# THE APPLICATION OF TOYOTA PRODUCTION SYSTEM IN THE AUTOMOTIVE INDUSTRY IN THAILAND.

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## ABSTRACT

A study application of The Toyota system to enhance component performance in the automotive industry. The objective is to (1) Study the characteristics of the application of the Toyota production system to enhance the performance of parts in the Automotive Industry. (2) Compare the application of The Toyota production system and the old system to enhance the performance of parts in the automotive industry. The Sample size was 150 persons. The tools used to collect data was questionnaire and the statistics used in the analysis consist of frequency, percentage, mean, standard deviation, t-test, F-test and fisher's least significant difference.

A study of the Toyota production system had increased component performance in the automotive industry. The focus area was located at The Amata nakorn industrial estate, phan thong district, Chonburi province. The majority of respondents have had less than 1 year of work experience, graduated from junior high school or lower and the average monthly income was about 10,000 -20,000 bahts per month and the level of opinion on the application of the Toyota production system to enhance the performance of parts in the automotive industry. The result consists of the (1) highest score (= 4.75, S.D. = 0.50) was found. (2)The process of Just-in-time (=4.77, S.D. = 0.48) followed by (3) the process separation of kanban (= 4.76, S.D. = 0.48) and (4) the process of warehouse management ( = 4.73, S.D.=0.53)

**Keywords:** Toyota Production System, Performance, utomotive Industry

## INTRODUCTION

Toyota production system; TPS is a suitable method of production. This is because the system aims to completely eliminate the elements that are not necessary in the production. The primary goal was to reducing production costs and basic idea of the system is to manufacture only the right product according to the right quantity and right time by Eiji Toyoda, Taiichi Ohno and Toyota's manager applied the concept from a visit to a Ford factory in 1950 and applied the concept of a pull system from a supermarket in America at that time to apply to the factory's own operating area. The fulfillment of products appeared when it decreased to the minimum point. And whenever necessary to substitute will cause pulling system which will be pulled sequentially until the starting of the production cycle by calling just in time (JIT), one of the two pillars of The Toyota production system (TPS) with management guidelines to get good productivity, lowest cost and the least lead time also safety in the production. The Toyota production system consists of 3 main activities which were consisted of Just in time (JIT), Jidoka and Kaizen (Pathompong Homsri, 2012).

Nowadays, many industries require timely production. (Just-in-time; JIT) Moreover, the purpose of the product was completed on the deadline to reduce the production process costs by the finished product before the delivery deadline and the finished product was delayed in the event that the product is finished ahead of schedule, the manufacturer will have to pay for expenses. In stock keeping because customers do not want to receive Products before the agreed time In addition, some products type may deteriorate until it cannot be used. On the other hand, if the manufacturer is not able to produce the product on time, the customer will be dissatisfied. And the manufacturer may have to pay a fine for that customer as well as negatively impact the company's image and may lose the opportunity. In the production of the next product Summarizing about the characteristics of scheduling problems just in time production Consists of problems at work each job has a common due date and the problem is that each job has a different due date. Distinct due dates early completion and late completion of each job may be the same (Common penalties) or different. In the past, researchers have developed methods to find answers to the flow shop scheduling problems and Flexible flow shop scheduling in a timely manner, in which the characteristics of the problem are different. And the components of the production in time, must know the continuous flow process The
raw materials will be changed into finished products to be sold for sale. The production process There are 4 basic types, transformation, assembling, disassembling, shape reform, inspection, standard transport comparison, re locations and storage time. There is no work, transportation, and inspection, in which materials and parts tend to go through these steps many times while in the production process. Privatization only which was adding value for the product (Anat chaimanee and Wisut sukhapit, 2015)

The efficiency of the production process is an important factor for the overall cost of the organization. In this research focus on improving the performance of the production process, starting from receiving orders from customers. Production plan was consistent with the product delivery schedule. However, these activities require cooperation in the organization There is sufficient communication, including To analyze problems in the production department, machine, raw materials, methods for employee efficiency By evaluating the ability of the operators The work procedures are appropriate. Or the wait doesn't flow. Wasted or not. And the most important part is the machine performance, because the machines are quite expensive to invest in important parts mentioned above. These will determine price, quality and delivery of the product. The automotive parts business is one of the machinery that is very important to the automobile industry. The Thai government is trying to push and support the automobile industry to be one. In the main industry that drives the national economy Causing the business of manufacturing auto parts in Thailand As an important machine Must have technology development, personnel and business management effectiveness In parallel with Especially in the midst of competition in the world market And change Environment that affects business operations Which brings opportunities and challenges for Car parts manufacturing business, resulting in medium-sized car parts business entrepreneurs Small and small businesses must keep an eye on situations, trends, opportunities and challenges, as well as adjust strategies Conducting business in a timely manner In the condition of competition increasing Making customers have the option to compare prices more accordingly. Therefore, business operators turn to focus on controlling production costs For increased performance Both in terms of cutting, reducing expenditures And increasing productivity Labor higher Which may turn to invest in changing machinery to increase production capability Which leads to more automation And reduces the use of unskilled labor Or use more skilled labor to help reduce manufacturing defects Resulting in quality and precision products More accurate Reducing losses from substandard products (Kornthikul Warawonghiran, 2016)

Cars have become a necessity in modern lifestyle. Although the oil price will increase but has very little effect on car sales, together with the first car policy, the government refunds the first car tax. This factor motivates young people who have just graduated and not work for long time. The popular with the first car had seen from the number of cars registered has increased, especially in Bangkok and major provinces. In each region According to the statistics of the department of transport in 2013, it is found that passenger cars are registered throughout Thailand. The sedan car were 6,736,562 vehicles, divided into Bangkok 3,356,099 cars and provincial regions 3,380,463 cars.

For the year 2012, found that passenger cars are registered throughout Thailand. Personal not more than 7 people, amount 5,437,988 cars, divided into Bangkok 2,972,305 cars and provincial area 2,884,149 cars. The cumulative registration rate increased to 19.28% (Department of Land Transport, 2013) when the car market has grown from the said external factors resulting in the car maintenance business to grow as well because these cars need to be maintained in order to be able to use at a high cost for the car. And most importantly, cars are likely to have accidents at all times. According to statistics from the Royal Thai Police, found that in 2013, there were 61,170 road traffic accident cases (Royal Thai Police Agency, 2013). At present, businesses in The manufacturing and service sectors are highly competitive. Especially in the automotive parts manufacturing industry Which is an important industrial product of Thailand, is a production base for exports in 2016, Thailand can produce the 13th highest car in the world and create export value in the category of cars, equipment and components up to 9.2 hundred thousand. Million baht, representing 12% of the total export value of Thai products with a production volume of 1.97 million vehicles in which Thailand has a total of 600 automotive parts manufacturers (Kasikorn Bank Research Center, January 2017)

From the above reasons, the researcher was interested to study on "The application of the Toyota system to increase the capacity of the parts production process in the automotive industry", which was founded in addition to being beneficial to the company in the case of the automotive parts manufacturer The research results can also be adapted to other companies within the automotive industry also.

## RESEARCH OBJECTIVE

The study of this research aim to.

1. To study the opinion level on the application of the Toyota system to enhance the performance of the parts production process in the automotive industry

2. To compare the perceive level the model and how to applied of Toyota system application to enhance the efficiency of the production process in the automotive industry.

## RESEARCH FRAMEWORK

In this research, the researcher aims to be a guideline in applying the Toyota system to increase parts performance
in the automotive part manufacturing industry. Located at Amata Nakorn Industrial Estate, Phan Thong District, Chon Buri Province For the purposes of this research The researcher summarized and determined the variables for the study as in Figure 2.2

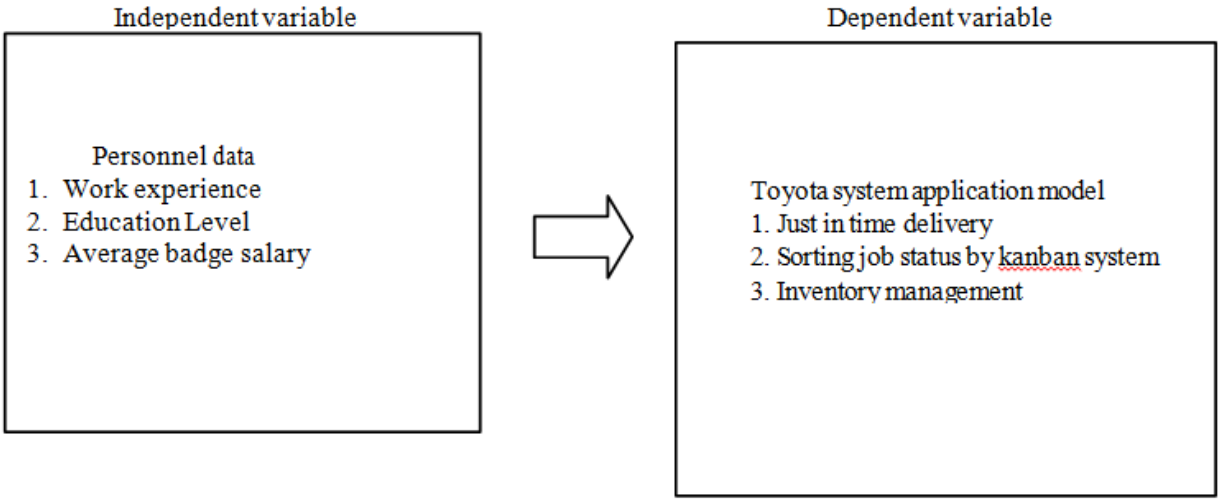


Figure 2.2 Research conceptual frameworks

## RESEARCH QUESTIONS

Based on the research framework above therefore the questions of this research are as follows: How to apply the Toyota system to increase the efficiency of the parts production process in the automotive industry affects the level of opinions on the model of the Toyota system to increase the efficiency of the parts production process in the parts manufacturing industry.

## RESEARCH HYPOTHESIS

1. Operators with different work experiences are different opinions on the application of the Toyota system to increase parts performance in the automotive industry.
2. Operators with different educational levels are different opinions on the application of the Toyota system to increase parts performance in the automotive industry.
3. Operators with different monthly incomes are different opinions on the application of the Toyota system to increase parts performance in the automotive industry.

## LITERATURE REVIEW

### *1. Toyota production system concept*

The production concept using the Toyota system is the production approach that use by Toyota and applied by lean system. James Womack and Daniel Jones define lean production in 5 processes: 1) Customer value 2) Value stream 3) Production flow 4) Pull back from customers' needs (Pull system) 5) Striving to excellence in which the TPS system is not just a set of tools such as the Just in time, cell formatting, or Kanba Systems. The TPS system is a sophisticated production system in which every component of the system is supported to achieve a complete system. The foundation of the system focuses on supporting and encouraging people to continually improve their processes. The TPS system has the following concepts: 1) consistent thinking 2) integrated management philosophy 3) A paying full attention to customer satisfaction 4) Working conditions of working as a group and improving 5) Continuous improvement 6) quality is integrated into the process 7) the place of performance of the system regulation 8) is developing very dynamically. Which, to be a potential producer It is necessary to have a concept that

leads to the flow of the product through an enrichment process without interruption. Which is a mechanism delivered from the needs of the customer, which will proceed only when the product is pulled out by the next operating point for a short period of time. Including the corporate culture in a form that everyone is committed to continuous improvement By working in the production Will consider the time since the customer has ordered Until when we receive money from customers And will shorten that period by eliminating wastage that does not add value (Ohno, 1988)

***2. Just-in-time; JIT Concept***

The concept of producing the right type of products at the right time when needed is called "timely production" (Phongsai Phet, 2010 and Sirat Chaengraksakul, 2010). In order to manufacture one car, Sub-assembly from the previous process must arrive at the main assembly line when it's time to make up the required quantity. If the condition is just in time having been treated thoroughly in the company, unnecessary materials in the factory will be completely eliminated and there will be no need for warehouses anymore. The cost of storage of remaining materials is hardly had to waste resulting in a higher capital turnover rate.

In summary, Just-in-time delivery (JIT) means the system for timely delivery in time of need in the required amount and meets the needs of customers.

***3. Kanban System Concept***

(Teerasan Chanachoke, 2018) said that the concept has been developed by Toyota about 75 years. The nature of the work is divided into small pieces. There are procedures that are appropriate for the operation in order to schedule the work to be minimal. At present, this concept has been applied to work in other fields. Including the software work by using Kanban, that is to create a work schedule, which is mainly focused on Software Development as a tool to help manage the original process, that is to say Make the software development process that we currently use on the Kanban table. There are 3 principles: 1) Visual the workflow - show the flow of the system in a clear picture. 2) Limit work in progress (WIP). The main point of Kanban is to limit work to one sub-unit. For example, for Development work, do not hold more than 2 jobs to prevent overload and cause loss. Waste 3) Measure the lead time - will measure performance and improve even further. This is called Cycle time or the average value that will be on the board from the beginning to the actual production. Divide into 2 sides to show the operation of the system clearly. Can tell where the work is currently stuck and will set the scope of work so as not to waste the working time. There is a discussion throughout the work by clearly specifying agreements. The accuracy of the work is checked to use the information to make decisions. To see the results that will occur in the future. Advantages Kanban has a clearly defined work process. Clearly know the status of the job at which stage there is a system to assign and divide the work to the people in the team systematically. Disadvantage Kanban is better for working on many projects at the same time. If having a part in one part is slow, it will make it all slower. In the system there must be a proper supply throughout. (Sukhum Munkong, 2011) said that the Kanban system means a part of the JIT system that has been developed to help the work to be coordinated good and efficiency jobs. Toyota's Kanban system uses a sheet of paper as a signal to indicate the need for "send additional parts" (Conveyance kanban: C- card) and use the same or similar sheet of paper as a signal of desire for "produce more parts" (Production kanban: P-Card) which will be attached to the container that contains raw materials. There are two-card system with criteria for operations 1. Each container must always have a card. 2. The assembly line will request the parts from the production unit by pulling system. 3. If there are no approval orders, the container will not be moved out of storage. 4. Containers must contain only the correct quantity and good quality components. 5. Only good parts will be delivered and used in the production line. 6. The total output will not be more than the production orders

recorded on the P-Card and the raw materials withdrawn must not exceed the number of parts recorded on the C-Card. Resulting in the idea of using Kanban, the production process of parts in the automotive industry to

1. Non-quality products will not be transferred to the next process.
2. The product should be withdrawn from the previous process.
3. Quantity in production must equal the amount withdrawn.
4. Parts will not be produced and moved when there is no kanban.
5. Kanban must be stuck on the parts.
6. The actual number of parts must be the same as specified in the kanban.

In summary, the job status classification with kanban (JSCK) means the use of cards, labels, or symbols. That can tell the work flow to control the operations in the factory and sort out the work status. There are 2 guidelines for controlling over production and shorten the production time.

### *4. Warehouse Management Concept*

Inventory is a type of current asset which an entity must have for sale or production (Thidarat Boonmak,2010). Raw materials are items or parts purchased for use in production line. Work in process is a work that is still in the production line or waiting to be produced in the next step while still not passing through every production process. Including maintenance materials, which are spare parts or machinery spare parts reserved for replacement when the original parts are damaged or expired and finished goods are the inputs that have passed all production processes and ready to be sold to customers.

In summary, inventory management is the management for materials, equipment, tools and machinery, material labor, work in production Including finished goods Remaining in the warehouse that is suitable for production and for sale, with a quantity that is not more than necessary and not less until not only for production and sales for the benefit. And the lowest cost of management.

Organization supply chain development by analyzing important components both inside and outside the organization which is an analysis of the competitive conditions of businesses that were currently running, such as services or responses per customer needs, delivery on time, etc Chitpong Ayasanond. (2018) .These things will know the factors that determine capabilities and advantages or disadvantages of competition in the organization. The results obtained from this analysis will be able to use as a guideline to determine the scope and key elements that must be managed for the organization. Performance competencies must be defined in order to be aware of the goals of each factor of the supply chain operational capabilities that can be applied (Logistics competency assessment handbook benchmark criteria for entrepreneurs, 2013)

## RESEARCH METHODOLOGY

This research was a quantitative research and data collection by questionnaires. The researcher determined the sample size by using the formula of Krejcie & Morgan to know the number of population with 95% confidence level. Therefore, the size of the sample population of not less than 150 people (Krejcie and Morgan, 1970, pp. 608-
610). Questionnaires had been developed based on objectives and conceptual frameworks of research on TPS
logistics service model management. The questionnaire was divided into 3 parts.

Part 1 The 3 fundamental personal questionnaires were a checklist question, with the actual responses of the personal fundamentals data.

Part 2 A questionnaires about the opinions of the Toyota application system to increase the performance of the
parts manufacturing process in the automotive industry, consisting of 15 items, is a Likert's rating scale with five responses. Choose to respond according to the level of feedback.

Part 3: Problems and Suggestions.

Researcher had created tools to collect data. The steps were as follows

- Study concepts and theories from academic papers, textbooks, websites, and related research of similar nature to bring information from various sources as a guideline to create a questionnaire.
- Analyze the objectives, content and structure of the research to determine the guidelines and scope of the questionnaire.
- Create a draft questionnaire, by defining the scope and scope of the question in accordance with the objectives of the research.
- Bring the draft questionnaire to the advisor for review, consideration and correction, and provide the experts with knowledge and experience in research title by statistics research and consider the questionnaire for 3 persons to review and make further recommendations. As well as content validity, understanding and using the language to evaluate the results of the decision to find the index of Item Objective Congruence (IOC).
- Complete a complete questionnaire for use in the research sample.

The researcher selected the questions with the IOC value of over 0.67 as a question. As well as improving the questionnaire was clear and comprehensive for the purpose of this research. The researcher used a questionnaire that was subjected to expert review and tried out the sample with the similarity to the sample with the similar characteristics.

The data analysis was a statistical computer analysis program. Compare the difference between the personal data of the sample, the mean and standard deviation of the opinions on the management of the rail transport model, using T-Test and One Way Anova statistics to test hypotheses that the users of education level, occupation, average income per month and the average monthly cost of subscribers varies.

## RESEARCH RESULT

The research Found that general information of respondents Most of them have less than 1 year work experience, 67 people, representing 44.66%, followed by work experience between 1-5 years, 56 people, representing 37.34% and the least have work experience more than 5 years, a total of 27 people. Representing 18.00 percent and most of them have education levels. 95 high school students or lower, equivalent to 63.33%, 55 high school students or higher are 27.33%, and 14 diploma or higher, 9.34% and most of them have average incomes per month. 10,001-20,000 baht, 85 persons, representing 56.67%, followed by average monthly income 20,001-30,000 baht, 43 people, representing 28.67% and the least, the average monthly income of more than 30,000 baht up to 22 people, accounting for 14.66%

The results of the analysis of opinions on the application of the Toyota system to enhance the performance of parts in the automotive industry for overall and separate into 3 parts as follow.

Table 1: factors influencing in feedback level on the application of the TPS to increase component performance

| Process | Mean | S.D | Factors influencing in component performance |
|---|---|---|---|
| Just in time delivery | 4.77 | 0.48 | Highest |
| Job status using Kamban system | 4.76 | 0.48 | Highest |
| Warehouse management | 4.73 | 0.53 | Highest |
| Average | 4.75 | 0.50 | Highest |

Table 2: factors influencing in feedback level on the application of the TPS in terms of delivery, just in time

| Process | Mean | S.D | Factors influencing in delivery Just in time |
|---|---|---|---|
| Inventory control of spare parts to a minimum level. | 4.83 | 0.41 | Highest |
| Delivery of automotive parts in the right time that customers need. | 4.81 | 0.43 | Highest |
| Delivery of automotive parts in the right quantity. | 4.77 | 0.48 | Highest |
| Average | 4.80 | 0.44 | Highest |

Table 3: factors influencing in feedback level on the application of TPS in term of job status with kanban

| Process | Mean | S.D | Factors influencing with kanban |
|---|---|---|---|
| Prevent misuse of automotive parts. | 4.85 | 0.38 | Highest |
| Control spare parts to prevent over production. | 4.84 | 0.38 | Highest |
| Reduce time in producing automotive parts. | 4.76 | 0.48 | Highest |
| Average | 4.82 | 0.41 | Highest |

Table 4: factors influencing in feedback level on the application of TPS to increase Inventory management

| Process | Mean | S.D | Factors influencing with inventory management |
|---|---|---|---|
| Reduce storage cost of automotive parts. | 4.80 | 0.44 | Highest |
| Just in time for delivery automotive parts. | 4.75 | 0.49 | Highest |
| Reduce waste in the auto part storage process. | 4.73 | 0.54 | Highest |
| Average | 4.76 | 0.49 | Highest |

Comparison of expectations and perceptions of individuals with different major factors toward the factors that influence to the application of Toyota Production System in the automotive industry in Thailand, classified by Just in time, kanban system and inventory management. There were same opinions.

## DISCUSSIN

This research found that an overview of opinion levels on issues affecting the application of the Toyota system to increase component performance in the automotive industry from the data collection of automotive parts manufacturing companies in Amata Nakorn Industrial Estate, Phan Thong District, Chon Buri Province. The overall level is the most agreed (= 4.75, S.D. = 0.50) when considering in each aspect, it was found that the average scores were at the highest level in 3 aspects, in order as follows, The JIT delivery process (= 4.80, SD =0.44) , followed by the kanban sorting process (=4.82, SD =0.41) and the warehouse management process (=4.76, SD =0.49) Summary of hypothesis testing on the application of the Toyota system to increase component performance in the automotive industry as follow

| The application of TPS | Opinion status | | |
|---|---|---|---|
| | Work experience | Education level | Average salary per month |
| 1. Just in time delivery | X | X | X |
| 2.Job status by kanban system | X | X | X |
| 3.warehouse management | √ | X | X |
| Result | X | X | X |

Remark: √ = There are significant differences at the .05 level.
X = There are no significant differences at the .05 level.

## CONCLUSION AND RECOMMENDATIONS

The study of the application of the Toyota system to enhance parts performance in the automotive industry can
be summarized as follows:

***1. General information of respondents.***

Most respondents have less than 1 year work experience, had completed lower secondary education or lower and had an average monthly income 10,000-20,000 baht

***2. The level of opinions towards the application of the Toyota system to enhance parts performance in the automotive industry.***

The overall opinions towards the application of the Toyota system to enhance the performance of the parts
in the automotive industry were at the highest level of agreement. When considered in each aspect, the average scores were at the highest level in 3 aspects, JIT delivery, Kanban job sorting and the process of inventory management in warehouse.

***3. Comparison of opinions on the application of the Toyota system to enhance parts performance in the automotive industry Classified by work experience.***

3.1 The operators with different work experiences have the same level of opinions on JIT delivery.

3.2 The operators with different work experiences have the same level on job status sorting by kanban..

3.3 The operators with different work experiences have different opinions about the inventory management in warehouse with statistically significant at the .05 level.

While the feedback level results in a reduce cost of storage of automotive parts, storage space and waste in the automotive storage process not different.

Suggestions for using research findings, JIT delivery should have the TPS applied to the logistics and supply chain management in order to adjust the delivery management to reduce the problems and increase the efficiency of the delivery management, reduce the steps In order to speed up the operation, using modern information technology to help manage the data delivery to avoid delays and errors. For the concept of the study on the TPS application to increase the parts performance in the automotive industry, it was analyzed together with the logistics and supply chain systems that will be applied to the company in order to increase the performance of parts in the automotive industry, manage the logistics and supply chain from upstream to downstream and should be applied information systems as a tool for all integration. Kanban system should be sets to operational standards and would be educates employees to be able to operate appropriately and to be consistent with current operations coordination in the production process. The mistakes were frequent occurred because one-way communication. Therefore should be coordinated with two-way communication will help reduce problems and make them more productive. The EDI systems should be used to control and manage warehouse management in order to reduce the process of managing equipment or parts. The number of delivery cycles should be specified to suit the production to reduce the overhead of shipping costs by establishing the minimum stock and maximum Stock system to control the fluctuation of the customer's work piece.

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