Executive Summary

Survey and prepare a report on productivity and performance of Thai industry (2019) Project
Fiscal Year 2020

January 2021

Executive Summary

Economic growth and development have an important fundamental from both the domestic and external resources in the economy combine with the capability of efficient resource utilization and the utility maximization that are a primary determinant of competitiveness in the global economy and source of difference in an economic growth path. Thus, every sector in the economy is important in an efficiency creation and competitiveness development to achieve economic growth and stability goal and increase competitiveness in the global value chain.

The Office of Industrial Economics (OIE), the Ministry of Industry (MOI) conducts a survey and a report on productivity and performance of Thai industry (2019) to support policy formulation, measure issuing, and public sector planning as well as business plan development for the private sector. This study gathers firm-level data from 3,128 enterprises to analyze the current state of Thai industry and to construct indicators, estimate Total Factor Productivity (TFP) and examine TFP growth (TFPG) at the national level, the industry level, and the enterprise level.

An analysis of the productivity and performance of industry investigate the value added, defined as the economic value generated by adding input factors into production or service processes to create finished goods or service. By using the growth accounting model, we can break down the sources of value-added growth into the changes of key input factors, namely labor and capital, and the Total Factor Productivity Growth (TFPG).

TFPG is a measure of the value-added growth caused by other factors, beyond the amount of labor and capital used in production. Generally, TFPG reflects an increase in value added created by quality factors such as the quality of labor and capital factors, management capability, technology advantage, research and development advancement, brand royalty, including various relevant market factors (both demand and supply sides).

Hence, TFP is an important factor of manufacturing competitiveness development because TFP can create value-added under a limitation of inputs and resource constraint especially labor. However, TFP development and improvement is a challenge and rely on coordination of all sector in the economy including ecosystem support policy and the business-friendly environment from the government, and efficient and sustainable operations from the private sector by apply and investment in knowledge, technology, and innovation for produce high-value products and services.

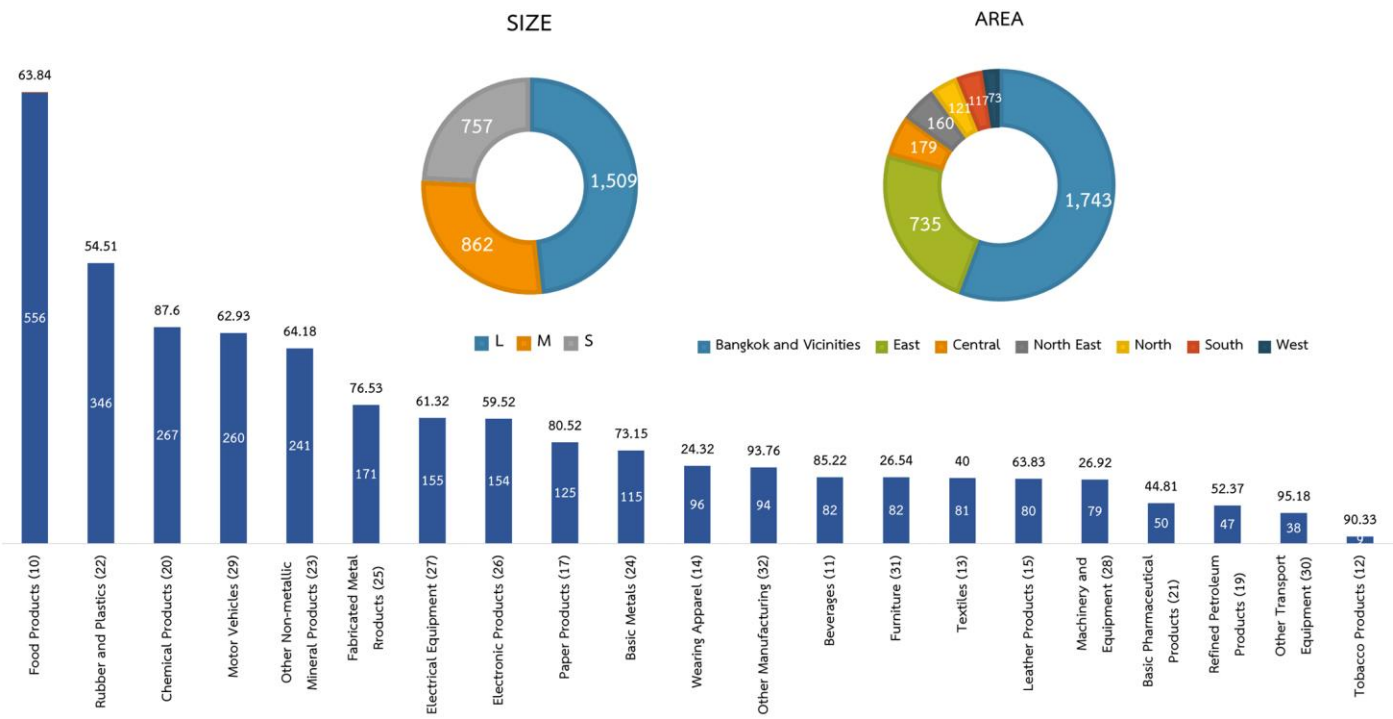
Survey Results and Industry Structure

The survey sampling in 2020 is designed to cover 21 manufacturing sectors under 2-digit Thailand Standard Industrial Classification (TSIC)[1], size of enterprise (small, medium and large), and region (Bangkok and vicinities, Central, West, East, Northeast, South, and North). The size of sample is 3,128 and it covers 61.78% of the total sales of the juristic persons in the manufacturing sector in the 2017 industrial census.

The manufacturing sectors with the highest number of samples were TSIC: 10 Manufacture of food products, 556 samples (17.77% of total samples), TSIC: 22 Manufacture of rubber and plastics products, 346 samples (11.06% of total samples), and TSIC 20: Manufacture of chemicals and chemical products, 267 samples (8.54 % of total samples). The sampled enterprises were mostly large, 1,509 samples (48.24% of total samples) followed by medium, 862 samples (27.56% of total samples), and small, 757 samples (24.20% of total samples). In term of the region, the samples were mostly collected from Bangkok and vicinities, 1,743 samples (55.72% of total samples), followed by East, 735 samples (23.50% of total samples), and Central, 179 samples (5.72% of total samples)

[1] 2-digit TSIC industries includes TSIC: 10 Manufacture of food products, TSIC: 11 Manufacture of beverages, TSIC: 12 Manufacture of tobacco products, TSIC: 13 Manufacture of textiles, TSIC: 14 Manufacture of wearing apparel, TSIC: 15 Manufacture of leather and related products, TSIC: 17 Manufacture of paper and paper products, TSIC: 19 Manufacture of coke and refined petroleum products, TSIC: 20 Manufacture of chemicals and chemical products, TSIC: 21 Manufacture of basic pharmaceutical products and pharmaceutical preparations, TSIC: 22 Manufacture of rubber and plastics products, TSIC: 23 Manufacture of other non-metallic mineral products, TSIC: 24 Manufacture of basic metals, TSIC: 25 Manufacture of fabricated metal products, except machinery and equipment, TSIC: 26 Manufacture of computer, electronic and optical products, TSIC: 27 Manufacture of electrical equipment, TSIC: 28 Manufacture of machinery and equipment, not elsewhere classified, TSIC: 29 Manufacture of motor vehicles, trailers and semi-trailers, TSIC: 30 Manufacture of other transport equipment, TSIC: 31 Manufacture of furniture, and TSIC: 32 Other manufacturing

Figure 1 : The Number of Samples Classified by TSIC, Size and Area



Source: Compiled and calculated by FPRI based on 2019 FF9 survey data, OIE

Note: Numbers in black color represents coverage (%) and numbers in white color represents numbers of sample

The analysis of TFP can classified by various criteria such as size of business (large, medium, and small), region (Bangkok and Vicinity, North, Northeast, Eastern, Central, Western and Southern regions), and manufacturing sector base on TSIC. The results can summarized as follows.

1) By size of business: SMEs were sensitive to economic variation and had lower adaptive capacity than large enterprises. For large enterprises, they had high market accessibility, the high skill of brand and product management, and risk-taking, and they also are rich resources to invest in machinery and labor quality as a result they can create high value-added. While small enterprises were exposed to greater debt risk and heavily relied on government support.

2) By region: The entrepreneurs in the Eastern and Bangkok and vicinity can access business promotion and have better adaptive capacity than in other regions. There are large businesses concentrated and/or being a promoted operator of foreign investment. Hence, they have high investment potential, and the use of machinery and equipment and likely to increase. In addition, the concentration of infrastructure readiness and business center make Bangkok was the highest producer of ODM and OBM. It also has the highest share of exports and utilization of E-Commerce. While the eastern region a target area for promoting investment

and has important industrial estates, well-established infrastructure causes lower operating costs. Moreover, it was a high potential area for developing innovation to support new target industries.

3) By sector: The high growth manufacturing sectors had support factors including good costs management by lower total costs to sales ratio and higher in value-added to sales ratio, and focus on labor skill development. While The low growth manufacturing sectors showed an adaptation by a rise in capital usage. Moreover, the medium-high and high technology sectors have greater ODM and OBM production, higher inputs quality both labor and capital as a result they can create higher value-added. For the medium to the high technology sector, they presented an increase in R&D to sales ratio. While the low technology sector is labor-intensive and high labor cost and showed a drop in R&D to sales ratio.

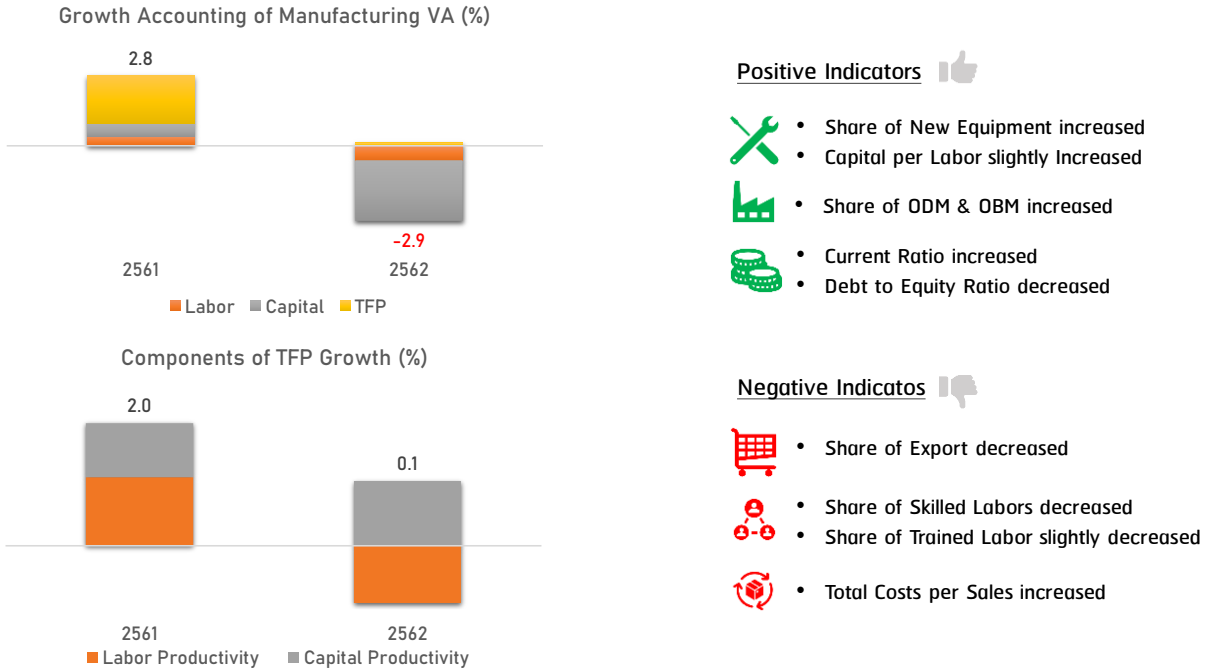
Results of Productivity and Performance Analysis

1. Overall Manufacturing Industry

In 2019 the value-added of the Thai manufacturing sector dropped 2.94% from last year's level due to a decline in labor factors and capital factors which fell at the rate of 2.47% and 0.59%, respectively. While the Total Factor Productivity Growth (TFPG) has continued to grow at the slower rate of 0.12% which was contributed from a decline in labor productivity of 0.91%, but capital productivity still rose 1.03%.

Our finding shows that positive factors for TFP growth included the larger share of less-than-5-years-old machinery, the higher ratio of machines to labor, and the larger share of the ODM and OBM production as a result they had a higher value-added to sales ratio. At the same time, they had lower financial risk as their liquidity and debts were improving. Currently, these enterprises will face some risk factors such as sluggish market conditions; sales shrinking, and a drop in exporting. Labor quality has decreased due to the reduced share of skilled workers, and training. While the cost of labor was increased and the trend of investment in research and development slows down.

Figure 2 : Value Added Growth and Components of Overall Manufacturing Industry



Source: Compiled and calculated by FPRI based on 2019 FF9 survey data, OIE

2. Status of Manufacturing Industry Classified by Value Added Growth and TFPG

The status evaluation of the manufacturing sector considered from value-added growth and TFP growth (TFPG) of the industry which can be separated into 4 groups namely:

- **Good group:** whose VA and TFP growths are positive
- **Poor group:** whose VA and TFP growths are negative
- **Better group:** whose VA growth is negative but TFP growth is positive.
- **Worsening group:** whose VA growth is positive but TFP growth is negative

When we separated the group of manufacturers by using value-added growth and TFPG showed that the good group was the manufacturers in Eastern which is the investment promote target area, and/or the manufacturers in manufacturing of pharmaceutical, and machinery which are target sectors and high technology sector, and beverage, and leather which have high market growth. While other manufacturers had a reduction in value-added. Moreover, the manufacturers that are larger enterprises, and/or the manufacturers in Bangkok and vicinity still had positive TFPG represented better resource and government support accessibility as a result they were less sensitive to economic variation than other groups.

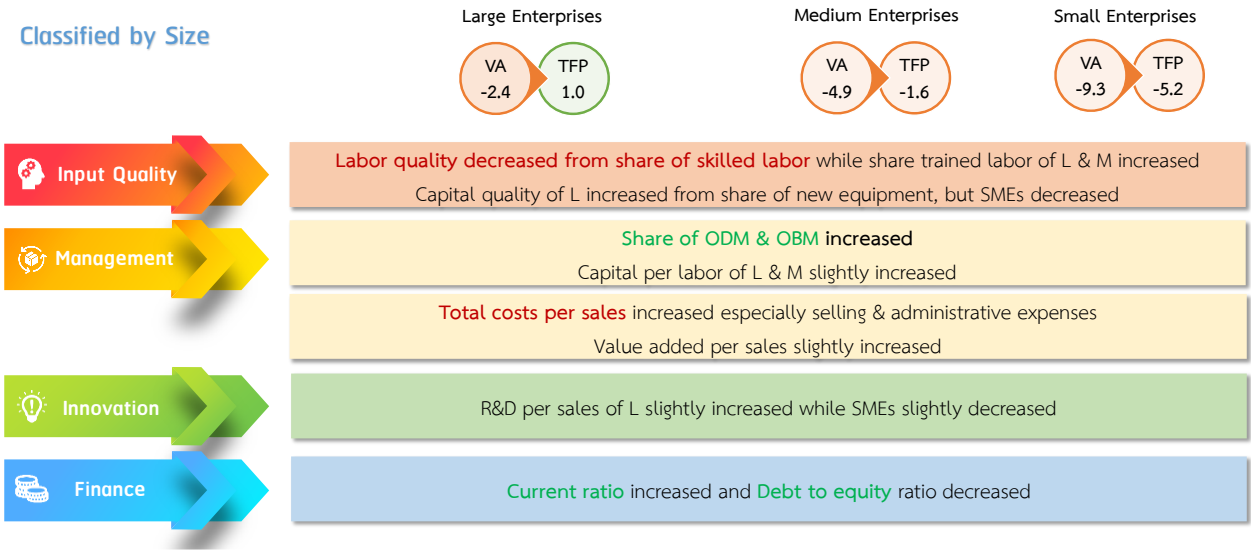
Table 1 : The Group of Manufacturers separated by Value Added Growth and TFPG

Better group: VA growth is negative but TFP growth is positive	Good group: VA and TFP growths are positive
• Size: Large • Region: Bangkok and vicinity • Sector: Food, Non-metallic, Furniture, Electronic, Plastic, Automotive, Electrical, Basic Metal, and Textile	• Region: Eastern • Sector: Beverage, Leather, Pharmaceutical, and Machinery
Poor group: VA and TFP growths are negative	**Worsening group: VA growth is positive but TFP growth is negative**
• Size: Medium, and Small • Region: Central, Northern, Southern, Northeastern, and Western • Sector: Chemical, Paper, Rubber, Fabricated Metal, Other Transports, Apparel, Other Products, Petroleum, and Tobacco	

Source: Compiled and calculated by FPRI based on 2018 FF9 survey data, OIE

1) By size of business: When we compare the manufacturers of different business sizes, each group of enterprises had a falling value-added and TFP in 2019, except for the large businesses that TFP expanded at a slower rate, although value-added dropped. While medium and small businesses had a decline in both value-added and TFP. The main positive indicators among different business sizes were the development in the production model and financial status. What made up for such differences was that large enterprises had a better quality of capital from the larger portion of new machinery and a higher level of R&D investment. Moreover, large enterprises were more capital intensive, had a higher proportion of labor with training, and a higher ratio of value-added to total sales. The factors that had negative impacts on the TFPG were sluggish market conditions, leading to lower sales and exports, worsening quality of labor from the lower share of skilled labor, and higher costs, especially sales and administrative costs. The distinct characteristics of medium and small enterprises were that they had lower quality of capital and lower investment in R&D.

Figure 3 : An Analysis of Manufacturing Industry by Business Size

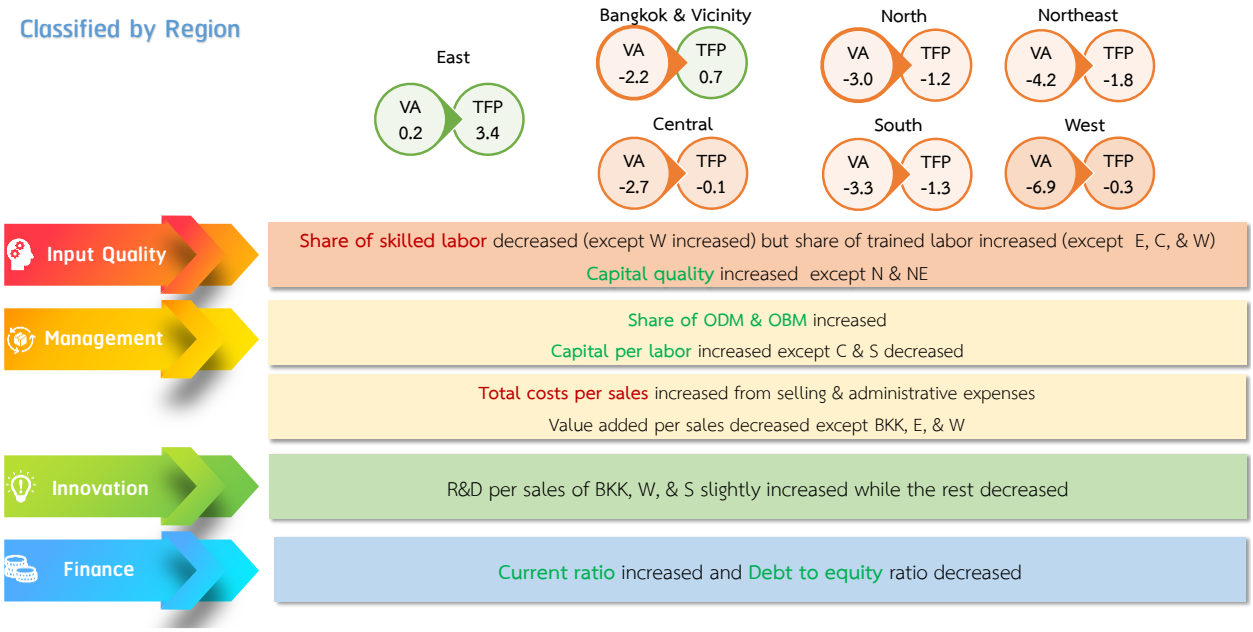


Source: Compiled and calculated by FPRI based on 2019 FF9 survey data, OIE

2) By region: In 2019, manufacturers in most regions faced a decrease in value-added and TFP, except for the Eastern region where value-added and TFP expanded and Bangkok and Vicinity where TFP expanded. The supporting factors for TFPG in all regions were a better production model and better financial status. In most regions, enterprises had a better capital-labor ratio, higher proportion of trained labor, and better quality of capital. By contrast, the negative factors for TFPG were higher costs. Furthermore, enterprises in most regions had to face sluggish market conditions, as well as declining quality of labor. We also found that the ratio of value-added to sales was falling, and the share of R&D investment was dropping.

Moreover, the government should support and diversify the skill of labor and training in various fields; more thoroughly and more intensively. To prepare the workforce for future industrial development and upgrading, it was also necessary to monitor the need to assist the entrepreneurs who have high risk in financial.

Figure 4 : An Analysis of Manufacturing Industry by Regions



Source: Compiled and calculated by FPRI based on 2019 FF9 survey data, OIE

3) By sector:

The analysis of the manufacturing industry by sector in 2019 showed that most of the value-added were shrink. There are only **4 sectors were a good status** TFP growths were positive namely **pharmaceutical and machinery** which was in the high technology industry, their markets had positive growth, and they were S-Curve industries. While **Leather and beverage** were in the low technology industry but their market growths were positive. Especially, leather products which were the raw materials of various industries and durable goods (such as automotive) have their export hike. For industries **were a poor status and need to improve their performance for the future namely tobacco, petroleum, apparel, other transport, paper, fabricated metal, and rubber**.

When we considered the analysis results of manufacturing subsectors classified by their value-added growth and TFPG, showed different main indicators of each group (Table 2).

Table 2 : Summary of Main Indicators of Manufacturing Sectors

Status	Positive Indicator	Negative Indicator
Good Group: 1) Beverage 2) Leather 3) Pharmaceutical 4) Machinery	Input Quality • Share of trained labor increased • Share of new equipment increased for machinery and beverage sector • Share of automation increased for pharmaceutical and leather sector	Input Quality • Share of skilled labor decreased (except pharmaceutical increased)

Status	Positive Indicator	Negative Indicator
	Management • Share of ODM & OBM increased (except beverage decreased) • Total costs per sales decreased from production costs (except machinery) • Value added per sales increased (except beverage slightly decreased) **Financial Status** • Current ratio increased and Debt to equity ratio decreased	
Better Group: TFPG > Average 1) Food 2) Non-metallic 3) Furniture 4) Electronics	**Management** • Share of ODM & OBM increased • Capital per labor increased (except furniture decreased) **Financial Status** • Current ratio increased (except furniture) • Debt to equity ratio decreased	**Input Quality** • Labor quality decreased from share of skilled labor (but share of trained labor of electronics & non-metallic increased) **Management** • Total costs to sales increased, • value added per sales decreased (except furniture which total costs per sales decreased and value added per sales increased) **Innovation** • R&D per sales decreased
TFPG < Average 5) Plastic 6) Automotive 7) Electrical 8) Basic Metal 9) Textile	**Input Quality** • Capital quality increased from share of new equipment (except basic metal & automotive) **Management** • Share of ODM & OBM increased **Financial Status** • Current ratio increased and Debt to equity ratio decreased	**Input Quality** • **Labor quality** decreased except basic metal increased **Management** • Total costs per sales increased especially selling & administrative expenses • Value added per sales decreased (except basic metal & automotive)
Poor Group: Medium & High Technology 1) Chemical 2) Rubber	**Management** • Share of ODM & OBM increased • Capital per labor slightly increased	**Input Quality** • **Labor quality & capital quality** decreased (except labor quality of chemical slightly increased)

Status	Positive Indicator	Negative Indicator
3) Other Transports 4) Other Products	**Financial Status** • Current ratio increased (except other transport decreased) • Debt to equity ratio decreased (except other transport increased)	**Management** • **Total costs per sales** increased (except other transport) **Innovation** • **R&D per sales** decreased (except other products slightly increased)
<u>Low Technology</u> 5) Paper 6) Fabricated Metal 7) Apparel 8) Petroleum 9) Tobacco	**Management** • Share of ODM & OBM increased (except apparel & papers) • Capital per labor increased (except apparel & papers) **Financial Status** • Current Ratio increased (except apparel unchanged)	**Management** • Total costs per sales increased • Value added decreased (except papers slightly increased)

Source: Compiled and calculated by FPRI based on 2018 FF9 survey data, OIE

Overall industry and almost manufacturing sector still had positive TFPG continuously especially the medium-high and high technology sectors had higher TFPG than the others. In addition, the positive and increase in TFPG were pharmaceutical and machinery. While the negative and decrease in TFPG were the medium and low technology sectors including apparel, tobacco, and rubber. Moreover, there were the sector TFPG became negative namely other transports, chemical, other products, petroleum, paper, and fabricated metal (Table 3).

Table 3 : The Growth Accounting of the Manufacturing Industry by Sector (%)

Growth Accounting (%)		2018						2019					
			VA Contributed by						VA Contributed by				
						TFPG Contributed by						TFPG Contributed by	
TSIC	Sector	Value Added	Labor	Capital	TFPG	Labor Productivity	Capital Productivity	Value Added	Labor	Capital	TFPG	Labor Productivity	Capital Productivity
10	Food	1.38	0.94	1.26	-0.82	-0.03	-0.80	-2.20	-2.30	-0.40	0.50	0.84	-0.35
11	Beverage	-3.97	-1.17	-1.41	-1.39	0.11	-1.49	6.18	1.31	3.03	1.83	0.35	1.48
12	Tobacco	-61.45	2.60	13.61	-77.66	-29.69	-47.97	-12.47	-3.44	-4.76	-4.27	-2.06	-2.21
13	Textile	2.84	-0.98	1.14	2.68	2.71	-0.04	-6.89	-0.73	-6.26	0.10	-3.37	3.47
14	Apparel	3.77	4.06	0.34	-0.63	-1.09	0.47	-5.58	1.78	-1.60	-5.76	-6.08	0.32
15	Leather	1.02	-0.15	0.21	0.96	0.91	0.05	2.67	-5.18	-0.52	8.37	7.13	1.25
17	Paper	3.81	1.34	0.42	2.06	0.89	1.17	-4.09	0.97	-0.95	-4.11	-3.35	-0.76
19	Petroleum	9.10	0.41	3.09	5.60	2.38	3.22	-8.03	0.38	-2.87	-5.54	-2.00	-3.55

Growth Accounting (%)		2018						2019					
			VA Contributed by						VA Contributed by				
						TFPG Contributed by						TFPG Contributed by	
TSIC	Sector	Value Added	Labor	Capital	TFPG	Labor Productivity	Capital Productivity	Value Added	Labor	Capital	TFPG	Labor Productivity	Capital Productivity
20	Chemical	5.62	0.68	-0.69	5.64	2.65	2.99	-0.84	0.15	-0.52	-0.48	-0.64	0.17
21	Pharma	13.64	3.25	5.52	4.87	4.56	0.32	6.95	-1.46	0.25	8.15	5.65	2.50
22	Rubber	-1.82	-0.07	-0.60	-1.14	-1.01	-0.13	-4.26	-1.58	-1.14	-1.54	-0.99	-0.56
23	Non-metallic	1.61	0.10	0.96	0.55	0.56	-0.00	-0.93	-1.07	-1.27	1.41	0.67	0.74
24	Basic Metal	2.69	0.72	1.17	0.80	0.41	0.39	-6.37	-0.46	-5.99	0.08	-2.23	2.31
25	Fabricated Metal	0.25	-0.35	0.20	0.39	0.49	-0.10	-5.38	-0.01	-2.00	-3.37	-3.02	-0.34
26	Electronic	6.06	-0.12	2.63	3.55	2.64	0.92	-2.85	-0.74	-4.22	2.12	-0.51	2.63
27	Electrical	-6.19	-0.61	-4.88	-0.70	-2.35	1.65	-4.48	-0.45	-4.27	0.24	-1.67	1.90
28	Machinery	6.83	0.50	2.30	4.03	3.59	0.44	3.60	-1.56	-0.03	5.19	3.74	1.45
29	Automotive	10.43	0.08	-2.08	12.43	5.31	7.13	-5.06	-0.25	-5.84	1.02	-2.35	3.37
30	Other Transport	1.57	-2.79	1.10	3.26	3.67	-0.40	-5.45	-0.81	-0.05	-4.59	-3.49	-1.09
31	Furniture	-1.71	-0.61	-2.33	1.23	-0.57	1.80	-1.57	-0.57	-1.79	0.80	-0.51	1.31
32	Other	-0.19	0.39	-4.12	3.53	-0.51	4.04	-6.54	1.55	-1.89	-6.19	-5.70	-0.49
Over all	**Manufac-turing**	**2.85**	**0.38**	**0.52**	**1.95**	**1.09**	**0.86**	**-2.94**	**-0.59**	**-2.47**	**0.12**	**-0.91**	**1.03**

Source: Compiled and calculated by FPRI based on 2018 FF9 survey data, OIE

Analysis of Characteristics of the Best Practice Enterprises

The analysis of leadership enterprises considered as the best practice will show important characteristics of high-potential and high growth enterprises to be competitive enterprises, and lead to support and policy development framework of government. The best practices were selected enterprises of the 422 which had TFP and the TFPG higher than half of the samples during 2017-2019. Most of these enterprises were in Bangkok and the vicinity and in the Eastern region. Additionally, most of them were large enterprises.

The Eastern region is the center of industrial clusters and has a large number of industrial estates and it has been the targeted area for the Government to drive economic, industrial and infrastructure policies. Therefore, the enterprises in this region receive benefits from various measures to promote foreign investment. There is a business environment and ecosystem that is conducive to the development and strengthening of the competitiveness. Therefore, most of the entrepreneurs operating in this region are leading companies from both domestic and international. Whereas the large enterprises have advantages in resources and

access to source of funds. So they have higher opportunities for further business development and investment in new technology and innovation than SMEs. Moreover, high production capacity and throughput of large enterprises result in economies of scale and the power to negotiate with their suppliers, resulting in low material costs and operating costs. Besides, large corporations have more opportunities to reach and connect with the Global Value Chain (GVC).

Table 4 : Number of the Best Practice Enterprises Classified by Different Dimensions

(a) By Region

Region	Sample (observations)	Best Practice (observations)	Share of Best Practices (%)
Bangkok & vicinity	1,774	205	11.6
Eastern	755	139	18.4
Central	186	27	14.5
Northeastern	159	20	12.6
Southern	125	15	12.0
Northern	123	11	8.9
Western	74	5	6.8

(b) By Business Size

Size	Sample (observations)	Best Practice (observations)	Share of Best Practices (%)
Large	1,539	264	32.3
Medium	879	129	24.7
Small	777	29	8.6

Source: Fiscal Policy Research Institute Foundation

The indicators of the best practice sample group that were significantly different from the others were the quality of both capital and labor factors of production. Including management factors related to production and operating cost. The best practice sample group had the mean of both factors above the average of the remaining enterprises with details as follows.

- **Quality of Production Factors:** The best practice enterprises had good labor quality with *the share of skilled labor to total labor* and *the share of labor with training* on average was higher than the others. The quality of the capital factor was reflected in *the share of fully- and semi-automated machineries* higher than other groups. The quality of the inputs was important basis for developing efficient production processes and enhancing the production of high-value products.

- **Management:** The group of best practice enterprises utilized a variety of machines and equipment to assist in production and operation with *a high share of fixed assets to labor*. By making use of various machines and equipment, production was more accurate and efficient, as well as being able to support the development of more digital operations. Moreover, the group of best practice enterprises also had good cost management ability. Their *total cost to sales ratio* was lower than the average of other enterprises and could generate significant added value. *The proportion of value added to sales* was higher than the average of other groups. Cost management was a key factor for most Thai industrial enterprises who were still in the middle stream of the GVC. While value-added creation implied an enterprise's ability to generate production return, might reflect the profitability as well. Most of the high value-added production required differentiation and innovation in manufacturing.

Table 5 : Indicators of Enterprises in the Best Practice and the Other Groups During 2017-2019

Indicators	Best Practices	Others	t-Statistics
TFP (2560=100)	130.14	54.19	
TFPG (%)	20.36	15.19	
Quality of Factor of Production			
Share of skilled labor to total labor (%)	55.68	50.95	2.6351***
Share of labor with training (%)	75.03	67.68	1.9305*
Share of less-than-5-years-old machineries (%)	7.29	6.63	0.4680
Share of fully- and semi-automated machineries (%)	33.86	29.89	2.2517**
Management			
Structure of Production and Sales			
Share of exports (%)	36.45	38.73	-0.3846
Share of importing raw materials (%)	45.95	43.77	0.3416
Share of ODM and OBM manufacturing (%)	44.70	53.46	-1.2972
Share of fixed assets to labor (ล้านบาท/คน)	8.03	2.54	3.4606***
Value Added and Costs			
Value-added to sales ratio (%)	30.52	24.82	7.0523***

Indicators	Best Practices	Others	t-Statistics
Costs-to-sales ratio (%)	93.61	96.65	-5.4270***
Innovation			
R&D-expenses-to-sales ratio (%)	0.01	0.02	-1.0986

Source: Fiscal Policy Research Institute Foundation

Note: The marks '***' '**' and '*' mean the two indicators differed significantly at confidence levels of 99, 95 and 90, respectively.

Policy Recommendations

According to the survey and analysis on value added and TFP growth in 2019, many sectors in manufacturing were worse off than last year. Our study on the problems in each sector lead to the following recommendations to improve the current situation in manufacturing.

1) **Process and Quality of Personnel Improvement:** Manufacturing sector has evolved from the past. The new generation of employees has new perception on working and workforce management. We need to improve work process by eliminating inefficient process and upgrade new skills for employees to match the new work. We should promote "Smart Work" rather than "Hard Work." This, in turn, should promote efficiency in workplace.

2) **Product Development and a Clear Strategy for Products and Services:** The study on new development of products and market trend will help entrepreneurs to set a direction of product development, which will satisfy the market demand or create more value on the existing products. If our products are in demand, there would be a better opportunity to generate more values from our products.

3) **Innovation and Technology for Management, Operation and Production:** Innovation and technology can help to cut unnecessary processes and excessive labor. We also need to consider the cost effectiveness of deploy new technology to improve efficiency in operation and production. For example, the use of AI technology to track employee check-in and check-out instead of employee time clock recorder due to possible time saving.

4) **Laws and Regulations Amendments for Promoting Industry, New Business Establishment and Fair Competition:** Presently, new entrepreneurs with potential products may face difficulties due to laws and regulations. It is necessary to study and amend these laws and regulations. Best practices from other countries should help bring our regulations on industry closer to the international standard.

5) **Research and Development Support for Thai Researchers:** Although the adoption of imported technologies is common in Thai manufacturing, new home-grown technologies from Thai R&D would capture higher value for Thai manufacturing and add more value to their products.

6) **Adaptation to Survive under New Social and Environment Setting:** Changes in social, cultural and economic situation may critically affect demand for some products. For example, in tobacco sector, smoking is not well-received in society and electric cigarette becomes more popular. For plastic products, environment consciousness through continuous awareness campaigns reduces demand for plastic bags. Therefore, entrepreneurs must be aware of the new trend and devise a strategy to cope with it such as new product development or process upgrade in response to changes in social and environmental condition.

Besides the common recommendations for all sectors, we also provide recommendations for each sector according to their performance in valued added and TFP as follows:

Table 6 : Recommendation by Sector and by Performance of Industry

(A) Above average growths of VA and TFP

Sector	Policy Recommendation
Beverage	• Improve products to focus more on health of consumers. • Conduct R&D to differentiate the products by its unique identity, aroma and taste, which satisfy the majority of consumers. • Explore new export markets as some segments of Thai beverage start to become saturated or decline. • Improve efficiency of production technology for domestic beverage production machineries on par with imported machineries at lower costs. • Improve knowledge and skill of labor in industry by integrating local knowledge with international standard to enhance value.
Leather	• Develop product designs to be modern and high of quality. • Create value-added for the product in industry. • Improve efficiency of production and investment in technology. • Improve knowledge and skill of labor in industry in the areas of production and design.

Sector	Policy Recommendation
Pharma	• Improve knowledge and skill of researcher in industry. • Support research and development of pharmaceutical and biological products by extending from raw materials and herbs. • Improve efficiency of production technology.
Machinery	• Improve R&D of machinery to meet demand • Seek for partnership & collaboration to build and transfer know-how to labor • Improve labor knowledge of sophisticated machinery and maintenance skilled

(B) Positive: Positive growths of VA and TFP, with TFP growth below average Group

Sector	Policy Recommendations
Food	• Upgrade from basic processed foods to high value ones, which meets market demand, especially for in-trend high quality foods. • Apply new technologies like AI to this industry from production process to sales and distribution, quality control, hygiene and labor cost saving. • Employ food traceability and declare source of raw materials to gain consumer's confidence. • Develop distribution channels via online platform.
Non-Metallic	• Improve efficiency of production technology • Expand branches or distribution channels to CLMV countries. • Create value-added for the product in industry.
Furniture	• Develop product designs to be modern and high of quality to meet market demand, space saving and function. Also, study how to use domestic materials • Expand branches or distribution channels to ASEAN's market. • Improve knowledge and skill of labor in industry.
Electronics	• Upgrade labor's skills and machinery to support production of parts used in smart electronic products. • Build allies with industry and service sectors, which are potential users of smart electronic products. • Provide more STEM courses in Diploma and Bachelor degree level • Introduce automation and robotics to production process. • Aim to be ODM and OBM and use e-Commerce channel for direct sales.
Automotive	• Prepare for an advent of electrical vehicle production, which is growing continuously. • Provide funding source for entrepreneurs. • Build strengths and differentiation of products. • Prepare for EV production, which is a rising trend.
Electrical	• Develop smart devices with IoT capability to satisfy the demand of domestic and foreign consumers. • Develop scientific and engineering classes in STEM curriculum to meet market demand and prepare personnel for automatic & robotics and digital technology. • Employ automation and robotics to production to save costs. • Have better cost control on raw materials sourcing.

Sector	Policy Recommendations
	• Promote the industry 4.0 and support the usage of IoT devices to create market for electrical equipment. • Foster cooperation between public and private sectors to attract investors from smart electronic sector, who mitigate for the existing GVC due to conflict between the U.S. and China.
Basic Metal	• Improve production process and invest in new machineries and equipment • Develop high-value added metal products as wells customized products for different needs of consumers. • Support exports to ASEAN markets, which have very high potential for Thai producers. • Facilitate an initiative to build production network within ASEAN to lower restrictions in importing or sourcing raw materials.
Textiles	• Develop innovative products with high value-added like complex fiber and technical textiles like light-weight fiber and carbon fiber. • Improve production process. and reduce cost of labor by using more technology in production as well as labor skill upgrading for more complexed production.

(C) Negative growths of VA and TFP Group

Sector	Policy Recommendation
Chemical	• Develop products with greater variety. • Enhance capacity of entrepreneurs to produce more complexed chemical products. • Lower redundancy in related laws and regulations • Develop capacity in raw material production for import substitution and facilitate the biochemical sector, which is one of the S-Curve industries. • Promote the usage of technology and machinery to enhance productivity.
Rubber	• Explore how to shift from existing products to medical products. Build alliances to enter new markets like defense industry and medical sector. • Learn how to develop environmental friendly products, follow measures and policies of other countries and expand to new markets. • Study and plan to invest in proprietary machinery and equipment. • Connect with join ventures and supply chain in global level. • Improve knowledge and skill of labor in industry. • Give importance to the use of financial instruments to reduce the risk of exchange rate.
Petroleum	• Develop new products and services to generate growth and diversify risks. • Implement cost control, especially for cost of raw materials and cost of funds. • Improve efficiency of oil refineries to enhance gross refining margin. • Increase efficiency through lower costs of biofuel production and better quality of fuel. • Support entrepreneurs to develop green petroleum products.
Other Transportation	• Develop products for new generation of automotive and study product development guidelines to develop products that reduce pollution.

Sector	Policy Recommendation
	• Improve knowledge and skill of labor in industry to match the development of new generation of automotive. • Support R&D for improving production process.
Tobacco	• Looking for a partner from abroad. • Developing product and raw material for utilize as an alternative product. • Improve knowledge and skill of labor in industry and technology of production process.
Paper	• Provide raw material sources through crop rotation of plants for paper production and sourcing from neighbouring countries. • Develop products to satisfy market demand and environment friendly. • Improve technology of production process.
Apparel	• Develop distribution channels via online platform. • Develop products with high innovation for example Heat Tech and Air Tech. • Improve knowledge and skill of labor in industry. • Improve technology of production process.
Other	• Encourage manufacturers to access new markets and connect them with low-cost foreign raw materials. • Improve technology of production process through investment in new machineries. • Improve knowledge and skill of labor in design and development of high value added products in this industry.

In 2020 Thai industry experienced an unprecedented crisis from the impact of COVID-19, which led to economic recession as well as disruption in numerous industries. The short-term measures are needed to help entrepreneurs and their employees survive while the government imposes COVID-19 prevention measure. The long-term measures will allow entrepreneurs to become more resilient in the face of future crises.

Short-term	Long-term
• Assist entrepreneurs in cost cutting, especially international transport costs and health and hygiene related costs in their operation. • Provide tax benefits or tax breaks for entrepreneurs to retain their employees • Increase new distribution channels of products and sourcing raw materials domestically and regionally. • Support entrepreneurs in this sector to have access to and utilize E-Commerce and other platform more effectively. • Raise awareness and provide knowledge regarding preventive measures and public health initiatives to entrepreneurs and their employees	• Plan the direction of skill and knowledge development for unemployed workers and create a job market, which helps entrepreneurs to recruit new workers. • Promote entrepreneurs to diversify into new export markets by establishing a platform and database for business matching • Support SMEs to participate in existing supply chains and promote large firms to connect with SMEs more. • Develop and upgrade digital infrastructure to support the use of industrial sector and provide more access for entrepreneurs.

Short-term	Long-term
to minimize the risk from the COVID-19 infection during the operation. • Set up a fund to provide assistance to entrepreneurs to survive and also offer a guarantee scheme to enhance borrower's credit in financial support measures.	• Continue to restructure Thai industry toward innovative industries as to become less dependent on tourism and train right personnel for these new industries.

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