production of dietary supplements from chemicals, extraction of substances from various glands of the body, extraction of substances from the blood and the production of plant and animal products used to treat diseases such as products made from plants and animals for use in pharmaceutical, herbal medicine, drugs made from animal organs, the production of dietary supplements from vegetables and fruits and the production of dietary supplements from algae.

Data from the 2017 Industrial Census shows that this industry had juristic persons as manufacturers totaling 358 establishments throughout the kingdom. Of this number, there were 60 large, 111 medium, and 187 small enterprises, with a total workforce of 29,184 people and a total product value of 66,746 million Baht, representing a Value-Added of 24,100 million Baht. The proportion of foreign shareholders was equal to 46 percent. The proportion of exports was 24 percent and the proportion of imports from overseas was 51.27 percent.

The pharmaceuticals, medicinal chemical products, or the modern medicine industry and medicinal chemicals can generally be divided into 1) The upstream stage of the invention of new drug production 2) The intermediate stage of the production of pharmaceutical raw materials, and 3) The downstream stage of the production of finished drugs. Raw materials of important drugs are imported from foreign countries to produce drugs in the proportion of up to 90 percent of the raw materials used in the production of ready-made drugs. Drugs produced are generic drugs. There are 161 modern medicine manufacturers (information as of January 2018) that meet GMP standards. Of this total, no more than 5 percent can produce active ingredients on their own (such as Aluminum Hydroxide, Aspirin, Sodium Bicarbonate, and Deferiprone). The majority of domestically produced drugs at approximately 95 percent, as consumed domestically. The domestic demand for medicines increased partly from the universal health insurance systems in the last five years (2013-2017). The value of domestic drug sales increased by an average of 4.6 percent per year, making it the second-largest market in the region, second to Indonesia. Exports accounted for about 5 percent of the total drug production volume. The exports of medicines grew by 9 percent per year. Exported drugs were generic drugs with low value, with approximately 58 percent being exported to CLMV countries. The current profitability or value creation of pharmaceutical manufacturers is limited because the Ministry of Public Health and the Comptroller General's Department will use the middle price to control pharmaceutical costs so that government hospitals can purchase drugs at reasonable prices. In addition, drug manufacturers must comply with good procedures in the production of GMPPIC/S drugs from Thailand as a member of the Pharmaceutical Inspection Co-operation Scheme since August 1, 2016, causing production costs to increase. However, the pharmaceutical industry in the next 1-2 years is likely to expand due to factors that the Thai people are increasingly experiencing chronic illnesses as the nation enters the aging society. The medical tourism industry is expected to grow, including the invention of biological solutions from large private group companies such as PTT and SCG groups.

For botanical and zoological products used to treat diseases, according to the 2017 Industrial Census, only accounted for 6 percent of the production value in the industrial group, which is considered a small proportion compared to the total industry. However, the herbal market has grown at a rapid pace. In 2017, the market grew by more than 30 percent (Director General of the Department of Thai Traditional Medicine and Alternative Medicine). Downstream industrial markets that use herbs as raw materials[11] valued over 2.6 billion Baht, of which 4 percent were herbal medicines, 77 percent of which were cosmetics. The trend of the herbal medicine industry is promising. Following the government’s policy for the Master Plan on Herbal Development 2017-2021, there are 4 Product Champion types, which are Turmeric, Asiatic Pennywort, Plai, and Black Galingale. The Ministry of Public Health has also encouraged hospitals and nursing homes to use more herbs by adding herbs to the Thailand National List of Essential Medicines (NLEM).

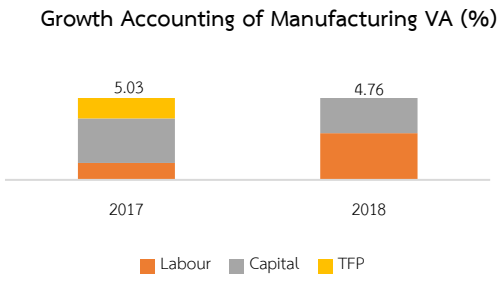
[11] Data from Kasikorn Thai Research Center

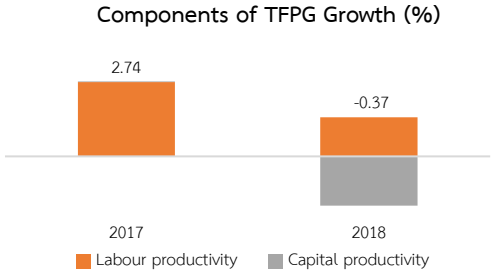
3.14.2 Results of Production Productivity Analysis and Key Indicators

In the survey data of 2018, the number of sample establishments manufacture of pharmaceuticals, medicinal chemical and botanical products totaled 22 establishments. This number divided into 16 large, 5 medium, and 1 small enterprises. The survey sample covered the sales value of the products at approximately 36.8 percent of the TSIC 21 category. Surveyed products were modern medicines, traditional medicines, dietary supplements, Hemodialysis Solution, etc.

According to the data from the survey, it was found that, in 2018, the value-added of the manufacturing industry of pharmaceuticals, medicinal chemical, botanical, and zoological products increased by 4.76 percent from the previous year. This was mainly from the increase of cost factor by 3.40 percent, followed by labor factor (1.73 percent). Meanwhile, TFP decreased by 0.37 percent reflecting in the decrease in productivity as illustrated in the figure 3.13.

Figure 3.13: The rate of change of Value-Added and labor, capital, and TFP factors in the manufacturing industry of pharmaceuticals, medicinal chemical and botanical products





Group of Improved Indicators

- Increased automation machinery.
- Proportion of skilled labor: 74%
- Increased value to sales.
- Reduced production costs per sales.
- Increased liquidity.

Group of Worsened Indicators

- Cost-to-sales increased slightly.
- Increased liabilities to equity.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis results of important indicators in the manufacture of pharmaceuticals, medicinal chemical, botanical, and zoological products industry in 2018, found that the proportion of capital to labor increased slightly from the previous year from 2.74 to 2.76 million Baht per person. The quality of labor was relatively good from the ratio of skilled labor to the total workforce at 74.39 percent. The average number of years of study was 12.53 years. The quality of machinery, as determined from the percentage of automated machinery, increased proportion from 41.0 percent to 42.28 percent, reflecting more efficient production processes. When considering the cost-to-sales ratio, the production cost increased slightly from 62.86 percent in the previous year to 62.95 percent. Sales and administrative expenses decreased from 22.42 percent to 22.07 percent, which contributed to the proportion of Value-Added on sales, which increased from 27.38 percent to 27.54 percent, which reflected the ability to create Value-Added. Liquidity increased, whereby the working capital ratio increased from 2.49 to 2.63 times. The debt to asset ratio and the debt to equity ratio increased slightly from the previous year to 0.38 times and 0.62 times, respectively.

In summary, the survey results show that in 2018, the manufacture of pharmaceuticals, medicinal chemical, botanical, and zoological products industry had a higher Value-Added but grew at a slower rate. The growth in Value-Added mainly came from the growth of capital and labor consumption. Meanwhile, the growth of the TFP slowed down. The proportion of Value-Added to sales increased due to better cost management and improved cost of sales and administration. However, despite the increased value, the price competition slowed down the value-added growth.

3.14.3 Problems/Obstacles

The top three problems and obstacles encountered by the sample group were labor/personnel efficiency, followed by raw material costs and labor costs. Business operators in the sample group placed importance on the efficiency of labor/personnel. This industry requires personnel to develop, research, and create new pharmaceutical products, which are important in creating more value for the business. Currently, the pharmaceutical manufacturing industry in Thailand lacks specialized personnel capable of inventing commercial research. In addition, direct costs, including raw material and labor costs, are important as it is the main component of the total production cost. The import of raw materials to produce pharmaceutical products from abroad produce higher costs, coupled with increased labor costs, which have an impact on business operations of the pharmaceutical manufacturing industry.

3.14.4 Policy Recommendations

Creating Value-Added in this industry requires increase production efficiency, both in terms of investment in modern machinery and equipment that can produce pharmaceutical products at standard quality and the development of skilled labor at the operational level and researchers to create, research, and develop new drugs. This will further extend the creation of new pharmaceutical products to the market, adding value to the industry. Production to replace imports and market expansions to foreign countries will further develop the industry. To achieve the said goal, the industrial sector needs to develop, and the government sector must provide support as follows:

1. Investment in research and development of new pharmaceutical raw materials leads to the development of new drugs by choosing to produce drugs with a wide effect or with high market demand. This will help Thailand to determine the price of medicines. The government should participate in supporting research funds, including personnel support and research laboratories, including joint ventures to start production in a prototype factory and support patents.
2. Source potential domestic and international investors as investments in pharmaceutical products require high investment. Foreign investors can contribute to technical support and marketing channels. The government helps to support joint ventures by providing tax incentives or subsidizing raw material prices for competition in the initial stage to increase cost competitiveness.
3. Personnel development, especially personnel in the development of raw material production technology, new drugs or new products, particularly experts in the field of Chemical Process Development for chemical pharmaceuticals and herbal medicine or botanical products, there is still a lack of herbal medicine prototypes, active ingredient research, including toxicology or side effects of herbal medicines.
4. Establish domestic and international marketing bases, incorporating marketing information to lead to increased sales, supporting government hospitals to procure locally produced pharmaceutical products from Thai manufacturers (at present, the government had procured drugs from the innovation account in 2017, worth 304 million Baht, accounting for only 0.26 percent of the revenue from medicines and herbs) and expand the market to other countries within ASEAN, aside from neighboring countries (CLMV).

Table 3.24: Growth accounting and indicators of the manufacturing industry of pharmaceuticals, medicinal chemical, botanical, and zoological products

(A) Growth accounting of the industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	5.03	0.63	1.65	2.74	2.71	0.03	4.76	1.73	3.40	-0.37	1.43	-1.80

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		2.74	2.76
Skilled labor-to-total labor proportion (%)			74.39
The average number of years of education received by labor (years)		12.56	12.53
On-the-job training proportion (%)		n.a.	29.26
Proportion of machinery and equipment under the age of 5 years (%)		0.0	0.0
Proportion of automatic machinery (%)		41.00	42.28
Management			
Capital			
Production cost-to-sales ratio (%)		62.86	62.95
Selling and administration expense to sales proportion (%)		22.42	22.07
Value-Added to sales ratio (%)		27.38	27.54
Raw material cost to production cost ratio (%)		68.87	67.35
Labor cost to total cost ratio (%)		3.75	3.68
Finance			
Working capital ratio (times)		2.49	2.63
Debt to assets ratio (times)		0.36	0.38
Debt to equity ratio (times)		0.57	0.62
Innovation			
The proportion of investment in research and development to sales* (%)		n.a.	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.15 TSIC 22: Manufacture of rubber and plastics products

3.15.1 Industrial Structure

The manufacture of rubber and plastic products (TSIC 22) is a sub-category of industrial economic activities in the production of rubber and plastic products. The production of rubber products consists of the Manufacture of rubber tires and tubes; retreading and rebuilding of rubber tires, the production of other rubber products, such as rubber sheets, rubber plates, sheets , lumps, and other shapes, the production of concentrated latex, the manufacture of rubber hygienic articles or pharmaceutical equipment and the production of other rubber products not elsewhere classified. The production of plastic products consists of the manufacturing of builders' plastics ware, plastic articles for the packing of goods, semi/finished plastic products and the production of other plastic products, including plastic tableware, kitchenware and toilet articles, fiberglass products, and the manufacture of other plastic products that are not classified elsewhere.

Data from the 2017 Industrial Census showed that this industry had juristic persons as manufacturers totaling 3,356 establishments throughout the kingdom. Of this number, there were 510 large, 951 medium, and 714 small enterprises, with a total workforce of 322,485 people and a total product value of 831,478 million Baht, representing a value-added of 201,151 million Baht. The proportion of foreign shareholders was equal to 59 percent. The proportion of exports was 44 percent and the proportion of imports from overseas was 33 percent.

3.15.2 Manufacture of rubber products

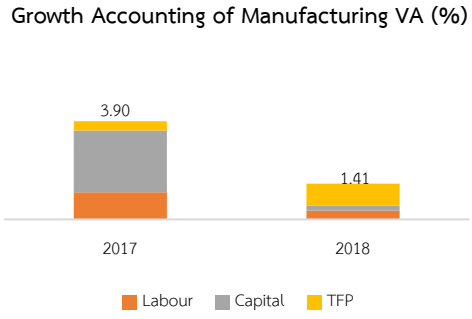
The rubber products industry in 2017 had good growth in exports as rubber products, including upstream processed rubber, tires, rubber gloves, and some types of rubber products, were demanded in international markets. As a result, the total export value of rubber products grew by 33.77 percent. However, in 2018, the total export value of rubber products declined by 4.71 percent. One reason was that the export of upstream processed rubber (rubber blocks and sheets) contracted by 24.23 percent due to decreased foreign demand, especially with the reduction of Chinese orders, which was Thailand's main export market. However, rubber product groups increased in exports. The tire product group had the highest export value, reaching up to 10.71 percent following the global automotive industry's growth. Exports of rubber gloves grew by 11.90 percent from the demand for hygienic gloves and the growth of the health business. Thailand's main export markets for rubber gloves included the United States, Germany, and Japan. The domestic market was in a good position from the growth in sales of almost all rubber products except motorcycle tires and tires for trucks and buses, which contracted by 11.72 percent and 10.00 percent, respectively. The rubber products industry should continue to be monitored, including risk factors that may affect the industry, which is 1. Increased competition in the exports of rubber products, especially

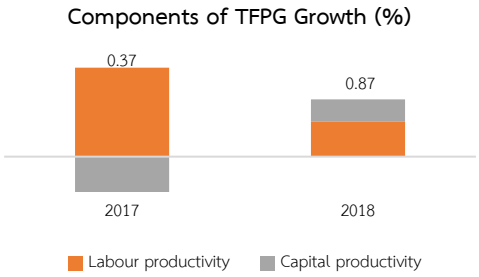
upstream rubber products with new exporters such as Cambodia, Laos, and Myanmar, which have started to export more natural rubber. Malaysian rubber gloves have played an increasing role in the United States' rubber gloves industry, and 2. Trends in the production of synthetic rubber gloves (nitrile rubber gloves) instead of natural rubber gloves from allergies to proteins in natural rubber. In addition, there is a demand for synthetic rubber gloves in the world's major markets such as the United States, including less volatile raw material prices.

- **Results of Production Productivity Analysis and Key Indicators**

In the 2018 survey, the number of sample establishments manufacturing of rubber products totaled 62 establishments. This number divided into 55 large, 5 medium, and 2 small enterprises. The survey covered 67.0 percent of TSIC 221's total product sales. The types of products surveyed were rubber tires and tubes, rubber plates, sheets, blocks, lumps, and other shapes, concentrated latex, rubber gloves, and other rubber products, etc. According to data processed from the survey, it was found that, in 2018, the rubber products manufacturing industry increased in value-added by 1.41 percent from the previous year, which grew from the increase of labor factor, cost factor, and TFP by 0.35 percent, 0.19 percent, 0.87 percent, respectively. This was due to the use of labor decreased by 0.56 percent, and the net value of fixed assets dropped 0.51 percent.

Figure 3.14: The rate of change of Value-Added and labor, capital, and TFP factors in the manufacture of rubber and plastics products.





Group of Improved Indicators

- Increased automation machinery.
- Increase the proportion of new machinery.
- The use of machinery/equipment per worker increased slightly.
- Liquidity decreased.
- Increased research investment.

Group of Worsened Indicators

- Skilled labor proportion: 60%
- The average number of years of study among workers decreased slightly.
- Increased total cost incurred from higher selling and administration expenses.
- Decreased sales and administrative expenses per sales.
- Decreased liabilities to equity.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of key indicators for the rubber and plastics products industry in 2018 compared to the previous year, showed that the ratio of capital to labor tend to increase from 3.34 to 3.40 million Baht per person. The results of the survey on the labor quality found that the ratio of skilled labor to total labor was 60.32 percent. In comparison, the average number of years of education received by labor was 12.17 years. As for machinery quality, the proportion of value of machinery and equipment under 5 years (%) projected to increase from 1.66 percent to 1.88 percent. Considering the cost-to-sales ratio, the trend of production costs decreased from 80.81 percent to 80.64 percent. Meanwhile, the selling and administrative expenses increased from 7.78 percent to 8.51 percent. The proportion of value-added to sales decreased slightly from 21.10 percent to 21.02 percent. This was reflected in the decrease in potential to create the value-added. Information from the Office of National Higher Education Science Research and innovation Policy Council (NXPO) showed that the proportion of investment in research and development to sales in this industry projected to increase slightly from 0.000 percent in 2016 to 0.0001 percent in 2017. It was found that key financial ratios of this industry tend to decrease in liquidity and debt creations. The working capital ratio declined from 1.34 to 1.24 times, while the debt to assets ratio decreased from 0.50 times to 0.48 times, and the debt to equity ratio decreased from 0.98 times and 0.92 times.

In summary, the survey shows that in 2018, the production of rubber products increased in value at a slower rate, following the amount of labor and capital that reduced. However, due to the increase in TFP's growth, the Value-Added continued to expand. The slowed growth in Value-Added has resulted in a decline in the Value-Added to sales ratio. The ability to manage production costs improved, but the cost of sales and management worsened. Meanwhile, the financial liquidity deteriorated, and the trend to create debt decreased. The proportion of investment in research and development in 2017 increased slightly from previous years.

- **Problems/Obstacles**

The problems and obstacles that business operators from the sample group ranked in the top three were the cost of raw materials, labor costs, and the efficiency of labor/personnel, including the efficiency of machinery/equipment. The rubber products industry covers upstream to downstream processed rubber, causing operators in the industry to pay more attention to direct costs in terms of raw material and labor costs. This is especially true in primary processed rubber, which has little Value-Added, causing profits to be more difficult to make. There is also a high production cost per unit. In addition, operators believe that increased production efficiency in both machinery and labor is important in making quality products in this industry and helps reduce production costs, making it more competitive.

- **Policy Recommendations**

Although at present rubber products are in constant demand from the market, some products were affected by both internal and external factors such as droughts, floods, the slowing global economy, the trade war between China and the United States, increased competition in the rubber product export market and the changing demand for products. This is a risk factor that may cause marketing and sales to change. Therefore, business operators in the rubber product manufacturing industry need to be monitored and adjusted as follows:

1. Business operators in the production of tires, rubber gloves, and various rubber products should study and use new technological innovations to strengthen production competitiveness, including improving and creating new products, which are an opportunity to create new markets and add value to the industry.
2. Business operators in the rubber product manufacturing industry should form alliances throughout the production chain to reduce production costs, allowing them to compete with other countries.
3. Business operators should form joint ventures with foreign companies and source funds for research and development, including investments in new machinery and equipment that are up to date to increase the production efficiency of the company.

4. The government sector should push for the development of comprehensive rubber. It should support the development of education for more research and development (R&D) in rubber and related industries to create new rubber products that can create higher Value-Added.

Table 3.25: Growth accounting and indicators of the manufacturing industry of rubber and plastics products

(A) Growth accounting of the industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	3.90	1.07	2.45	0.37	1.35	-0.98	1.41	0.35	0.19	0.87	0.53	0.34

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		3.34	3.40
Skilled labor-to-total labor proportion (%)		n.a.	60.32
The average number of years of education received by labor (years)		12.22	12.17
On-the-job training proportion (%)		n.a	25.88
Proportion of automatic machinery (%)		22.06	23.16
Proportion of value of machinery and equipment under 5 years (%)		1.66	1.88
Management			
Capital			
Production cost-to-sales ratio (%)		80.81	80.64
Selling and administration expenses to sales proportion (%)		7.78	8.51
Value-Added to sales ratio (%)		21.10	21.02
Raw material cost to production cost ratio (%)		63.98	63.66
Labor cost to total cost ratio (%)		2.78	3.08
Finance			
Working capital ratio (times)		1.34	1.27
Debt to assets ratio (times)		0.50	0.48
Debt to equity ratio (times)		0.98	0.92
Innovation			
The proportion of investment in research and development to sales* (%)	0.0000	0.0001	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

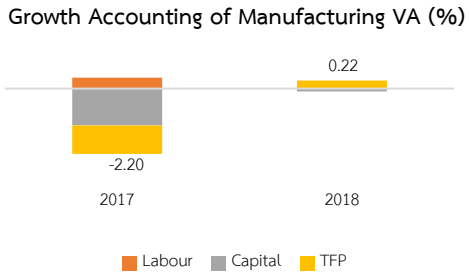
3.15.2 Manufacture of plastic products

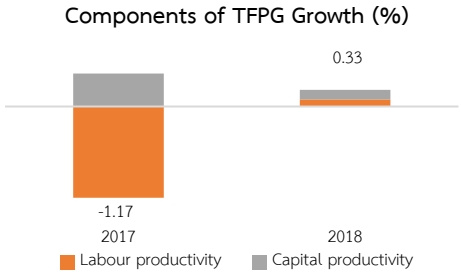
The manufacture of plastic products in 2018 had a slight growth of 0.23 percent, following increased domestic demand for food and beverages, increased demand for plastic packaging and investments in infrastructure that has led to the expansion of factories, warehouses, and residences, resulting in increased demand for plastic products for construction. For exports, plastic products used for conveying or packing products, including corks and other covers, had the highest export value of 1,283 million USD, followed by plastic parts used in industrial plants and plastic sheets, respectively, with the export value of 1,159 million USD and 942 million USD, respectively. Within the increased export value, plastic flooring accounted for largest export growth at 48.29 percent from the development of infrastructure in ASEAN countries, followed by tableware, kitchen utensils made of plastic and tubes, pipes, and various installation equipment (such as joints, elbow sockets, and pads) made of plastic, in which exports grew by 16.48 percent and 13.91 percent, respectively. The main export markets for Thai plastic products were the United States, Japan, and China. However, the plastic products industry still had various risk factors and issues that needed to be monitored that may affect the industry, including 1. The shrinkage of plastic bags in both production and sales, both domestically and abroad, which has been affected by today's consumers turning to use woven bags, paper bags, and biodegradable plastic bags instead, by following the current trend of reducing the use of plastic bags. 2. Fluctuations in oil prices which resulted in plastic pellets being the main raw material in production, being relatively volatile and affecting the cost of plastic products production, and 3. Single-use plastic measures from many agencies, both in Thailand and other countries, with campaigns to reduce and eliminate the use of single-use plastics such as plastic bags, straws, glasses, water bottles, and food boxes, due to overpopulation and plastic waste spillage into the sea. Manufacturers of such plastic products will be directly affected.

- **Results of Production Productivity Analysis and Key Indicators**

Data from the 2017 Industrial Census showed that this industry had juristic persons as manufacturers totaling 97 establishments throughout the kingdom. Of this number, there were 79 large, 12 medium, and 6 small enterprises. The survey sample covered the sales value of the products at approximately 35.4 percent of the TSIC 222 category. Surveyed products were builders' plastics ware, plastic articles for the packing of goods, semi-finished/finished plastic products, plastic tableware, kitchenware and toilet articles, glass fibers, other plastic products, etc. According to the data from the survey, it was found that, in 2018, the value-added of the manufacturing industry of plastic products increased by 0.22 percent from the previous year. This was mainly from the increase of TFP by 0.33 percent. Meanwhile, the value-added caused by labor and cost factors dropped 0.01 percent and 0.11 percent, respectively, because the use of labor decreased by 0.01 percent and the net value of fixed assets dropped 0.01 percent.

Figure 3.15: The rate of change of Value-Added and labor, capital, and TFP factors In the manufacturing industry of rubber and plastics products





Group of Improved Indicators

- Increased automation machinery.
- Increase the proportion of new machinery.
- Increased sales and administrative expenses per sales.
- Increased liabilities to equity.
- Liquidity decreased slightly.
- Increased research investment.

Group of Worsened Indicators

- The use of machinery/equipment per worker decreased slightly.
- Skilled labor proportion: 63%
- The average number of years of study among workers decreased slightly.
- Increased total cost incurred from higher Production cost and higher selling and administration expenses.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of key indicators for the plastics products industry in 2018 compared to the previous year, showed that the ratio of capital to labor decreased from 1.68 to 1.65 million Baht per person. The results of the survey on the labor quality found that the ratio of skilled labor to total labor was 62.89 percent. In comparison, the average number of years of study was 12.30 years. Regarding machinery quality, proportion of value of machinery and equipment under 5 years increased from 2.90 percent to 3.57 percent. Considering the production cost-to-sales ratio, it was found that production cost increased from 81.36 percent to 82.44 percent, while selling and administration expenses decreased from 8.55 percent to 7.72 percent. The proportion of the value-added to sales increased slightly from 17.84 percent to 17.99 percent. This was reflected a potential to create more value-added. From information from the Office of National Higher Education Science Research and innovation Policy Council (NXPO), the proportion of investment in research and development to sales in this industry increased from 0.0009 percent in 2016 to 0.0015 percent in 2017. Considering key financial ratios, it was found that this industry tended to have more liquidity and less debt. The working capital ratio increased from 1.84 times to 2.24 times, while the debt to assets ratio decreased from 0.30 times to 0.29 times, and the debt to equity ratio decreased from 0.43 times and 0.42 times.

In summary, the survey results showed that, in 2018, the plastic products increased in value following the growth of TFP, causing the Value-Added to expand. As a result, the Value-Added to the sales ratio increased, but the amount of labor and capital reduced. Meanwhile, the ability to manage production costs decreased, but sales and administrative expenses improved. The financial liquidity increased, and the trend for debt creation decreased.

- **Problems/Obstacles**

The problems and obstacles that business operators from the sample group ranked in the top three were the efficiency of the machinery/equipment, efficiency of labor/personnel, and raw material costs. It can be seen that the operators in the sample placed importance on increasing production efficiency for both machinery/equipment and labor/personnel to reduce production costs and various losses in the production process, including the production of quality and standardized products. In addition, operators paid attention to the cost of raw materials, as plastic pellets produced from petroleum are the main raw material in the production of plastic products that have face fluctuations in prices, which will directly affect the cost of plastic product production.

- **Policy Recommendations**

Although plastic products are currently in demand in the market, some products were affected by both internal and external factors such as the slowdown of the global economy, the trade war between China and the United States, changes in oil prices in the world market and exchange rates, including current global conservation and environmental preservation. This is a risk factor that may impact marketing and sales; therefore, operators in the plastic product manufacturing industry need to monitor and adjust as follows:

1. World and environmental conservation have become a topic in the global plastic industry, with campaigns to reduce plastic use, switching to use woven bags, paper bags, bioplastics and compostable plastics, which affects business operators in the plastics manufacturing industry. Therefore, plastic manufacturers must adapt and cope with the changing industry, which requires the education and production of environmentally friendly products to meet the increasing market demand. It also contributes to expanding new markets and creating Value-Added for the industry.
2. Manufacturers in the plastic products manufacturing industry should monitor market prices, exchange rates, and have proper cost management so that raw materials can be purchased at low prices to reduce costs.
3. Business operators in the industry should invest in buying new machinery/equipment and provide training for personnel to have more specialized knowledge to increase production efficiency and so that the manufactured products use resources that are worthwhile and reduce various losses.

Table 3.26 Account of Business Growth and Indicators of Manufacture of Plastics Products

(A) The Account of Growth in the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	-2.20	0.45	-1.49	-1.17	-1.82	0.66	0.22	-0.01	-0.11	0.33	0.14	0.19

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		1.68	1.65
Skilled labor-to-total labor proportion (%)		n.a.	62.98
The average number of years of education received by labor (years)		12.32	12.30
On-the-job training proportion (%)		n.a.	23.52
Proportion of automatic machinery (%)		24.90	26.14
Proportion of value of machinery and equipment under 5 years (%)		2.90	3.57
Management			
Capital			
Production cost-to-sales ratio (%)		81.36	82.44
Selling and administration expense to sales proportion (%)		8.55	7.72
Value-Added to sales ratio (%)		17.84	17.99
Raw material cost to production cost ratio (%)		59.73	58.13
Labor cost to total cost ratio (%)		3.47	4.12
3.34Finance			
Working capital ratio (times)		1.84	2.24
Debt to assets ratio (times)		0.30	0.29
Debt to equity ratio (times)		0.43	0.42
Innovation			
The proportion of investment in research and development to sales* (%)	0.0009	0.0015	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.16 TSIC 23: Manufacture of other non-metallic mineral products

3.16.1 Industrial Structure

The manufacture of other non-metallic mineral products (TSIC 23) is a subcategory of industrial economic activities related to manufacturing of other non-metallic mineral products, which transforms raw material into finished articles. This includes the manufacture of glass and glass products, ceramic products, tiles and baked clay products, and cement and plaster, including the manufacture of shaped and finished stone and other mineral products.

Data from the 2017 Industrial Census shows that this industry had juristic persons as manufacturers totaling 2,539 establishments throughout the kingdom. Of this number, there were 244 large, 534 medium, and 1,761 small enterprises, with a total labor force of 154,553 people. The product sales value was 404,122 million Baht, representing a Value-Added of 121,446 million Baht. The proportion of foreign shareholders was 50.58 percent. The export ratio was 37.71 percent, and the imports of raw materials averaged 36.48 percent.

The overall domestic production of other non-ferrous minerals in 2018 decreased by 0.29 percent from the previous year (Industrial Statistics, Office of Industrial Economics (OIE) due to the decreased production of tiles and sanitary ware products. Meanwhile, the production of glass products, cement, and concrete increased. Domestic sales increased by 4.76 percent from 2017, due to the growth in cement and concrete sales, followed by tiles, sanitary ware, and ceramic appliances. Meanwhile, glass products and bottles decreased in sales, but the export volume increased. The demand for cement and concrete products increased due to the support from the construction of government infrastructure and residential real estate of the private sector, especially the condominium market that grew by 17[12] percent from last year, resulting in the increased price of construction materials in the concrete product group from 129.2 in 2017 to 131.9 in 2018. This is in line with the producer price index for non- ferrous minerals that increased from 101.3 in 2017 to 101.8 in 2018 (Trade and Economic Index Database, Ministry of Commerce). This reflects the increase in production costs. As a result, the Bank of Thailand decided to issue measures to regulate housing loans (LTV), which may result in property sales and the launch of new projects to slow down. In addition, the industry should monitor the Thai Baht appreciation, which may affect exports, including fluctuating fuel energy costs following the world market price, which may affect production cost. The industry should also monitor the Thai economy's contraction and the effects of layoffs, which may impact the purchasing power of the property market. As a result, sales of ceramics and concrete sanitary ware products decreased.

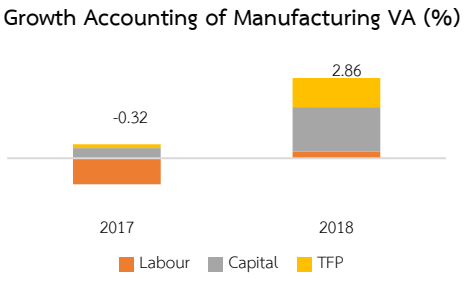
3.16.2 Results of Production Productivity Analysis and Key Indicators

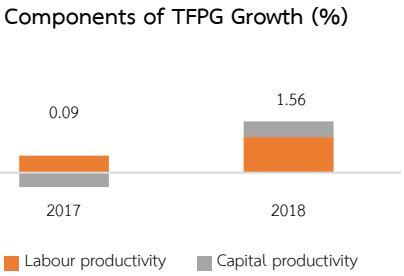
In the survey data of 2018, the number of sample establishments manufacturing other non-metallic mineral products totaled 81 enterprises. This number divided into 64 large, 13 medium, and 4 small enterprises. The survey covered approximately 54.70 percent of TSIC 23's total product value. The types of products surveyed were concrete products, glass and glass products, ceramic products, tiles, containers and table ware of glass, etc. According to data processed from the survey, in 2018, the industry manufacturing other non-metallic mineral products had an increased value-added by 2.86 percent from the previous year as the result of the increased TFP by 1.56 percent. Meanwhile, the labor and cost factors

[12] Data from Thansettakij Newspaper on "A strong condominium market; new LTVs on the rise at 3.1 billion Baht" dated December 30, 2018

caused the value-added to grow by 0.17 percent and 1.12 percent, respectively, due to the increase in labor utilization by 0.04 percent and the net value of fixed assets by 2.00 percent.

Figure 3.16: The rate of change of value-added and labor, capital, and TFP factors in the manufacturing industry of other non-metallic mineral products





Group of Improved Indicators

- Increased automation machinery.
- The average number of years of study among workers increased.
- Liquidity increased slightly.
- Debts decreased slightly.
- Increased research investment.

Group of Worsened Indicators

- Decrease the proportion of new machinery.
- Skilled labor proportion: 55%
- Increased total cost incurred from higher production cost.
- Proportion of value-added to sales decreased slightly.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of key indicators for manufacturing industry of other non-metallic mineral products in 2018 compared to the previous year, showed that the ratio of capital to labor remained at 3.00 million Baht per person from last year. The results of the survey on the labor quality found that the ratio of skilled labor to total labor was 54.82 percent. In comparison, the average number of years of education received by labor was 12.09 years, and the proportion of on-the-job training was 25.50 percent. The quality of machinery tended to decline, whereby the proportion of machinery and equipment under 5 years decreased from 0.74 percent to 0.68 percent. This was reflected that the industry had a moderate quality of labor factor, while the quality of cost factors decreased. Considering the cost-to-sales ratio, it was found that the trend of production costs increased from 78.03 percent to 78.600 percent, while selling and administrative expenses decreased from 11.97 percent to 11.56 percent. The proportion of Value-Added to sales decreased from 21.08 percent to 20.30 percent. Information from the Office of National Higher Education Science Research and innovation Policy Council (NXPO) reflected that the proportion of investment in research and development to sales in this industry in 2017 was 0.75 percent, up 0.49 percent in the previous year. Regarding key financial ratios, it was found that this industry tends to have more liquidity and creates less debts. The working capital ratio increased from 1.16 to 1.19 times, while debt to

assets ratio decreased from 0.42 times to 0.41 times, and debt to equity ratio decreased from 0.73 times to 0.71 times.

In summary, the survey results show that in 2018, the manufacturing of other non-ferrous mineral products continued to increase in value. The growth in Value-Added was mainly due to the positive growth rate of capital and labor factors, while TFP also expanded. The labor quality is at a medium level, but the quality of capital decreased. The ability to manage the production cost also decreased, but the cost of sales and administration improved. Meanwhile, the financial liquidity improved, and the trend for debt reduced.

3.16.3 Problems/Obstacles

The top three problems and obstacles encountered by the sample group were labor costs, raw material costs, and the efficiency of labor/personnel. Business operators in the sample group had the most problems with labor costs, low labor efficiency, and a lack of skilled labor since the industry focuses on skilled workers such as in ceramics. In addition, business operators also faced high costs of raw materials, which resulted in disadvantaged business operators from higher production costs, as price competitiveness decreased.

3.16.4 Policy Recommendations

From the industry analysis, the production of other products made from non-ferrous minerals grew in TFP and Value-Added. The industry has improved production efficiency, cost management, product development, and wider market expansion. These factors will encourage this industry to have more competitive potential in the future. The announcement of the Bank of Thailand's loan-to-value (LTV) regulations impacted the real estate market at the end of last year, which grew from accelerating purchase and transfer of houses or condominiums before the LTV measure came into force. Government infrastructure progressed, causing the construction material market such as cement products, concrete, and sanitary ware to grow, as there were concerns that the enforcement of the LTV measures would decrease ownership transfer. The launch of new projects slowed down, which would result in the market for construction materials to grow at a slower rate. In addition, the economic downturn may affect purchasing power in the market. However, the government has approved the housing loan measures of the Government Housing Bank (GHB) to people with incomes of no more than 1.2 million Baht per year. The measures allow people in this category to take a loan for houses not over 3 million Baht with a 2.5 percent fixed interest rate for three years and cashback payment of 50,000 Baht to the first 100,000 qualified people. The measures aim to stimulate spending on the real estate sector. The policy recommendations are as follows:

1. The construction materials market in the cement and concrete group, which are considered as the main raw material for construction accounting for 35 percent of the market, is likely to continue to expand from the construction of government infrastructure in situations where product price cuts may affect the ability to compete. Therefore, entrepreneurs should pay more attention to the development of services and product quality to stimulate consumers' purchasing decisions.
2. Expanding branches or distribution channels to CLMV countries to expand the customer base as the construction of infrastructure in neighboring countries is continuously expanding. In addition, the export data from Trademap in 2018 reported that Thailand exports 30 percent of cement products to Cambodia, followed by Laos with 29 percent and an increase of 12 percent from 2017. Therefore, it is a good opportunity for business operators to increase sales.
3. For sanitary ware and ceramic appliances, manufacturers should develop products to have a higher value as well increase product variety to meet the needs of customers and functionality, as well as improve raw materials and production processes such as reducing product weight but having the same durability, including designing and developing various product functions (customized product).

Table 3.27: Growth accounting and indicators of the manufacturing industry of other non-metallic mineral products

(A) Growth Accounting of the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	-0.32	-0.66	0.26	0.09	0.52	-0.44	2.86	0.17	1.12	1.56	1.08	0.48

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		3.00	3.00
Skilled labor-to-total labor proportion (%)			54.82
The average number of years of education received by labor (years)		12.03	12.09
On-the-job training proportion (%)			25.50
Automatic machinery proportion (%)		36.12	37.18
Proportion of machinery and equipment under the age of 5 years (%)		0.74	0.68
Management			
Capital			
Production cost-to-sales ratio (%)		78.03	78.60
Selling and administration expenses to sales proportion (%)		11.97	11.56
Value-Added to sales ratio (%)		21.08	20.30
Raw material cost to production cost ratio (%)		64.01	62.73
Labor cost to total cost ratio		1.80	1.76
Finance			
Working capital ratio (times)		1.16	1.19
Debt to assets ratio (times)		0.42	0.41
Debt to equity ratio (times)		0.73	0.71
Innovation			
The proportion of investment in research and development to sales* (%)	0.49	0.75	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.17 TSIC 24: Manufacture of basic metals

3.17.1 Industrial Structure

Manufacture of basic metals (TSIC 24) is a subclass of industry according to classification of economic activities—manufacture of basic metals from smelting and/or refining ferrous and non-ferrous metals from ore, pig or scrap, using electrometallurgic and other process metallurgic techniques, including the manufacture of metal alloys and super-alloys by introducing other chemical elements to pure metals. The output of smelting and refining, usually in ingot form, is used in rolling, drawing and extruding operations to make products such as plate, sheet, strip, bars, rods, wire, tubes, pipes and hollow profiles, and in molten form to make castings and other basic metal products. This class includes the manufacture of basic iron and steel, basic precious and other non-ferrous metals, and casting of metals.

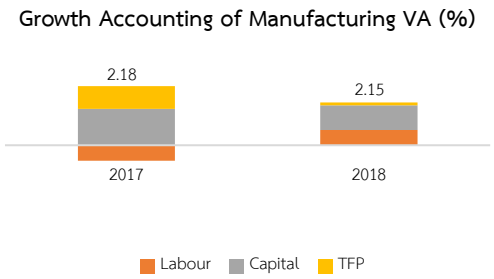
Data from the 2017 Industrial Census shows that this subclass had juristic persons as manufacturers totaling 1,066 establishments throughout the kingdom. Of this number, there were 234 large, 292 medium, and 540 small enterprises, with a total labor force of 99,199 people. The product sales value was 508,263 million Baht, representing a Value-Added of 139,945 million Baht. From the data, the average proportion of foreign shareholders was 67.45 percent. The average proportion of exports was 35.11 percent, and the average proportion of imported raw materials was 44.21 percent.

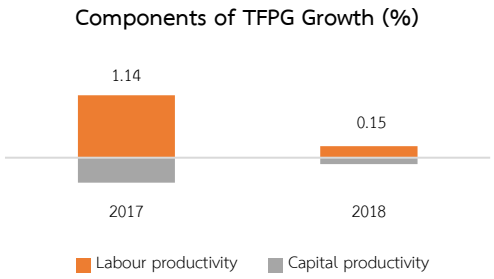
Thai steel demand in 2018 continuously increased. Domestic steel production grew by 3.4 percent, and finished steel production grew by 3.4 percent from the previous year due to the expansion of government infrastructure projects, including the growth of downstream industries that use iron and steel as raw materials, such as the automotive industry. Meanwhile, crude steel production decreased by 3.7 percent. Total imports of steel increased by 5.8 percent, whereas semi-finished steel products and finished steel products expanded by 9.7 and 6.2 percent, respectively. Raw materials declined by 1.3 percent. The products with the highest imports were hot-rolled coils. Overall steel exports grew by 21 percent. Raw materials exports increased by 64 percent, followed by finished steel products by 19 percent, with steel pipes having the largest export volume. Most exports were to ASEAN countries, accounting for 57 percent, while exports of semi-finished steel products contracted by 32 percent (Iron & Steel Intelligence Unit). A key issue for Thai steelmakers was retaliation and trade measures between the United States and China on taxation, resulting in China, the world's top steel-producing and using country, to release steel products to ASEAN, including Thailand, resulting in an oversupply in domestic steel volume. Global steel prices dropped, reflected by the price of construction materials in the steel category, which continued to drop from 101.1 in January to 98.6 in December 2018 (Trade and Economic Index Database).

3.17.2 Results of Production Productivity Analysis and Key Indicators

In the 2018 survey, the number of sample establishments manufacturing basic metals was 104 establishments, divided into 93 large and 11 medium enterprise. The surveyed samples covered 74.70 percent of TSIC 24's total product value. The types of products surveyed were iron and steel, aluminium and products thereof, etc. According to data processed from the survey, it was found that, in 2018, the industry increased in value-added by 2.15 percent from the previous year, which grew from the TFP by 0.15 percent. Meanwhile, labor factors and capital factors contributed to the increase of value-added by 0.76 percent and 1.24 percent, respectively, due to the increase of labor utilization by 0.04 percent and the net value of fixed assets by 2.55 percent.

Figure 3.17: The rate of change of Value-Added and labor, capital, and TFP factors in the manufacturing industry of basic metals





Group of Improved Indicators

- Increased automatic machinery.
- Skilled labor proportion: 68%
- Decreased total cost incurred from lower selling and administration expenses.

Group of Worsened Indicators

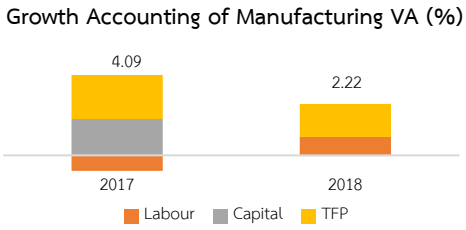
- The average number of years of education received by labor decrease slightly.
- Decreased liquidity.
- Increased debts.
- Value-added to sales ratio decrease slightly.

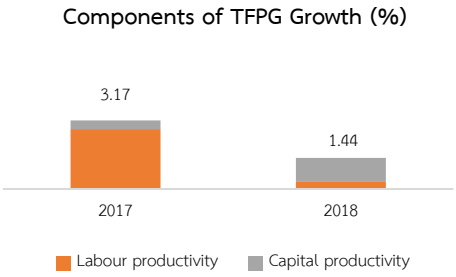
Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of the basic metal manufacturing industry's key indicators in 2018 compared to the previous year showed that the proportion of capital to labor decreased from 5.60 to 5.58 million Baht per person. The workforce has a proportion of skilled labor to the total labor force of 67.47 percent. The average number of years of study was 12.47 years, and the proportion of labor training was 40.47 percent. The quality of machinery decreased as the proportion of machinery and equipment not over five years old decreased from 1.50 percent to 1.42 percent, reflecting that this industry has a good quality of labor. However, the quality of capital factors decreased. The growth of TFP, despite the positive value, increased at a slower rate from the previous year. When considering the cost-to-sales ratio, production costs increased from 89.50 percent to 92.20 percent, while the sales and administrative expenses decreased from 4.39 percent to 3.85 percent in proportion. The Value-Added to sales decreased from 14.87 percent to 13.10 percent, reflecting the decreased potential to create value. Data from the Office of the National Higher Education Science Research and Innovation Policy Council (NXPO) found that the proportion of investment in research and development on the sales of this industry in 2017 was 0.02 percent, unchanged from the previous year. The key financial ratios show that this industry tended to decrease liquidity and increase debt. The working capital ratio decreased from 1.17 to 1.08 times, while the debt to assets ratio increased from 0.71 to 0.72 times, and the debt to equity ratio increased from 2.45 to 2.61 times.

The production productivity analysis of iron and steel products, which is considered as the main product in TSIC 24, increased in value by 2.22 percent from the previous year. The growth came from a 1.44 percent increase in TFP. The labor and capital factors affected the growth of the Value-Added, which increased by 0.81 and minus 0.03, respectively. The amount of labor increased by 1.57 percent, and the net value of fixed assets was negative at 0.06 percent.

Figure 3.18: The rate of change of Value-Added and labor, capital, and TFP factors & improved and worsened indicators of the iron and steel products





Group of Improved Indicators

- Increased automatic machinery.
- Skilled labor proportion: 68%

Group of Worsened Indicators

- Decreased proportion of new machinery.
- The use of machinery/equipment per labor decreased slightly.
- The average number of years of education received by labor decreased slightly.
- Decreased liquidity.
- Increased debts.
- Increased total cost incurred from higher selling and administration expenses.
- Value-added to sales ratio decreased slightly.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of key indicators in 2018 compared to the previous year, showed that the ratio of capital to labor decreased from 5.93 to 5.72 million Baht per person. The results of the survey on the labor quality found that the ratio of skilled labor to total labor was 67.47 percent. In comparison, the average number of years of education received by labors was 12.52 years, and the proportion of on-the-job training was 43.43 percent. The quality of machinery tended to decline, whereby the proportion of machinery and equipment under 5 years decreased from 0.68 percent to 0.59 percent. This reflected that the manufacture of iron and steel had a good quality of labor factor, but the quality of cost factors decreased. The growth rate of TFP was positive even though it grew at a slower pace from last year. Considering the cost-to-sales ratio, it was found that the trend of production costs increased from 91.03 percent to 92.60 percent.

Meanwhile, the trend of selling and administrative expenses decreased from 4.08 percent to 3.61 percent. The proportion of value-added to sales decreased significantly from 14.27 percent to 11.99 percent, reflecting the potential to create less value-added. Regarding key financial ratios, it was found that the industry tended to have less liquidity and created more debts. The working capital ratio decreased from 1.37 to 1.25 times, while debt to assets ratio increased from 0.72 times to 0.76 times, and debt to equity ratio increased from 2.89 times to 3.11 times.

In summary, the survey results showed that in 2018, the basic metal production industry had a higher Value-Added. The growth in Value-Added was mainly due to the growth rate of capital and labor factors, while the growth rate of TFP was also positive. Labor quality was good; however, the proportion of Value-Added to sales declined, reflecting the potential to create reduced Value-Added. This caused the rate of value-added growth to slow down from 2017. The ability to manage production costs decreased, but the sales and administrative expenses improved. Meanwhile, financial liquidity decreased with the trend to increase debt.

3.17.3 Problems/Obstacles

The top three problems and obstacles encountered by the sample group were raw material costs, labor costs, and the efficiency of labor/personnel. Business operators in the sample group had the biggest issue with material costs as operators have to compete on price. There were more imports of tin and chromium coated steel from foreign countries, which is cheaper than steel produced in Thailand, together with the appreciation of the Baht compared to the U.S. Dollar. This resulted in downstream industry operators such as the canned food industry and the automotive industry to use more foreign steel, which affected sales of Thai entrepreneurs. In addition, higher labor costs, along with reduced labor efficiency, also resulted in higher production costs and reduced productivity.

3.17.4 Policy Recommendations

At present, the Thai upstream metal production industry has been affected by inexpensive steel imports from China, causing an oversupply. The situation has subsequently caused the dumping of steel in Thailand and for domestic steel prices to fall. As a result, all parties involved need to adjust as follows:

1. Domestic steel producers should develop steel products to have more value and respond to the needs of customers according to the functionality (customized product). Investment in research and development is important for the product to be innovative and of higher quality, increasing production capacity, and creating more value for products.

2. Improve the production process, invest in tools and machinery, and raise capital productivity for increased production productivity, which will result in economies of scale. Business operators will have a price advantage because of lower steel production costs.

3. Establish trade partnerships with foreign manufacturers that produce high-quality steel, which is essential for the transfer of technology and specialized knowledge. This will increase the ability to produce higher quality products that are worth more, by developing the quality to be equal or better than imported products from China. Import data from 2018 from Trademap reported that Thailand's imported steel products from Japan ranked top at 38 percent, followed by China and South Korea at 20 percent and 13 percent, respectively. Therefore, starting to establish trade partnership with Japan and South Korea to learn about production technology is a challenge.

Table 3.28: Growth accounting and indicators of the manufacturing industry of basic metals

(A) Growth Accounting of the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	2.18	-0.78	1.83	1.14	1.90	-0.76	2.15	0.76	1.24	0.15	0.35	-0.19

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		5.60	5.58
Skilled labor-to-total labor proportion (%)			67.47
The average number of years of education received by labor (years)		12.50	12.47
On-the-job training proportion (%)			40.47
Automatic machinery proportion (%)		36.63	35.88
Proportion of machinery and equipment under the age of 5 years (%)		1.50	1.42

Indicators	2016	2017	2018
Management			
Capital			
Production cost-to-sales ratio (%)		89.50	92.20
Selling and administration expenses to sales proportion (%)		4.39	3.85
Value-added to sales ratio (%)		14.87	13.10
Raw material cost to production cost ratio (%)		74.43	73.56
Labor cost to total cost ratio		1.63	1.43
Finance			
Working capital ratio (times)		1.17	1.08
Debt to assets ratio (times)		0.71	0.72
Debt to equity ratio (times)		2.45	2.61
Innovation			
The proportion of investment in research and development to sales* (%)	0.02	0.02	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

Table 3.29: Growth accounting and indicators of the manufacturing industry of iron and steel

(A) Growth Accounting of the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	4.09	-0.68	1.60	3.17	2.78	0.39	2.22	0.81	-0.03	1.44	0.33	1.11

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		5.93	5.27
Skilled labor-to-total labor proportion (%)			67.47
The average number of years of education received by labor (years)		12.57	12.52
On-the-job training proportion (%)			43.43
Automatic machinery proportion (%)		23.46	24.94
Proportion of machinery and equipment under the age of 5 years (%)		0.68	0.59
Management			
Capital			
Production cost-to-sales ratio (%)		91.03	92.60
Selling and administration expenses to sales proportion (%)		4.08	3.61
Value-added to sales ratio (%)		14.27	11.99
Raw material cost to production cost ratio (%)		74.67	73.84
Labor cost to total cost ratio		1.87	1.60
Finance			
Working capital ratio (times)		1.37	1.25
Debt to assets ratio (times)		0.74	0.76
Debt to equity ratio (times)		2.89	3.11
Innovation			
The proportion of investment in research and development to sales* (%)	n.a.	n.a.	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.18 TSIC 25: Manufacture of fabricated metal products, except machinery and equipment

3.18.1 Industrial Structure

Manufacture of fabricated metal products (except machinery and equipment) (TSIC 25) is the subclass of the industry according to economic related activities—the manufacture of fabricated metal products (except machinery and equipment), which cover the manufacture of combinations or assemblies of such metal products (sometimes with other materials) into more complex units that work with moving parts. This excludes purely electrical, electronic or optical products. The manufacture of structural metal products, weapons and ammunition, other fabricated metal products and metalworking service activities are also included in this industry.

Data from the 2017 Industrial Census shows that this industry had juristic persons as manufacturers totaling 7,999 establishments throughout the kingdom. Of this number, there were 319 large, 788 medium, and 6,891 small enterprises, with a total labor force of 254,280 people. The product sales value was 521,463 million Baht, representing a value-added of 148,367 million Baht. From the data, the average proportion of foreign shareholders was 68.27 percent. The export ratio averaged 35.93 percent, and the imports of raw materials averaged 43.25 percent.

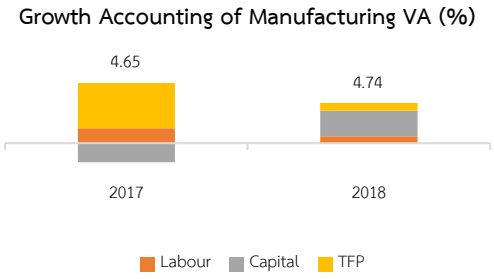
The manufacture of fabricated metal products industry (except machinery and equipment) in 2018 had two major production branches which are **1) metal packaging production** and **2) spring chain, bolts, and screws production**. The production of metal packaging in 2018, reached a total volume of 458,281 tons, an increase of 4.42 percent from the previous year. The total sales volume reached 379,499 tons, an increase of 1.40 percent of the prior year, which was a result of expansion in the canned food processing industry and seafood exports, including the production of canned beverages that increased. The import value dropped by 3.87 percent, and export value decreased by 6.26 percent from the previous year, as trade partner countries in the ASEAN region produced metal can components themselves, such as Vietnam. Furthermore, manufacturers in Thailand expanded the production capacity to central trading partner countries to reduce the cost of logistics (Packaging Intelligence Unit, OIE). Products in the chain, springs, bolts, and screws group increased in production by 6.23 percent, with a total of 165,976 tons. The growth of production and sales had positive influences from the construction sector, which is likely to expand from the construction of government infrastructure and private sector real estate. The import and export value grew by 10.42 percent and 7.38 percent from last year, respectively (Industrial Statistics, OIE). Data from Trademap[13] reported that the primary export market in 2018 was the United States of America (14 percent), Indonesia (12 percent), India (9 percent), and Japan (7 percent). In the CLMV export markets, Cambodia, Lao PDR, and Vietnam grew in exports the most by 18 percent, 17 percent, and 6 percent respectively, as the demand for construction materials in neighboring countries increased from infrastructure construction projects.

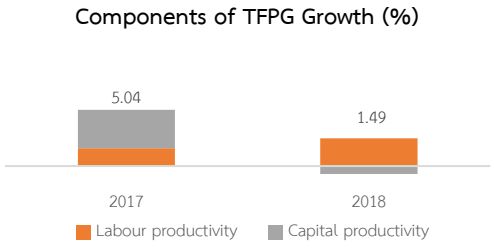
[13] HS Code: 7315 (Chain), 7318 (Screws and Bolts) and 7320 (Springs)

3.18.2 Results of Production Productivity Analysis and Key Indicators

In the survey data of 2018, the number of sample establishments manufacturing fabricated metal products (except machinery and equipment) totaled 90 establishments. This number divided into 66 large, 11 medium, and 13 small enterprises. The surveyed samples covered approximately 57.10 percent of TSIC 25's total product value. The types of product surveyed were the manufacture of metal products made by forging, pressing, stamping and roll-forming, manufacture of chains, springs, bolts and screws, and the manufacture of metal cans and other metal containers. According to data processed from the survey, it was found that, in 2018, the manufacturing industry of fabricated metal products (except machinery and equipment) increased in value-added by 4.74 percent from the previous year, which grew from the increase of TFP by 1.49 percent. Meanwhile, labor factors and capital factors contributed to the increase of value-added by 0.68 percent and 2.58 percent, respectively, due to the increase in labor utilization by 1.02 percent and the net value of fixed assets by 7.73 percent.

Figure 3.19: The rate of change of Value-Added and labor, capital, and TFP factors & improved and worsened indicators of the manufacturing industry of fabricated metal products (except machinery and equipment).





Group of Improved Indicators

- Increased automatic machinery.
- The use of machinery/equipment per labor increased.
- The average number of years of education received by labor increased slightly.
- Increased liquidity.
- Increased research investment.

Group of Worsened Indicators

- Skilled labor proportion: 62%
- Decreased proportion of new machinery.
- Total cost incurred from higher production cost per sales increased.
- Value-added to sales proportion decreased slightly.
- Slightly increased of liabilities.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

Analysis results of key indicators in the fabricated metal products industry (except machinery and equipment) in 2018, compared to the previous year, found that the proportion of capital to labor is likely to increase from 1.82 to 1.85 million Baht per person. The quality of labor had a ratio of skilled labor to total labor at 62.20 percent, the average number of years of study was 12.25 years, and the proportion of labor training was 26.03 percent. The quality of machinery declined, as the proportion of machinery and equipment under the age of 5 years decreased from 1.56 percent to 1.41 percent, reflecting that this industry has a moderate quality of labor. The quality of capital factors decreased. As a result, the TFP growth rate, although still positive, grew at a slower pace than last year. When considering the cost-to-sales ratio, it was found that production costs rose from 81.41 percent to 81.56 percent due to increased labor costs and other costs. In comparison, sales and administrative expenses decreased from 7.37 percent to 7.10 percent. The ratio of Value-Added to sales fell considerably from 21.37 percent to 20.82 percent, reflecting a reduced potential of the Value-Added. According to data from the Office of the National Higher Education Science Research and Innovation Policy Council (NXPO), the proportion of investment in research and development to sales in this industry was 0.11 percent, up from 0.04 percent in the previous year. Key financial ratios found that this industry had an increasing trend in liquidity and debt. The working capital ratio increased from 1.72 to 1.84 times while the debt to assets ratio was stable from 0.35 times last year, whereas the debt to equity ratio increased from 0.53 to 0.54 times.

In summary, the survey results show that in 2018, the fabricated metal products industry (except machinery and equipment) continued to have higher Value-Added. The amount of labor and capital increased, and the growth in Value-Added was mainly due to the positive growth rate of the TFP. The labor quality remained at a moderate level. However, the proportion of Value-Added to sales decreased, reflecting the potential to create reduced Value-Added, causing the growth rate of Value-Added to decelerate from the previous year. The ability to manage production costs decreased, but the cost of sales and management improved. While financial liquidity improved, the debt generation also increased.

3.18.3 Problems/Obstacles

The top three problems and obstacles encountered by the sample group were the efficiency of labor/personnel, labor costs, and fuel and energy cost used in production. Business operators in the sample group gave much importance to labor issues due to rising labor costs, a lack of skilled labor, and the cost of fuel and energy used in production, which fluctuated, resulting in higher production costs. This was coupled with a non-thriving economy and increased business competition. Therefore, finding ways to reduce production costs in terms of raw materials, fuel, and labor to manage the business, is very necessary for business operators.

3.18.4 Policy Recommendations

From the analysis of the fabricated metal products industry (except machinery and equipment), although the growth of TFP and Value-Added (VA) increased from the previous year, the growth rate slowed down. Improving production efficiency, cost management, product development, and expanding the market wider is essential and will make this industry more competitive in the future. Policy recommendations are as follows:

1. The development of quality metal packaging to increase competitiveness is necessary because the food and beverage industry has continuously grown, resulting in higher demand for metal packaging. In addition, ASEAN partner countries have started to produce metal packaging components themselves. Manufacturers must design packaging to be safe following international standards such as the Food and Drug Administration, as well as create Value-Added for the packaging to be appealing and to meet the customers' needs.
2. Products in chains, springs, bolts, and screws have a good chance of growth in the international market. This is especially the case for developing domestic infrastructure, especially essential export markets such as Cambodia, Lao PDR, and Vietnam. The growth reflects the increasing demand for construction materials and reduced transportation costs, resulting in better production cost management

Table 3.30: Growth accounting and indicators of the manufacturing industry of fabricated metal products, (except machinery and equipment)

(A) Growth Accounting of the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	4.65	1.51	-1.90	5.04	1.59	3.45	4.74	0.68	2.58	1.49	2.48	-1.00

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		1.82	1.85
Skilled labor-to-total labor proportion (%)			62.20
The average number of years of education received by labor (years)		12.24	12.25
On-the-job training proportion (%)			26.03
Automatic machinery proportion (%)		34.81	36.85
Proportion of machinery and equipment under the age of 5 years (%)		1.56	1.41
Management			
Capital			
Production cost-to-sales ratio (%)		81.41	81.56
Selling and administration expenses to sales proportion (%)		7.37	7.10
Value-added to sales ratio (%)		21.37	20.82
Raw material cost to production cost ratio (%)		68.28	65.62
Labor cost to total cost ratio		3.81	3.84
3.34Finance			
Working capital ratio (times)		1.72	1.84
Debt to assets ratio (times)		0.35	.35
Debt to equity ratio (times)		0.53	.34
Innovation			
The proportion of investment in research and development to sales* (%)	0.04	0.11	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.19 TSIC 26: Manufacture of computer, electronic and optical products

3.19.1 Industrial Structure

The manufacture of computers, electronics and optical equipment industry (TSIC 26) (electronics industry), is an economic activity of production of computers, peripheral equipment, communication equipment, and similar electronic products, including components of the said product, with the design and use of integrated circuits and the application of ultra-small technology. It consists of the production of electronic components and boards, computers and peripherals, communication equipment, household electric appliances, measuring, testing, pilot and control equipment, including clocks, radiation, medical and electrical therapy machines, optical instruments and photographic equipment and magnetic and optical media.

Data from the 2017 Industrial Census shows that this industry had juristic persons as manufacturers totaling 799 establishments throughout the kingdom. Of this number, there were 278 large, 177 medium, and 343 small enterprises, with a total labor force of 298,2244 people. The product sales value was 1,360,964 million Baht, representing a value-added of 300,145 million Baht. From the data, the proportion of foreign shareholders averaged 72 percent. The export ratio averaged 57 percent, and the imports of raw materials averaged 53 percent.

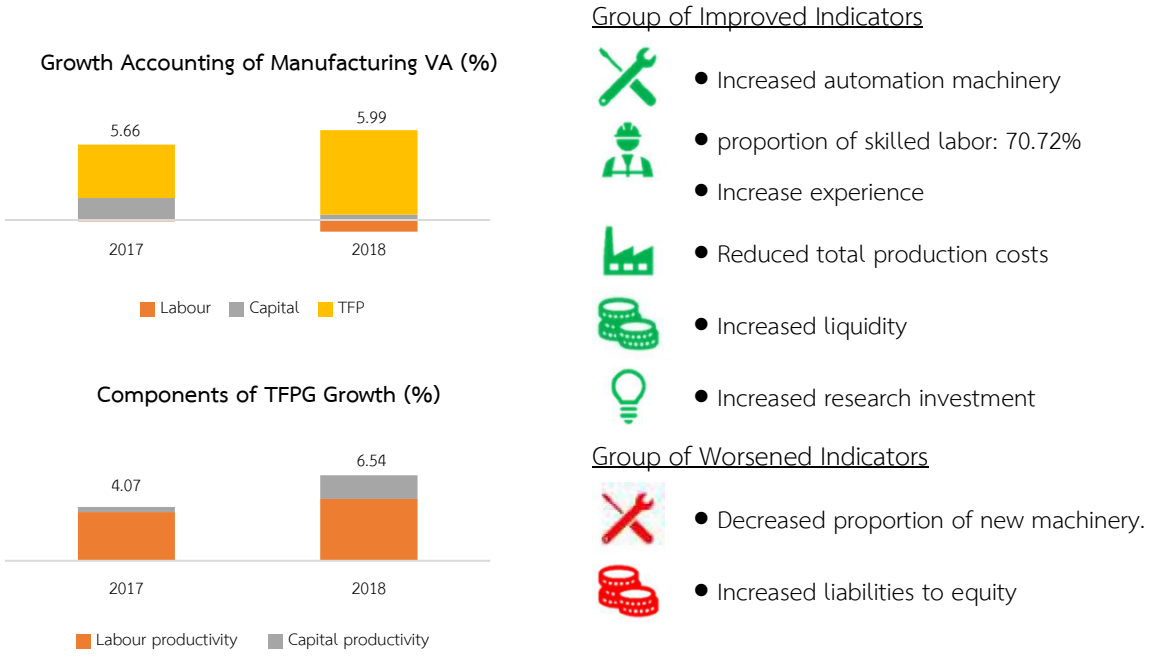
Exports of electronic products in 2018 valued 38,063.26 million USD, a growth by 4.27 percent from 2017 with an export value of 36,505.23 million USD. There was still a decline in growth compared to 2017. Most of the exported products were computer components and accessories with an export value of 15,131.37 million USD, an increase of 5.38 percent from 2017 with an export value of 14,358.12 million USD. This was followed by integrated circuits with an export value of 8,267.22 million USD, a growth by 0.20 percent from 2017 with an amount of 8,250.85 million USD. It was found that the products which shrank in exports considerably were fax machines, which contracted by 77.36 percent in 2018, whereby the export value in 2018 stood at 0.10 million USD, down from 2017 with a value of 0.45 million USD. The contraction reflects the change from paper communication to increased communications via emails. Additionally, components and equipment for transmission or reception of sound, image, or other data, including signal editing and routing equipment, contracted in exports by 8.53 percent in 2018, whereby the export value was at 901.66 million USD, which decreased from 2017 which valued 985.76 million USD.

The electronics industry in 2018 faced a trade war between the United States and China. As a result, the company that manufacturers parts for Chinese manufacturers faced a decrease in purchase orders, including competition from the major competitors such as Vietnam, which is a substantial production base for leading companies like Samsung or Intel. Vietnam has an advantage over Thailand in terms of labor costs and English language skills, with Vietnam becoming more active in the production of electronic components and with a continuously increasing rate. In addition, Thai manufacturers still faced the demand for more complex products, such as sensors and integrated circuits that are smaller and more complex, especially the production of circuits that are used in intelligent electronic products in various industries which were more demanded from users such as the automotive industry, including sensor systems to alert and control vehicle operations. Exports of automotive printed circuit boards in Thailand accounted for 76.2 percent of the total turnover of printed circuit boards. Thai manufacturers must adapt to the production of complex and different products for use in the electrical and electronics industry only.

3.19.2 Results of Production Productivity Analysis and Key Indicators

In the survey data of 2018, the number of sample establishments manufacturing computer, electronic and optical products totaled 90 establishments. This number divided into 177 large, 37 medium, and 5 small enterprises. The surveyed samples covered approximately 70.7 percent of TSIC 26's total product sales value. The types of product surveyed were the manufacture of electronic components and boards, bare printed circuit boards, and the manufacture and assembly of electronic components. According to data processed from the survey, it was found that, in 2018, the electronics industry increased in value-added by 6 percent from the previous year, which grew from the increase of TFP, cost factor, and the net value of fixed assets by 6.5 percent, 0.4 percent, and 0.97 percent, respectively. Meanwhile, value-added decreased slightly from labor factor by 0.9 percent, due to the decrease in labor utilization by 1.42 percent.

Figure 3.20: The rate of change of Value-Added and labor, capital, and TFP factors & improved and worsened indicators of the manufacturing industry electronics products



Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of key indicators in the electronics industry in 2018 compared to the previous year, showed that the ratio of capital to labor is likely to increase from 1.50 to 1.52 million Baht per person. The quality of labor is good at 70.72 percent, but most of the workers had an education that was lower than a Bachelor's degree or a vocational certificate. The industry improved the usage of capital factors. As a result, the growth rate of TFP remained positive. The quality of machinery decreased, considering the proportion of machinery and equipment that are not over five years old, which reduced from 0.05 percent to 0.02 percent. Considering the ratio of cost to sales, the trend of production costs decreased from 86.87 percent to 86.84 percent, while the cost of sales and administration decreased from 3.82 percent to 3.76 percent. The proportion of Value-Added to sales decreased from 14.37 percent to 14.22 percent. Raw material costs to production cost decreased from 54.33 percent to 53.28 percent. Labor costs to total cost decreased from 1.98 percent to 1.87 percent. The trend of liquidity increased as the working capital ratio decreased from 1.76 to 1.67 times. Debt decreased as the debt to assets ratio increased from 0.40 to 0.42 times, and the debt to equity ratio increased from 0.67 to 0.74. Data from the Office of the National Higher Education Science Research and Innovation Policy Council (NXPO) found that the proportion of investment in research and development to sales in this industry was 0.36 percent, up from 0.28 percent in the previous year.

In summary, the survey results showed that in 2018, the electronics industry had a slightly higher Value-Added. Although it was mainly due to the very positive growth of the TFP, the proportion of capital only increased slightly. The labor factor reduced from the number of hours worked, and capital factors increased but not much compared to 2017. The high Value-Added from TFP shows that the industry has technological development, especially in the proportion of research and development to promote sales in 2017, which indicates that manufacturers increasingly focused on research and development. This focus supported intelligent products in electronics, electrical appliances, and other industries that use electronic components as parts. The proportion of Value-Added to sales that decreased in 2018 shows that although there were more research and development, the products produced did not add much value. The ability to manage production costs, sales, and administrative expenses improved, while the financial liquidity deteriorated, and the trend of debt increased.

3.19.3 Problems/Obstacles

The top three problems and obstacles encountered by the sample group were labor costs, labor/personnel efficiency, and machinery/equipment efficiency. Business operators in the sample placed importance on direct costs, in terms of labor costs as this industry faces competition in labor costs among competitors, especially countries competing with Thailand. It is also an industry that uses advanced production technology; therefore manufacturers pay attention to indirect costs, especially the quality of the factors of production, including labor/personnel efficiency and the efficiency of the machinery/equipment which is essential, as manufacturers need to conduct research and development for increased efficiency, both in terms of labor and machinery used in production.

3.19.4 Policy Recommendations

Research and development have helped the industry create more value and promote competitiveness now and in the future. The industry trend focuses on producing intelligent products, including other sectors that use electronic components to produce products. In 2018, the industry will face changes in various situations, whether it is the need for more intelligent electronic components, taxes on the import of products from China imposed by the United States and exports of major competing countries such as Vietnam for example, causing the electronics industry to have to adjust considerably.

1. Components manufacturers should move towards the intelligent electronics industry. Manufacturers must develop their products to support the production of more smart electronic products. Manufacturers must promote themselves to have research and development capabilities, including the development of existing labor skills to be more skilled in design, which will add more value to manufacturers.
2. Developing diploma and bachelor degree programs especially in STEM education, allowing students who graduate in science and engineering to design more electronics and meet the needs of the market trend, focusing on more intelligent products.
3. Electronic component manufacturers should focus on other target industries, whether it is the automotive industry, all-inclusive medical industry, the aviation industry, or the agricultural industry, which has demanded more intelligent electronic products.
4. Modify machines to use more automation and robotics in production, which will help improve production, such as reducing wastage, to help save costs. It is also necessary to increase the quality of labor in the industry to be able to work with automation and robotics.

Table 3.31: Growth accounting and indicators of the manufacturing industry of electronics

(A) Growth accounting of the industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	5.7	-0.1	1.7	4.1	3.7	0.4	6.0	-0.9	0.4	6.5	4.7	1.8

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		1.50	1.52
Skilled labor-to-total labor proportion (%)			70.72
The average number of years of education received by labor (years)		11.88	11.90
Proportion of machinery and equipment under the age of 5 years (%)		0.05	0.02
Management			
Capital			
Production cost-to-sales ratio (%)		86.87	86.84
Selling and administration expense to sales proportion (%)		3.82	3.76
Value-Added to sales ratio (%)		14.37	14.22
Raw material cost to production cost ratio (%)		54.33	53.28
Labor cost to total cost ratio (%)		1.98	1.87
Finance			
Working capital ratio (times)		1.76	1.67
Debt to assets ratio (times)		0.40	0.42
Debt to equity ratio (times)		0.67	0.74
Innovation			
The proportion of investment in research and development to sales* (%)	0.28	0.36	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.20 TSIC 27: Manufacture of electrical equipment

3.20.1 Industrial Structure

The electrical device production industry (TSIC 27) is an economic activity in the category of products related to the production, distribution, and use of electricity, including the production of electric lamps, signaling devices, and household electrical appliances, consisting of the production of electric motors, power generators, power transformers, and electrical control and distribution equipment, the manufacture of batteries and accumulators, electric wires and equipment, electrical equipment for lighting, household appliances and the production of other electrical devices.

Data from the 2017 Industrial Census shows that this subclass had juristic persons as manufacturers totaling 965 establishments throughout the kingdom. Of this number, there were 184 large, 264 medium, and 517 small enterprises, with a total labor force of 118,849 people. The product sales value was 394,800 million Baht, representing a value-added of 79,573 million Baht. From the data, the proportion of foreign shareholders was 61 percent. The export proportion was 37 percent, and the import proportion of raw materials was 41 percent.

The electrical devices' exports in 2018 valued 17,491.67 million, a growth of 1.01 percent from 2017, which had an export value of 17,317.63 million USD. The most exported products were equipment for the protection of electrical circuits and components. The value of exports in 2018 was 1,619,73 million USD, a contraction from 2017 where exports valued 1,673.17 million USD. This was followed by the export of refrigerators, which valued 1,506,46 million USD, a decrease of 6.59 percent compared to 2017, which valued 1,612.78 million USD. The most promising export product was air purifiers, which grew by 42.78 percent, reaching an export value of 21.36 million USD in 2018 compared to14.96 million USD in 2017. The second most promising export product was electrical devices with built-in electric motors. Exports grew by 25.30 percent, reaching a value of 28.39 million USD in 2018 from 22.66 million USD in 2017.

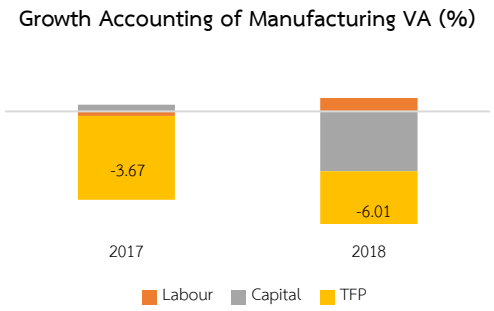
Exports of electric power products in 2018 reached an export value of 6,553.59 million USD, a growth of 2.63 percent from 2017 with an export value of 6,385.92 million USD. The most exported products were switches and electrical control panels, with an export value of 1,752.83 million USD in 2018, an increase of 5.80 percent from 2017 with an export value of 1,656.81 million USD. This was followed by electrical change machines, with an export value of 1,459.51 million USD in 2018, a growth of 17.21 percent from 2017, and an export value of 1,245.23 million USD. Products that contracted in exports in 2018 were solar cells, which contracted by 38.25 percent, with an export value of 537.60 million USD in 2018 from 870.55 million USD in 2017. This was followed by bushing and tap changer, coupled with connectors for transformers, which contracted by 20.35 percent from 2018 with an export value of 0.14 million USD, a decrease from 0.17 million USD in 2017.

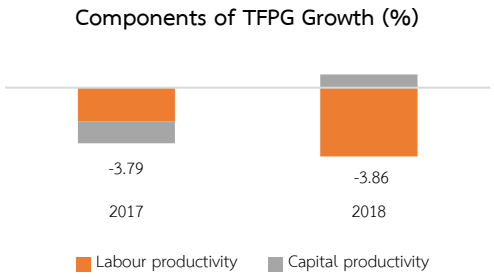
The electrical equipment industry in Thailand is faced with technological changes, especially Smart Homes, which has caused electrical products to trend towards IoT products. Manufacturers need to research and develop in response to market demand but still face cheaper IoT products from China. Exports of electrical appliances such as the production of washing machines faced measures on the setting of quotas for importing washing machines and components, as well as rising import and export tariffs for three years, resulting in manufacturers having to control the export of washing machines and parts to remain within the quota set by the United States of America. In addition, household electrical appliances received favorable results from the property market that continued to expand in 2018, due to sales promotions to boost sales before the enforcement of control measures on housing loans in 2019 This was coupled with capital investment in government infrastructure investment projects such as electric train projects that resulted in a higher demand for electrical products.

3.20.2 Results of Production Productivity Analysis and Key Indicators

In the 2018 survey, the number of sample establishments manufacturing electrical equipment was 83 establishments, divided into 62 large, 17 medium, and 4 small enterprises. The surveyed samples covered 100 percent of TSIC 27's total product sales value. The types of products surveyed were the manufacture of electric motors, generators, electric household appliances, electric wires and cables, etc. According to data processed from the survey, it was found that, in 2018, the electrical equipment industry decreased in value-added by 6.01 percent from the previous year. The decrease of value-added mainly resulted from the decline of TFP by 3.86 percent and the cost factor by 2.71 percent due to the decrease in the net fixed asset value of 8.75 percent, even the growth of value-added from labor factor was positive (0.56 percent) from the increase in labor utilization by 0.81 percent.

Figure 3.21: The rate of change of Value-Added and labor, capital, and TFP factors in the electrical equipment industry





Group of Improved Indicators

- Increased automation machinery.
- Proportion of skilled labor: 69.21%
- Increase experience.
- Total cost decreased slightly.
- Increased liquidity.
- Decreased debts.
- Increased research investment.

Group of Worsened Indicators

- Decreased proportion of new machinery.
- Increased total cost as the increase of production cost

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of the key indicators in the electrical equipment industry in 2018 compared to the previous year, showed that the ratio of capital to labor decreased from 1.70 to 1.54 million Baht per person. The rate of skilled labor to the total workforce accounted for 69 percent. The quality of machinery declined and the proportion of machinery and equipment not over five years old, reduced from 6.28 percent to 5.99 percent. Machinery and equipment are critical factors in this industry. As a result, the TFP growth rate decreased. The ratio of cost to sales showed that the production costs increased from 84.19 percent to 84.29 percent, while the cost of sales and administration decreased from 8.56 percent to 8.15 percent. The proportion of Value-Added to sales fell considerably from 12.40 percent to 11.97 percent, indicating that the industry was unable to add value to the products it produced. The liquidity increased from the working capital ratio, which increased from 1.70 to 1.86 times, and the debt reduced from the debt to assets ratio, which decreased from 0.46 to 0.43 times. The debt to equity ratio decreased from 0.85 to 0.76. Data from the Office of the National Higher Education Science Research and Innovation Policy Council (NXPO) found that the proportion of investment in research and development to sales in this industry in 2017 was 0.23, an increase of 0.74 percent in the previous year.

In summary, the survey found that in 2018, the electrical device production industry continuously increased in value. Despite the increased use of labor factors, the growth was mainly due to the use of capital and TFP, which reduced significantly. Capital factors from machinery were especially important from rapid technological change, whereby the aging of machinery reflects outdated production technology. The lower Value-Added to the reduced sales shows that manufactured products could not add much value, indicating that the industry is not well adapted to rapid technological changes, such as intelligent electrical appliances, which can create Value-Added. Furthermore, the availability of cheap foreign products from China caused manufacturers to face high competition in this industry. Regarding labor factors, although the industrial value increased, the proportion of skilled labor to total labor should be higher as skilled labor is an integral part of this industry. Meanwhile, the trend of the ratio that reflects financial also improved, with reduced debt.

3.20.3 Problems/Obstacles

The top three problems and obstacles encountered by the sample group were raw material costs, labor costs, and labor/personnel efficiency. Business operators in the sample group placed importance on direct costs, both in terms of raw material costs and labor costs which are essential for industrial production because it is faced with competition from major competitors that have production cost advantages such as China, which has cheaper products to sell in the country, including other various countries that Thailand exports to. It is also an industry that pays attention to indirect costs such as increasing labor efficiency, which is a vital part of growing product value, especially product design with high technology.

3.20.4 Policy Recommendations

The analysis of the electrical device production industry reflects that the use of modern machinery, cost management in production and product development is essential to make the sector more competitive. The industry must face trends of intelligent products that are the demand of the market at present and in the future, such as smart electronic devices or IoT. This will cause manufacturers to adjust to the market trend well. The industry also needs to modify production, using more modern machinery, skilled workers in product design and development, including the introduction of automation and robotics to assist in production. This will help reduce time and waste from manufacturing, which will contribute to lower production costs and capturing a broader market for cheap products from abroad. Adjustments of the industrial sector should be as follows:

1. Manufacturers of electrical equipment and appliances should develop products that have a higher Value-Added, such as smart devices with IoT, to meet the needs of users in both the domestic and foreign markets. The industry should also be part of the value chain of other industries that can use electrical devices such as the automotive industry. In addition, there should be research and development of products that better meet the needs of users.
2. Develop science and engineering courses related to STEM to meet the market demand, including skills development for workers to have more electronic design capabilities.
3. Improve or modify the machinery and equipment used in the production by using more automation and robots to reduce production costs.
4. Manufacturers should manage production costs, especially reducing production costs, in addition to automation and robots. The process of purchasing raw materials used in production should have a system that helps production planning in cost management.

Table 3.32 Account of Business Growth and Indicators of food industry

(0) **The Account of Growth in the Manufacturing Industry (percentage)**

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	-3.7	-0.2	0.3	-3.8	-2.3	-1.5	-6.0	0.6	-2.7	-3.9	-4.7	0.9

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		1.70	1.54
Skilled labor-to-total labor proportion (%)			69.21
The average number of years of education received by labor (years)		12.02	12.04
Proportion of machinery and equipment under the age of 5 years (%)		6.28	5.99
Management			
Capital			
Production cost-to-sales ratio (%)		84.19	84.92
Selling and administration expense to sales proportion (%)		8.56	8.15
Value-Added to sales ratio (%)		12.40	11.97
Raw material cost to production cost ratio (%)		59.38	58.49

Indicators	2016	2017	2018
Labor cost to total cost ratio (%)		2.52	2.72
Finance			
Working capital ratio (times)		1.70	1.86
Debt to assets ratio (times)		0.46	0.43
Debt to equity ratio (times)		0.85	0.76
Innovation			
The proportion of investment in research and development to sales* (%)	0.23	0.74	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.21 TSIC 28: Manufacture of machinery and equipment n.e.c.

3.21.1 Industrial Structure

According to the definition of the National Statistical Office, the subsection of the manufacture of machinery and tools that are not classified elsewhere (TSIC 28) will be diverse, consisting of the production of machinery and equipment used for materials, whether mechanical or heating or processed with materials (such as fastening, spraying, weighing or packaging), including mechanical components and main parts manufactured and used with that machine. It also includes the production of equipment with a wide range of applications, whether mounted or movable, and manual types of machinery regardless of whether it is designed for use in industrial applications, construction, and civil engineering, agriculture, or household use. The production of specialized equipment for transporting passengers or goods within establishments, w is also classified in this subcategory. Therefore, machinery production is divided into general-purpose machinery production and the production of machinery used in a specific job.

According to the 2017 industry census data, there were a total of 1,788 entrepreneurs, small firms accounted for 68 percent (1,211 firms), and 22 percent (396 firms) were medium-sized, and 10 percent (181 firms) were large companies. This industry employed a total of 113,039 workers. The total industrial output value was 577,084 million Baht, which added a total value of 109,899 million Baht. This industry has a foreign shareholding proportion averaging at 74 percent and exports averaging at 49 percent of the overall product value. The main products in this subcategory were the production of chillers, tractors used in agriculture and office machinery and equipment (except computers and peripherals), which will be the main business that will be used for further analysis.

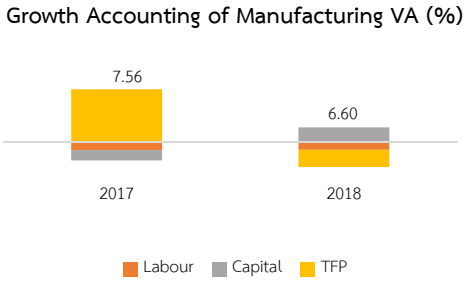
The demand for machinery and tools depends on the factors that affect the demand and supply of those critical businesses. The production of air-conditioning coolers depends on consumer purchasing power. The air conditioner export market resumed in 2018, despite the global warming that has caused increased weather volatility. The La Nina phenomenon (beginning in 2017) made the rainy season last longer than usual, and the temperature decreased. At the same time, the real estate market grew in 2017 and 2018, especially in condominiums. Loans for real estate operators, real estate buyers, and licensed areas increased the overall domestic air conditioner market. However, compressor production decreased due to more imports from China.

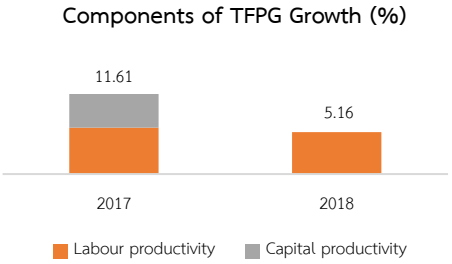
The trend of agricultural labor decreased, and the Thai agricultural sector's low productivity resulted in increased demand for agricultural machinery. In addition, the price of agricultural products increased following the world's population. Smart farming policies and the need to increase production and productivity in neighboring countries will affect the demand for agricultural machinery, while machinery and office equipment are dependent on economic growth that will cause investment, business expansion, and the start of more new businesses. However, technological advances and the need to reduce office costs will reduce the demand for office equipment and machinery.

3.21.2 Results of Production Productivity Analysis and Key Indicators

The analysis used data from the 2018 survey data, which contained 114 samples of TSIC 28 establishments, representing 60.20 percent of the total output value of this industry. The sample group will cover TSIC 28's diverse core businesses, from the production of engines and turbines to the output of other specialized machinery. According to the survey, the value of this industry has continuously increased. In 2018, the Value-Added grew by 6.60 percent due to the increase of capital factors and the expansion of TFP at 3.18 percent and 5.16 percent, respectively. The rise in investment caused the value of net fixed assets to rise by 6.76 percent. The slowing growth of the TFP was mainly due to the productivity of capital, while the ability of labor in this industry continued to grow.

Figure 3.22: The rate of change of Value-Added and labor, capital, and TFP factors in the manufacturing industry of machinery and equipment not elsewhere classified





Group of Improved Indicators

- Increased investment and better capital-to-labor proportions.
- Production cost-to-sales ratio decreased slightly.
- Debt burden decreased, better debt to assets ratio & debt to equity ratio.
- Better current capital ratio
- Selling and administration expenses to sales proportion decreased slightly.

Group of Worsened Indicators

- Value-added to sales proportion decreased.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

Most of the TSIC 28 industry indicators reflect the increased investment that will increase the productivity of this industry in 2018. The ratio of capital to labor slightly increased to 1.96 million Baht per person, the proportion of machinery and devices that are less than five years old, slightly reduced to 7.98 percent. For indicators that reflect the ability to manage costs, although the ratio of production costs to sales began to increase, the rate of sales and administrative expenses to sales decreased to 7.99 percent, respectively. The proportion of research and development investments to sales in 2017 was 0.25 percent. Financial indicators also showed better signals, with this industry having increased liquidity with a decreased debt burden.

Overall, the TSIC 28 industry consists of critical activities, which are the production of chillers, tractors used in agriculture, and machinery and office equipment, which can continuously increase value by increasing investment and reducing dependence on labor. The TFP played a decreasing role in creating Value-Added. This industry's Value-Added reflects the increasing demand in the world market and the trend of using more agricultural machinery in the future. In addition, increased investment helped improve the efficiency and financial status of this industry.

3.21.3 Problems/Obstacles

Business operators in the sample group placed importance on the issues of raw material costs, labor costs, and financial costs the most, which reflects the importance of cost control in this industry to be able to compete with competitors in domestic and international markets. The problem of financial costs shows that businesses in this industry still do not have many financing options, resulting in high financial costs, which affects overall costs.

3.21.4 Policy Recommendations

The diversity of the TSIC 28 industry means that this industry should be considered at the principle activity level. The production of chillers depends on the purchasing power and climate of each year, and the increasing demand will influence agricultural tractors in the country due to the reduced labor force and the goal of increasing production efficiency and intelligent agriculture promotion policy while other developing countries need to improve their agriculture to support their domestic needs and improve their export potential. The production of office machinery and equipment will depend on the purchasing power and the tendency to reduce office space to reduce costs. Therefore, the recommendations for this industry are as follows:

1. The production of refrigeration, especially air conditioners, must focus on developing production capabilities and continuously innovating products to enable Thailand to remain a vital air-conditioner production base in the world. Industrial development will be the direction considering environmental protection, the Internet of Things (IoT), and Artificial Intelligence (AI).
2. The production of agricultural tractors must raise the standards of production and increase production efficiency. Thai business operators must build confidence and understand the needs of farmers in each area following the different geographies, weather, and the crop produced. The industry should cooperate with the government to help farmers understand and benefit from the government's intelligent agriculture development policy.
3. The production of office machinery and equipment must adjust to the market trends and changing consumer behavior. Business operators should, therefore, have innovation in their products while also increasing production efficiency by maintaining the quality of the products to match consumer needs.

Table 3.33: Growth accounting and indicators of the manufacturing industry of machinery and equipment not elsewhere classified

(A) Growth accounting of the industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	7.56	-1.80	-2.24	11.61	5.81	5.79	6.60	-1.74	3.18	5.16	5.24	-0.08

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		1.82	1.96
Skilled labor-to-total labor proportion (%)			77.82
The average number of years of education received by labor (years)		13.06	13.06
Proportion of machinery and equipment under the age of 5 years (%)		8.49	7.98
Management			
Capital			
Production cost-to-sales ratio (%)		77.48	78.09
Selling and administration expense to sales proportion (%)		8.53	7.99
Value-Added to sales ratio (%)		22.11	22.34
Raw material cost to production cost ratio (%)		73.36	74.10
Labor cost to total cost ratio (%)		4.57	5.01
Finance			
Working capital ratio (times)		2.10	2.18
Debt to assets ratio (times)		0.34	0.32
Debt to equity ratio (times)		0.50	0.47
Innovation			
The proportion of investment in research and development to sales* (%)	0.17	0.25	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.21 TSIC 29: Manufacture of motor vehicles, trailers and semi-trailers

3.21.1 Industrial Structure

The production of motor vehicles, trailers, and semi-trailers (TSIC 29) is a sub-sector of the industry following economic activities in the category of motor vehicles, trailers, and semi-trailers. The group consists of the production of various types of vehicles such as personal cars, 1-ton pickup trucks, and other types of vehicles used for passenger travel and not classified elsewhere. For example, the manufacture of engines for motor vehicles, the production of motor vehicles, the production of trailers, semi-trailers, and containers, the production of parts and accessories for motor vehicles such as automotive interior seats, electrical equipment for motor vehicles and other parts and accessories for motor vehicles.

Data from the 2017 Industrial Census shows that this industry had juristic persons as manufacturers totaling 1,441 establishments throughout the kingdom. Of this number, there were 528 large, 355 medium, and 558 small enterprises, with a total labor force of 319,270 people. The product sales value was 1,791,670 million Baht, representing a value-added of 382,153 million Baht. From the data, the proportion of foreign shareholders was 70 percent. The export proportion was 37 percent, and the import proportion of raw materials was 41 percent.

The Thai automotive industry in 2017 was affected by the economic slowdown of the major trading partner countries, especially Australia and the Middle East. As a result, the total automotive exports in Thailand in 2017 decreased by 2.9 percent. However, in 2018, the entire automotive exports in Thailand resumed growth by 2.8 percent. From the classification of vehicles exported in 2018, passenger cars with a cylinder capacity between 1,801-2,400 cc had the highest export at 27.0 percent, followed by passenger cars with a cylinder capacity not exceeding 1,800 cc and pickups trucks at 4.8 percent and 0.7 percent, respectively. Domestic automotive sales faced a favorable situation from the termination of car ownership requirements of at least five years of the first car policy at the end of 2016, promoting people to start selling old cars and then switching to new vehicles. The total domestic motor vehicle sales grew by 21.7 percent, with pickup trucks having the highest sales growth of 24.7 percent, followed by passenger cars with cylinder capacity between 1,801 cc and passenger cars with cylinder capacity between 1,800-2,400 cc which grew by 18.7 percent and 12.7 percent, respectively. In addition, the production volume of motor vehicles increased in all types of cars, in response to increased domestic and international demand. For automotive parts, there was an expansion of exports as well. Automotive components and equipment grew by 10.3 percent, and vehicle bodies grew by 7.9 percent following the global automotive industry. In addition, automobile emissions were another cause of impact on the automotive industry in Thailand in the future. As many countries are aware of environmental problems and air emission, they have announced the cancellation of the use of combustion vehicles to reduce pollution, such as China, Norway, the

Netherlands, France, and England. Electric cars in foreign countries are becoming very popular, causing reduced production of export vehicles in Thailand. However, the automotive industry still has various risk factors and other issues that need to be monitored that may affect the industry, including 1. Automotive product standards from Emission standards for passenger cars, increasing from Euro 4 to Euro 5 which will go into force in 2021 to reduce the problems of small dust particles under 2.5 microns, allowing operators two years[14] to adjust in advance. 2. Ride/vehicle sharing is to share vehicles or travel (especially cars) which may cause reduced vehicle purchases[15] and 3. Non-tariff trade block (NTB) measures in ASEAN due to Vietnam's import control measures regarding issuance for motor vehicles imported from abroad and checking the quality of new imported cars for sale. If there is no long-term correction, it may affect Thai automotive industry.[16]

3.21.2 Results of Production Productivity Analysis and Key Indicators

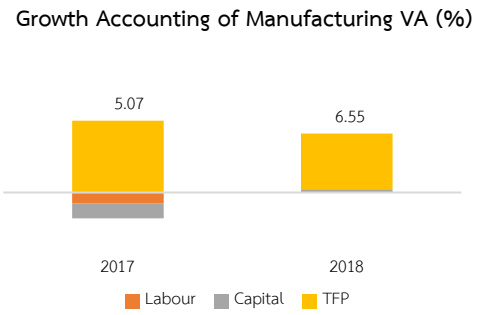
In the 2018 survey, the number of sample establishments manufacturing motor vehicles, trailers and semi-trailers was 188 establishments, divided into 170 large, 17 medium, and 1 small enterprises. The surveyed samples covered approximately 89.2 percent of TSIC 29's total production value. The types of products surveyed were the manufacture of motor vehicles, engines, bodies (coachwork) for motor vehicles, parts and accessories for motor vehicles such as car seats, motor vehicle electrical equipment, parts and accessories for motor vehicles, etc. According to data processed from the survey, it was found that, in 2018, the motor vehicles industry increased in value-added by 6.55 percent from the previous year. The increase resulted from the growth of labor factor, cost factor, and TFP by 0.03 percent, 0.32 percent, and 6.19 percent, respectively, because the use of labor increased by 0.06 percent and the net value of fixed assets increased by 0.69 percent.

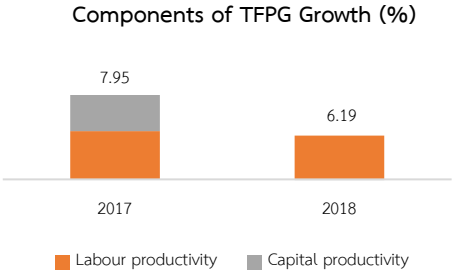
[14] Information from the www.prachachat.net website (News on March 17, 2019)

[15] Information from the Bank of Thailand on "Sharing Economy: implication to the Thai economy"

[16] Information from the Public Relations Department on "The situation of importing cars from Thailand to Vietnam."

Figure 3.23: The rate of change of Value-Added and labor, capital, and TFP factors in the manufacturing industry of motor vehicles, trailers and semi-trailers





Group of Improved Indicators

- Automatic machinery proportion increased.
- New machinery proportion increased.
- The use of machinery/equipment per worker increased slightly.
- The average number of years of education received by labor increased slightly.
- Slightly decreased in total cost as production cost dropped.
- Value-added to sales increased.
- Liquidity increased slightly.

Group of Worsened Indicators

- Skilled labor proportion: 63.87%
- Selling and administration expenses increased.
- Debts increased slightly.
- Investment in research decreased slightly.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of key indicators for the manufacturing industry of motor vehicles, trailers and semi-trailers in 2018 compared to the previous year, showed that the ratio of capital to labor projected to increase from 2.18 to 2.21 million Baht per person. The results of the survey on the labor quality found that the ratio of skilled labor to total labor was 63.87 percent. In comparison, the average number of years of education received by the labor was 12.28 years. Regarding the quality of machinery, it was found that the proportion of value of machinery and equipment under 5 years projected to increase from 3.14 percent to 3.89 percent. Considering the cost-to-sales ratio, the trend of production costs decreased from 84.82 percent to 83.93 percent. Meanwhile, selling and administration expenses tend to increase from 6.84 percent to 7.15 percent. Value-Added to sales proportion increased from 12.38 percent to 12.89 percent, reflecting a potential to create more value-added. Information from the Office of National Higher Education Science Research and innovation Policy Council (NXPO) reflected that the proportion of investment in research and development to sales in this industry projected to decrease from 0.0034 percent in 2016 to 0.0025 percent in 2017. The key financial ratios show that this industry tended to decrease liquidity and increase few debts. The working capital ratio increased from 1.68 to 1.73 times, while the debt to assets ratio remained at 0.42 times, and the debt to equity ratio increased from 0.71 to 0.72 times.

In summary, the survey results show that in 2018, the production of vehicles, trailers, and semi-trailers continued to increase in value, from the amount of labor and capital that grew, including the growth of TFP. The proportion of Value-Added to sales increased. Reflecting the potential to create higher value-added, resulting in a continued increase in Value-Added. The ability to manage sales and administrative expenses increased slightly, while the financial liquidity improved, and the debt tendency increased slightly.

3.19.3 Problems/Obstacles

The top three problems and obstacles from the sample groups in the automotive, trailer, and semi-trailer manufacturing industry were the efficiency of machinery/equipment, labor costs, and raw material costs used in production. Business operators in this industry placed the utmost importance on increasing machine efficiency and cost savings because, in the production of vehicles and automotive parts, it is necessary to use efficient machinery and equipment to produce products that meet quality standards. It also reduces losses in the production process. Business operators also focused on quality labor and raw materials. Therefore, if the production machinery is efficient and has low production costs, it will help operators in this industry to compete.

3.19.4 Policy Recommendations

Although the Thai automotive industry currently has good sales both in Thailand and overseas, the automotive export sector must continually monitor the industry. The sector is exposed to risks from external factors such as fluctuations in the world economy and major trading partner countries because of the trade war between the United States and China's Non-Tariff Measures (NTB) in ASEAN, the Baht appreciation and oil price levels, including the changing automotive demand. Especially nowadays, the electric motor industry is gaining more popularity in foreign countries as it helps reduce the occurrence of environmental problems and air pollution, which will result in a decrease in demand for motor vehicles and motor vehicle parts in the future. Therefore, entrepreneurs in the automotive and parts industry need to adjust as follows:

1. Businesses must study and use more innovation in production to create strengths and differentiation of products and to maintain production and delivery standards products. Companies should also give importance to the development of skilled labor to be a group with more diverse skills and expertise and invest in modern machinery and equipment.
2. Business operators should diversify their production into other automotive parts by applying, improving, changing, and developing new products by utilizing existing expertise as a benefit. This will be an opportunity to explore a new channel to find new markets.

3. Business operators should monitor product prices in the market, including exchange rates. They should have proper cost management so that raw materials can be purchased at low prices to help reduce costs.
4. The increasing popularity of electric vehicles will result in a decrease in demand for motor vehicles and auto parts that use oil. Therefore, business operators should adjust to industry changes, by preparing and studying the production of components for electric vehicles such as batteries, motors, battery management systems (BMS), drive control units (DCU), inverters and converters for example.

Table 3.34: Growth accounting and indicators of the manufacturing industry of motor vehicles, trailers and semi-trailers industry

(A) Growth accounting of the industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	5.07	-1.23	-1.65	7.95	3.93	4.02	6.55	0.03	0.32	6.19	3.45	2.74

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		2.18	2.21
Skilled labor-to-total labor proportion (%)		n.a.	63.87
The average number of years of education received by labor (years)		12.27	12.28
On-the-job training proportion (%)		n.a.	17.37
Proportion of automatic machinery (%)		41.30	42.89
Proportion of machinery and equipment under the age of 5 years (%)		3.14	3.89
Management			
Capital			
Production cost-to-sales ratio (%)		84.82	83.93
Selling and administration expense to sales proportion (%)		6.84	7.15
Value-Added to sales ratio (%)		12.38	12.89
Raw material cost to production cost ratio (%)		69.77	70.74
Labor cost to total cost ratio (%)		1.58	1.57
Finance			

Indicators	2016	2017	2018
Working capital ratio (times)		1.68	1.73
Debt to assets ratio (times)		0.42	0.42
Debt to equity ratio (times)		0.71	0.72
Innovation			
The proportion of investment in research and development to sales* (%)	0.0034	0.0025	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.23 TSIC 30: Manufacture of other transport equipment

3.23.1 Industrial Structure

The manufacture of other transportation equipment (TSIC 30) is a subcategory of industries under the economic activities category of other transportation equipment production. It consists of shipbuilding and ship manufacturing, the construction of locomotives, aircraft and spacecraft, the manufacture of military vehicles for use in combat and the production of transportation equipment not classified elsewhere (such as the production of motorcycles, bicycles and vehicles for the disabled), including the production of components for aforementioned.

Data from the 2017 Industrial Census shows that this industry had juristic persons as manufacturers totaling 258 establishments throughout the kingdom. Of this number, there were 39 large, 71 medium, and 148 small enterprises, with a total labor force of 33,283 people. The product sales value was 143,479 million Baht, representing a value-added of 30,135 million Baht. From the data, the proportion of foreign shareholders was 60 percent. The export proportion was 49 percent, and the import proportion of raw materials was 45 percent.

The other transportation equipment manufacturing industry has three important production branches: 1) Motorcycle and components production, 2) Shipbuilding, and 3) Aircraft and components production. In 2018, the Thai motorcycle industry[17] continued to grow. Motorcycle production (CBD) and motorcycle parts (CKD) reached a production volume of 2,578,161 units, an increase of 1.67 percent from the previous year. The export volume reached 886,275 units, an increase of 4.38 percent of the prior year, and the value of exports was 61,654 million Baht, an increase of 12.45 percent of the preceding year. The major export markets of Thailand were Cambodia, Indonesia, and Japan. Meanwhile, the domestic market declined in line with the economic slowdown. The Thai Industrial Standards Institute (TISI) is preparing to

[17] Data from the automotive industry group the Federation of Thai Industries (FTI)

upgrade the motorcycle industry product standards from the Euro 3 to Euro 4 exhaust standards, which will help reduce the number of pollutants emitted by 50 percent. However, this may cause the price of motorcycles to increase by 10-15 percent. Business operators have been allowed several months in advance[18] to adjust and prepare, whereby the standard will be enforced around February 2020. The trend of the Thai shipbuilding industry in 2018 continued to grow as the recovery of Thailand's international trade. Exports and imports rose 7.5 percent and 13.7 percent from the previous year, respectively. There was also an opportunity for more employment from the government's significant investment projects. The Thai aircraft and components industry 2018, grew following the country's air traffic volume. The number of passengers was approximately 162 million people, an increase of 6.7 percent from the previous year. The total number of flights was 1,098 thousand, an increase of 5.8 percent of the prior year. Meanwhile, the air cargo volume was at 1,619 thousand tons, down by 2.8 percent from last year. Key factors that affect this industry trend are the global and domestic economy, the growth of the tourism industry, investment in the aviation industry, and requesting investment promotion from the Office of the Board of Investment, including government policies and investment promotion programs.[19]

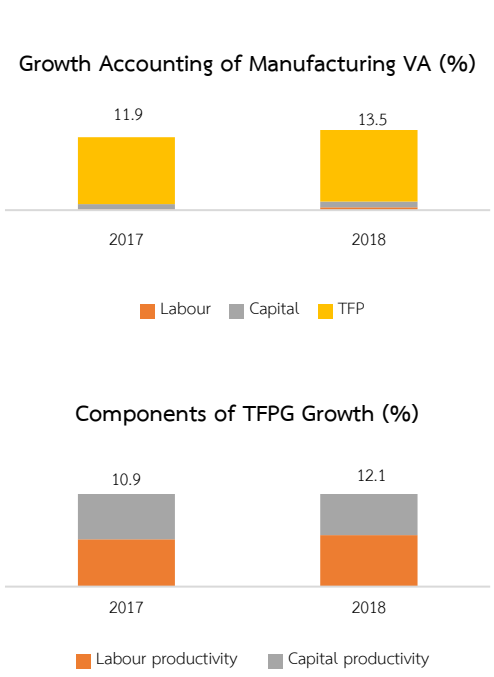
3.23.2 Results of Production Productivity Analysis and Key Indicators

In the 2018 survey, the number of sample establishments manufacturing other transport equipment was 45 establishments, divided into 37 large, 6 medium, and 2 small enterprises. The surveyed samples covered approximately 71.9 percent of TSIC 30's total product sales value. The types of products surveyed were the building of ships and floating structures, railway locomotives, aircraft and parts, equipment used on the aircraft, motorcycles and parts, including bicycles and parts. According to data processed from the survey, it was found that, in 2018, the manufacturing industry of other transport equipment increased in value-added by 13.50 percent from the previous year, which grew from the TFP by 12.10 percent. Meanwhile, labor factors and capital factors contributed to the increase of value-added by 0.44 percent and 0.96 percent, respectively, due to the increase of labor utilization by 0.99 percent and the net value of fixed assets by 1.74 percent.

[18] Data from the www.posttoday.com website (News on February 8, 2019)

[19] Data from Situation Report on Thailand Aviation Industry in 2018, prepared by Aviation Economics Division, Aviation Industry Promotion Department

Figure 3.24: The rate of change of Value-Added and labor, capital, and TFP factors in the manufacturing industry of other transport equipment



Group of Improved Indicators

- Skilled labor proportion: 65.8%
- The average number of years of education received by labor increased slightly.
- Capital-to-labor proportions increased slightly.
- Selling and administration expenses decreased.
- Value-Added to sales increased.
- Increased liquidity.
- Decreased debts.

Group of Worsened Indicators

- Proportion of new machinery and equipment decreased.
- Investment in research decreased.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of the key indicators of the other transportation equipment manufacturing industry in 2018, compared to the previous year, found that the proportion of capital to labor remained stable at 0.91 million Baht per person. The quality of labor found that the ratio of skilled labor to total labor was 70.81 percent, while the average number of years of study was 12.34 years. The proportion of machinery and equipment that is less than five years old decreased from 4.37 percent to 4.04 percent. Considering the cost-to-sales ratio, the trend of production costs slightly reduced from 83.31 percent to 82.99 percent, while sales and administrative expenses decreased from 5.83 percent to 4.91 percent. The proportion of Value-Added to sales increased from 15.21 to 16.30 percent, reflecting the potential to create Value-Added. From critical financial ratios, the industry increased liquidity and reduced debt. The working capital ratio increased from 1.98 to 2.11 times, while the debt-to-assets rate decreased slightly from 0.42 to 0.41 times, and the debt-to-equity ratio decreased from 0.73 to 0.69. Data from the Office of the National Higher Education Science Research and Innovation Policy Council (NXPO) found that the proportion of research and development investment to sales in this industry in 2017 was 0.10 percent, down from 0.18 percent in the previous year.

In summary, the survey results show that in 2018, the value of the other transportation equipment manufacturing industry continued to increase at a slower pace, following the amount of labor and capital, which grew at a slower rate. But with the accelerated growth of TFP, the Value-Added still grew. Therefore, the proportion of Value-Added to sales increased. The ability to manage sales and administrative expenses improved, including financial liquidity and debt on a declining trend.

3.23.3 Problems/Obstacles

The problems and obstacles that businesses from the sample group ranked in the top three were labor costs, fuel, and energy costs used in production and machinery/equipment efficiency. In this industry, businesses placed great importance on cost savings. They increased production efficiency, which is an essential factor to help manufacturers in this industry compete in the domestic and foreign markets.

3.23.4 Policy Recommendations

From the analysis of the other transportation equipment manufacturing industry, it can be seen that this industry had a continuous growth trend, and the growth rate of TFP remained at a good level. Production efficiency improvements, cost management and product development, and expanded markets will help this industry become more competitive in the future. The policy suggestions are as follows:

1. The motorcycle industry needs to develop product standards to support the announcement of the Thai Industrial Standards Institute to improve emission standards from Euro 3 to Euro 4, which are expected to come into effect in early 2020. It is likely that in the future, measures will be raised to Euro 5 as well. The issue that needs to be followed is the reorganization of the motorcycle excise tax structure from the original storage capacity of the cylinder to be stored according to the amount of carbon dioxide emissions, which will come into effect from January 1, 2020 onwards. Therefore, investment in research and development will be an essential factor that will enhance product features. It is necessary to develop and improve the production process to be efficient in reducing production costs. Higher product quality will help create more value for the product. In addition, expanding the market, especially in foreign countries, will increase sales and help to save on size.

2. Shipbuilding and aerospace industries are likely to receive positive benefits from significant government investment projects, especially the Eastern Economic Corridor (EEC) project. But in 2019, it may experience a slowdown due to sluggish exports and the tourism industry, partly affected by the trade war between the United States and China, including Baht appreciation. However, in the long run, these industries of Thailand will have the potential to increase their competitiveness. Thailand has strengths in being a transportation and cargo hub of Southeast Asia, which can attract tourists and foreign investment. It should increase production productivity through skill development, quality of machinery and equipment, technology and innovation, and the ability to manage various fields to be more efficient.

Table 3.35: Growth accounting and indicators of the manufacturing industry of other transport equipment

(A) Growth Accounting of the industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	11.90	0.15	0.84	10.91	5.18	5.73	13.50	0.44	0.96	12.10	5.61	6.48

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		0.91	0.91
Skilled labor-to-total labor proportion (%)			70.81
The average number of years of education received by labor (years)		12.26	12.34
On-the-job training proportion (%)			9.31
Proportion of automatic machinery (%)		32.61	33.29
Proportion of machinery and equipment under 5 years (%)		4.37	4.04
Management			
Capital			
Production cost-to-sales ratio (%)		83.31	82.99
Selling and administration expense to sales proportion (%)		5.83	4.91
Value-Added to sales ratio (%)		15.21	16.30
Raw material cost to production cost ratio (%)		82.70	80.95
Labor cost to total cost ratio		2.42	2.43

Indicators	2016	2017	2018
Finance			
Working capital ratio (times)		1.98	2.11
Debt to assets ratio (times)		0.42	0.41
Debt to equity ratio (times)		0.73	0.69
Innovation			
The proportion of investment in research and development to sales* (%)	0.18	0.10	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.24 TSIC 31: Manufacture of furniture

3.24.1 Industrial Structure

Furniture production (TSIC 31) is an economic activity of all types of furniture made from various materials (except stone, concrete or ceramics) for use in multiple places and purposes, except for the production of lamps, assembling and installation of furniture into sets, furniture partitions for laboratory equipment.

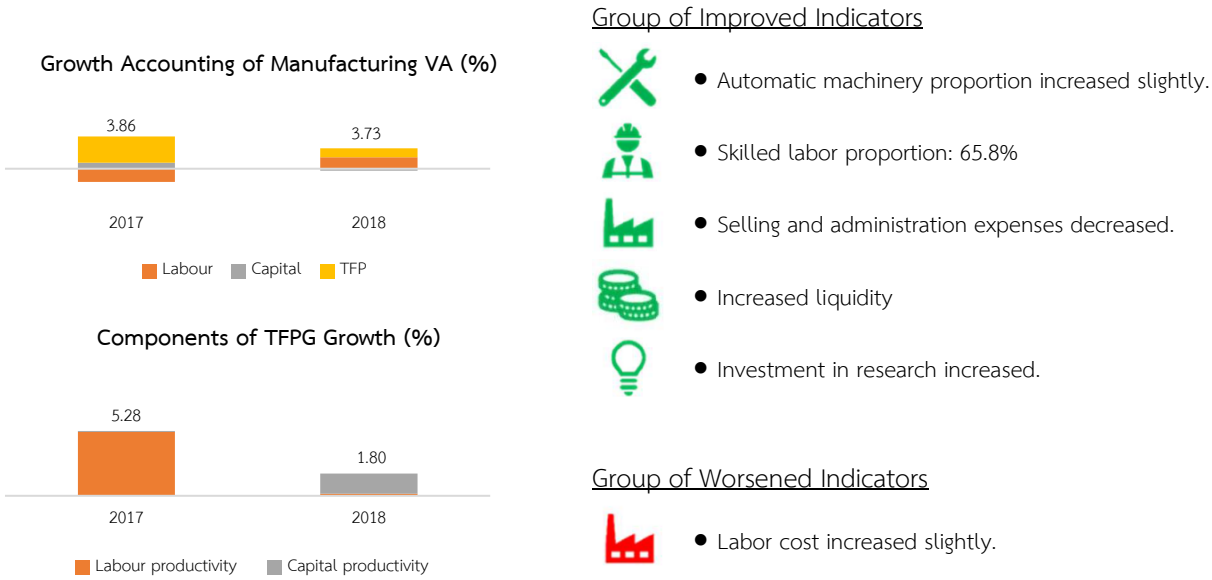
Data from the 2017 Industrial Census shows that this industry had juristic persons as manufacturers totaling 1,510 establishments. Of this number, there are 95 large firms, 296 medium firms, and 1,119 small firms, with a total workforce of 66,028 people, a total product sale value of 85,361 million Baht, representing a value-added of 28,305 million Baht. From the data, the average proportion of foreign shareholders was 67 percent. The export proportion averaged 51 percent and the import proportion of raw materials from overseas averaged 33.73 percent.

Furniture and parts exports in 2017 reached a total value of 1,185.17 million USD, with a growth rate of 3.48 percent compared to the same period last year. The top 5 export markets were Japan, the United States of America, China, Malaysia, and the United Kingdom. The value of exports was 610.96 million USD (51.55 percent of the total export value of furniture and parts) and had a growth rate of 1.11 percent. Considering the growth rate of the export market, China had the most significant growth at 23.74 percent (export value of 127.76 million USD), followed by India (22.99 percent), South Africa (19.5 percent), Myanmar (17.51 percent) and Brazil (16.43 percent), respectively. Considered at the product level, it was found that furniture parts had the highest export value at 450.98 million USD, followed by wooden furniture and other furniture.

3.24.2 Results of production productivity analysis and key indicators

In the 2018 survey, the number of sample companies for the production of furniture was 23 enterprises, comprising 14 large firms, 4 medium, and 5 small firms. The survey covered 32.3 percent of TSIC 31's total product sales. The types of products surveyed included manufacturing of wooden furniture, metal furniture, mattress and bases, sofa, all types of furniture and leather furniture, etc. According to data processed from the survey, in 2018, the furniture industry decreased in Value-Added by 3.73 percent from the previous year, which decreased from capital factors and the TFP by 0.38 percent and 1.80 percent, respectively. However, the value-added from the use of labor factors increased by 2.31 percent.

Figure 3.25: The rate of change of Value-Added and labor, capital, and TFP factors; improved and worsened indicators in the furniture industry



Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of key indicators in the furniture production industry in 2018 compared to the previous year, showed that the ratio of capital to labor increased from 1.34 to 1.4 million Baht per person. In 2018, the proportion of skilled labor to total labor was 66.59 percent. Considering the cost-to-sales ratio, it was found that the production costs increased from 77.08 percent to 78.04 percent, while sales and administrative expenses decreased from 19.15 to 18.06 percent. The proportion of Value-Added to sales increased from 16.04 to 17.31 percent, reflecting the potential to create Value-Added. This industry had grown liquidity and reduced debt creation. The working capital ratio increased from 1.04 to 1.11 times, while the debt to assets ratio decreased from 0.58 to 0.55 times, and the debt to equity ratio decreased from 1.41 to 1.21. Data from the Office of the National Higher Education Science Research and Innovation Policy Council (NXPO) found that the proportion of research and development investment to sales in this industry in 2017 was 0.15 percent, down from 0.08 percent in the previous year.

In summary, the survey results showed that in 2018, the furniture production industry had decreased value-added growth. This is due to the expansion of capital factors and the decrease of the TFP, while the labor factors had a positive effect on the growth of Value-Added. The proportion of Value-Added to sales increased, showing that it has the potential to create more value in the industry. The percentage of selling and administrative expenses reduced, which reflects the ability to manage production costs better. The financial liquidity factor also improved. In addition, the industry still tended to create lower debt, and the proportion of investment in research and development increased.

3.19.3 Problems/Obstacles

The top three problems and obstacles encountered by the sample group were the efficiency of labor/personnel, efficiency of machinery/equipment, and raw material costs. It can be seen that business operators in the sample group placed importance on labor factors as it is an industry that requires fineness and sophistication in the production of goods. It also focused on machinery and equipment with excellent production efficiency to produce products that meet standards and quality to meet customers' needs. The problems that the sample group was concerned with in the last rank were raw material costs such as various types of wood, rattan, and rubber. If these raw materials have higher prices, it will directly affect the production cost of the operators.

3.19.4 Policy Recommendations

The production of furniture in Thailand has strengths or advantages over competing countries in terms of having a lot of resources or raw materials in the country such as rubber and wood. In addition, skilled labor in this industrial sector is famous for its fineness. Therefore, the product has a well-known and accepted form and quality by the international market. Business operators/manufacturers in the industry can adjust production to meet the needs of customers as well. However, Thailand still has problems and obstacles concerning rising raw material costs. Since the price of lumber in the past year has increased, it has affected production cost. There is also a shortage of labor in the industrial sector. Therefore, industrial manufacturers should adjust to the industry's situation, and the government should support it as follows:

1. The government should support and promote the development of skilled labor in the industry to prevent the shortage of labor in the industrial sector.
2. Encourage Thai businesses to use other raw materials in the case of increased prices of primary raw materials, such as using different types of wood instead of wood that rose in price. Thailand has the advantage of finding raw materials, which will help reduce the production cost of business operators.
3. Create the image of Thai furniture to be unique and different, to create more value for the product by relying on the outstanding features of fineness in skills.
4. Promote exports by focusing on potential markets such as the United States, China, Japan, and India.

Table 3.36: Growth accounting and indicators of furniture industry

(A) Growth Accounting of the Industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	3.86	-2.66	1.24	5.28	5.21	0.07	3.73	2.31	-0.38	1.80	0.17	1.63

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		1.34	1.40
Skilled labor-to-total labor proportion (%)		n.a.	66.59
The average number of years of education received by labor (years)		11.48	11.48
On-the-job training proportion (%)			1.38
Proportion of automatic machinery (%)		31.78	31.99
Proportion of machinery and equipment under 5 years (%)		0.00	0.00
Management			
Capital			
Production cost-to-sales ratio (%)		77.08	78.04
Selling and administration expense to sales proportion (%)		19.15	18.06
Value-Added to sales ratio (%)		16.04	17.31
Raw material cost to production cost ratio (%)		47.76	46.62
Labor cost to total cost ratio		4.43	4.63
Finance			
Working capital ratio (times)		1.04	1.11
Debt to assets ratio (times)		0.58	0.55
Debt to equity ratio (times)		1.41	1.21
Innovation			
The proportion of investment in research and development to sales* (%)	0.08	0.15	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.25 TSIC 32: Other manufacturing

3.25.1 Industrial Structure

The manufacture of other products (TSIC 32) is an economic activity of the production of various products not classified elsewhere. As the last subcategory in output, the classification criteria for large groups, subgroups, and activities in this subcategory cannot be considered from the production process, raw materials used, and the use of the products.

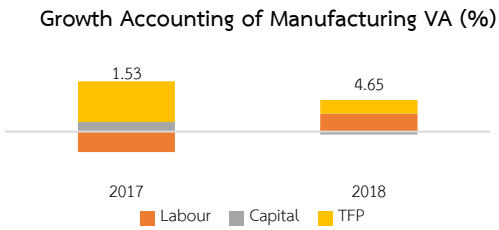
Data from the 2017 Industrial Census shows that this industry had juristic persons as manufacturers totaling 1,393 establishments throughout the kingdom. Of this number, there were 168 large, 320 medium, and 904 small enterprises, with a total labor force of 119,1350 people. The product value was 175,849 million Baht and a value-added of 58,634 million Baht. From the data, the proportion of foreign shareholders was 61 percent. The export proportion was 68 percent, and the import proportion of raw materials was 48 percent.

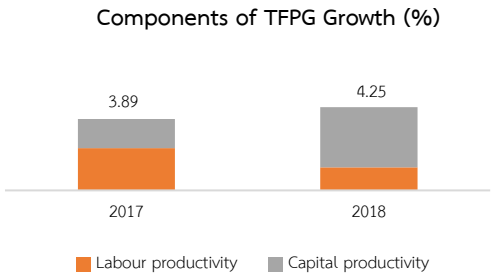
This subcategory consists of various industries, including jewelry and gemstones, medical tools and equipment production, and other output. Here, the most critical sector is gem and jewelry production. The production and distribution of the gems and jewelry industry in Thailand during 2018, found that exports of all gems and jewelry products decreased by 13.77 percent compared to the same period last year, valued at 9,182.77 million USD. However, considered by product type, the export value of imitation jewelry increased by 25.39 percent, focusing on the export of small items (casual). In addition, the export of jewelry (jewels, pearls) and authentic jewelry (silver and gold jewelry) grew in export value. Therefore, it reflects that during the past year, the industry concerning the production of gems and jewelry expanded and grew well. However, there are still risk factors that may obstruct Thai exports whether it is a matter of the global political situation such as the trade war between China and the United States, and the United Kingdom's withdrawal from the European Union (Brexit), which will affect the economic conditions of trading partners and Thai exports.

3.25.2 Results of Production Productivity Analysis and Key Indicators

In the 2018 survey, the number of sample establishments manufacturing other products (TSIC 32) was 26 establishments, divided into 12 large, 4 medium, and 10 small enterprises. The surveyed samples covered approximately 95.9 percent of TSIC 32's total production value. The types of products surveyed were the manufacture of jewellery, bijouterie and related articles, medical and dental instruments and supplies, dolls, toys, sport goods, stationeries, etc. According to data processed from the survey, it was found that, in 2018, the manufacturing industry of other products increased in value-added by 4.97 percent from the previous year, which increased from the TFP by 4.55 percent. The labor factor also contributed to the growth of value-added by 2.81 percent, but the capital factor caused the value-added to dropped 2.39 percent.

Figure 3.26: The rate of change of Value-Added and labor, capital, and TFP factors & improved and worsened indicators of the other manufacturing





Group of Improved Indicators

- Automatic machinery proportion increased slightly.
- Skilled labor proportion: 70%

Group of Worsened Indicators

- Administration expenses increased.
- Administration costs increased.
- Decreased liquidity
- Debt ratio increased
- Investment in research decreased.

Source: Processed from survey data by the Fiscal Policy Research Institute Foundation

The analysis of key indicators of the other products manufacturing industry in 2018 compared to the previous year showed that the ratio of capital to labor decrease slightly from 0.18 percent to 0.17 percent, in million Baht per person. The machinery's quality decreased from 28.07 percent to 28.02 percent, while the ratio of skilled labor to total labor in 2018 was 69.76 percent. Considering the cost-to-sales rate, the cost of production decreased from 92.0 percent to 90.54 percent, while sales and administrative expenses increased from 4.59 percent to 5.19 percent. The proportion of Value-Added to sales increased from 12.28 percent to 15.85 percent. The trend of financial liquidity decreased, and debt increased. The working capital ratio decreased from 5.85 to 5.69 times, and the debt-to-asset rate increased slightly from 0.16 to 0.17 times. The debt-to-equity ratio increased from 0.19 to 0.21. Data from the Office of the National Higher Education Science Research and Innovation Policy Council (NXPO) found that the proportion of research and development investment to sales in this industry in 2017 was 0.13 percent, down from 0.22 percent in the previous year.

In summary, the survey results show that in 2018, the furniture manufacturing industry had higher Value-Added. This was due to the positive growth of TFP and a slight increase in the use of labor factors. Meanwhile, the use of capital factors decreased and negatively affected the Value-Added. The ratio of Value-Added to sales increased slightly, reflecting the potential and trends in value creation and good cost management in the industry. However, the financial situation had improved risks from reduced financial liquidity and the tendency to increase debt.

3.25.3 Problems/Obstacles

The top three problems and obstacles encountered by the sample group were labor costs, labor/personnel efficiency, and financial costs. It can be seen that business operators in the sample group gave importance to labor in the industry in terms of labor costs and efficiency. The production of gems and jewelry requires excellent resolution and blending skills in art at every step. Therefore, labor skills in the industry are relatively limited, both in terms of design and production. In addition, financial costs are another important problem, as it requires modern technology to be used in the production process to get a beautiful and standardized product for exports.

3.25.4 Policy Recommendations

The main factors that determine the demand for products in this industry are both domestic and foreign customers. Gems and jewelry are considered commodities in the fashion group; therefore, entrepreneurs need to produce and develop products to be modern and meet the needs of customers today. However, exporters in the Thai industry have an advantage in the export market and among trade partners in the world market. Thailand is one of the world-famous gemstone trading markets. Also, Thailand has the advantage of skilled labor in the industry in terms of skills and the design of jewelry, but personnel/labor are still in shortage, which is in line with the problems and obstacles that the business operators were concerned about. Therefore, industrial manufacturers should adapt to the situation of the industry, and the government should support as follows:

1. Both the government and business operators should follow the global political situation such as the trade war of China and the United States and the United Kingdom's withdrawal from the European Union (Brexit). These events all have an impact on Thailand's exports. The government should prepare countermeasures by finding new export markets for entrepreneurs and increase sales and the export value in the industry.
2. Promote skill development in product design and production for personnel/labor in the industrial sector to raise the quality and standard of Thai gems and jewelry.

3. Supporting expenses or capital costs for business operators, especially SMEs, for the development of technology efficiency used in the production process. This will help increase the value of exports among SMEs.

Table 3.37: Growth accounting and indicators of other manufacturing

(A) Growth Accounting of the industry (%)

Item	2017						2018					
	Value-Added	Source of Value-Added					Value-Added	Source of Value-Added				
		Labor	Capital	TFPG	Source of TFPG			Labor	Capital	TFPG	Source of TFPG	
					Labor Productivity	Capital Productivity					Labor Productivity	Capital Productivity
Account of Growth (%)	1.53	-1.04	-1.31	3.89	2.30	1.59	4.97	2.81	-2.39	4.55	1.25	3.30

(B) Key Indicators

Indicators	2016	2017	2018
Quality of Production Factors			
Capital-to-labor proportions (million baht/person)		0.18	0.17
Skilled labor-to-total labor proportion (%)			69.57
The average number of years of education received by labor (years)		12.45	12.41
On-the-job training proportion (%)			12.63
Proportion of automatic machinery (%)		39.79	39.96
Proportion of machinery and equipment under 5 years (%)		28.09	28.05
Management			
Capital			
Production cost-to-sales ratio (%)		92.02	90.62
Selling and administration expense to sales proportion (%)		4.46	5.03
Value-Added to sales ratio (%)		12.31	15.85
Raw material cost to production cost ratio (%)		70.06	74.42
Labor cost to total cost ratio		7.90	10.26
Finance			
Working capital ratio (times)		5.92	5.76
Debt to assets ratio (times)		0.16	0.17
Debt to equity ratio (times)		0.18	0.21
Innovation			
The proportion of investment in research and development to sales* (%)	0.22	0.13	n.a.

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: * Data from the Office of National Higher Education Science Research and Innovation Policy Council (NXPO)

3.26 Testing Factors That Determine Overall Productivity

Testing the factors that determine the overall productivity of the industry will create awareness of the critical factors that determine productivity overall and by the production sector in the past. The test relies on variable data and indicators calculated from the field survey and estimation of regression.

In the form of a panel regression of the data from 2016 to 2018, the details are as follows. For the industry as a whole, the critical determinants of the TFP were the concentration of machinery used to labor, reflected from the ratio of fixed assets to the number of workers. The rate has a positive impact on TFP if the ratio of machinery use is higher, indicating that the machinery that can operate on its own and workers require the knowledge and skills to work and supervise these machines. Therefore, resulting in increased production capability. Meanwhile, managing production costs based on the indicator of the total cost to sales ratio, which negatively affects TFP, includes the management of cost and operating expenses with having a low proportion of the total cost. In addition, the nature of operations among most Thai industrial operators is still in the form of OEM; therefore, the focus is on cost management rather than creating value in innovation.

In the case of the industry in each of the production branches, the key indicators for TFP are the quality of production factors. In particular, the concentration of machinery use to labor is statistically significant in 12 production branches (out of 24 branches). Other indicators of quality are age and average education, which indicates the workers' experience and knowledge, including the proportion of new machinery and automated machinery, which reflects the efficiency of the machinery. These factors were found to be less statistically significant. However, the development and improvement of the quality of these production factors need to be carried out concurrently with both labor and machinery, as there is a direct connection between the production and operational process.

Meanwhile, other indicators had a little statistical significance, including the group of links with foreign countries in both the proportion of exports and import of raw materials. It can generate additional income directly from an increasingly extensive market, including indirect benefits from the absorption and transfer of various technologies and the development of trade relationships. If these indicators grow, they are linked to the world value chain, therefore increasing the TFP. This link with foreign countries is necessary to take into account the net interests of business operators. There should be a long-term approach for enhancing the role in this international supply chain as well. Management indicators of significance were cost management by considering the ratio of the total cost to sales. This is an essential primary variable in business operations, especially the operational characteristics of most Thai manufacturers with the OEM format. In addition, there are significant fundamental indicators of innovation. The proportion of investment in research and development to sales is an indicator of the ability to create value from different and high value-added products and more efficient production processes. However, the critical constraints on innovation indicators are the time requirement and ongoing capital. Most by-products and results are not shown in the short-term, which is an essential limitation for SMEs.

However, test results should be monitored and data collected for further testing, with indicators having no statistical significance. There is still importance in tracking and promoting. The test results of the indicators still have limitations on the completeness and characteristics of the data and reflect only past behavioral traits.

Table 3.38: Summary of the test of the factors determining the overall production productivity

Sectors		Quality of production factors					Linking the global value chain		Management			Innovation
		Concentration of machine use	Labor experience	Education level	Proportion of new machines	Proportion of automated	Ratio of proportion	Proportion of imported raw	Cost-to-sales ratio	Current ratio	Debt to assets ratio	Proportion of R&D investment
Overall		+							-			
10	Food Products	+										
11	Beverages	+										+
12	Tobacco											
13	Textiles										-	
14	Wearing Apparel	+										
15	Leather Products	+										
16	Wood	+				+						
17	Paper											

Sectors		Quality of production factors					Linking the global value chain		Management			Innovation
		Concentration of machine use	Labor experience	Education level	Proportion of new machines	Proportion of automated	Ratio of proportion	Proportion of imported raw	Cost-to-sales ratio	Current ratio	Debt to assets ratio	Proportion of R&D investment
18	Printing											
19	Petroleum Products			+								
20	Chemicals	+						+				
21	Pharmaceuticals										-	
22	Rubber and Plastics	+										
23	Non-Metallic Mineral	+										
24	Basic Metals											
25	Fabricated Metal											
26	Electronic		+					+	-			
27	Electrical Equipment	+										
28	Machinery								-			
29	Motor Vehicles	+					+		-			
30	Other Transport											+
31	Furniture	+		+								
32	Other Manufacturing			+								
33	Repair	+										

Source: Survey results, according to Ror.Ngor. 9 in 2018 form of the Office of Industrial Economics, compiled and processed by the Fiscal Policy Research Institute Foundation.

Note: Green indicates the positive impact on TFP, and orange means the negative effect on TFP.

3.27 Readiness for Industry 4.0

The survey results of business operators in the manufacturing industry regarding readiness for development into an Industry 4.0 from Table 3.39 shows that overall, business operators prioritized intelligent products, with a weight of 17 percent. This was followed by a smart factory and smart operations, which accounted for 16 percent and 15 percent.

Table 3.39: Weight on readiness to enter into business 4.0

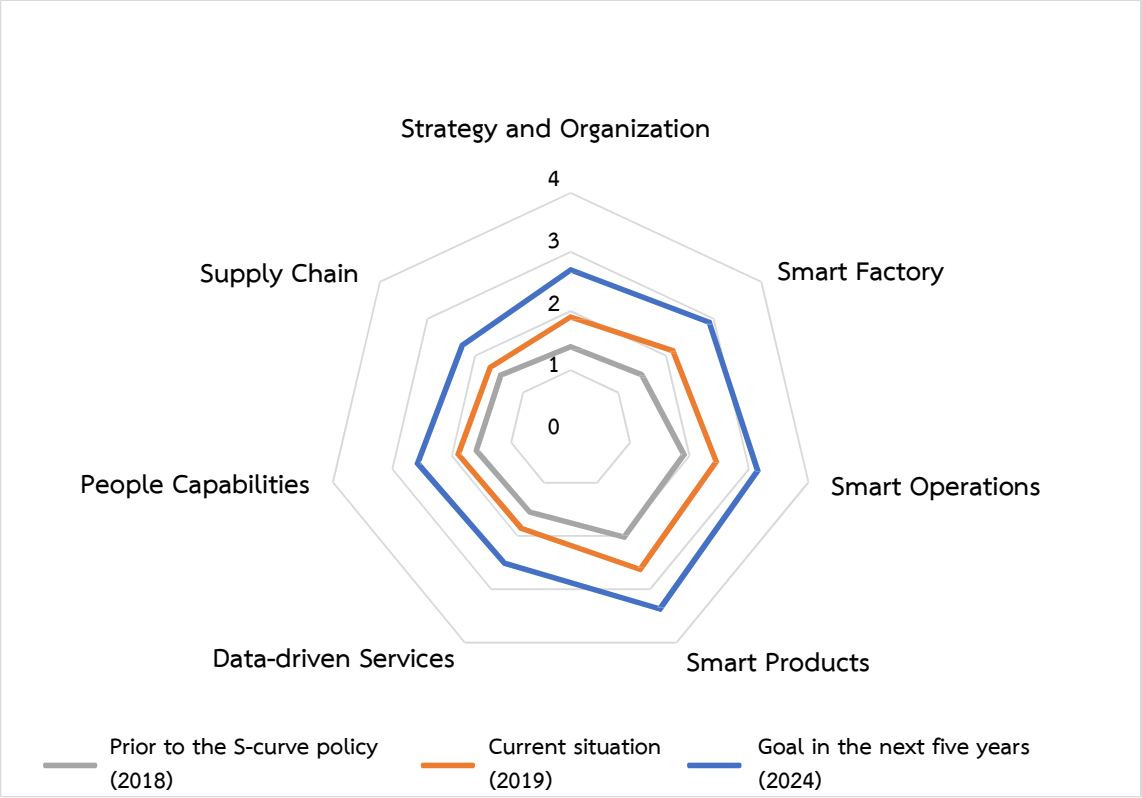
Dimension	Weight
Strategy and Organization	14
Smart Factory	16
Smart Operations	15
Smart Products	17
Data-driven Services	13
People Capabilities	14
Supply Chain	11

Source: Source: The Fiscal Policy Research Institute Foundation (FPRI) is compiled using data from a field survey in 2019.

For an overview of business operators in the readiness for an industry 4.0, the data compares the current situation (2019) to the period of 5 years ago (2015) and the goal of preparedness in supporting the entry into an industry 4.0 in the next five years (2024). The results from the self-assessment of business operators from the sample show that businesses are currently ready for support into becoming an industry 4.0 at the beginning stages, close to the middle level, or equal to 2.2 points. They are the most prepared in terms of personnel capabilities but are least ready in terms of strategy and organization. Compared to the current situation and the last five years, found that the business operators improved from 2015 at the initial level (1.68 points) with the development of readiness in the ability of personnel to support the development of industry 4.0 the most.

The target for the next five years, in 2024, for the overall manufacturing industry, is the preparation to enter the industry 4.0 at an average of 2.86 points, which is a moderate level. The aspect which is most likely to be ready is the readiness of personal capabilities. The least is the strategy and organization, including intelligent operations. However, business operators in the manufacturing industry still aim to improve the personnel's ability to be compatible with the industry 4.0, which is a necessary foundation to take advantage of the infrastructure, including information and various systems to be truly beneficial

Figure 3.27: Readiness of entrepreneurs in industrial sectors entering into the Industry 4.0



Source: Source: The Fiscal Policy Research Institute Foundation (FPRI) is compiled using data from a field survey in 2019.