

Investment of SMEs toward Automation System in Automotive Parts Industry

Somrerkanwivat*, Naris Penpokai and Fuangfa Amponstira

Management Program, School of Management, Shinawatra University, Pathum Thani 12160

*To whom correspondence should be addressed. e-mail: karnwivat@hotmail.com

Received: 16 October 2020, **Revised:** 15 December 2020, **Accepted:** 23 December 2020

Abstract

This research aimed to explore: 1) the fundamentals of a companies in Bangkok, Samutprakarn, Chachoengsao, Chonburi, Nonthaburi, and Pathum Thani which were manufacturers in the automotive industry. 2) the relationship between fundamental factors of the strategic decision, accounting decision, labor decision, governmental regulation and investment of SMEs factors, and 3) factor drivers investors to invest in flexible(soft) automation. The sample used in the research was 20 executives in 7 small enterprises and only 3 medium enterprises, ie survey research. The methodology used to research various companies where face to face interview among the directors of various automotive part makers. Data were analyzed by descriptive statistics in terms of mean and percentage.

The research results found that the fundamentals of a companies that the most manufacturing were located in the convenient transportation area. if the supply chain was disrupted from other external factors that caused uncertainty in business operations. The relation between flexible automation and investment decision 45%, labor cost 60%, output factors 55%, government regulation 60% showed all positive sign towards investment decision which was the right solution.

Keywords : Investment, Flexible Automation, Automotive Parts

Introduction

In the past two hundred and fifty years since the dawn of the Industrial Revolution, the world has undergone a tremendous transformation. People now live longer, healthier, more productive, and more fulfilling lives. All of the while, manufacturing has been one of the key drivers in advancing technology, changing society, and shaping the world around us. The manufacturing is the key driving force for the development of economies worldwide [1]. Many great scientists have helped to change the ways of manufacturing starting from water powering for metalworking, rolling mills. The introduction of the assembly line by Henry Ford in 1913 constitutes a great sample of the incredible influence manufacturing has on society. The division of labor within the organization has enabled us to mass produce the same product with great efficiency and effectiveness. Today, we are on the brink of the fourth industrial revolution that is expected to significantly change the industry again [2]. This revolution is essential because of the increasing cost and the need to reduce errors. Today the industry has evolved from hard manual labor towards technology which has enabled small firms from around the world to produce the same quality product at a reasonable price. This has led to the development into many small firms working towards the industry for the same common goal economies of scale. Through this the investor wants to add more return on investment where the customer wants a better quality product from the money they paid. Automation and new technology have contributed to increase the production size

of all types of business. It has never been this easy for small business to operate in small scale but producing in large quantities. The technique, method, or system of operating or controlling a process by highly automatic is known as automation. The two kinds of automation hard and soft have huge differences. [3] Especially industry follows hard automation which allows them to produce in mass quantities. This increases the economy of scale since it is very expensive to install such machines into the factory. Many emerging countries like Thailand use this kind of technology for quick development of product. Soft automation can be used to produce a variety of parts with virtually no time lost for changeovers from one part style to another or for multiple small batches of a single product. No lost production time results when reprogramming the system. Soft automation or flexible automation on the other hand allows different product to be produced along with the ability to produce more. Tesla is a great example of soft automation. It has developed an army of robots which help tesla to produce their latest car. Within this report, I have tried to explain the need for flexible automation allowing the economy of scope to be achieved as well as economy of scale. If we could increase automation flexibility we could allow small and medium enterprises to produce different kinds of product in large quantities within one single roof [4].

The automation has contributed towards manufacturing flexibility and efficiency. The product life cycle has shortened, faster delivery and higher expectation has made manufacturing even more challenging. Different types of industry exist around the world, most developed has already made their transition towards tier 4 industry, full automation, other emerging countries has adopted automation towards a small extent. The manufacturing industry within this emerging country must make a quick transition towards tier 4 to adopt flexible manufacturing through the use of automation. This research aimed to explore factor drivers investors to invest in flexible automation and consist of strategic decision, accounting/cost decision, labor decision, governmental regulation etc.

Literature Review

This study focused on how the SMEs can take benefit from technology from flexible automotive industry. SMEs will be adapted to be the changed of Automation system and to find the purpose of the study.

Flexible Automation

Flexible automation is the ability for a robot or system to be quickly and easily re-tasked to change product design for both low and high mix manufacturing. When properly utilized, a flexible automation cell can evolve with your process and demand, reduce and fix production costs, improve quality, and eliminate health and safety issues [3].

Automation System

Automated systems have been incorporated into production lines and machines for years. The main purpose of an automated system was to help speed up a process. Tasks that are time-consuming or inconvenient are often incorporated into systems. Some manufacturing companies will work to develop automated systems that can handle jobs that would be difficult for a human to do [5]. Automated systems can be used to handle a wide range of tasks. Systems have key components that allow them to function properly including a control system, a way to interpret and distribute data and a human interface. Programmable logic allows the system to process data and controls it.

Investment

An investment is an asset or item that is purchased with the hope that it will generate income or will appreciate in the future. In an economic sense, an investment is the purchase of goods that are not consumed today but are used in the future to create wealth [6].

Payback Period

Payback period is the time in which the initial cash outflow of an investment is expected to be recovered from the cash inflows generated by the investment. It is one of the simplest investment appraisal techniques. The formula to calculate payback period of a project depends on whether the cash flow per period from the project is even or uneven. In case they are even, the formula to calculate payback period as below.[3]

$$\text{Payback Period} = \frac{\text{Initial Investment}}{\text{Cash Inflow per Period}}$$

Decision Rule: Accept the project only if its payback period is less than the target payback period. All manufacturers want to identify those automation investments with the best return of investment (ROI), but the right way to accomplish this task isn't always immediately evident. Too many manufacturers focus on the wrong areas, taking an approach that isn't oriented to finding the best overall solutions with the lowest total cost of ownership (TCO). Automation projects in particular can show a huge divergence from expected and actual ROI if TCO isn't taken into account. As shown in grinding process, TCO takes into account all the cost and savings. These factors show how much profit they have from the transformation into fully automated systems. Benefits of flexible automation include reducing manual controls without changing the basic set up, increasing labor productivity, consistent quality, and better utilization of material as below in figure 2

Conceptual Framework

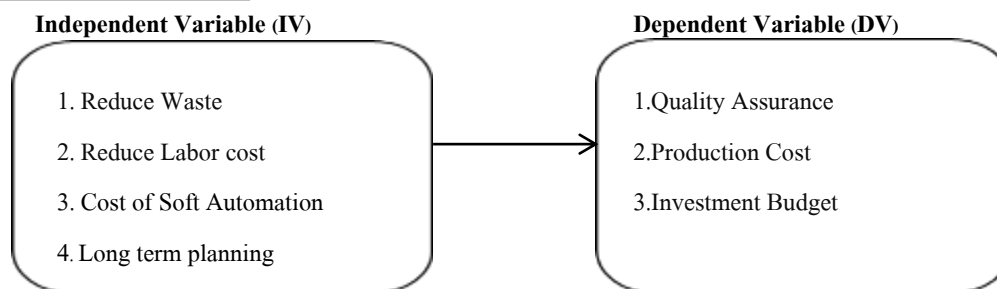


Figure 1. Conceptual Framework

Research Objectives

The study focused on the “flexible automation of technology for the production of auto parts”. 1) the fundamentals of a companies in Bangkok, Samutprakarn, Chachoengsao, Chonburi, Nonthaburi, and Pathum Thani which were manufacturers in the automotive industry. 2) the relationship between fundamental factors of the strategic decision, accounting decision, labor decision, governmental regulation and investment of SMEs factors. 3) factor drivers investors to invest in flexible(soft) automation, and 4) the transformational factors of SMEs with Influencing the development of conventional production to flexible automation

Hypotheses

In the study, it proposed that each construct of benefits from flexible automation system will contribute to each construct of factors that influence to investment of SMEs in automotive parts industry as follow:

H1: There is a relationship between reducing waste and factors that influence to investment of SMEs in the automotive parts industry.

H2: There is a relationship between reduce labor cost and factors that influence to investment of SMEs in automotive parts industry.

H3: There is a relationship between cost of automation and factors that influence to investment of SMEs in automotive parts industry. Process Improvement

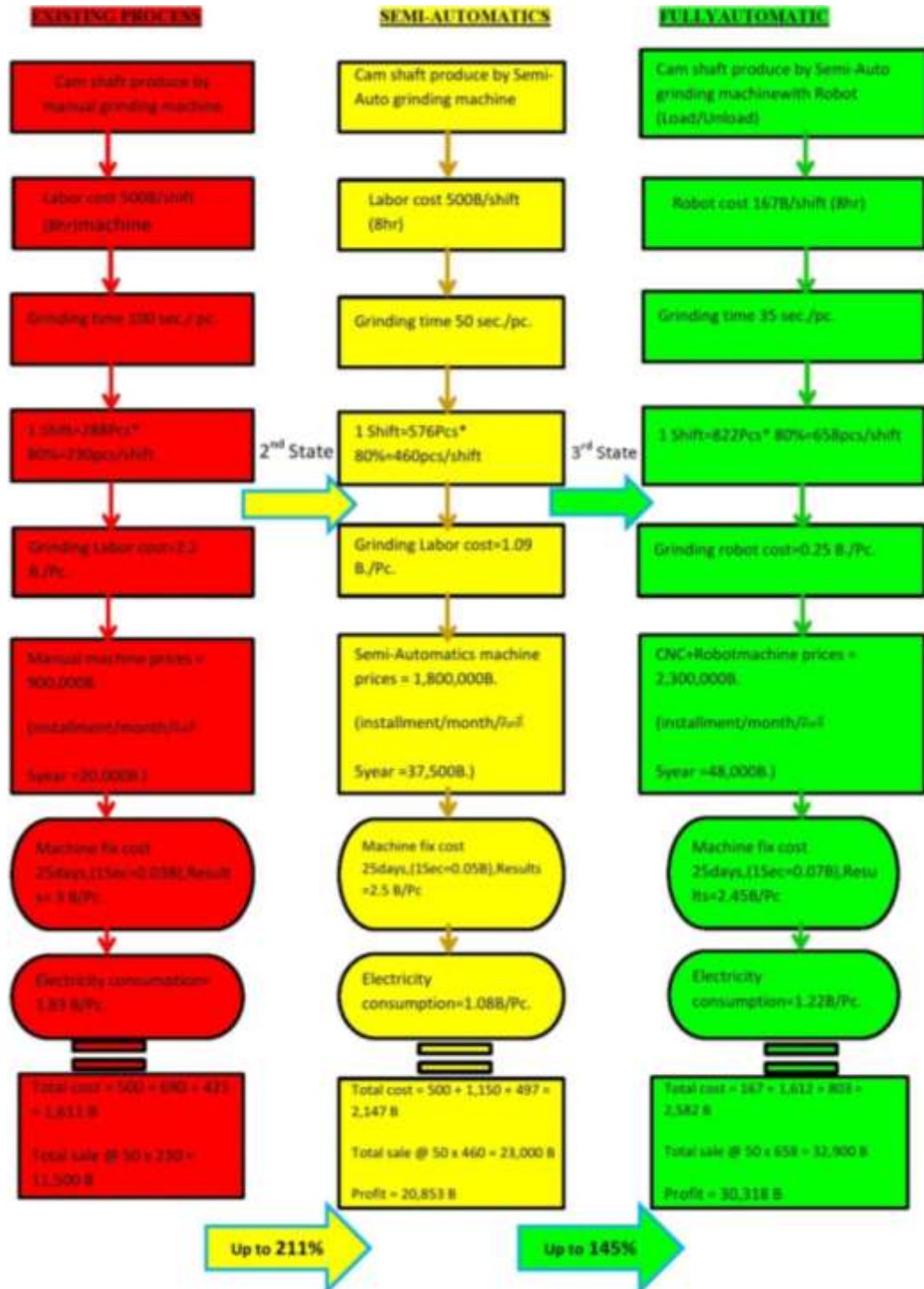


Figure 2. Benefits of flexible automation included reducing manual controls without changing the basic set up.

Methods and Questionnaires design:

The methodology used to research various companies where face to face interview among the directors of various auto parts makers. These interviewees were asked unstructured questions and each interviewee were recorded for further gathering information. Each factory was observed to find out how the production was carried out and to find about the involvement of labors in the production process. After the identification of various other methods was later used like formal structured questions were asked. The research conducted interview in 10 different companies within the automotive industry. Among the sample size companies, 7 small enterprises and only 3 medium enterprises were selected for this research. The percentage for investment on a soft automation decision based on which factors, along with ROI, based on cost of soft automation, cost of Labor, output factors, government factors by deep interviews (unstructured questions) were calculated, recorded, including the average percentage was obtained from the interview.

Sample population and sample size: interview and questionnaire the SMEs agreed on the better outcome from flexible(soft) automation. The questionnaire that we presented was to 20 directors within the companies of SMEs. Most of the directors stated that the strategic decision made them to choose soft automation. These directors consider long term planning to be important factor to determine their investment decision on soft automation.

Data Analysis: The researcher used the data finding were presented as below based on the interview conducted.

Results And Discussion

The research was conducted in Bangkok 1, Samutprakarn 2, Chachoengsao 1, Chonburi 3, Nonthaburi 1, and Pathumthani 2 (Small/Midium) as shown in Table 1

Table 1. Places of selected automotive companies

Automation Systems	Bangkok	Samutprakarn	Chachoengsao	Chonburi	Nonthaburi	Pathumthani
Fixed (Hard) Automation	-	-	-	-	-	-
Flexible (Soft) Automation	1	2	1	3	1	2

Table 2. Total percentage of responses given based on investment decision

Investment on a soft automation decision based on which factors					
Investment decision based on which factor and their percentage	Strategic Decision	Accounting/ Cost decision	Labor decision	Governmental regulation	Other factors
Average	26%	30%	24%	13%	7%



Figure 3. Pie chart of total responses from the investment decision criteria

From the interview and questionnaire, the SMEs agreed on the better outcome from flexible(soft) automation. The questionnaire was presented to 20 directors within the companies within SMEs. Most of the directors stated that the strategic decision made them to choose soft automation. These directors considered long term planning to be important factor to determine their investment decision on soft automation. From figure 3, they mentioned that 26% of their strategic decision was based on long term planning decision. Cost decision was the 2ndmajor factor that they considered. They stated that the cost of soft automation and the operating cost of this technology were major factors. 30% of their decision was based on the cost factor. Labor factor was the other major factor holding 24%. The labor working within SMEs as stated by the directors wanted to stay for a short time period and focused on their salary. The work was below per level and this increased wastage along with mishandling of the technology provided for efficient work. From the table 3. below these statements can be further proved. The SMEs agreed that the soft automation had provided them with better return of investments. Most of the companies mentioned that they received in between 15% -35% of their investment. Even through the cost of soft automation was said to be higher than hard automation in the long run the company were receiving better return on investment. 40% claimed that the cost of soft automation made them think about the investment decision they had to make.

Table 3. Company list along with their ROI

Items	Company	Number of Labour	Type of Business	Capital Regist.	Soft Automation Invest.	ROI
1	PJ Golbal Co.,Ltd.	8 Pers.	Small	1 MB	2MB	25-35%
2	Well Mech Micronics Co.,Ltd.	9 Pers.	Small	1 MB	2MB	25-35%
3	VCT-09 Co.,Ltd.	18 Pers.	Medium	8 MB	2MB	20-30%
4	Meiwa Engineering Co.,Ltd	35 Pers.	Medium	20 MB	5MB	15-20%
5	Multi-More Engineering Limited Partnership.	15 Pers.	Small	2 MB	2MB	25-35%
6	Chajjaren Engineering and Supply Co.,Ltd.	13 Pers.	Small	1 MB	2MB	20-30%
7	M.F. System Mold Co.,Ltd.	7 Pers.	Small	1 MB	2MB	25-30%
8	Zawa Mould & Engineering Limited Partnership.	15 Pers.	Small	0.35 MB	2MB	25-35%
9	Suwankosit Group Co.,Ltd.	15 Pers.	Medium	10 MB	2.5MB	25-35%
10	SP Engineering and Parts Co.,Ltd.	38 Pers.	Small	3 MB	2MB	25-35%

From our research, we reject the fact that cost of soft automation affect investment decisions. The cost was already running high and to differentiate between each member which was the product differentiation there were producing. Each member said that they produced different kinds of product but these products must be in aligning to big manufacturers who produced the cars.

Since, any organization wants to invest for long term. The owner of SMEs is also willing to have equipment for a longer time. This led them to invest in expensive automation if it can provide better outcome (investment, output) case of operation etc. Hence, we reject that cost of soft automation affect investment decision.

Table 4. Investment Decision Based on Cost of Soft Automation

Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Cost of Soft Automation has a influence in investment decision	3	6	5	4	2

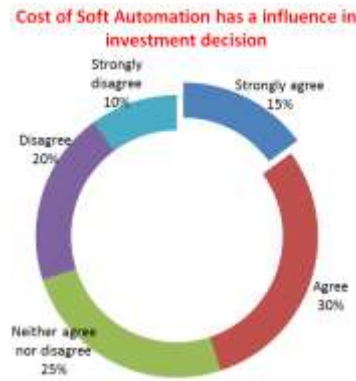


Figure 4. Pie chart of investment decision based on cost of soft automation

The labour factor was also the problem for the company. The labour turnover was a major concern for the company. Each labour was unskilled and had hard time operating heavy equipment. The growing and changing workforce had a higher demand for soft automation. From manual to computerized system, the change brought in manufacturing was enormous. Each machine requires more labour force and these members could not afford to increase the salary of each member. The numbers of labour were also high in following hard automation. The high regard for elimination of errors required a skilled and efficient workforce. Soft automation required semi-skilled or highly educated workforce to operate equipment. These workforces were able to effectively operate this equipment and numbers of labour required were also lower than hard automation. Hence, from this research the higher number of directors accepting the fact that labour cost affected to investment decision in soft automation can be seen clearly. Around 50% of the directors have shown that cost of labour was a factor to consider when investing in soft automation as shown in figure 4.

Table 5. Investment Decision based on the Cost of Labor

Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Cost of labor affects investment decision on soft autmation	6	6	3	3	2

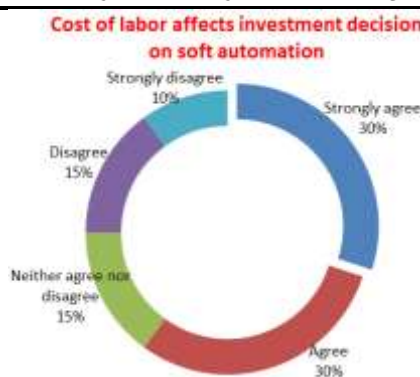


Figure 5. Pie chart Investment decision based on the cost of labor

Output also plays an important role in investment decision in soft automation. In compared to hard automation, soft automation output per unit is higher which leads to efficient usage of resources. The production cost can also be reduced since soft automation; energy consumption was lower in comparing to hard automation. From Figure 5, we can see a reduction in wastage when produced by soft automation. The higher output per time had also increased by soft automation. Hence we accepted the fact that output factors determined investment decision in soft automation.

Table 6. Investment decision based on output per production time

Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Output Factors has a influence on soft automation investment decision	6	5	3	4	2

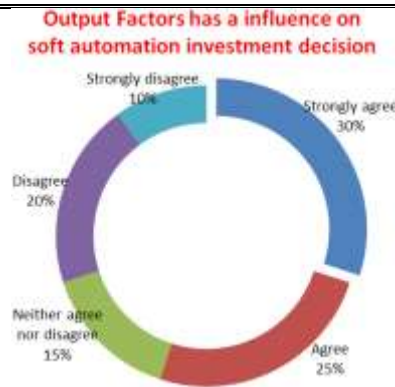


Figure 6. Pie chart Investment decision based on output per production time

Government also plays a role in the investment decision. The creation of favorable environment helps in the trust in investors' confidence. The environment policy, tax, import policy, support policy affect the decision made by SMEs. The SMEs owners were willing to invest in automation when government provided tax exemption even when the cost was higher. The government created [7] to facilitate Soft Loan to SMEs for the growth in this sector. Due to these reasons SMEs even though a small impact feels the need of government policy for investment decision in soft automation. Explain as shown in figure 6. example for Output per units cost influence on investment decision on Soft Automation, Soft automation reduce waste to increase output, Production time can be Increase in Soft Automation almost more than 60% agreement as per table 8

Table 7. Investment decision based on governmental factors

Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
Overall the government regulation policy affect investment decision in soft automation	6	6	3	3	2

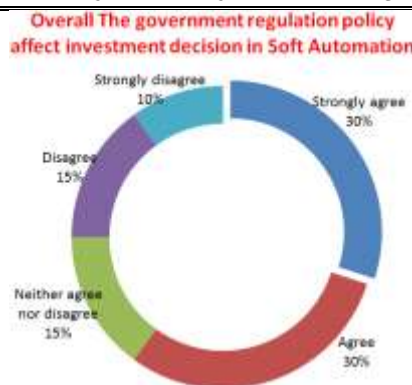


Figure 7. Pie chart investment decision based on governmental factors

Discussion

The results obtained from the research objective showed that most operators were located in the convenient transportation area close to each other. Most executives who interviewed face-to-face with open-ended questions agree with these factors, such as strategic decision, accounting, cost decision, labor decision, government regulation affect decision was affected to investment[8]. Without the full support of government and various entities working within the automotive industry[9], it was very hard for SMEs survival. The long term planning and cost were major factors that affect investment in soft automation. With the recent trend of computerized system and aging Thai population soft automation is a must but it should be supported by the government for efficient transformation into new technology. [2][8]

Table 8. Investment Decision based on which factors and base on percentage

Number of interviewees based on gender	Male	Female	Investment on soft automation decision based on which factors					
	16	4	Strategic decision	Accounting/ Cost decision	Labor decision	Government regulation	Other factors	
Number of interviewees based on educational background	Education background							
	Masters	Bachelors	High school					
	14	4	2					
Investment decision based on which factor and their percentage	Average							
	26%	30%	24%	13%	7%			
Description	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree	Explanation		
Cost of Soft Automation has a influence in investment decision	3	6	5	4	2	Low Variable Cost		
Cost of Operation of soft automation has a influence on investment decision	4	3	6	4	3	Chance of competitor		
Output Factors has a influence on soft automation investment decision	6	5	3	4	2	Economy of scope		
Output per units cost influence on investment decision on Soft Automation	4	8	5	1	2	Constancy output		
Can soft automation reduce waste to increase output?	5	6	4	3	2	Decrease Human Error		
Production time can be increase or(decrease) in Soft Automation	6	6	4	2	2	Fish bone method		
Cost of labor affects investment decision on soft automation	6	6	3	3	2	Out of control(cost)		
Working with Soft Automation required any training	4	7	6	2	1	Work Instruction		
Is skill laborer required to operate soft automation	3	8	7	1	1	Training follow WIP		
Reduce Waste have influence to Quality Assurance	6	6	5	2	1	Influence		
Reduce Waste have influence to Production Cost	5	6	5	4	0	Equation		
Reduce Waste have influence to Investment decision	6	8	3	3	0	Profits		
Reduce Waste have influence to Turnover Rate	5	6	6	3	0	Probably WIP		
Reduce Labor Cost have influence to quality assurance	5	7	4	2	2	Which one better than		
Reduce Labor Cost have influence to Production Cost	6	7	4	1	2	Equation		
Reduce Labor Cost have influence to Turnover Rate	6	4	8	1	1	Which Solution		
Overall The government regulation policy affect investment decision in Soft Automation	6	6	3	3	2	Which one advantaged		
The government policy of Tax affect investment decision in Soft Automation	6	4	6	3	1	Tax Extemp		
The government environment policy affect investment decision in Soft Automation	5	7	4	3	1	Not strong		
The government support policy affect investment decision in Soft Automation	6	5	5	3	1	CSR it is OK		
Provision of soft loan by government affect investment decision on soft automation	6	6	3	3	2	Interest and Long terms		

Table 9. ROI and cost of production per period

Items	Company	Work piece	Sales price	Hard Automation				Innovation to	Flexible Automation				Total Change ROI	From Secondary Data
				Production Cost	Labor Cost	Waste	ROI		Production Cost	Labor Cost	Waste	ROI		
1	PJ Global Co., Ltd.		17 B/Ea.	10 B/Ea.	4.8 B/Ea.	1.7 B/Ea.	3.03		9 B/Ea.	3.2 B/Ea.	1 B/Ea.	28.79	25.76	25-35%
2	Well Mech Electronics Co., Ltd.		36 B/Ea.	23 B/Ea.	9 B/Ea.	2.5 B/Ea.	4.35		21 B/Ea.	5.2 B/Ea.	1.5 B/Ea.	29.96	25.62	25-35%
3	VCT-09 Co., Ltd.		66 B/Ea.	43 B/Ea.	17 B/Ea.	3.5 B/Ea.	3.94		29 B/Ea.	12 B/Ea.	1.5 B/Ea.	25.71	21.78	20-30%
4	Hema Engineering Co., Ltd.		78 B/Ea.	52 B/Ea.	16 B/Ea.	1.8 B/Ea.	11.75		49.5 B/Ea.	11 B/Ea.	0.8 B/Ea.	27.24	15.50	15-20%
5	Multi-More Engineering and Supply Co., Ltd.		78 B/Ea.	52 B/Ea.	16 B/Ea.	1.5 B/Ea.	12.23		48 B/Ea.	12 B/Ea.	1 B/Ea.	27.87	15.64	25-35%
6	Chaijarn Engineering and Supply Co., Ltd.		8 B/Ea.	4 B/Ea.	2.5 B/Ea.	1 B/Ea.	6.67		3.5 B/Ea.	2.2 B/Ea.	0.5 B/Ea.	29.03	22.37	20-30%

7	M.F. System Mold Co., Ltd.		120 B/Ea.	64 B/Ea.	38 B/Ea.	4.5 B/Ea.	12.68		58 B/Ea.	33 B/Ea.	3.8 B/Ea.	26.58	13.91	25-30%
8	Zena Mold & Engineering Limited Partnership		105 B/Ea.	54 B/Ea.	38 B/Ea.	3.5 B/Ea.	9.95		50 B/Ea.	32 B/Ea.	1.5 B/Ea.	25.75	15.80	25-35%
9	Suwankosit Group Co., Ltd.		12 B/Ea.	6.5 B/Ea.	2.5 B/Ea.	1.5 B/Ea.	14.29		6.3 B/Ea.	2.2 B/Ea.	1 B/Ea.	26.32	12.03	20-30%
10	SP Engineering and Parts Co., Ltd.		95 B/Ea.	67 B/Ea.	20 B/Ea.	3.5 B/Ea.	4.57		61.5 B/Ea.	13 B/Ea.	1 B/Ea.	25.83	20.86	25-35%

Conclusion

1. the fundamentals of a companies that the most manufacturing were located in the convenient transportation area close to each other.

2. the relationship between fundamental factors the relation between flexible Automation and Investment decision, labor cost, output factors, government regulation

shows all positive sign towards investment decision which was the right solution. If we produce cause to lower-cost change from one part to another which will improve capital utilization. It controlled lower direct labor cost due to the reduction number of workers. Mission to consistent and better quality was due to the automated control. Eliminate errors, reworks, repairs and rejects can increase profits.

3. Factor drivers investors to invest in flexible(soft) automation the relation between Tax, Environmental policy, Supporting Policy affect investment decision in flexible automation.

4. the transformational factors of SMEs with Influencing the development of conventional production to flexible automation- involved hardware and software.

The implementation of flexible automation involves development of various manufacturing concepts from which a few specific alternatives are selected and then evaluated so that a single alternative can be selected and implemented. In flexible automation, different product can be made at the same time at the same manufacture system; also the cost of capital equipment and its supporting software will be a major driving factor as well as limiting factor in the ability of a company to remain competitive in the world market. Example: Automobile assembly line.

Suggestion

The greater demand for flexible(soft) automation in SMEs, the more efficient manufacturing directors of SMEs will be guided towards better allocation of their resources and better understanding of soft automation. The report can also help academics students and teachers a like to future understand how oft automation can affect production systems. Even for future researcher they can focus on individual topic drawing specific knowledge in the field of manufacturing. Our Aim in this report was to find the influencing factors for investment in Flexible Automation by SMEs of Automotive Industry. So we first need to know the difference in Hard & Flexible(Soft) Automation and what factor drivers investors to invest in Flexible (Soft) Automation from the study we found.

References

- [1] Schwab, k. The global competitiveness report. [Internet] .2015 [cited 2016 Jan 12] .Available from:http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf
- [2] Koch, V., Kuge, S., Geissbauer, R., & Schrauf, S. Industry 4.0" opportunities and challenges of the industrial [Internet].2015 [cited 2019 May 30] . Available from: <http://www.strategyand.pwc.com/reports/industry-4-0>
- [3] Irfanullah Jan. Payback Period. [Internet].2013[cited 2019 May 24]. Available from:<https://xplained.com/849768/paybackperiod>
- [4] Cross. What is Flexible Automation?. [Internet].2014[cited 2020]. Available from: <https://www.crossco.com/resources/technical/fixd-versus-flexible-automation/>
- [5] The World Bank. Thailand Economic Monitor - June 2016: Aging Society and Economy. [Internet].2016 [cited 2016 July 27]. Available Retrieved from: <http://www.worldbank.org/en/country/thailand/publication/thailand-economic-monitor-june-2016-aging-society-and-economy>
- [6] HAYES, A., Investment. [Internet].2015[cited 2021 Feb 25].Available from : <http://www.investopedia.com/terms/i/investment.asp>
- [7] The Office of SMEs Promotion .SME. [Internet].2016[cited 2019 November 29]. Available from : www.sme.go.th/th/index.php/news/1015-smes-2016
- [8] Royal Thai Government. (N.d.) PM hands over SMEs promotion policies. [Internet]. 2018 [cited 2018 April 19].Available from:<http://www.thaigov.go.th/index.php/en/component/search/?searchword=SME&searchphrase=all&start=80>
- [9] Thailand Board of Investment. Opportunities in Thailand's Automotive Industry. [Internet].2012[cited 2017 March 1].Available from http://www.boi.go.th/index.php?page=opp_automotive
- [10] AGI. Hard vs. soft assembly automation increased factory productivity. [Internet] .2014 [cited 2016 June 15]. Available from: <http://www.agi-automation.com/2014/05/hard-vs-soft-assembly-automation-increased-factory-productivity/>