

ANALYSIS AND COUNTERMEASURE TO IMPROVE A LOW TAKT
PRODUCTION ITEM BASED ON LPS EVALUATION AT HICOM TECK SEE SDN.
BHD.

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ABSTRACT

Toyota Production System (TPS) is derived from Toyota's original idea was just in time (JIT) which it is the idea of sakiichi Toyoda, Toyoda kinchiri their engineers, taiichi Ohno. Objective of this system is to design out a muda (waste), mura (inconsistency) and muri (work load). In Malaysia this system at first adopted in the automotive industry, especially in Proton and Perodua as well as their vendors. Hicom Teck See (M) Sdn. Bhd. is one of the Proton and Perodua vendors that produce parts made from plastic as the front bumper. From the results of evaluation of LPS in May 2011, Takt Production showed the lowest criteria, in order to solve this problem one of the seven QC tools are used, next by used CFMEA and FMEA for determined the potential of the root causes why the production is the lowest criteria. By obtaining these potentials occur this problem, suggestions for improving these criteria are shown. By taking one of the products produced Hicom Teck See, a case study have been done. For this case study, a visits to Hicom Teck See have been done, all data on these products is taken to produce a proposal. The proposal is expected to improve Takt production criteria, and thus increase the score assessment of LPS in the next evaluation. By prepare proposals, Hicom Teck can see self-improvement / kaizen at work stations to reduce the lead time to customers and reduce the workload on the operator.

ABSTRAK

Toyota Production system (TPS) adalah dihasilkan daripada Toyota, idea asalnya adalah *just in time* (JIT) dimana ia adalah idea dari sakiichi toyoda, kinchiri toyoda dan jurutera mereka, taiichi Ohno. Tujuan utama sistem ini adalah untuk merekabentuk muda (pembaziran), mura (ketidakselarasan) dan muri (bebanan kerja) Di Malaysia system ini mula digunapakai di dalam industri automotif, terutamanya di Proton dan Perodua begitu juga dengan vendor-vendor mereka. Hicom Teck See (M) Sdn. Bhd. merupakan salah satu vendor Proton dan Perodua yang menghasilkan bahagian yang diperbuat daripada plastic seperti bumper depan. Daripada keputusan penilaian LPS pada Mei 2011, *Takt Production* menunjukkan criteria paling rendah, bagi menyelesaikan masalah ini salah satu 7 alat QC diggunakan, kemudian menggunakan CFMEA dan seterusnya FMEA bagi mendapatkan potensi untuk terjadinya punca masalah mengapa *takt production* merupakan kriteria paling rendah. Dengan memperoleh potensi-potensi terjadinya masalah ini, cadangan bagi memperbaiki kriteria ini ditunjukkan. Dengan mengambil salah satu produk yang dihasilkan Hicom Teck See, satu kajian kes dilakukan. Bagi membuat kajian kes satu lawatan ke Hicom Teck See dilakukan, segala data mengenai produk tersebut diambil bagi meghasilkan cadangan tersebut. Cadangan ini diharap dapat memperbaiki kriteria *takt production*, dan seterusnya menaikkan score penilaian LPS pada penilaian akan datang. Dengan menyediakan cadangan, hicom teck see dapat membuat peningkatan/ *kaizen* pada stesen kerja bagi mengurangkan *lead time* kepada pelanggan dan mengurangkan beban kerja kepada operator.

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LIST OF ABBREVIATIONS

CFME	Cause Failure Mode Element
FMEA	Failure Mode Element Analysis
JIT	Just In Time
HTS	Hicom Teck See
HMS	Hicom Management System
LPS	Lean Production System
MJEPA	Malaysia-Japan Economic Partnership Agreement
MAJAICO	Malaysia-Japan Automotive Industry Cooperation
RPN	Risk Priority Number
SWCT	Standard Work Combination Table
SWC	Standard Work Chart
TPS	Toyota Production System
WIP	Work In Progress

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF PROJECT

LPS was developed by Toyota or known as TPS (Toyota Production System), Kinchiri Toyoda and Taiichi Ohno had to go to America to visit and observe what are the systems used by Ford to develop their production until they succeed, after visiting the Ford plant Kinchiri Toyoda and Taiichi Ohno were not satisfied because they saw a lot of cars at Ford inventory, and wait for customers to order. They were impressed when they went to one shop known as Piggly Wiggly, they observed that the simple idea of an automatic drink resupplied; when the customer wants a drink, he takes one, and another replaces it. The delegation was inspired by how the supermarket only reordered and restocked goods once they had been bought by customers. So they have used this system on their production and known as JIT (Just in Time). This system the subsequent work station withdraws the necessary product on the necessary quantities at the necessary time, (Miyazaki, S, 1996). The objective of TPS or the top of TPS house is to improve quality, reduce cost, and improve delivery time, employee involvement and high morale. TPS house has 2 pillars which are JIT and Jidoka. Jidoka is stop and identify the abnormalities. Figure 1.1 shows the house of TPS, which is the objective of this system to produce high quality of product with lowest cost to produce it and shortest lead time, have high morale of workers and safety work place.

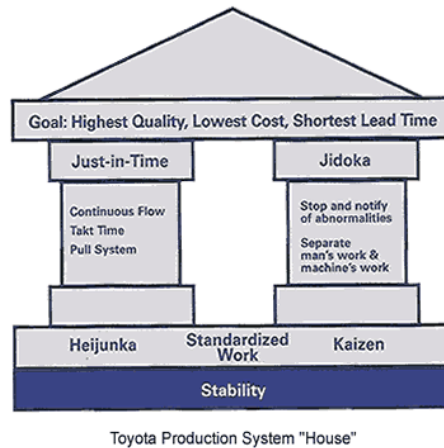


Figure 1.1: House of TPS

Source: <http://beyondlean.wordpress.com/tag/six-sigma/>

Lean Production System (LPS) is an assembly-line methodology developed originally for Toyota and the manufacturing of automobiles. It is also known as the Toyota Production System or Just-In-Time production. LPS usually implement at automotive area at our country such as Proton, Perodua and their vendor, but now this system also had apply at office, usually at government office to make sure they are lean and can achieve what customer need. Applying lean production tools of the Toyota Production System (TPS) has helped Porsche to increase their operational result from - 122 million € in 1994 to 933 million € in 2004 (A. Thorsten, 2006). This shows that any company that committed to apply this system may produce a profit. But mostly it depends on top management commitment to apply it.

Now, LM has become a widely acceptable and adoptable best manufacturing practice across countries and industries (Holweg, 2007). Malaysia start launching the first national car project or known as PROTON (Perusahaan Automobil Nasional) on 1985 and the first car build is proton saga, a joint-venture with Mitsubishi motors' (Arshad M.S.I.,2001) In Malaysia most of automotive industry players such as Proton, Perodua and their vendor had applied this lean system to their organization. This is good news, because lean manufacturing is based on Toyota production system and Toyota is one of the automotive companies that lead the automotive industry, so

Malaysia automotive industry players had cascade Toyota system to apply at their system.

But in reality how far and committed automotive company apply this system at their organization. The investigation is based on MAJAICO programme, The Malaysia-Japan Automotive Industry Cooperation (MAJAICO) programme was set up under the Malaysia Japan Economic Partnership Agreement. Signed in 2006, MAJAICO is a five years project that helps Malaysian Automotive Industries in various fields from the technical base to the business negotiations. This programme actually Initiated under Malaysia-Japan Economic Partnership Agreement (MJEPA) which one of the objective is to Improve productivity through Lean Production System. This programme is to target small medium enterprise (SME) automotive sector which the Benefits gained by companies under MAJAICO Programme is:

1. Improvement in productivity from 30% to 200%;
2. reduction in unscheduled machine & tooling downtime from 4 days to 2 days;
3. Reduction in rejection rate from 5% to 2 %;
4. Reduce stock inventory by 17% - improvement in space utilisation and housekeeping;
5. Create opportunity for employees to contribute and make improvement in their working areas on a regular basis; and
6. Potential to penetrate into the international market.

To make sure LPS is implement and apply at 13 model company, this company are categorized as small medium enterprise (SME) which is this company Manufacturing Related Services and Agro -based Industry and Annual sales turnover less than RM25 million or Full time employees less than 150 people. On this evaluation, the benchmark company was Denso which is has the best LPS implementation standard at Malaysia. There have 11 criteria that need to evaluate, on this evaluation the level of implementation will be graded from level 1 until level 5. Each company will have their target to achieve when the time to evaluate has come. On this study, Hicom Teck See Sdn. Bhd has selected to make a case study for this project. On their evaluation level, hicom teck see became one of the top scorers among 13 Model Company that attach on MAJAICO programme with 4.44 point. But they have a problem on takt time

production criteria, where this criteria didn't achieve the target and the difference between targets and actual is too high.

1.2 PROBLEM STATEMENT

These studies will focus on this criteria, how to improve it, give solution by using a few analysis tools and give an example of solution. To go further for this research some research questions need to take serious consideration, there are:

1. Why criteria of Takt time are the lowest pointer?
2. How to improve the Takt production level
3. How to make sure this problem cannot occur anymore

1.3 OBJECTIVE OF PROJECT

1. To identify why Takt time is the lowest pointer among criteria.
2. To give a proposal for a solution.

1.4 SCOPE OF PROJECT

1. Time

The period of this study is on February until June 2012.

2. Area

Area of study is at HTS which is a vendor to Proton and Perodua for automotive plastic components.

3. Tools use.

The tools that will be used for this study are Ishikawa diagram, FMEA and Action planning for failure mode.

1.5 ASSUMPTION

Assumptions are used to make sure there are no errors of interpretation about data collection and data analysis when this study is going on, following is the assumption that used on this study:

1. Evaluation result only taken on May 2011, by assuming no evaluation take on May 2012.
2. Cycle time taken on fix operator, by assuming all operators has a same time of movement.

1.6 DATA COLLECTION

There are two type of data collection on this study which is:

1. Premier data collection

This type of collection needs writer to observe on the company and by doing short interview with head of department of Hicom Management System (HMS) and also collecting data based on current situation at that company, such as cycle time of process to produce a part

2. Secondary data collection

The data that collected by find suitable books and journal that has related to this study

1.7 ORGANIZATION OF WRITING

Organize of writing mean the flow of processing this thesis from beginning of the problem until it finish up, this flow will be describe as follow by chapter. The following is the chapter that consists on this thesis:

CHAPTER 1 INTRODUCTION

This chapter consists of problem statement, objective of project, scope of project, assumption, data collection and organization of writing.

CHAPTER 2 LITERATURE REVIEW

This chapter will told about what is theory that had been use, what are tools that used to solve the problem.

CHAPTER 3 METHODOLOGY

This chapter will explain about the flow of this thesis will held and explain about each of processes on the flow chart.

CHAPTER 4 DATA COLLECTION AND PROCESSING

On this chapter all data that had been collect will processed

CHAPTER 5 ANALYSIS AND RECOMMENDATION

On this chapter, all data will be analyzed to determine the root causes of problem. And a pilot solution will be provided for company to apply

CHAPTER 6 CONCLUSION

This chapter consist the conclusion that can be made after the root causes had identify and the pilot solution had been made

CHAPTER 2

LITERATURE REVIEW

2.1 TOYOTA PRODUCTION SYSTEM

Toyota production system or TPS had been developed by Toyota. After World War II Japanese manufacturers were faced with vast shortages of material, financial, and human resources. These conditions resulted in the birth of the “lean” manufacturing concept (Womack et al., 1990). Kiichiro Toyoda, the president of Toyota Motor Company at the time, recognized that American automakers of that era were out-producing their Japanese counterparts by a factor of about ten this system usually apply by automotive industries. The oldest part on Toyota production system is 'jidoka', it developed by sakichi toyoda on 1902. This concept pertains to notion of building in quality at the production process as well as enabling separation of man and machine for multi-process handling. Toyota developer, sakichi toyoda, his son, kinchiri toyoda and engineer taiichi ohno , These guys had gone to American to study the system that use by ford. But what they found, ford has a lot of car at their inventory. So this not impressed them, while they go to supermarket, these supermarket is known as piggly wiggy , they observed that the simple idea of an automatic drink resupplied; when the customer wants a drink, he takes one, and another replaces it the delegation was inspired by how the supermarket only reordered and restocked goods once they had been bought by customers. Toyota applied the lesson from Piggly Wiggly by reducing the amount of inventory they would hold only to a level that its employees would need for a small period of time, and then subsequently reorder. The principles underlying the TPS are embodied in Way. Production shop focus to use just in time concept among job that exists on manufacturing industry (Amasaka.k , 2007).

The main objective of TPS is to reduce muda (waste), mura (inconsistence) and muri (overburden). There are 7 type of waste that listed by TPS, there are transportation, overproduction, over processing, waiting, movement, defect and inventory. While mura (inconsistence), when doing something, the job must be consistence, example operator collect a part that come out from injection moulding machine, then need to collect before put into polybox. So they need to collect 5 part before put the part into polybox, to make it consistence, they need to make sure the part is 5 units of parts before put the part into polybox. And muri (overburden) is more related to operator, they operator shouldn't to a job that are dangerous and heavy. Figure 2 show house of TPS, the top of TPS house is improve quality, reduce cost, and improve delivery time, employee involvement and high morale. Then it has two pillars, which is JIT and Jidoka. Jidoka is stop and identify the abnormalities

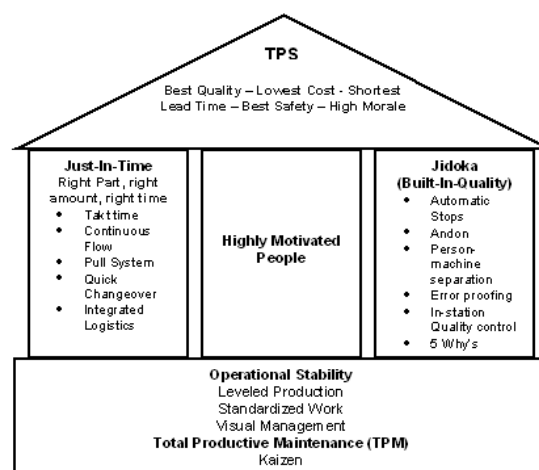


Figure 2.1: Toyota Production House

Source: <http://www.emsstrategies.com/dm050104article2.html>

Toyota production system “house” consist a few part. the initial concept came from the invention of the automatic loom that allowed the loom to stop as soon as the thread would break, allowing one worker to support 12 machines instead of just one dramatically dropping the cost of weaving. Jidoka also consist a few elements such as andon , andon is an information tool which provides instant visible and audible warning to the operators team that there is an abnormality within that area, then poka yoke, Japanese term that means "fail-safing" or "mistake-proofing", Its purpose is to

eliminate product defects by preventing, correcting, or drawing attention to human errors as they occur. Next is automatic stop, this mean if there any problems at production line, the operator will pull a tool that can stop the line, so the line will automatically stop and they can identify and repair the problem. Next person machine separation or autonotation , It may be described as "intelligent automation" or "automation with a human touch (Taiichi Ohno, 1988). After that in station quality control, this mean the part that come out from a station must be check before the part go to other station. And lastly are 5 why's, the 5-Why analysis method is used to move past symptoms and understand the true root cause of a problem, asking why for 5 times can solve the problem because we can identify the root causes (Taiichi Ohno,1988). Next is pull system, this system will reducing stocks because they try to eliminate queues, not provide for them (M.C Bonney , Zongmao Zhang, M.A Head, C.C Tien, R.J Barson, 1999). Toyota only produce what customer order, they don't make an inventory for the car. After that quick change over or single minute exchange die (SMED), SMED is rapid changing for next product, this can reduce production lot size and thereby improve production flow. And lastly is integrated logistics, is an integrated approach to the management of logistic disciplines in the military, similar to commercial product support or customer service organizations.

For JIT pillar also has a few elements, first is takt time, takt time is the maximum allowable time in order to meet demand, Takt Time is the pace by which product is produced and must fall within the Takt Time or set equal to the Takt time; if not, then there will be customer demand that might go unfulfilled (Ana.,R, 2008). Second is continuous flow, produces a part via a just-in-time and kanban production approach, and calls for an ongoing examination and improvement efforts which ultimately requires integration of all elements of the production system.

At the bottom of the house is heijunka, standardized and kaizen. And to support the entire element it needs stability. Heijunka is leveling; ideally production can easily be leveled where demand is constant but in the real world where actual customer demand appears to fluctuate two approaches have been adopted in lean: Demand leveling and production leveling through flexible production. While kaizen (continuous) improvement, is as a key factor in the economic success of Japanese industries. With

"traditional" techniques such as quality circles (or small-group activity) and management circles (plan-do-check-act), kaizen may turn a profitless company into a profitable one without an enormous investment in equipment (Lyu, J.R, 1996).

2.2 LPS EVALUATION

LPS level evaluation is to determine how far the implementation of each company that is attached by the MAJAICO programme, Malaysia Japan Automotive Industries Cooperation or MAJAICO was initiated under the Malaysia Japan Economic Partnership Agreement in July 2006 in order to develop and improve Malaysian Automotive Industries to become more competitive as global players. Signed in 2006, MAJAICO is a five years project that helps Malaysian Automotive Industries in various fields from the technical base to the business negotiations. The companies that follow this programme are vendors of Perodua and Proton, they are applying LPS at their company. So to determine the level of each company this evaluation sheet has been introduced. And the benchmark for this evaluation is Denso Company. This evaluation consists of 11 criteria that need to be evaluated, there are:

1. Condition of model company
2. Maintenance and improvement system
3. 5S
4. Visualization
5. Man power skill training
6. Target accomplishment situation at work
7. Next pull process
8. Smooth process flow
9. Stop at completion
10. Takt production
11. Stop at abnormality

The first criteria are condition Model Company, it consist 4 items which is, top management involvement, it mean the top management has high interest on LPS Kaizen and understand the realities of the plant site through visit. Also they always make an effort to the manpower development and creating environment that can achieve LPS. Next is independent organization (LPS department) mean an independent organization (LPS Department) exists, and promote LPS Kaizen company-wide with authority. Then dedicated staffs for LPS kaizen mean dedicated staff members for LPS Kaizen exist and have authority to promote LPS Kaizen company-wide including training and extending LPS Kaizen to all process line on long-term basis. And lastly is policy development condition mean Based on the policy, the LPS improvement content are extended to the all process line and company-wide.

Second criteria is maintenance and improvement system, this criteria also have 4 item which is the first item is, Ability of maintenance staff and re-occurrence prevention mean There is an advanced maintenance kaizen where there are organization and manpower who can maintain any in-house or external made equipment. Second item is Spare parts for equipment management mean appropriate equipment and spare parts exist and are arranged in order. Next is Monozukuri (Making Things) Kaizen ability meaning an improvement organization or manpower within the company for Monozukuri Kaizen. And lastly is Die maintenance system which means including in-house or outsourcing operation, organization and manpower exist to implement regular die maintenance periodically and repair timely without obstructing production.

Third criteria is 5s, consist 3 item which is the first item is time keeping mean Determined time, such as working/break time and meeting start/end are well kept. Second item, Application of safety gears (safety boots, helmet, glasses etc) mean Safety gears are applied and worn properly. And lastly is. Entire factory Seiri and Seiton condition mean Necessary/unnecessary goods are clarified. Place to store is clearly indicated and goods are properly stored.

Then Fifth criteria is visualization which consist 3 item, there are production progress control mean Progress by hour is clarified and delay is properly solved, then plant management index Index and standards for plant management on quality, amount,

safety, etc. are clear and well-managed and lastly is 'morning market', is being held and necessary information is shared and necessary action is always taken.

Sixth criteria are target accomplishment situation of work that has five item, there are downtime at customer, mean no downtime, or if it happens there is a prompt system to counter the downtime exist. Then quality mean there is a quality target, and the target has been achieved for the recent six months, and the quality system is established and functioning, next is production mean The production control is done periodically, and appropriate treatment is taken promptly, then operation ratio, mean Available operation time is 90% compared to the scheduled operation time and lastly is safety, mean There is no disaster for one year, and a potential near miss decreases recently by a positive security precaution.

The seventh criteria is next process pull that consist two item, kanban production and on site logistic , first item kanban mean Follow the KANBAN rule and use it as per right method and second item mean the route is simple and multi-conveyance is done.

The eighth criteria is smooth process flow, has three item and there are Streamline of process flow and machine layout based on process order mean One process flow without separation/merge. Next production lot size means smaller lot as much as possible. One by one (1 piece flow) production is implemented (even though trial base), which is the final target. And lastly is setup time mean Setup time is improved, targeting to shorten the setup time.

Ninth criteria is takt production that consist four item,first is Establishment of production plan and production control mean Fill-up production is done based on delivery result. The pull production and the push production are appropriately used properly responding to the production amount and the delivery date. Then takt production Takt production is stabilized and consistent Kaizen for productivity improvement is promoted. Next Man power arrangement mean Labor-saving, manpower saving and labor reducing are considered. Challenge to 1 Ninku (full manpower) is executed and high productivity is maintained. And lastly is Standardized

operation meaning Standard operation is clarified and observed. Standard operation is consistently revised based on Kaizen.

Then tenth stop at completion mean Separation of man/machine work (labor saving and labor reducing). And the last criteria that need to evaluate is stop at abnormality that consist four item, the first item is Pokayoke application and maintenance mean Pokayoke is applied on process, and the quality of product is built at process. Second is Condition management of equipment/ device mean Equipment conditions and control standards are clear and well observed, third item location of defect mean Location to store defects is clear. Actions to defects are done every day and re-occurrence prevention is implemented and last item is built in Quality system means System to build quality products at process is established and no quality defects occur.

2.3 STANDARD WORK CHART

Standard work chart or SWC is a chart that explain the sequence that operator need to follow if there are working it one work station. This SWC only show the sequence on one work station only. Usually to start make an improvement, SWC must be create first to show the sequence and time of each operation and operator. To build SWC there must have a few criteria that need been identify, there are:

a. Takt Time

This is the rate at which products must be made in a process to meet customer demand. The formula to produce takt time is Customer demand divide to Working hours.

$$T = \frac{T_a}{T_d}$$

Where

T = Takt time, e.g. [minutes of work / unit produced]

T_a = Net time available to work, e.g. [minutes of work / day]

T_d = Time demand (customer demand), e.g. [units required / day]

But, as a vendor to Proton, the time demand must be working hours for customer working hours not hicom teck see working hours.

b. Work sequence

Work sequence for the work station must be know and write, this is important to see the current sequence, because from the current sequence we can identify the problem if cycle time of the process is higher than takt time. After we make an improvement we can see a difference sequence before and after improvement.

c. Standard inventory

Inventory is a finish good that store at the warehouse, where this part are preparation if the delivery for finish good product has a problem to deliver to customer, or there has a problem in production line that make the line stop, so production cannot continue and inventory can be use to settle this problem. Each company must have their own standard inventory so if there has a problem, finish good from inventory can be use.

To make standard work chart, some tools need to be ready, there are time study and standard work combination table. These tool need to be complete up before standard work chart have to make. There are Time study table and SWCT (Standard Work Combination Table).

a. Time study table

Time study were develop by Federick winslow Taylor, it's part of scientific management. It use to collect time based on operator movement, people that use this chart must identify the movement of operator (work element) first before they take time of each movement and recorded by stop watch, and the movement of operator must same from start until end of this process, figure 2.2 show the format that use by HTS to determine cycle time for a processes. The objective of time study is to determine time for a qualified worker to perform specified work under stated conditions and at a defined rate of working. On time study it has allowance as an extra time to give a relaxation