Chapter VI

System Evaluation

6.1 Design of Evaluation Method

6.1.1 Source of Data

There are three sources of data according to the studied objective that will be used to compare the performance between existing material management system and development material management system.

1. The historical data of case studied company by using the existing method of material management system.
2. The output simulation of material management system by using the developing method

6.1.2 Timing for testing

The timing for the simulation is chosen from June and July 2005. In June, there was a maximum production since June is the last month of second quarter. In July, there was a moderate production since July is the first month of third quarter.

6.2 Evaluation Method

The method for evaluation material management system is to compare the actual outputs with before and after implementation of the proposed system. The simulation outputs from newly developed system are compared with actual data.

6.2.1 Evaluation Assumptions

1. Only HSA Part no 14R8838 is being evaluated
2. Any machine or tool break down, cleaning, or calibration, etc. will also be reflected on the output of developing material management system.
3. On time delivery performance is focusing on HSA finished good inventory as a product.

6.2.2 Evaluation Criteria

1. Service Levels: Service Levels measure availability of part supply, how often the part supply is available once the production is required

   Part Supply Shortage acceptable (time/month) = time/month

   Service levels = 100% - part supply shortage

2. On time delivery performance: On time delivery performance measures how often is the HSA finished good available at the time next process, Hard Disk Enclosure (HDE), is required or available on the expected date

   On time Delivery performance

   $$= \frac{\text{Total time of HDE Requirement} - \text{no. of times HSA is unavailable Requirement}}{\text{Total time of HDE Requirement}}$$

3. Production Resource Utilization: Production Resource Utilization measures how intensively HSA Production line is being used to produce HSA.

   $$\text{Production Resource Utilization} = \frac{\text{Actual time HSA production line used}}{\text{Available time of HSA production line}}$$

4. Total Inventory Costs: Total Inventory costs include purchasing cost, ordering cost, holding cost, shortage cost, and system operation cost. Total Inventory Costs measure how much case studied company spent for having the amount of inventory at the certain period of time.

6.3 Evaluation Result

6.3.1 Evaluation Result on Service levels

June	Existing System	Developed System	Differences
Washer	100%	100%	0%
Spacer	99%	100%	1%
Carriage	97%	100%	3%
Screw	100%	100%	0%
HSA Screw	92%	100%	8%
Flex Cable	91%	100%	9%
HGA Up	81%	96%	14%
HGA Down	82%	94%	12%
Damper	100%	100%	0%
Suspension Up	81%	94%	13%
Suspension Down	82%	94%	12%
Slider Up	81%	96%	14%
Slider Down	82%	97%	14%

Table 6.3.1 June 2005 Service Levels Result

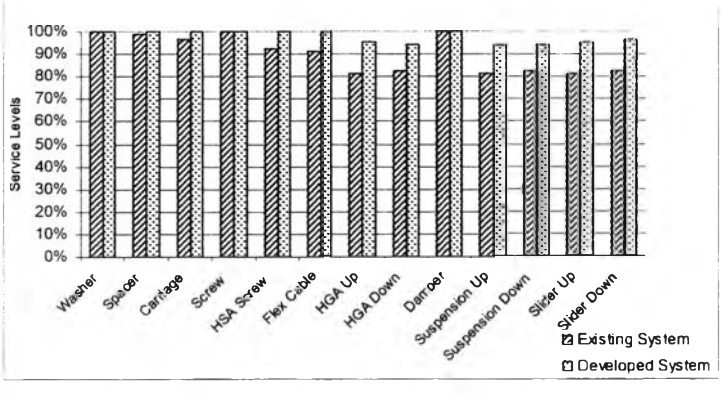

Figure 6.3.1 June 2005 Service Levels Result

From table 6.3.1 and figure 6.3.1, it shown that June service levels performance of developed system is significantly higher than the result from existing system.

July	Existing System	Developed System	Delta
Washer	100%	100%	0%
Spacer	100%	100%	0%
Carriage	96%	100%	4%
Screw	100%	100%	0%
HSA Screw	100%	100%	0%
Flex Cable	90%	100%	10%
HGA Up	86%	99%	13%
HGA Down	82%	99%	17%
Damper	100%	100%	0%
Suspension Up	85%	94%	10%
Suspension Down	89%	96%	7%
Slider Up	94%	97%	3%
Slider Down	93%	96%	3%

Table 6.3.1.1 July 2005 Service Levels Result

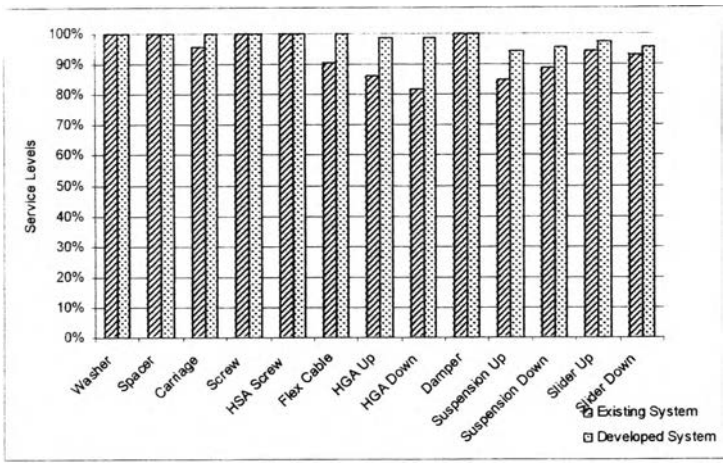

Figure 6.3.1.1 July 2005 Service Levels Result

From table 6.3.1.1 and figure 6.3.1.1, it shown that July service levels performance of developed system is also significantly higher than the result from existing system.

6.3.2 Evaluation Result on Delivery

HSA On Time Delivery	22	23	24	25	26
Existing System	100%	83%	75%	67%	58%
Developed System	100%	100%	100%	100%	100%

Table 6.3.2 June 2005 On Time Delivery Result

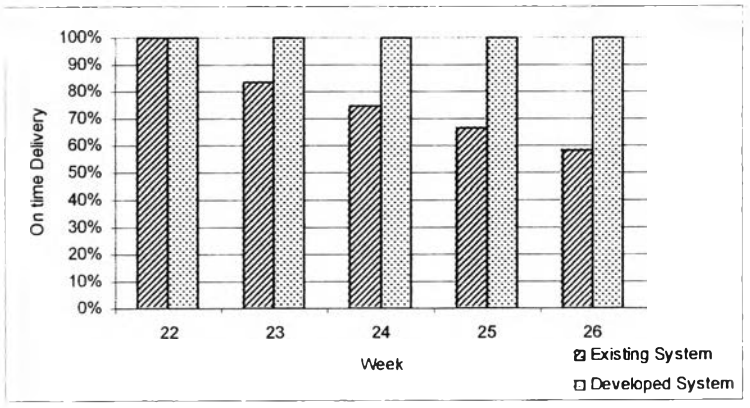

Figure 6.3.2 June 2005 On Time Delivery Result

From table 6.3.2 and figure 6.3.2, it shown that June on time delivery performance of developed system is significantly higher than the result from existing system.

HSA On Time Delivery	27	28	29	30
Existing System	92%	83%	92%	83%
Developed System	100%	100%	100%	100%

Table 6.3.2.1 July 2005 On Time Delivery Result

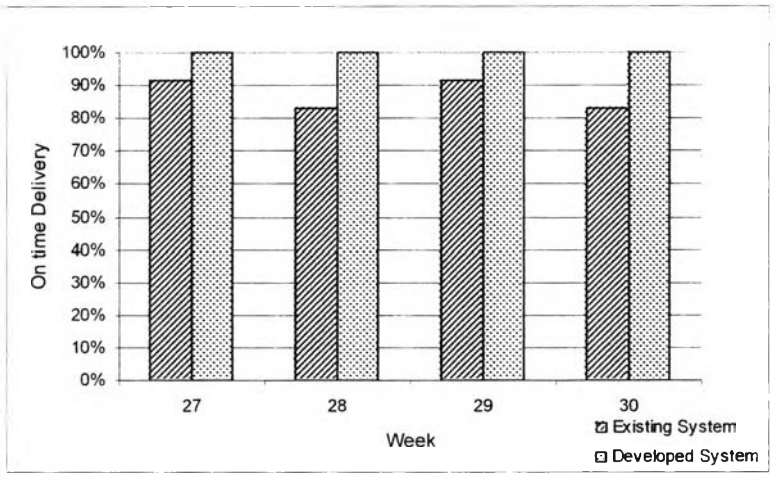

Figure 6.3.2.1 July 2005 On Time Delivery Result

From table 6.3.2.1 and figure 6.3.2.1, it shown that July on time delivery performance of developed system is significantly higher than the result from existing system.

6.3.3 Evaluation Result on Production Resource Utilization

Utilization / Wk	22	23	24	25	26
Existing system	78.6%	88.1%	81.7%	84.9%	77.8%
Developed System	78.6%	92.1%	96.0%	93.7%	96.0%

Table 6.3.3 June 2005 Production Resource Utilization Result

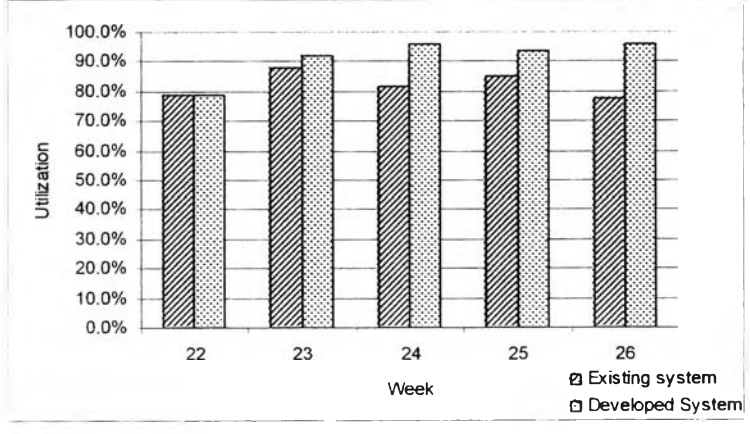

Figure 6.3.3 June 2005 Production Resource Utilization Result

From table 6.3.3 and figure 6.3.3, it shown that production resource utilization performance of developed system is significantly higher than the result from existing system on June.

Utilization / Wk	27	28	29	30
Existing system	88.9%	92.9%	95.2%	89.7%
Developed System	97.6%	96.8%	96.0%	95.2%

Table 6.3.3.1 July 2005 Production Resource Utilization Result

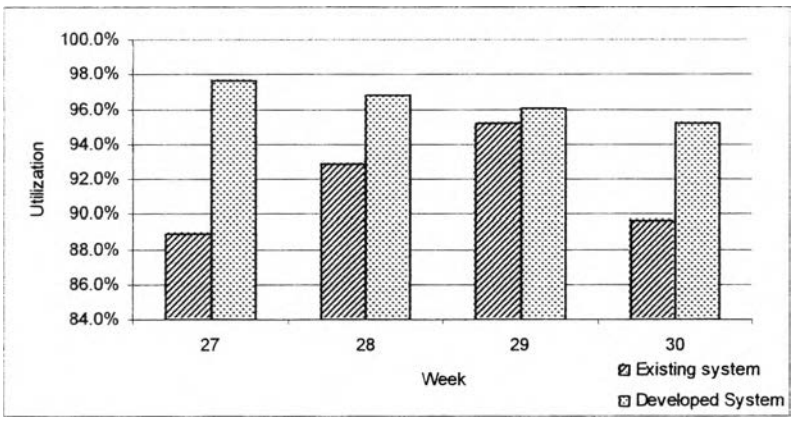

Figure 6.3.3.1 July 2005 Production Resource Utilization Result

From table 6.3.3.1 and figure 6.3.3.1, it shown that production resource utilization performance of developed system is significantly higher than the result from existing system on July.

6.3.4 Evaluation Result on Total Inventory Costs

Total Inventory Cost in June	Existing System	Developed System
WASHER	6.00	2.08
SPACER	6.00	2.19
CARRIAGE	962.88	1018.58
SCREW	5.33	2.43
HSA SCREW	7.00	3.00
FLEX CABLE	1614.60	1620.58
HGA UP	2063.02	1255.89
HGA DOWN	2063.02	1162.94
DAMPER	1.80	1.00
SUSPENSION UP	523.40	401.44
SUSPENSION DOWN	571.40	433.44
SLIDER UP	553.68	449.68
SLIDER DOWN	609.92	438.60
Total Cost	8988.05	6791.85

Table 6.3.4 June 2005 Total Inventory Costs Result

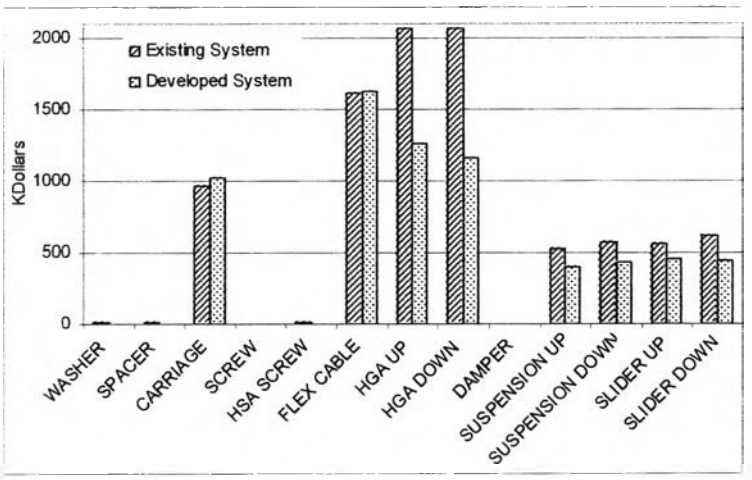

Figure 6.3.4 June 2005 Total Inventory Costs Result

From table 6.3.4 and figure 6.3.4, it shown that the total inventory cost of developed system is lower than total inventory cost of existing system on June.

Total Inventory Cost in July	Existing System	Developed System
WASHER	3.60	1.42
SPACER	3.60	1.43
CARRIAGE	490.88	511.27
SCREW	3.07	1.40
HSA SCREW	3.12	1.41
FLEX CABLE	741.52	746.30
HGA UP	957.80	496.52
HGA DOWN	975.88	496.75
DAMPER	0.62	0.81
SUSPENSION UP	258.32	321.64
SUSPENSION DOWN	259.92	321.64
SLIDER UP	254.32	322.52
SLIDER DOWN	256.00	322.56
Total Cost	4208.65	3545.66

Table 6.3.4.1 July 2005 Total Inventory Costs Result

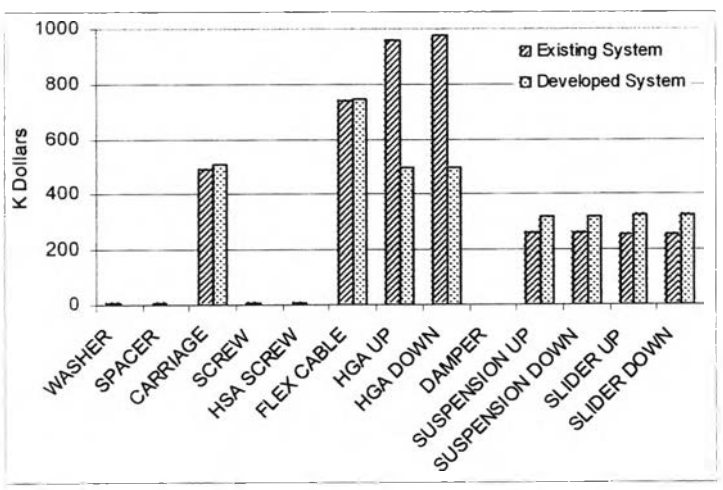

Figure 6.3.4.1 July 2005 Total Inventory Costs Result

From table 6.3.4.1 and figure 6.3.4.1, it shown that the total inventory cost of developed system is lower than total inventory cost of existing system on July.

6.4 Discussions of Results

From 6.3 Evaluation Result, there are four types of performance measurement. The discussions will be on the evaluation result and performance comparison between existing and developed system.

1. Service Levels

   The result of developed material management system shows significant improvement on service levels comparing to existing material management system. The improvement of service levels also means the improvement of part supply shortage. However, service levels result in week 22 and week 23 between existing system and developed system are about the same. The reason came from week 22 and week 23 is the first and second week of June and supplier was not able to support according to the demand change. The improvement of service levels performance can be expected from the establishment of scrap allowance.

2. On Time Delivery

   The result of developed material management system shows significant improvement on On Time Delivery comparing to existing material management system. The developed material management system shows that there is a better ability on managing and planning HSA finished good. The improvement of on time delivery performance can also be expected from the establishment of scrap allowance.

3. Production Resource Utilization

   The result of developed material management system shows significant improvement Production Resource Utilization comparing to existing material management system. The improvement of Product Resource utilization means the increasing time of operating on HGA production line. The improvement of

Production Resource Utilization performance can also be expected from the establishment of developed MRP with HGA Capacity. Since the developed MRP has a make-buy decision, which automatically generate the requirement of part level code 2 and work order for HGA up and down according to available capacity. From this ability, it will definitely support the performance of production resource utilization.

4. Total Inventory Costs

   The result of developed material management system shows less total inventory costs on both June and July comparing to existing material management system. The improvement of Production Resource Utilization performance can be expected from the establishment of developed MRP and also the lot sizing technique. From the developed MRP, cased studied company had spent more money on product level code 2 (slider, suspension, and damper) than HGA (product level code 1), which has high cost. Therefore, the developed MRP will not only benefit on production resource utilization but also total inventory costs. The improvement of total inventory costs performance can also be expected from the establishment of lot sizing technique. Washer, spacer, HSA screw, and screw M1 which use POQ techniques shown less total inventory costs due to less ordering cost.

6.5 Analysis of the Developed Material Management

6.5.1 Advantages and Disadvantages of the Developed Material Management System

Advantages

1. The developed Material Management System combines HGA capacity into Material Requirement Planning. The objective of HGA Capacity is for make and buy decision making. The policy of the case studied company is to maximize line utilization (produce decision) as a first priority then purchase the remaining requirement from suppliers. The developed Material Management System will automatically generate the decision according to the policy of case studied company.

2. From Demand Policy for establishing MPS, frozen zone has to be established which means that demand change is not allowed in the near horizon as specified in chapter four. The frozen zone helps control the fluctuation on demand and supply in near term. The frozen zone will also decrease the Bullwhip effect through out the supply chain.
3. The study provides work procedure for developed Material Management System. Work procedure helps inexperience planners on MRP task. Moreover, the developed Material Management System is easy to reconcile both data and result.
4. The developed Material Management System includes the implementation of Lot Sizing. There are two types of lot sizing techniques for child part of HSA product, one is Lot for Lot and another one is Period Order Quantity. From the Lot sizing technique, it will assist case studied company to avoid remnants and give lower costs with lumpy demand.
5. The developed Material Management System determines scrap allowance by using befitting methodology. Scrap allowance will support case studied company when there is an unexpected situation.
6. The developed Material Management System supports case studied company objectives. Some of objectives are service levels, on time delivery, production resource utilization, and total inventory costs.
7. The developed Material Management System is not a sophisticated system. Therefore, runtime of the developed Material Management System is decreasing compare to the existing one. Planner then will have more time on data analysis and suppliers are possible to get the purchase order in advance. From this reason, supply chain will be more effective.
8. The developed Material Management System will eliminate the manual calculation on supplier sourcing and work order assignment. Manual calculation frequently generates error and variation.

Disadvantages

1. There are some disadvantages from the implementation of Demand Policy for establishing MPS. The disadvantage on demand policy is in the frozen zone

implementation. Frozen zone creates low responsiveness and low flexibility for customer on near period of demand.

2. In Lot sizing formula, there are holding cost and annual cost to carry. However, holding cost and annual cost to carry are undisclosed information. In the study, holding cost and annual cost to carry are the estimated value. From this reason, the lot sizing technique may not be 100% reliable.
3. Algorithm for alternative parts is not available in the developed Material Management System.

6.5.2 Comparison of Existing Material Management System with the developed Material Management System.

After analysis of evaluation result and the disadvantages and advantage of existing Material management system and developed Material Management System, The comparison can be concluded in many aspects as follow:

1. Supplier Sourcing Process: Currently, case studied company is using manual process to calculate and allocate plan order released for each supplier. The developed Material Management System will establish sourcing policy and automatic allocation system for plan order released.
2. HGA Capacity Allocation: Case studied company allocates HGA capacity independently without concerning of supply management. According to company's policy, line utilization is also one of the policies. Therefore, in the developed Material Management System has planned to establish HGA capacity allocation dependently with supply management. From the establishment, the result will contribute on company's policy, production line utilization.
3. Demand Policy for establishing MPS: Current demand management policy of case studied company is to have a flexible demand even in the short term planning horizon. The developed Material Management System is to establish frozen zone for short term planning horizon in order to solve supply problem and bullwhip effect through out supply chain.

4. Work Order Assignment: The process of Work order assignment for HGA production involves with part supply availability and HGA capacity. However, case studied company is using manual allocation without procedure. From the current process, it caused low production utilization as well as low HSA on time delivery. The developed Material Management System will allocate the work order automatically under the consideration of part supply availability and available HGA capacity. Moreover, the strategy of developed Material Management is tried to satisfy HGA capacity as a first priority. From the implementation, it will definitely improve production utilization and HSA on time delivery.
5. Response to the policies of the company: The developed Material Management System can response to case studied company better than the existing system.
6. The relation of each parameter: The developed Material Management tries to get all involve parameter together for the better result of work order and purchase order released. There are some relationships between parameter and dependency issues. The existing one calculates and allocates work order and purchase order released independently.
7. Scrap Allowance and Lot Sizing Policy: Existing system does not have scrap allowance and lot sizing policy. Scrap allowance for each item is identified by planner and it relies on experience of the planner. Current technique for Lot sizing is Lot for Lot technique. The developed Material Management System decided to apply the safety factor for scrap ratio based on standard deviation of scrap ratio and 99% of service levels. The developed system is decided to implement POQ technique for some parts.

Item	Factor	Existing System	Developing System
1	Supplier Sourcing Process	Manual and no procedure	Automatic with procedure
2	HGA Capacity Allocation	Independence	Dependence
3	Demand Policy for Establishing MPS	Flexible	Defined Frozen zone
4	Work Order Assignment	Independence/Manual Assignment	Dependence/Automatic Assignment
5	Response to the Company's Policies	Low	High
6	The Relation of Each Parameter	Independence	Dependence
7	Scrap Allowance and Lot Sizing Policy	Not defined/LFL	Define/ LFL and POQ

Table 6.5.2 Comparison between Existing System and Developing System