

## Second-order confirmatory factor analysis of auto parts manufacturing industry management guidelines for sustainable success

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### ABSTRACT

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Due to the slowdown of the world economy, the growth of the world's automobile manufacturing industry has declined. As a result, the production rate of automotive parts tends to decrease as well. The objective of this study was to investigate the guidelines for managing the automotive parts manufacturing for sustainable success. The study was conducted qualitatively and quantitatively. The results of the study revealed four components of the management of the automotive parts manufacturing industry; namely, 1) development of servitization, 2) development of organization, 3) development of labor skill, and 4) development of technology. As for the analysis of the second-order confirmatory factor model developed, it was found that the model passed the assessment criteria and was consistent with the empirical data.

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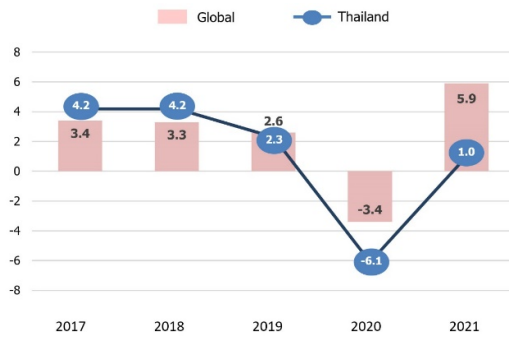
### 1. Introduction

The 4<sup>th</sup> Industrial Revolution (Industry 4.0) brought about a major change in the world. Customers were more focused as the center of the production system to meet their various needs. Production methods and production processes have been changed to optimize speed, accuracy, and cost savings (Guo, Li, Zhong, & Huang, 2021). Each country, therefore, needs a strong manufacturing industry, an ability to increase productivity or create productivity for its country to drive adaptation, change and increase competitiveness. This is no exception to Thailand. A Thailand 4.0 policy was set as a strategy to drive the country forward with a stable, prosperous and sustainable economy in a concrete manner (Sriratana, 2018). Modern technology has been adopted in the industrial sector (Wattanakomol, 2021), especially in the automotive parts manufacturing industry, which is the main industry that drives the Thai economy (Yoopraphat & Tantakool, 2020). According to the competitiveness ranking of 64 countries around the world reported by IMD World Competitiveness Center (2021), Thailand rank was found to be in a continuous decline. Its global competitiveness ranking has dropped from 25th in 2020 to 28th in 2021. The assessment of the International Monetary Fund has forecasted that global real GDP growth would grow up to 5.9 percent in 2021. On the contrary, the Thai economy tended to be affected by limitations and risk factors and would result in the economy recovering more slowly than expected. Thailand's Real GDP Growth was anticipated to rise only 1.0 percent (International Monetary Fund, 2021), as shown in Fig. 1. Although the automotive parts industry in Thailand has tended to grow continuously due to the domestic demand for parts that expands at a rate of 0-5% per year. It grew from both the demand for parts for automotive assembly to serve the volume of production of cars and motorcycles and that for replacement parts that would continue to expand as the number of cars and motorcycles accumulated (Yongpisanphob, 2019). Due to the problem of major changes (Megatrend), whether it is a disruption in technology or the slowdown in the economy due to the epidemic situation of the Covid-19 virus, they all affect the growth of the world's automobile manufacturing industry. As a

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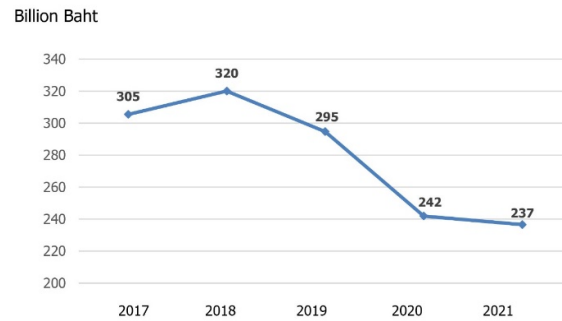
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result, the production rate of automotive parts in Thailand has a tendency to decline as well. In 2017, the export value was 305 billion baht, reduced to 237 billion baht in 2021, as shown in Fig. 2.



**Fig. 1.** The comparison of global Real GDP Growth and Thailand's from years 2017-2021

Source: International Monetary Fund, 2021



**Fig. 2.** The comparison of global Real GDP Growth and Thailand's from years 2017-2021

Source : Information and Communication Technology Center, Ministry of Commerce, 2021

Nowadays, sustainability strategies are being developed in every industry as part of their business strategy development (Cavaleri & Shabana, 2018; Soalheira, 2020). According to Global Reporting Initiative Standard (2020), it is considered that sustainable management of the organization is the main goal of maintaining a balance of business operations to last long. Therefore, if the automotive parts manufacturing industry has a business management approach for sustainable success, it will enable the business to operate continuously and stably in the future.

## 2. Literature Review

Key issues of guidelines for a business organization to manage the automotive parts manufacturing industry for sustainable success have been reviewed as follows:

### 2.1 PEST Analysis

It is an analysis that allows businesses to understand the market situations during growth and contraction, and to understand the overall environment outside the organization at a macro level (Kaplan and Norton, 2008). These factors are always changing and plays an important role in setting the vision, mission and creating strategies for the organization. Therefore, businesses must be prepared to deal with the impact of these factors. The external environmental factors are divided into 4 main types; namely, politic (P), economic (E), social (S), and technology (T). The development of workforce skills is very important to the adaptation of a business organization. Workforce skills are a key factor in driving a business towards its goals. However, business organizations often face labor shortages, especially knowledgeable workers who have skills that correspond to the production process and high technology control. Businesses need to develop various factors in order to maintain a quality workforce that is loyal and able to stay with the business for a long time by creating job satisfaction. This is in line with Feldman and Arnold's theory that says keeping employees in business affects the success of the business organization. How long you can keep them depends on six different factors: wages, supervision, work itself, co-workers, promotional opportunity, and working conditions which was also in accordance with Expectancy Theory proposed by Vroom (Tiangtavaj et al., 2017; Sveningsson & Sorgarde, 2020) to describe the process of motivating employees to increase their efficiency. In practice, when people are motivated to increase their productivity, there is an expectation of reward. Herzberg's Two-Factor Theory (1959) elaborates that there are two important factors in human resource management: the one that motivates employees to be satisfied with their work, known as motivation factors, and another one that prevents personnel from feeling regression or having negative thoughts or the so-called hygiene factors. One of the ways to sustain a successful business is the Sufficiency Economy Philosophy approach. This is a philosophy that indicates the way of life that His Majesty King Bhumibol Adulyadej proposed to Thai people in 1974 as a guideline for solving Thailand's economic problems sustainably. The philosophy itself has received the highest recognition from the United Nations (UN) as a philosophy that can be initiated to boost immunity to individuals, to villages, and ultimately to a broader economy. This philosophy is useful not only to Thailand but also to other countries. Its principle is of 3 pillars and 2 conditions; namely, moderation, reasonableness, and self-immunity on the condition of knowledge and morality (Von Feigenblatt, Pardo, & Cooper, 2021). The decision-making on any activities must be based on sufficiency principles.

The objective of this study was to analyze the second-order confirmatory factors of the automotive parts manufacturing industry management approach for sustainable success.

### 3. Research Methods

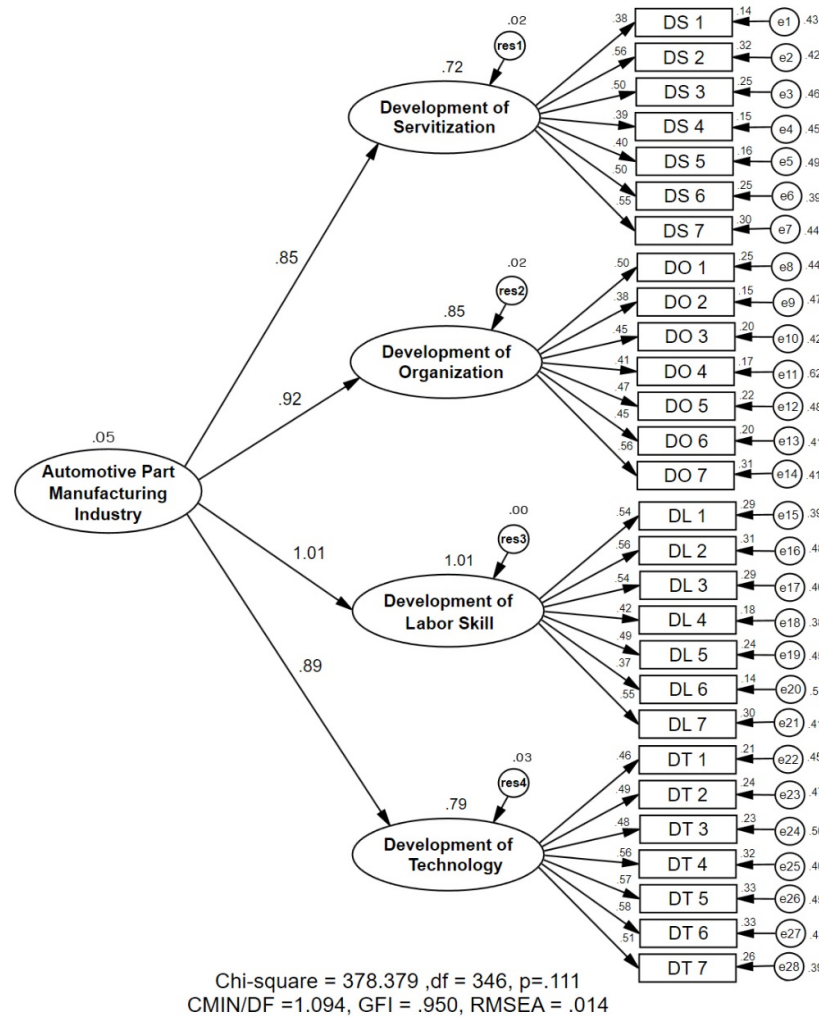
This study was of a qualitative and quantitative type whose methods were as follows:

The samples used in the qualitative part were collected from the successful auto parts manufacturers obtained by purposive sampling. Error reduction was set at 0.50-0.48, and the net change at 0.02. The total of 18 experts were obtained (McMillan, 1971). An in-depth interview was employed to obtain the data. The population used in the quantitative research were 2,409 entrepreneurs or executives of the auto parts manufacturing industry with profitable turnover for 5 consecutive years. The sample size was set based on Comrey and Lee’s criteria (Lawrence, Glenn & Guarino, 2017) was determined at 500. Multi stage sampling technique was used to obtain the samples.

The tools used in the quantitative research were of a 5-point rating scale questionnaire of 100 items provided according to the Likert method (David & Sutton, 2011). The quality of the instruments were tested and found that its Index of Item Objective Congruence (IOC) was 0.60–1.00, its discrimination was 0.31–0.84, and the reliability as calculated via Cronbach’s Alpha Coefficient was 0.97.

Interview was used to collect the data for the quantitative part. Both descriptive and reference statistics were employed to analyze the data, using SPSS software while AMOS software was used for Multivariate Statistical Analysis. Four criteria used for evaluating the data-model fit were 1) Chi-square Probability Level > 0.05, 2) Relative Chi-square < 2, 3) Goodness of fit Index > 0.90, and 4) Root Mean Square Error of Approximation < 0.08 (Arbuckle, 2011).

### 4. Research Results



**Fig. 3.** The model of second-order confirmatory factor of auto parts manufacturing industry management guidelines for sustainable success

**Table 1**

Statistical values of second-order confirmatory factor of auto parts manufacturing industry management guidelines for sustainable success

Abbreviation	Weight	R <sup>2</sup>	Variance	C.R.	P	Mean	S.D.
SCFA			0.05			4.21	0.37
TDS	0.85	0.72	0.02			4.22	0.44
DS 1	0.38	0.14	0.43			4.28	0.71
DS 2	0.56	0.32	0.42	6.83	***	4.25	0.78
DS 3	0.50	0.25	0.46	6.52	***	4.19	0.78
DS 4	0.39	0.15	0.45	5.76	***	4.30	0.73
DS 5	0.40	0.16	0.49	5.87	***	4.17	0.77
DS 6	0.50	0.25	0.39	6.53	***	4.22	0.72
DS 7	0.55	0.30	0.44	6.77	***	4.12	0.79
TDO	0.92	0.85	0.02	6.30	***	4.22	0.44
DO 1	0.50	0.25	0.44			4.22	0.77
DO 2	0.38	0.15	0.47	6.71	***	4.25	0.74
DO 3	0.45	0.20	0.42	7.50	***	4.27	0.73
DO 4	0.41	0.17	0.62	7.08	***	4.12	0.86
DO 5	0.47	0.22	0.48	7.76	***	4.25	0.78
DO 6	0.45	0.20	0.41	7.51	***	4.23	0.72
DO 7	0.56	0.31	0.41	8.65	***	4.23	0.77
TDL	1.01	1.01	0.00	6.59	***	4.23	0.46
DL 1	0.54	0.29	0.39			4.26	0.75
DL 2	0.56	0.31	0.48	9.51	***	4.20	0.83
DL 3	0.54	0.29	0.46	9.62	***	4.23	0.80
DL 4	0.42	0.18	0.38	7.73	***	4.34	0.68
DL 5	0.49	0.24	0.45	8.65	***	4.23	0.77
DL 6	0.37	0.14	0.51	6.95	***	4.18	0.77
DL 7	0.55	0.30	0.41	9.41	***	4.20	0.77
TDT	0.89	0.79	0.03	6.07	***	4.17	0.48
DT 1	0.46	0.21	0.45			4.19	0.75
DT 2	0.49	0.24	0.47	7.65	***	4.18	0.79
DT 3	0.48	0.23	0.50	7.56	***	4.18	0.81
DT 4	0.56	0.32	0.40	8.23	***	4.25	0.77
DT 5	0.57	0.33	0.45	8.30	***	4.15	0.82
DT 6	0.58	0.33	0.43	8.32	***	4.10	0.81
DT 7	0.51	0.26	0.39	7.82	***	4.16	0.72

\*\*\* Significant at the 0.001 level

R<sup>2</sup> : Square Multiple Correlations, C.R. : Criteria Ratio, S.D. : Standard Deviation

*The results of second-order confirmatory factor analysis of auto parts manufacturing industry management guidelines for sustainable success as a whole*

Fig. 3 and Table 1 show the statistical values obtained from assessing the IOC of the improved model of second-order confirmatory factors of auto parts manufacturing industry management guidelines for sustainable success. After the indices were modified, it was found that the values of Chi-square Probability Level, Relative Chi-square, Goodness of fit Index, and Root Mean Square Error of Approximation were 0.111 (> .05), 1.094 (< 2), 0.950 (> .90) and .014 (< 0.08) respectively some of which were less while some were more than the set criteria as bracketed. It can, therefore, be concluded that all 4 statistical values passed the assessment criteria, and the developed model was consistent with the empirical data after the improvement.

The second-order confirmatory factor of auto parts manufacturing industry management guidelines for sustainable success consisted of 4 latent variables that can be sorted in descending order of weight values as follows: 1) Development of Labor Skill: Standardized Regression Weight = 1.01 at the statistical significance level of 0.001, R<sup>2</sup> = 1.01, Variance = 0.00, 2) Development of Organization: Standardized Regression Weight = 0.92 at the statistical significance level of 0.001, R<sup>2</sup> = 0.85, Variance = 0.02, 3) Development of Technology: Standardized Regression Weight = 0.89 at the statistical significance level of 0.001, R<sup>2</sup> = 0.79, Variance = 0.03, and 4) Development of Servitization: Standardized Regression Weight = 0.85, R<sup>2</sup> = 0.72, Variance = 0.02 respectively.

*The results of second-order confirmatory factor analysis of auto parts manufacturing industry management guidelines for sustainable success by factors*

Fig. 3 and Table 1 show the results of the second-order confirmatory factor analysis of auto parts manufacturing industry management guidelines for sustainable success in 4 factors each of which consisted of 7 observed variables presented in descending standardized regression weight (SRW) as follows:

Development of Servitization: 1) DS 2: focusing on research and development unique automotive parts for valuable customers (SRW = 0.56), 2) DS 7: Helping customers with a comprehensive consulting expert (SRW = 0.55), 3) DS 6: Setting up a unit to listen to customers' suggestions for continuous improvement (SRW = 0.502), 4) DS 3: Having a plan to produce parts to support the investment in electric vehicles (SRW = 0.50), 5) DS 5: Creating multiple communication channels between the organization and its customers (SRW = 0.40), 6) DS 4: Customers being able to check production and delivery information online (SRW = 0.39), and 7) DS 1: Cultivating the organization's personnel with a consciousness of service to excellence (SRW = 0.38) respectively.

Development of Organization: 1) DO 7: Providing modern tools for convenience and accuracy in operation (SRW = 0.56), 2) DO 1: Having A coordinated and integrated process within the agency (SRW = 0.50), 3) DO 5: Leaders being knowledgeable, having a systematic mind, and getting along well with others (SRW = 0.47), 4) DO 6: Allocating personnel according to their abilities and responsibilities (SRW = 0.447), 5) DO 3: Cooperating with the community in social and environmental development in a sustainable way (SRW = 0.446), 6) DO 4: Having a waste disposal policy that meets international standards and is environmentally friendly (SRW = 0.41), and 7) DO 2: Joining as a member of an agency related to the automotive industry (SRW = 0.38) respectively.

Development of labor skills: 1) DL 2: Reinforcing workers with knowledge to enable them to control modern technology (SRW = 0.56), 2) DL 7: Managing the transfer of knowledge among workers in a systematic way (SRW = 0.55), 3) DL 1: Encouraging workers to develop a wide range of skills (SRW = 0.539), 4) DL 3: Recruiting talented workers to prepare them for a job as a supervisor (SRW = 0.537), 5) DL 5: Encouraging workers to obtain professional qualification standards (SRW = 0.49), 6) DL 4: Motivating workers to accept change in various fields (SRW = 0.42), and 7) DL 6: Encouraging workers to visit modern technology trade fairs (SRW = 0.37) respectively.

Development of Technology: 1) DT 6: Developing the production of parts that require high precision (SRW = 0.58), 2) DT 5: Having a modern information system that supports data linking via the Internet (SRW = 0.57), 3) DT 4: Using modern tools to check the workpieces to meet the standards (SRW = 0.56), 4) DT 7: Establishing a database system for use in technology development and innovation (SRW = 0.51), 5) DT 2: Continuously improving technology in the production process (SRW = 0.49), 6) DT 3: Creating cooperation between organizations to promote innovation (SRW = 0.48), and 7) DT 1: Building understanding with personnel before applying automation technology to the production line (SRW = 0.46) respectively.

*The results of the analysis of the importance level of guidelines for automotive parts manufacturing industry management for sustainable success.*

It is found, as illustrated in Table 1, that the management guidelines for the automotive parts manufacturing industry for sustainable success, as a whole, was of a high importance level with a mean of 4.21. When considering the level of importance on a case-by-case basis, it was found that all aspects were also of a high importance level, each of which was presenting in descending order of means as follows: 1) Development of Labor Skill  $\bar{X} = 4.23$ , 2) Development of Servitization  $\bar{X} = 4.224$ , 3) Development of Organization  $\bar{X} = 4.218$ , and 4) Development of Technology  $\bar{X} = 4.17$  respectively.

*The results of the analysis of the importance level of guidelines for the automotive parts manufacturing industry management for sustainable success, item by item*

When considering the importance of the guidelines for automotive parts manufacturing industry management for sustainable success, item at a time, it was found that all of them were important at a high level. The top 3 items were presented in descending order of mean as follows:

Development of Servitization: 1) Customers being able to check production and delivery information online ( $\bar{X} = 4.30$ ), 2) Cultivating the organization's personnel with a consciousness of service to excellence ( $\bar{X} = 4.28$ ), and 3) Focusing on research and development unique automotive parts for valuable customers ( $\bar{X} = 4.25$ ) respectively.

Development of Organization: 1) Cooperating with the community in social and environmental development in a sustainable way ( $\bar{X} = 4.27$ ), 2) Leaders being knowledgeable, having a systematic mind, and getting along well with others ( $\bar{X} = 4.254$ ), and 3) Joining as a member of an agency related to the automotive industry ( $\bar{X} = 4.246$ ) respectively.

Development of Labor Skills: 1) Motivating workers to accept change in various fields ( $\bar{X} = 4.34$ ), 2) Encouraging workers to develop a wide range of skills ( $\bar{X} = 4.26$ ), 3) Recruiting talented workers to prepare them for a job as a supervisor ( $\bar{X} = 4.23$ ) respectively.

Development of Technology: 1) Using modern tools to check the workpieces to meet the standards ( $\bar{X} = 4.25$ ), 2) Building understanding with personnel before applying automation technology to the production line ( $\bar{X} = 4.19$ ), and 3) Continuously improving technology in the production process ( $\bar{X} = 4.18$ ) respectively.

The results of the hypothesis test on the importance levels of the guidelines for automotive parts manufacturing industry management for sustainable success, as a whole, were displayed in Table 2.

**Table 2**

Different importance levels of the guidelines for automotive parts manufacturing industry management for sustainable success, as a whole

Importance Level	Levene's Test for Equality of Variances		t-test for Equality of Means			
	F	Sig.	t	df	Sig. (2-tailed)	
SCFA	Equal variances assumed	.446	.505	1.661	498	.097
	Equal variances not assumed			1.661	495.597	.097

\* Significant at the 0.05 level

Table 2 showed the results of the hypothesis test of the studied guidelines, as a whole. No differences in perceiving the importance level of those guidelines were found among small, medium, and large industrial businesses at the statistical significance level of 0.05.

## 6. Discussion

According to the study results, it was found that the development of labor skills got the highest weight and importance level. This was so because in the automotive parts manufacturing industry, customer demand did not stop only at the products being delivered as scheduled. Labor skills were necessary to be developed to meet customers' needs (Genzlinger, Zejnilovic and Bustinza, 2020). This is in line with a study by Chanthapong and Pornpattanapaisalkul (2019) that found that the major cause why industrial enterprises need to focus on developing workforce skills was the development of business organizations and the introduction of modern technology into the production process. As a result, the automotive parts manufacturing industry needs to equip workers with up to date skills, knowledge, and abilities to handle the new production process, technology used, and the nature of productivity that has been changed. Upskill and re-skill were, consequently, necessary for organizational development towards sustainability.

Developing the production of parts that require high precision was a guideline that receives the highest weight value in this study. It was a factor under the aspect of the development of technology. A study by Santoso and Bukit (2019) found that entrepreneurs in the automotive parts manufacturing industry placed a high priority on quality management systems in the production process because automotive parts were the products that required high precision in order not to make a mistake in assembling vehicles before delivering to the drivers. It could be seen that the automotive parts manufacturing industry recognized the importance of using technology and automation in the production process, inspection, and quality control in order to develop a production process that requires high precision, accuracy, and quality (Jaffery, 2018).

The guideline receiving the highest recognition in this study was the one related to motivating workers to accept change in various fields. It has been well known that no organizations can survive without change. Changes are universal in nature to organizations. It may occur incrementally or radically. No matter what form it occurs in, it always results in labor stress, fear, anxiety and can even cause resistance to such change (Ruanggoon, 2013). Therefore, motivating workers to accept the change by creating incentives and telling the positive impact may be able to reduce the resistance to the change that might occur.

Whether a business was of a large or small scale of investment, managing such business requires long-term stability rather than just the short-term maximum profit figure. Sustainable business operations should adopt the sufficiency economy philosophy. According to this philosophy, maximum profit is not the first obligation of business (Wheelen & Hunger, 2015). Its principle adheres to the success of "worth" rather than "break-even." Creating customer satisfaction is more important as it will lead to loyalty. As a result, the business can eventually be sustained.

## 7. Suggestions

The automotive parts manufacturing industry plays an important role in creating a very competitive advantage for the country. Thus the government and related agencies should seriously and cooperatively support this industry both in terms of importing raw materials and exporting the products to be able to meet the needs of buyers around the world. As for the operators themselves, they must change their traditional way of business operation by investing in modern automation, information and innovation in order to produce the products with high quality and high resolution, which is an important factor affecting the customer's next purchase decision.

In the past, development of labor skills in the automotive parts manufacturing industry usually focused on the development of hard skills, nonetheless, nowadays, soft skills are not less important. Soft skills are related to the ability to live with others, interpersonal interactions, socialization, and emotional control to handle the problems encountered. In addition to technology and innovation control skills, labor's soft skills in the Thai auto parts manufacturing industry needs to be developed in parallel so that workers are equipped with multiple skills and can work happily both in the context of the production of new products and the control of new machines through the use of digital technology.

Generally, most entrepreneurs in the automotive parts manufacturing industry are OEM, or Original Equipment Manufacturer. They do contract manufacturing according to the designs specified by customers. Presently, customers do not only look for a factory to manufacture auto parts according to their own style, but also look for alternative manufacturers that can give advice on developing automotive parts with unique characteristics, different from other competitors. In addition to producing good quality products lower than the past year, and delivering on time, entrepreneurs in the automotive parts manufacturing industry must also have the ability to produce unique modern products to meet the customers' needs effectively as well.

Change is essential to the long-term survival of the organization. This is no exception to the automotive parts manufacturing industry. Whenever a change occurs, resistance is accompanied. This is a key factor that causes organizational changes to fail. Executives should adopt change management strategies with an action plan, a communication plan, and create incentives and rewards to motivate colleagues to achieve their desired goals. This is, therefore, considered a key success factor for sustainable organization.

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