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APPENDICES

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## APPENDIX A

### A-1: CUSTOMER SURVEY FORM

1. Please rate the level of impact base on your viewpoint regarding the following points? On the scale of 1 = less impact, 2 = impact, 3 = extremely impact. Please write X in the block and also give the reason if you had encountered the problem.

Description of the problem	Level	Encounter	Reason
Problem with the sale:			
1. Showroom	[ ]	[ ]	
2. Service from sale staff	[ ]	[ ]	
3. Hand in the car to customer	[ ]	[ ]	
4. Quality of car assembled	[ ]	[ ]	
5. After sale service	[ ]	[ ]	
Problem with the maintenance:			
6. Service center	[ ]	[ ]	
7. Service from service advisor/receptionist	[ ]	[ ]	
8. Service from technician	[ ]	[ ]	
9. Quality of repair work/maintenance	[ ]	[ ]	
10. Reliability, trust towards the company	[ ]	[ ]	
11. Waiting time(duration in maintenance)	[ ]	[ ]	
12. Service charge	[ ]	[ ]	
13. Cleanliness	[ ]	[ ]	
14. After maintenance service	[ ]	[ ]	

<b>Customer's Personal Data</b>
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Please write X in the selected block

2. Sex       1. Male             2. Female
3. Age       1. 20-30 years     2. 31-40 years  
                   3. 41-50 years     4. Above 50 years
4. Married status     1. Single             2. Marry
5. Your highest education  
 1. Primary school/lower     2. Secondary/certificate  
 3. Bachelor degree/higher
6. Your occupation  
 1. Private office     2. A government official     3. Student  
 4. Executive         5. Has an own business     6. Housewife  
 7. Others
7. Your salary per month (Baht)  
 1. 10,000-15,000     2. 15,001-20,000     3. 20,001-30,000  
 4. 30,001-50,000     5. 50,001-70,000     6. 70,001-90,000  
 7. Above 100,000     8. N/A

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**Thank you for your cooperation**

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## A-2: SAMPLE OF EVALUATED FORM

### CUSTOMER SURVEY ON IMPLEMENTATION

1. Please rate the level of impact base on your viewpoint regarding the following points? On the scale of 1 = less impact, 2 = impact, 3 = extremely impact. Please write X in the block and also give the reason if you had encountered the problem.

Description of the problem	Level	Encounter	Reason
Problem with the sale:			
1. Showroom	[2]	[ ]	
2. Service from sale staff	[1]	[ ]	
3. Hand in the car to customer	[1]	[ ]	
4. Quality of car assembled	[1]	[ ]	
5. After sale service	[3]	[ ]	
Problem with the maintenance:			
6. Service center	[2]	[ ]	
7. Service from service advisor/receptionist	[3]	[✓]	
8. Service from technician	[2]	[ ]	
9. Quality of repair work/maintenance	[3]	[✓]	
10. Reliability, trust towards the company	[1]	[ ]	
11. Waiting time(duration in maintenance)	[3]	[✓]	
12. Service charge	[2]	[✓]	
13. Cleanliness	[1]	[ ]	
14. After maintenance service	[2]	[✓]	

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<b>Customer's Personal Data</b>
---------------------------------

Please write X in the selected block

2. Sex     1. Male        [ ] 2. Female
3. Age    [ ] 1. 20-30 years    [ ] 2. 31-40 years  
            3. 41-50 years    [ ] 4. Above 50 years
4. Married status    [ ] 1. Single         2. Marry
5. Your highest education  
    [ ] 1. Primary school/lower        [ ] 2. Secondary/certificate  
     3. Bachelor degree/higher
6. Your occupation  
    [ ] 1. Private office    [ ] 2. A government official    [ ] 3. Student  
    [ ] 4. Executive         5. Has an own business    [ ] 6. Housewife  
    [ ] 7. Others
7. Your salary per month (Baht)  
    [ ] 1. 10,000-15,000    [ ] 2. 15,001-20,000        [ ] 3. 20,001-30,000  
    [ ] 4. 30,001-50,000    [ ] 5. 50,001-70,000        [ ] 6. 70,001-90,000  
    [ ] 7. Above 100,000     8. N/A

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**Thank you for your cooperation**

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## A-3: SUMMARY &amp; RESULT

Customer rating on the significance of individual problem	
Description of the problem	Customers viewpoint on significance level of each problem
Problem with the sale:	
1. Showroom	4 customer rated level 3 12 customer rated level 2 44 customer rated level 1
2. Service from sale staff	32 customer rated level 3 26 customer rated level 2 2 customer rated level 1
3. Hand in the car to customer	8 customer rated level 3 36 customer rated level 2 6 customer rated level 1
4. Quality of car assembled	All 60 customer rated level 3
5. After sale service	52 customer rated level 3 8 customer rated level 2
Problem with the maintenance function:	
6. Service center	13 customer rated level 3 40 customer rated level 2 7 customer rated level 1
7. Service from service advisor/receptionist	25 customer rated level 3 33 customer rated level 2 2 customer rated level 1
8. Service from technician	28 customer rated level 3 29 customer rated level 2 3 customer rated level 1
9. Quality of repair work/maintenance	All 60 customer rated level 3



10. Reliability, trust towards the company	23 customer rated level 3 32 customer rated level 2 5 customer rated level 1
11. Waiting to long ( duration in maintenance)	55 customer rated level 3 5 customer rated level 2
12. Service charge	19 customer rated level 3 20 customer rated level 2 21 customer rated level 1
13. Cleanliness of the car	6 customer rated level 3 40 customer rated level 2 14 customer rated level 1
14. After maintenance service	16 customer rated level 3 32 customer rated level 2 9 customer rated level 1

List of problems that customer had encounter during April 04 – June 04

Description of the problems	Frequency			
Problem with the sale:				
	Apr-04	May-04	Jun-05	Total
1. Showroom	1	4	3	8
2. Service from sale staff	-	5	1	6
3. Hand in the car to customer	-	2	-	2
4. Quality of car assembled	3	3	5	11
5. After sale service	6	4	2	12
Problem with the maintenance:				
6. Service center	4	-	2	6
7. Service from service advisor/receptionist	5	3	6	14

8. Service from technician	5	5	7	17
9. Quality of repair work/maintenance	6	11	9	26
10. Reliability, trust towards the company	7	3	6	16
11. Waiting to long ( duration in maintenance)	8	11	9	28
12. Service charge	14	9	9	32
13. Cleanliness of the car	-	-	6	6
14. After maintenance service	2	4	6	12

### Data processing

Since, the level of significance and frequency of problem that customer had encounter are both equally important. Therefore, it is important to take into consideration the weighting value of the outcome from both units by multiplying the mode significance and frequency together in order to obtain the problem rating. The mode significance can be obtained from Table 4.1. Since, MODE is a value in the set that occurs most often. Then the value of mode significance is clearly presented on the second column of Table 4.3 and the value of calculated problem rating is presented on the fourth column of the same table

### Calculation of Problem rating.

Description of the problem	Mode significance of the problem	Frequency of problem	Problem rating
Problem with the sale:			
1. Showroom	1	8	8
2. Service from sale staff	3	6	18
3. Hand in the car to customer	2	2	4

4. Quality of car assembled	3	11	33
5. After sale service	3	12	36
Problem with the maintenance:			
6. Service center	2	6	6
7. Service from service advisor/receptionist	2	14	28
8. Service from technician	2	17	34
9. Quality of repair work/maintenance	3	26	78
10. Reliability, trust towards the company	2	16	32
11. Waiting to long( duration in maintenance)	3	28	84
12. Service charge	1	32	32
13. Cleanliness of the car	2	6	12
14. After maintenance service	2	12	24

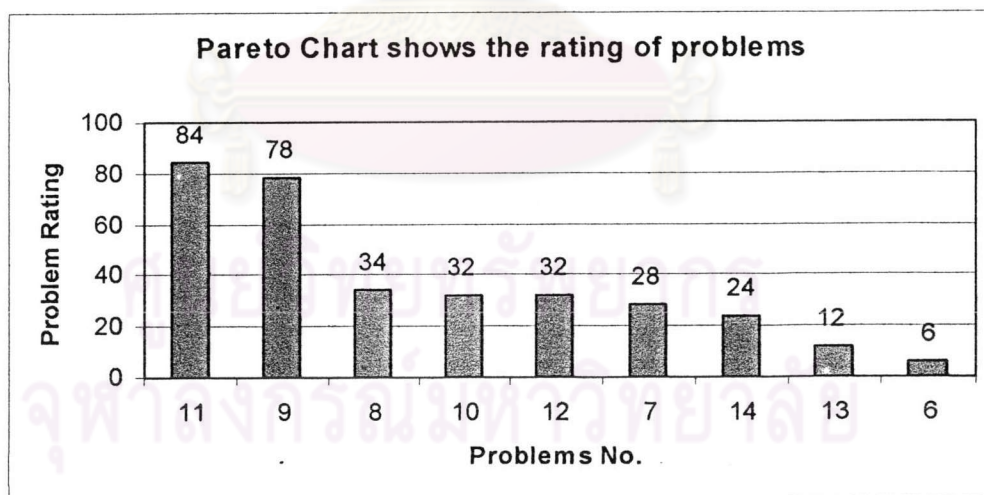
From the calculation above, the problem is being rearranged in descending order by starting at the top with the problem that scored the highest problem rating down to the least rating at the bottom. Since the scope of this thesis is limited to maintenance unit, the problems with sale unit are then neglected.

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### New ranking of problems by Problem Rating

Problem No.	Description of Problems	Problem rating
11	Waiting to long( duration in maintenance)	84
9	Quality of repair work/maintenance	78
8	Service from technician	34
10	service Reliability, trust towards the company	32
12	Service charge	32
7	Service from service advisor/receptionist	28
14	After maintenance service	24
13	Cleanliness of car	12
6	Service center environment	6

A Pareto chart in a form of vertical bar graph, is then being plot from the Table 4.4. The Pareto chart is used to analyze the problems by placing the data in the order of importance. The below figure summarized the problem rating data by using Pareto chart.



APPENDIX B

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### B-1: PIs VALIDATION FORM

#### Validation of Key Performance Indicator of Maintenance Unit at Benz Talingchan Co., Ltd.

Please answer the following question by ticking in case of KPI is applicable.  
 If you have any recommended indicators that you think they are important please fill the provided area.

Goal	Objective	KPIs	Applicable
<b>Financial Perspective:</b>			
<i>Profit Maximization</i>	Management Cost Reduction	Percentage of management cost from operation cost	<input type="checkbox"/>
Other recommended Indicators:			
<b>Customer Perspective:</b>			
<i>Executive/Customer Satisfaction</i>	Operation Timeliness Satisfaction	Percentage of operation time variance	<input type="checkbox"/>
	Product Quality Satisfaction	Degree of quality on finished job	<input type="checkbox"/>
<i>Store Function Satisfaction</i>	Minimize the storage	Average number of day on storing spare part	<input type="checkbox"/>
Other recommended Indicators:			

**Internal Business Process Perspective:**

<i>Efficiency Operation</i>	Waste Reduction	Percentage of value of material lost from used material	<input type="checkbox"/>
<i>Providing Quality Maintenance</i>	Quality Increasing	Average percentage of work quality	<input type="checkbox"/>
<i>Timeliness Of Operation Process</i>	Availability of Resource	Number of job lacking of employee (weekly)	<input type="checkbox"/>
		Number of job lacking of spare part (weekly)	<input type="checkbox"/>
		Number of job lacking of equipment (weekly)	<input type="checkbox"/>
	Accuracy of operation time	Number of the job delay (weekly)	<input type="checkbox"/>

Other recommended Indicators:

**Learning/ Growth Perspective:**

<i>Personal Improvement</i>	Employee Skill Improvement	Frequency training of employee (hr/week)	<input type="checkbox"/>
	Employee Satisfaction	Percentage increasing of employee's income	<input type="checkbox"/>
<i>Technology/ Method Improvement</i>	Improvement efficiency of maintenance	Acquiring new technology/method for operation process	<input type="checkbox"/>

Other recommended Indicators:

**B-2: SAMPLE OF EVALUATED FORM**

**Validation of Key Performance Indicator of Maintenance Unit at Benz Talingchan Co., Ltd.**

Please answer the following question by ticking in case of KPI is applicable if you have any recommended indicators that you think they are important please fill the provided area.

Goal	Objective	KPIs	Applicable
<b>Financial Perspective:</b> Profit Maximization	Management Cost Reduction	Percentage of management cost from operation cost	<input checked="" type="checkbox"/>
Other recommended Indicators:	<i>Material Leakage</i>		
<b>Customer Perspective:</b> Executive Customer Satisfaction Store Function Satisfaction	Operation Timeliness Satisfaction Product Quality Satisfaction Minimize the storage	Percentage of operation time variance Degree of quality on finished job Average number of day on storing spare part	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input checked="" type="checkbox"/>
Other recommended Indicators:			

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**Internal Business Process Perspective:**

<i>Efficiency Operation</i>	Waste Reduction	Percentage of value of material lost from used material	<input checked="" type="checkbox"/>
<i>Providing Quality Maintenance</i>	Quality Increasing	Average percentage of work quality	<input checked="" type="checkbox"/>
<i>Timeliness Of Operation Process</i>	Availability of Resource	Number of job lacking of employees (weekly)	<input checked="" type="checkbox"/>
		Number of job lacking of spare part (weekly)	<input type="checkbox"/>
		Number of job lacking of equipment (weekly)	<input type="checkbox"/>
	Accuracy of operation time	Number of the job delay (weekly)	<input checked="" type="checkbox"/>

Other recommended Indicators:

*Defect/OP - Complaint / Job*

**Learning/ Growth Perspective:**

<i>Personal Improvement</i>	Employee Skill Improvement	Frequency training of employee (hr/week)	<input checked="" type="checkbox"/>
	Employee Satisfaction	Percentage increasing of employee's income	<input type="checkbox"/>
<i>Technology/ Method Improvement</i>	Improvement efficiency of maintenance	Acquiring new technology/method for operation process	<input checked="" type="checkbox"/>

Other recommended Indicators:

## B-3: SUMMARY &amp; RESULT

## The Result of Validation of Key Performance Indicator of Maintenance Unit at Benz Talingchan Co., Ltd.

Goal	Objective	KPIs
<b>Financial Perspective:</b>		
<i>Profit Maximization</i>	Management Cost Reduction	Percentage of management cost from operation cost Validated
<b>Other Recommended Indicators:</b>		
<i>Profit Maximization</i>	Operation Cost Reduction	Percentage of value material lost from operation cost Validated
<b>Customer Perspective:</b>		
<i>Executive/Customer Satisfaction</i>	Operation Timeliness Satisfaction	Percentage of operation time variance Validated
<i>Store Function Satisfaction</i>	Product Quality Satisfaction Minimize the Storage	Degree of quality on finished job Average number of day on storing spare part Validated
<b>Other Recommended Indicators:</b>		
<i>Executive Satisfaction</i>	Operation Cost Satisfaction	Percentage of operation cost variance Validated

Goal	Objective	KPIs
<b>Internal Business Process Perspective:</b>		
<i>Efficiency Operation</i>	Waste Reduction	Percentage of value of material lost from used material Validated
<i>Providing Quality Maintenance</i>	Quality Increasing	Average percentage of work quality Validated
<i>Timeliness Of Operation Process</i>	Availability of Resource	Number of job lacking of employee (weekly) Validated
		Number of job lacking of spare part (weekly) Validated
	Accuracy of Operation Time	Number of job lacking of equipment (weekly) Validated
		Number of the job delay (weekly) Validated
<b>Learning/ Growth Perspective:</b>		
<i>Personal Improvement</i>	Employee Skill Improvement	Frequency training of employee (hr/week) Validated
	Employee Satisfaction	Percentage increasing of employee's income Validated
<i>Technology/ Method Improvement</i>	Improvement Efficiency of Maintenance	Acquiring new technology/method for operation process Validated

### B-4: SELECTION OF KPIS FORM

Please rate the level of impact base on your viewpoint regarding the following Pis. On the scale of 1 = The least impact, 2 = less impact, 3 = impact, 4 = more impact, and 5 = the most impact.

Pis	Data availability &	Timeliness & cost	Clarity & Validity of	Comparability of KP
<b>Financial Perspective:</b>				
Percentage of management cost from operation cost				
Percentage of value material lost from operation cost				
Power cost to operation cost ratio				
Depreciation to operation cost ratio				
<b>Customer Perspective:</b>				
Percentage of operation time variance				
Degree of quality on finished job				
Average number of day on storing spare part				
Percentage of operation cost variance				
<b>Internal Business Process Perspective:</b>				
Percentage of value of material lost from used material				
Average percentage of work quality				
Number of job lacking of employee				
Number of job lacking of sapre part				
Number of job lacking of equipment				
Number of job delay				
Quality of defect per quinity of operation				
Number of customer complaint per number of job				
<b>Learning/Growth Perspective:</b>				
Frequency training of employee				
Percentage increasing of employee's income				
Acquiring new technology/method for operation process				

**B-5: SAMPLE OF EVALUATED FORM**

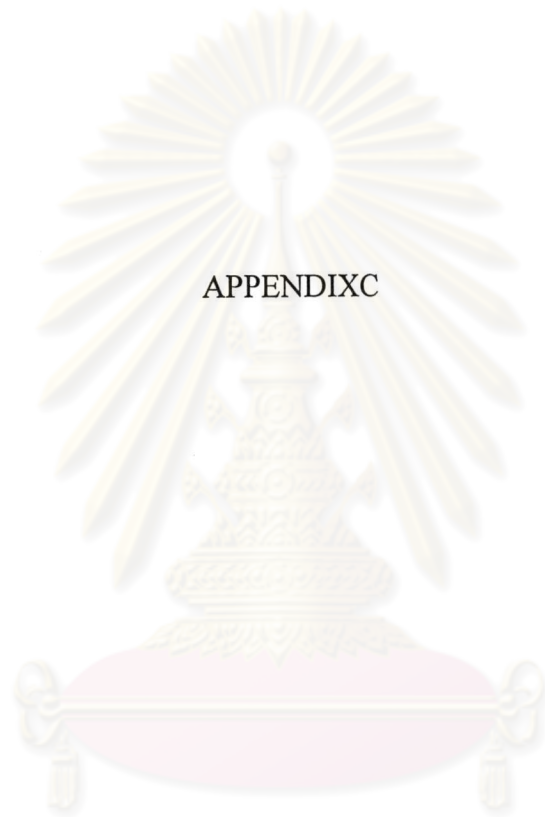
Please rate the level of impact base on your viewpoint regarding the following PIs. On the scale of 1 = The least impact, 2 = less impact, 3 = impact, 4 = more impact, and 5 = the most impact.

PIs	Data availability & Timeliness & cost	Clarity & Validity of Comparability of KP
<b>Financial Perspective:</b>		
Percentage of management cost from operation cost	3	5
Percentage of value material lost from operation cost	2	2
Power cost to operation cost ratio	1	2
Depreciation to operation cost ratio	1	3
<b>Customer Perspective:</b>		
Percentage of operation time variance	2	3
Degree of quality on finished job	2	4
Average number of day on storing spare part	5	3
Percentage of operation cost variance	2	2
<b>Internal Business Process Perspective:</b>		
Percentage of value of material lost from used material	3	4
Average percentage of work quality	4	3
Number of job lacking of employee	2	2
Number of job lacking of spare part	2	3
Number of job lacking of equipment	2	1
Number of job delay	3	5
Quality of defect per quantity of operation	1	4
Number of customer complaint per number of job	1	4
<b>Learning/Growth Perspective:</b>		
Frequency training of employee	3	3
Percentage increasing of employee's income	1	2
Acquiring new technology/method for operation process	1	2

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## B-6: SUMMARY &amp; RESULT

PIs	Data availability & Accuracy			Timeliness & cost of data collection			Clarity & Validity of KPI			Comparability of KPI						
	1	2	3	1	2	3	1	2	3	1	2	3	Total			
	Total			Total			Total			Total						
<b>Financial Perspective:</b>																
Percentage of management cost from operation cost	3	4	2	3	3	1	2	3	5	4	3	4	3	5	4	4
Percentage of value material lost from operation cost	2	1	1	2	1	1	1	1	2	3	4	3	3	3	3	3
Power cost to operation cost ratio	1	1	1	1	1	1	1	1	2	2	2	2	3	3	3	3
Depreciation to operation cost ratio	1	1	1	1	1	1	1	1	3	1	2	3	1	3	2	2
<b>Customer Perspective:</b>																
Percentage of operation time variance	2	2	5	3	3	3	3	3	4	3	5	4	3	3	3	3
Degree of quality on finished job	2	2	2	2	3	2	1	2	5	1	3	3	4	4	4	4
Average number of day on storing spare part	5	5	2	4	2	5	5	4	3	4	5	4	3	3	3	3
Percentage of operation cost variance	2	2	2	2	2	2	2	2	1	4	1	2	1	2	3	2
<b>Internal Business Process Perspective:</b>																
Percentage of value of material lost from used material	3	3	3	3	4	5	3	4	1	3	2	3	4	4	4	4
Average percentage of work quality	4	4	4	4	2	4	3	3	4	4	4	4	5	5	5	5
Number of job lacking of employee	2	3	1	2	3	1	2	2	2	1	3	3	3	3	3	3
Number of job lacking of spare part	2	3	1	2	2	2	2	2	3	3	3	3	2	1	3	3
Number of job lacking of equipment	2	2	2	2	2	2	2	2	1	3	2	3	3	3	3	3
Number of job delay	3	4	5	4	4	5	3	4	5	4	3	4	5	5	5	5
Quality of defect per quantity of operation	1	1	1	1	1	1	1	1	4	4	4	4	2	2	2	2
Number of customer complaint per number of job	1	1	1	1	1	1	1	1	4	5	3	4	4	4	4	4
<b>Learning/Growth Perspective:</b>																
Frequency training of employee	3	3	3	3	4	4	5	4	3	3	3	3	2	5	2	3
Percentage increasing of employee's income	3	3	5	4	4	5	4	4	1	2	5	3	4	2	3	3
Acquiring new technology/method for operation process	1	1	1	1	1	1	1	1	2	1	3	2	2	2	2	2



APPENDIXC

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### C-1: LEVEL OF IMPORTANCE ON KEY AREAS FORM

Evaluation the important of each key area for business maintenance unit  
 Please answer the following question by circle around the number wherever importance  
 ( 1 is the least important and 3 is the most important).

Objective	KPIs	Customer viewpoint	Company Objective	Personal viewpoint
Waste Reduction	Percentage of value of material lost from used material	3 2 1	3 2 1	3 2 1
Quality Increasing	Average percentage of work quality	3 2 1	3 2 1	3 2 1
Conformity to operation process	Quality of defect per quantity of operations	3 2 1	3 2 1	3 2 1
The ability quality inspection	Number of customer complaint per number of job done	3 2 1	3 2 1	3 2 1
Availability of Resource	Number of job lacking of employee (daily)	3 2 1	3 2 1	3 2 1
	Number of job lacking of spare part (daily)	3 2 1	3 2 1	3 2 1
	Number of job lacking of equipment (daily)	3 2 1	3 2 1	3 2 1
Accuracy of operation time	Number of the job delay (daily)	3 2 1	3 2 1	3 2 1



**C-2: SAMPLE & EVALUATED FORM**

Evaluation the important of each key area for business maintenance unit  
 Please answer the following question by circle around the number wherever importance  
 (1 is the least important and 3 is the most important).

Objective	KPIs	Customer viewpoint	Company Objective	Personal Viewpoint
Waste Reduction	Percentage of value of material lost from used material	3	2	1
Quality Increasing	Average percentage of work quality	2	1	3
Conformity to operation process	Quality of defect per quantity of operations	2	1	3
The ability quality inspection	Number of customer complaint per number of job done	2	1	3
Availability of Resource	Number of job lacking of employee (daily)	3	2	1
	Number of job lacking of spare part (daily)	3	2	1
	Number of job lacking of equipment (daily)	3	2	1
Accuracy of operation time	Number of the job delay (daily)	2	1	3

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### C-3: SUMMARY & RESULT

The result of evaluation the important of each key area for business maintenance unit

Objective	KPIs	Evaluator										Total	
		Executive			Manager			Technician					
		C	O	P	C	O	P	C	O	P			
Waste Reduction	Percentage of value of material lost from used material	1	1	3	1	1	2	1	1	1	1	1	12
Quality Increasing	Average percentage of work quality	3	3	2	3	2	2	2	2	2	2	2	21
Conformity to operation process	Quality of defect per quantity of operations	3	3	1	3	3	2	3	3	2	3	2	23
The ability quality inspection	Number of customer complaint per number of job done	3	3	2	3	3	2	3	3	1	3	1	23
Availability of Resource	Number of job lacking of employee (daily)	1	1	3	1	1	3	1	1	1	1	1	13
	Number of job lacking of spare part (daily)	1	2	1	1	2	2	1	2	3	2	3	15
	Number of job lacking of equipment (daily)	1	1	1	1	1	3	1	1	1	3	1	13
Accuracy of operation time	Number of the job delay (daily)	3	3	3	3	3	3	3	3	3	3	2	26

Note: C = Customer view point

O = Company objective

P = Personal viewpoint



APPENDIX D

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

### D-1: PROCESS ACTIVITY MAP FORM (JUNE 04)

PRESENT METHOD <input type="checkbox"/>	<b>FLOW PROCESS CHART</b>	PAGE 1/1																											
PROPOSED METHOD <input type="checkbox"/>		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th colspan="2" style="text-align: center;">SUMMARY</th> <th style="text-align: center;">NO.</th> </tr> <tr> <td style="text-align: center;">○ OPERATIONS</td> <td style="text-align: center;">13</td> <td style="text-align: center;">13</td> </tr> <tr> <td style="text-align: center;">⇨ TRANSPORTATIONS</td> <td style="text-align: center;">16</td> <td style="text-align: center;">16</td> </tr> <tr> <td style="text-align: center;">□ INSPECTIONS</td> <td style="text-align: center;">2</td> <td style="text-align: center;">2</td> </tr> <tr> <td style="text-align: center;">D DELAYS</td> <td style="text-align: center;">9</td> <td style="text-align: center;">9</td> </tr> <tr> <td style="text-align: center;">▽ STORAGES</td> <td style="text-align: center;">2</td> <td style="text-align: center;">2</td> </tr> <tr> <td colspan="2" style="text-align: right;"><b>TOTAL STEPS</b></td> <td style="text-align: center;"><b>42</b></td> </tr> <tr> <td colspan="2" style="text-align: right;"><b>DISTANCE TRAVELED (MEAN)</b></td> <td></td> </tr> <tr> <td colspan="2" style="text-align: right;"><b>TOTAL TIME (MEAN)</b></td> <td></td> </tr> </table>		SUMMARY		NO.	○ OPERATIONS	13	13	⇨ TRANSPORTATIONS	16	16	□ INSPECTIONS	2	2	D DELAYS	9	9	▽ STORAGES	2	2	<b>TOTAL STEPS</b>		<b>42</b>	<b>DISTANCE TRAVELED (MEAN)</b>			<b>TOTAL TIME (MEAN)</b>	
SUMMARY		NO.																											
○ OPERATIONS	13	13																											
⇨ TRANSPORTATIONS	16	16																											
□ INSPECTIONS	2	2																											
D DELAYS	9	9																											
▽ STORAGES	2	2																											
<b>TOTAL STEPS</b>		<b>42</b>																											
<b>DISTANCE TRAVELED (MEAN)</b>																													
<b>TOTAL TIME (MEAN)</b>																													
PRAT NAME: _____																													
PROCESS DESCRIPTION: _____																													
DEPARTMENT: _____																													
PLANT: _____																													
DATE: _____																													

Step	Symbol	DESCRIPTION	Distance	Time
1	● ⇨ □ D ▽	Customer pull over		
2	○ ⇨ □ ● ▽	Wait for routine card		
3	○ ⇨ □ D ▽	Drive to the parking lot		
4	● ⇨ □ D ▽	Park the car		
5	○ ⇨ □ D ▽	Walk to SA desk		
6	● ⇨ □ D ▽	Ask for mileage check		
7	○ ⇨ □ D ▽	Walk to sitting area		
8	○ ⇨ □ ● ▽	Wait for the receiving order print out		
9	○ ⇨ □ D ▽	Walk back to SA desk		
10	● ⇨ □ D ▽	Receive the order print out		
11	○ ⇨ □ ● ▽	Wait for driver		
12	○ ⇨ □ D ▽	Driver walk to customer car		
13	○ ⇨ □ D ▽	Drive to the garage		
14	● ⇨ □ D ▽	Park the car		
15	○ ⇨ □ ● ▽	Technician wait for customer data print out		
16	● ⇨ □ D ▽	Assign job to mechanical		
17	○ ⇨ □ D ▽	Mechanical walk to the shelf		
18	● ⇨ □ D ▽	Pick up cover cloth and tool		
19	○ ⇨ □ D ▽	Walk to customer car		
20	● ⇨ □ D ▽	Cover seat and part that are risk to dirtiness		
21	○ ⇨ □ ■ D ▽	Inspect the level and quality of engine oil, break oil, etc		
22	● ⇨ □ D ▽	Fill the ordering form		
23	○ ⇨ □ ● ▽	Wait for technician to sign order form		
24	○ ⇨ □ D ▽	Walk to warehouse		
25	○ ⇨ □ ● ▽	Wait for manager to sign and wait for ordering item		
26	○ ⇨ □ D ▽	Back to customer car		
27	● ⇨ □ D ▽	Change engine oil, brake oil, and etc		
28	● ⇨ □ D ▽	Fill in the form for the updated change		
29	○ ⇨ □ ● ▽	Wait for driver		
30	○ ⇨ □ D ▽	Driver drive to the washing area		
31	● ⇨ □ D ▽	Wash and dry		
32	○ ⇨ □ D ▽	Drive to the storage		
33	○ ⇨ □ ■ D ▽	QC check the finish job		
34	○ ⇨ □ D ▽	Storage		
35	○ ⇨ □ D ▽	Customer walk to cashier desk		
36	○ ⇨ □ D ▽	Walk to sitting area		
37	○ ⇨ □ ● ▽	Wait for receipt		
38	○ ⇨ □ D ▽	Walk to cashier desk		
39	● ⇨ □ D ▽	Pay money		
40	○ ⇨ □ D ▽	Walk to sitting area		
41	○ ⇨ □ ● ▽	Wait for the car		
42	○ ⇨ □ D ▽	Go home		
<b>Total</b>				

D-2: SAMPLE & EVALUATED FORM

PRESENT METHOD <input checked="" type="checkbox"/>		FLOW PROCESS CHART		PAGE 1/1	
PROPOSED METHOD <input type="checkbox"/>				SUMMARY	
PRAT NAME: <u>E 2206di</u>				OPERATIONS	NO.
PROCESS DESCRIPTION: <u>Mileage check</u>				TRANSPORTATIONS	16
DEPARTMENT: <u>Maintenance</u>				INSPECTIONS	2
PLANT: <u>6-100</u>				DELAYS	9
DATE: <u>July 28 2004</u>				STORAGES	2
				TOTAL STEPS	42
				DISTANCE TRAVELED (MEAN)	284 m
				TOTAL TIME (MEAN)	150 m
Step	Symbol	DESCRIPTION		Distance	Time
1	● → □ □ ▽	Customer pull over		-	-
2	○ → □ □ ▽	Wait for routine card		-	1
3	○ → □ □ ▽	Drive to the parking lot		25	-
4	● → □ □ ▽	Park the car		-	4
5	○ → □ □ ▽	Walk to SA desk		17	-
6	● → □ □ ▽	Ask for mileage check		-	-
7	○ → □ □ ▽	Walk to sitting area		7	-
8	○ → □ □ ▽	Wait for the receiving order print out		-	14
9	○ → □ □ ▽	Walk back to SA desk		7	-
10	● → □ □ ▽	Receive the order print out		-	-
11	○ → □ □ ▽	Wait for driver		-	10
12	○ → □ □ ▽	Driver walk to customer car		17	-
13	○ → □ □ ▽	Drive to the garage		55	-
14	● → □ □ ▽	Park the car		-	5
15	○ → □ □ ▽	Technician wait for customer data print out		-	3
16	● → □ □ ▽	Assign job to mechanical		-	2
17	○ → □ □ ▽	Mechanical walk to the shelf		13	-
18	● → □ □ ▽	Pick up cover cloth and tool		-	2
19	○ → □ □ ▽	Walk to customer car		13	-
20	● → □ □ ▽	Cover seat and part that are risk to dirtiness		-	3
21	○ → □ □ ▽	Inspect the level and quality of engine oil, brake oil, etc		-	10
22	● → □ □ ▽	Fill the ordering form		-	3
23	○ → □ □ ▽	Wait for technician to sign order form		-	2
24	○ → □ □ ▽	Walk to warehouse		12	-
25	○ → □ □ ▽	Wait for manager to sign and wait for ordering item		-	10
26	○ → □ □ ▽	Back to customer car		12	-
27	● → □ □ ▽	Change engine oil, brake oil, and etc		-	21
28	● → □ □ ▽	Fill in the form for the updated change		-	4
29	○ → □ □ ▽	Wait for driver		-	5
30	○ → □ □ ▽	Driver drive to the washing area		43	-
31	● → □ □ ▽	Wash and dry		-	10
32	○ → □ □ ▽	Drive to the storage		12	-
33	○ → □ □ ▽	QC check the finish job		-	7
34	○ → □ □ ▽	Storage		-	-
35	○ → □ □ ▽	Customer walk to cashier desk		-	-
36	○ → □ □ ▽	Walk to sitting area		7	-
37	○ → □ □ ▽	Wait for receipt		-	5
38	○ → □ □ ▽	Walk to cashier desk		7	-
39	● → □ □ ▽	Pay money		-	6
40	○ → □ □ ▽	Walk to sitting area		7	-
41	○ → □ □ ▽	Wait for the car		-	15
42	○ → □ □ ▽	Go home		-	-
Total				284	150

ศูนย์วิจัยและพัฒนา  
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## D-3: SUMMARY &amp; RESULT

Step	DESCRIPTION	AUTO I		AUTO II		AUTO III		AUTO IV		AUTO V		MEAN	
		Distance	Time	Distance	Time	Distance	Time	Distance	Time	Distance	Time	Distance	Time
1	Customer pull over	-	-	-	-	-	-	-	-	-	-	-	-
2	Wait for routine card	-	1	-	1	-	1	-	1	-	1	-	1
3	Drive to the parking lot	32	-	29	-	26	-	34	-	25	-	29.2	-
4	Park the car	-	2	-	4	-	3	-	5	-	4	-	3.6
5	Walk to SA desk	22	-	14	-	18	-	23	-	17	-	18.8	-
6	Ask for mileage check	-	-	-	-	-	-	-	-	-	-	-	-
7	Walk to sitting area	7	-	8	-	6	-	9	-	7	-	7.4	-
8	Wait for the receiving order print out	-	12	-	13	-	11	-	15	-	14	-	13
9	Walk back to SA desk	7	-	8	-	6	-	9	-	7	-	7.4	-
10	Receive the order print out	-	-	-	-	-	-	-	-	-	-	-	-
11	Wait for driver	-	9	-	8	-	11	-	8	-	10	-	9.2
12	Driver walk to customer car	22	-	14	-	18	-	23	-	17	-	18.8	-
13	Drive to the garage	64	-	58	-	52	-	60	-	55	-	57.8	-
14	Park the car	-	3	-	4	-	2	-	3	-	5	-	3.4
15	Technician wait for customer data print out	-	3	-	3	-	3	-	3	-	3	-	3
16	Assign job to mechanical	-	1	-	2	-	2	-	1	-	2	-	1.6
17	Mechanical walk to the shelf	10	-	13	-	11	-	12	-	13	-	11.8	-
18	Pick up cover cloth and tool	-	2	-	1	-	2	-	1	-	2	-	1.6
19	Back to customer car	10	-	13	-	11	-	12	-	13	-	11.8	-
20	Cover seat and part that are risk to dirtiness	-	3	-	3	-	2	-	2	-	3	-	2.6
21	Inspect the level and quality of engine oil, break oil, etc	-	10	-	9	-	11	-	8	-	10	-	9.6
22	Fill the ordering form	-	3	-	3	-	3	-	3	-	3	-	3
23	Wait for technician to sign order form	-	2	-	2	-	2	-	2	-	2	-	2
24	Walk to warehouse	10	-	11	-	13	-	14	-	12	-	12	-
25	Wait for manager to sign and order	-	12	-	14	-	9	-	13	-	10	-	11.6
26	Back to customer car	10	-	11	-	13	-	14	-	12	-	12	-
27	Change engine oil, brake oil, and etc	-	30	-	28	-	32	-	29	-	29	-	29.6
28	Wait for driver	-	4	-	3	-	4	-	3	-	4	-	3.6
29	Fill in the form for the updated change	-	4	-	5	-	3	-	4	-	5	-	4.2
30	Driver drive to the washing area	36	-	42	-	40	-	37	-	43	-	39.6	-

DATA COLLECTED DURING JUNE 2004

31	Wash and dry	-	-	9	-	11	-	12	-	12	-	10	-	10.8
32	Drive to the storage	40	48	-	45	-	46	-	42	-	-	-	44.2	-
33	QC check the finish job	-	-	5	-	6	-	7	-	5	-	7	-	6
34	Storage	-	-	-	-	-	-	-	-	-	-	-	-	-
35	Customer walk to cashier desk	-	-	-	-	-	-	-	-	-	-	-	-	-
36	Walk to sitting area	7	6	-	8	-	9	-	7	-	-	-	7.4	-
37	Wait for receipt	-	-	5	-	6	-	6	-	6	-	5	-	5.6
38	Walk to cashier desk	7	6	-	8	-	9	-	7	-	-	-	7.4	-
39	Pay money	-	-	6	-	4	-	5	-	4	-	6	-	5
40	Walk to sitting area	7	6	-	8	-	9	-	7	-	-	-	7.4	-
41	Wait for the car	-	-	15	-	10	-	12	-	13	-	15	-	13
42	Go home	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>TOTAL</b>		<b>291</b>	<b>287</b>	<b>141</b>	<b>283</b>	<b>140</b>	<b>320</b>	<b>143</b>	<b>284</b>	<b>141</b>	<b>284</b>	<b>150</b>	<b>293</b>	<b>143</b>

### D-4: PROCESS ACTIVITY MAP FORM (PROPOSED)

PRESENT METHOD <input type="checkbox"/>	<b>PAGE 1/1</b>																											
PROPOSED METHOD <input checked="" type="checkbox"/> <b>FLOW PROCESS CHART</b>																												
PRAT NAME: _____	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: center;">SUMMARY</th> <th style="text-align: center;">NO.</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><input type="radio"/></td> <td>OPERATIONS</td> <td style="text-align: center;">10</td> </tr> <tr> <td style="text-align: center;"><input checked="" type="radio"/></td> <td>TRANSPORTATIONS</td> <td style="text-align: center;">9</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>INSPECTIONS</td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>DELAYS</td> <td style="text-align: center;">3</td> </tr> <tr> <td style="text-align: center;"><input type="checkbox"/></td> <td>STORAGES</td> <td style="text-align: center;">2</td> </tr> <tr> <td colspan="2" style="text-align: right;"><b>TOTAL STEPS</b></td> <td style="text-align: center;"><b>27</b></td> </tr> <tr> <td colspan="2"><b>DISTANCE TRAVELED (MEAN)</b></td> <td></td> </tr> <tr> <td colspan="2"><b>TOTAL TIME (MEAN)</b></td> <td></td> </tr> </tbody> </table>	SUMMARY		NO.	<input type="radio"/>	OPERATIONS	10	<input checked="" type="radio"/>	TRANSPORTATIONS	9	<input type="checkbox"/>	INSPECTIONS	3	<input type="checkbox"/>	DELAYS	3	<input type="checkbox"/>	STORAGES	2	<b>TOTAL STEPS</b>		<b>27</b>	<b>DISTANCE TRAVELED (MEAN)</b>			<b>TOTAL TIME (MEAN)</b>		
SUMMARY		NO.																										
<input type="radio"/>	OPERATIONS	10																										
<input checked="" type="radio"/>	TRANSPORTATIONS	9																										
<input type="checkbox"/>	INSPECTIONS	3																										
<input type="checkbox"/>	DELAYS	3																										
<input type="checkbox"/>	STORAGES	2																										
<b>TOTAL STEPS</b>		<b>27</b>																										
<b>DISTANCE TRAVELED (MEAN)</b>																												
<b>TOTAL TIME (MEAN)</b>																												
PROCESS DESCRIPTION: _____																												
DEPARTMENT: _____																												
PLANT: _____																												
DATE: _____																												

Step	Symbol	DESCRIPTION	Distance	Time
1	● → □ D ▽	Customer pull over/ask for mileage check		
2	○ → □ ● ▽	Wait for routine card		
3	○ → □ D ▽	Drive to the garage		
4	● → □ D ▽	Park the car		
5	● → □ D ▽	SA greet customer and covering the seat		
6	○ → □ D ▽	Customer walk to sitting area		
7	○ → □ ● ▽	Wait for the order print out		
8	○ → □ D ▽	Walk back to SA desk		
9	● → □ D ▽	Receive the order print out		
10	○ → □ ● ▽	Mechanic wait for the customer data print out		
11	○ → □ D ▽	Walk to the shelf		
12	● → □ D ▽	Pick up tools		
13	○ → □ D ▽	Transport to customer car		
14	○ → □ D ▽	Inspect the level and quality of engine oil, break oil, etc		
15	● → □ D ▽	Pick up engine oil, brake oil, and etc.		
16	● → □ D ▽	Change engine oil, brake, and etc		
17	● → □ D ▽	Fill in the form for the updated change		
18	○ → □ D ▽	QC check the finish job		
19	○ → □ D ▽	Driver drive to the washing area		
20	● → □ D ▽	Wash and dry		
21	○ → □ D ▽	Drive to the parking lot		
22	○ → □ D ▽	Storage		
23	○ → □ D ▽	Customer walk to cashier desk		
24	○ → □ D ▽	Cashier search for the receipt		
25	● → □ D ▽	Print receipt		
26	● → □ D ▽	Pay money		
27	○ → □ D ▽	Go home		
<b>Total</b>				

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D-5: SAMPLE & EVALUATED FORM

PRESENT METHOD <input type="checkbox"/>		FLOW PROCESS CHART		PAGE 1/1	
PROPOSED METHOD <input checked="" type="checkbox"/>				SUMMARY	
PRAT NAME: E 220 cd1				NO.	
PROCESS DESCRIPTION: Mileage check				<input type="checkbox"/> OPERATIONS	10
DEPARTMENT: Maintenance unit				<input type="checkbox"/> TRANSPORTATIONS	9
PLANT: Garage				<input type="checkbox"/> INSPECTIONS	3
DATE: 9/8/04				<input type="checkbox"/> DELAYS	3
				<input type="checkbox"/> STORAGEES	2
				<b>TOTAL STEPS</b>	27
				<b>DISTANCE TRAVELED (MEAN)</b>	191 m
				<b>TOTAL TIME (MEAN)</b>	103 min

Step	Symbol	DESCRIPTION	Distance	Time
1	● → □ □ ▽	Customer pull over/task for mileage check	-	-
2	○ → □ □ ● ▽	Wait for routine card	-	2
3	○ → □ □ □ ▽	Drive to the garage	51	-
4	● → □ □ □ ▽	Park the car	-	4
5	● → □ □ □ ▽	SA greet customer and covering the seat	-	3
6	○ → □ □ □ ▽	Customer walk to sitting area	9	-
7	○ → □ □ ● ▽	Wait for the order print out	-	13
8	○ → □ □ □ ▽	Walk back to SA desk	9	-
9	● → □ □ □ ▽	Receive the order print out	-	-
10	○ → □ □ ● ▽	Mechanic wait for the customer data print out	-	4
11	○ → □ □ □ ▽	Walk to the shelf	5	-
12	● → □ □ □ ▽	Pick up tools	-	5
13	○ → □ □ □ ▽	Transport to customer car	15	-
14	○ → □ □ □ ▽	Inspect the level and quality of engine oil, broak oil, etc	-	8
15	● → □ □ □ ▽	Pick up engine oil, brake oil, and etc.	-	3
16	● → □ □ □ ▽	Change engine oil, brake, and etc	-	29
17	● → □ □ □ ▽	Fill in the form for the updated change	-	3
18	○ → □ □ □ ▽	QC check the finish job	-	6
19	○ → □ □ □ ▽	Driver drive to the washing area	45	-
20	● → □ □ □ ▽	Wash and dry	-	10
21	○ → □ □ □ ▽	Drive to the paiking lot	57	-
22	○ → □ □ □ ▽	Storage	-	-
23	○ → □ □ □ ▽	Customer walk to cashier desk	-	-
24	○ → □ □ □ ▽	Cashier search for the receipt	-	5
25	● → □ □ □ ▽	Print receipt	-	5
26	● → □ □ □ ▽	Pay money	-	5
27	○ → □ □ □ ▽	Go home	-	-
<b>Total</b>			<b>191</b>	<b>103</b>

ศูนย์วิทยทรัพยากร  
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## D-6: DATA COLLECTED DURING JULY 04

Step	DESCRIPTION	AUTO I		AUTO II		AUTO III		AUTO IV		AUTO V		MEAN	
		Distance	Time	Distance	Time	Distance	Time	Distance	Time	Distance	Time	Distance	Time
1	Customer pull over/ask for mileage check	-	-	-	-	-	-	-	-	-	-	-	-
2	Wait for routine card	-	1	-	2	-	2	-	2	-	1	-	1.6
3	Drive to the garage	50	-	54	-	53	-	48	-	52	-	51.4	-
4	Park the car	-	3	-	2	-	2	-	4	-	2	-	2.6
5	SA greet customer and covering the seat	-	3	-	2	-	2	-	5	-	3	-	3
6	Customer walk to sitting area	12	-	10	-	13	-	11	-	11	-	11.4	-
7	Wait for the order print out	-	13	-	12	-	12	-	15	-	12	-	12.8
8	Walk back to SA desk	12	-	10	-	13	-	11	-	11	-	-	-
9	Receive the order print out	-	-	-	-	-	-	-	-	-	-	5.2	-
10	Mechanic wait for the customer data print out	-	4	-	3	-	3	-	3	-	3	-	3.2
11	Walk to the shelf	4	-	6	-	5	-	6	-	5	-	19	-
12	Pick up tools	-	5	-	3	-	3	-	4	-	3	-	3.6
13	Transport to customer car	22	-	18	-	16	-	19	-	20	-	-	-
14	Inspect the level and quality of engine oil, break oil, etc	-	8	-	9	-	9	-	8	-	7	-	8.2
15	Pick up engine oil, brake oil, and etc.	-	3	-	4	-	4	-	2	-	3	-	3.2
16	Change engine oil, brake, and etc	-	29	-	28	-	28	-	31	-	26	-	28.4
17	Fill in the form for the updated change	-	3	-	4	-	4	-	4	-	4	-	3.8
18	QC check the finish job	-	6	-	5	-	5	-	6	-	6	-	5.6
19	Driver drive to the washing area	40	-	37	-	41	-	38	-	44	-	40	-
20	Wash and dry	-	10	-	9	-	9	-	10	-	10	-	9.6
21	Drive to the parking lot	59	-	64	-	61	-	56	-	63	-	60.6	-
22	Storage	-	-	-	-	-	-	-	-	-	-	-	-
23	Customer walk to cashier desk	-	-	-	-	-	-	-	-	-	-	-	-
24	Cashier search for the receipt	-	3	-	2	-	2	-	1	-	2	-	2
25	Print the receipt	-	3	-	4	-	2	-	3	-	3	-	3
26	Pay money	-	5	-	5	-	5	-	5	-	6	-	5.2
27	Go home	-	-	-	-	-	-	-	-	-	-	-	-
<b>TOTAL</b>		199	99	199	94	202	99	189	103	206	91	199	95.8

## D-7: DATA COLLECTED DURING AUGUST 04

DATA COLLECTED DURING AUGUST 2004													
Step	DESCRIPTION	AUTO I		AUTO II		AUTO III		AUTO IV		AUTO V		MEAN	
		Distance	Time	Distance	Time	Distance	Time	Distance	Time	Distance	Time	Distance	Time
1	Customer pull over/ask for mileage check	-	-	-	-	-	-	-	-	-	-	-	-
2	Wait for routine card	-	2	-	2	-	1	-	2	-	2	-	1.8
3	Drive to the garage	51	-	57	-	49	-	53	-	53	-	52.6	-
4	Park the car	-	4	-	3	-	5	-	2	-	3	-	3.4
5	SA greet customer and covering the seat	-	3	-	3	-	4	-	3	-	3	-	3.2
6	Customer walk to sitting area	9	-	15	-	11	-	9	-	13	-	11.4	-
7	Wait for the order print out	-	13	-	12	-	12	-	15	-	14	-	13.2
8	Walk back to SA desk	9	-	15	-	11	-	9	-	13	-	11.4	-
9	Receive the order print out	-	-	-	-	-	-	-	-	-	-	-	-
10	Mechanic wait for the customer data print out	-	4	-	3	-	3	-	3	-	3	-	3.2
11	Walk to the shelf	5	-	11	-	7	-	5	-	7	-	7	-
12	Pick up tools	-	5	-	3	-	3	-	4	-	3	-	3.6
13	Transport to customer car	15	-	23	-	21	-	19	-	21	-	19.8	-
14	Inspect the level and quality of engine oil, break oil, etc	-	8	-	9	-	9	-	8	-	7	-	8.2
15	Pick up engine oil, brake oil, and etc.	-	3	-	4	-	4	-	2	-	3	-	3.2
16	Change engine oil, brake, and etc	-	29	-	28	-	28	-	31	-	26	-	28.4
17	Fill in the form for the updated change	-	3	-	4	-	4	-	4	-	4	-	3.8
18	QC check the finish job	-	6	-	5	-	5	-	6	-	6	-	5.6
19	Driver drive to the washing area	45	-	43	-	37	-	45	-	47	-	43.4	-
20	Wash and dry	-	10	-	9	-	9	-	11	-	10	-	9.8
21	Drive to the parking lot	57	-	59	-	65	-	63	-	61	-	61	-
22	Storage	-	-	-	-	-	-	-	-	-	-	-	-
23	Customer walk to cashier desk	-	-	-	-	-	-	-	-	-	-	-	-
24	Cashier search for the receipt	-	3	-	2	-	2	-	4	-	2	-	2.6
25	Print the receipt	-	5	-	2	-	3	-	2	-	2	-	2.8
26	Pay money	-	5	-	5	-	5	-	5	-	6	-	5.2
27	Go home	-	-	-	-	-	-	-	-	-	-	-	-
<b>TOTAL</b>		191	103	223	94	201	97	203	104	215	94	206.6	98

D-8: DATA COLLECTED DURING SEPTEMBER 04

DATA COLLECTED DURING SEPTEMBER 2004													
Step	DESCRIPTION	AUTO I		AUTO II		AUTO III		AUTO IV		AUTO V		MEAN	
		Distance	Time	Distance	Time	Distance	Time	Distance	Time	Distance	Time	Distance	Time
1	Customer pull over/ask for mileage check	-	-	-	-	-	-	-	-	-	-	-	-
2	Wait for routine card	-	1	-	2	-	2	-	1	-	2	-	1.6
3	Drive to the garage	53	-	50	-	54	-	53	-	56	-	53.2	-
4	Park the car	-	2	-	2	-	2	-	2	-	4	-	2.4
5	SA greet customer and covering the seat	-	3	-	3	-	2	-	3	-	3	-	2.8
6	Customer walk to sitting area	13	-	12	-	10	-	9	-	11	-	11	-
7	Wait for the order print out	-	12	-	12	-	11	-	10	-	13	-	11.6
8	Walk back to SA desk	13	-	12	-	10	-	9	-	11	-	11	-
9	Receive the order print out	-	-	-	-	-	-	-	-	-	-	-	-
10	Mechanic wait for the customer data print out	-	3	-	3	-	3	-	4	-	4	-	3.4
11	Walk to the shelf	7	-	4	-	6	-	5	-	4	-	5.2	-
12	Pick up tools	-	4	-	3	-	3	-	3	-	5	-	3.6
13	Transport to customer car	21	-	22	-	18	-	19	-	17	-	19.4	-
14	Inspect the level and quality of engine oil, break oil, etc	-	8	-	7	-	7	-	7	-	8	-	7.4
15	Pick up engine oil, brake oil, and etc.	-	2	-	3	-	5	-	3	-	3	-	3.2
16	Change engine oil, brake, and etc	-	29	-	26	-	28	-	26	-	29	-	27.6
17	Fill in the form for the updated change	-	4	-	4	-	5	-	4	-	3	-	4
18	QC check the finish job	-	6	-	6	-	5	-	6	-	6	-	5.8
19	Driver drive to the washing area	47	-	40	-	37	-	45	-	42	-	42.2	-
20	Wash and dry	-	9	-	10	-	9	-	8	-	10	-	9.2
21	Drive to the parking lot	61	-	59	-	64	-	63	-	65	-	62.4	-
22	Storage	-	-	-	-	-	-	-	-	-	-	-	-
23	Customer walk to cashier desk	-	-	-	-	-	-	-	-	-	-	-	-
24	Cashier search for the receipt	-	1	-	2	-	3	-	2	-	3	-	2.2
25	Print the receipt	-	2	-	3	-	2	-	2	-	4	-	2.6
26	Pay money	-	5	-	6	-	4	-	6	-	5	-	5.2
27	Go home	-	-	-	-	-	-	-	-	-	-	-	-
<b>TOTAL</b>		215	91	199	92	199	91	203	87	206	102	204.4	92.6

## D-9: SUMMARY &amp; RESULT

DATA COLLECTED DURING JULY 2004 – SEPTEMBER 2004												
Step	DESCRIPTION	JULY		AUGUST		SEPTEMBER		MEAN				
		Distance	Time	Distance	Time	Distance	Time	Distance	Time			
1	Customer pull over/ask for mileage check	-	-	-	-	-	-	-	-	-	-	-
2	Wait for routine card	-	1.6	-	1.8	-	1.6	-	-	-	1.7	-
3	Drive to the garage	51.4	-	52.6	-	53.2	-	52.4	-	-	-	-
4	Park the car	-	2.6	-	3.4	-	2.4	-	-	-	2.8	-
5	SA greet customer and covering the seat	-	3	-	3.2	-	2.8	-	-	-	3	-
6	Customer walk to sitting area	11.4	-	11.4	-	11	-	11.3	-	-	-	-
7	Wait for the order print out	-	12.8	-	13.2	-	11.6	-	-	-	12.5	-
8	Walk back to SA desk	-	-	11.4	-	11	-	11.3	-	-	-	-
9	Receive the order print out	5.2	-	-	-	-	-	-	-	-	-	-
10	Mechanic wait for the customer data print out	-	3.2	-	3.2	-	3.4	-	-	-	3.3	-
11	Walk to the shelf	19	-	7	-	5.2	-	5.8	-	-	-	-
12	Pick up tools	-	3.6	-	3.6	-	3.6	-	-	-	3.6	-
13	Transport to customer car	-	-	19.8	-	19.4	-	19.4	-	-	19.4	-
14	Inspect the level and quality of engine oil, break oil, etc	-	8.2	-	8.2	-	7.4	-	-	-	7.9	-
15	Pick up engine oil, brake oil, and etc.	-	3.2	-	3.2	-	3.2	-	-	-	3.2	-
16	Change engine oil, brake, and etc	-	28.4	-	28.4	-	27.6	-	-	-	28.1	-
17	Fill in the form for the updated change	-	3.8	-	3.8	-	4	-	-	-	3.9	-
18	QC check the finish job	-	5.6	-	5.6	-	5.8	-	-	-	5.7	-
19	Driver drive to the washing area	40	-	43.4	-	42.2	-	41.9	-	-	-	-
20	Wash and dry	-	9.6	-	9.8	-	9.2	-	-	-	9.5	-
21	Drive to the parking lot	60.6	-	61	-	62.4	-	61.3	-	-	-	-
22	Storage	-	-	-	-	-	-	-	-	-	-	-
23	Customer walk to cashier desk	-	-	-	-	-	-	-	-	-	-	-
24	Cashier search for the receipt	-	2	-	2.6	-	2.2	-	-	-	2.3	-
25	Print the receipt	-	3	-	2.8	-	2.6	-	-	-	2.8	-
26	Pay money	-	5.2	-	5.2	-	5.2	-	-	-	5.2	-
27	Go home	-	-	-	-	-	-	-	-	-	-	-
<b>TOTAL</b>		199	95.8	206.6	98	204.4	92.6	203.3	95.5			



APPENDIX E

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

**E-1: QUESTIONNAIRE FORM****CUSTOMER SURVEY ON IMPLEMENTATION**

DATE: \_\_\_\_\_

 BEFORE  
 AFTER

Please write X in the selected block.

1. What is your opinion in overall time use since you arrive till have your car back?  
 [5] Very fast      [4] Fast      [3] Moderate    [2] Slow      [1] Very slow
2. Is the job completed on arrangement?  
 [5] Very fast      [4] Fast      [3] Moderate    [2] Slow      [1] Very slow
3. What is your opinion in payment time?  
 [5] Very fast      [4] Fast      [3] Moderate    [2] Slow      [1] Very slow
4. What is your opinion in waiting for your car after payment?  
 [5] Very fast      [4] Fast      [3] Moderate    [2] Slow      [1] Very slow
5. What is your opinion for the cleanliness of your car?  
 [5] Very good      [4] Good      [3] Moderate    [2] Bad      [1] Very bad
6. Will you come back again to use our service?  
 [5] Certainly      [4] Might come back      [3] uncertain  
 [2] might not come back    [1] Definitely no
7. Will you introduce your relatives to purchase or use service at Benz Talingchan Co., Ltd.?  
 [5] Surly      [4] Might introduce      [3] uncertain  
 [2] might not introduce    [1] Definitely not
8. What would you rate company for the effort in trying to improve the management?  
 [5] Very good      [4] Good      [3] Moderate    [2] Bad      [1] Very bad

**E-2: SAMPLE OF EVALUATED FORM (BEFORE)****CUSTOMER SURVEY ON IMPLEMENTATION**

DATE: 3 - - 02

 BEFORE  
 AFTER

Please write X in the selected block.

1. What is your opinion in overall time use since you arrive till have your car back?  
[5] Very fast [4] Fast [3] Moderate  Slow [1] Very slow
2. How do you feel with the time use for ordering job print out?  
[5] Very fast [4] Fast [3] Moderate  Slow [1] Very slow
3. What is your opinion in payment time?  
[5] Very fast [4] Fast [3] Moderate [2] Slow  Very slow
4. What is your opinion in waiting for your car after payment?  
[5] Very fast [4] Fast [3] Moderate [2] Slow  Very slow
5. What is your opinion for the cleanliness of your car?  
[5] Very good  Good [3] Moderate [2] Bad [1] Very Bad
6. Will you come back again to use car service?  
[5] Certainly [4] Might come back [3] uncertain  
[2] might not come back [1] Definitely no
7. Will you introduce your relatives to purchase or use service at Benz Talingchan Co., Ltd.?  
[5] Surely [4] Might introduce  uncertain  
[2] might not introduce [1] Definitely not
8. What would you rate company for the effort in trying to improve the management?  
[5] Very good [4] Good  Moderate [2] Bad [1] Very bad

คุณชัชวาลย์พรพิกุล  
จุฬาลงกรณ์มหาวิทยาลัย



**E-3: SAMPLE OF EVALUATED FORM (AFTER)****CUSTOMER SURVEY ON IMPLEMENTATION**

DATE: 8/2/2554

 BEFORE  
 AFTER

Please write X in the selected block.

1. What is your opinion in overall time use since you arrive till have your car back?  
[5] Very fast [4] Fast [3] Moderate [2] Slow [1] Very slow
2. How do you feel with the time use for ordering job print out?  
[5] Very fast [4] Fast [3] Moderate [2] Slow [1] Very slow
3. What is your opinion in payment time?  
[5] Very fast [4] Fast [3] Moderate [2] Slow [1] Very slow
4. What is your opinion in waiting for your car after payment?  
[5] Very fast [4] Fast [3] Moderate [2] Slow [1] Very slow
5. What is your opinion for the cleanliness of your car?  
[5] Very good [4] Good [3] Moderate [2] Bad [1] Very bad
6. Will you come back again to use our service?  
[5] Certainly [4] Might come back [3] uncertain  
[2] might not come back [1] Definitely no
7. Will you introduce your relatives to purchase or use service at Benz Talingchan Co., Ltd.?  
[5] Surly [4] Might introduce [3] uncertain  
[2] might not introduce [1] Definitely not
8. What would you rate company for the effort in trying to improve the management?  
[5] Very good [4] Good [3] Moderate [2] Bad [1] Very bad

ศูนย์วิจัยและพัฒนา  
จุฬาลงกรณ์มหาวิทยาลัย

## E-4: SUMMARY &amp; RESULT

SUMMARY OF CUSTOMER SURVEY BEFORE IMPLEMENTATION								
Customer	Category							
	1	2	3	4	5	6	7	8
1	3	1	2	3	5	4	3	3
2	2	1	1	1	4	5	3	2
3	2	3	2	1	4	4	3	2
4	3	1	2	1	4	3	2	2
5	3	1	3	1	5	5	2	2
6	1	3	2	2	4	5	3	1
7	2	1	3	1	4	5	1	1
8	1	3	3	1	5	4	3	2
9	3	1	2	3	5	5	3	2
10	2	1	2	1	4	2	3	2
11	1	1	2	1	3	4	3	3
12	1	3	1	1	3	2	2	2
13	3	1	2	3	4	5	4	3
14	2	2	2	2	3	4	4	3
15	2	2	2	2	4	5	3	1
16	3	1	2	3	3	3	3	2
17	1	3	3	1	3	5	4	2
18	2	1	1	2	4	4	3	2
19	3	2	1	2	4	5	4	1
20	3	2	3	1	4	5	3	1
21	2	2	2	3	3	4	3	2
22	2	3	1	3	5	3	3	2
23	1	1	2	2	5	2	4	2
24	2	2	1	2	4	5	3	3
25	2	2	2	1	4	5	3	3
26	1	1	2	3	4	5	3	1
27	2	2	1	1	5	3	4	2
28	3	1	2	1	5	5	3	2
29	1	3	3	2	5	3	3	2
30	2	2	3	2	4	2	3	3
<b>Total</b>	<b>61</b>	<b>53</b>	<b>60</b>	<b>53</b>	<b>122</b>	<b>121</b>	<b>91</b>	<b>61</b>
<b>Mean</b>	<b>2.0</b>	<b>1.8</b>	<b>2.0</b>	<b>1.8</b>	<b>4.1</b>	<b>4.0</b>	<b>3.0</b>	<b>2.0</b>
<b>Mean Mean</b>	<b>2.6</b>							
<b>SD</b>								

SUMMARY OF CUSTOMER SURVEY AFTER IMPLEMENTATION								
Customer	Category							
	1	2	3	4	5	6	7	8
1	3	3	4	4	5	5	5	4
2	4	5	4	5	3	3	4	5
3	4	2	5	5	4	5	5	4
4	3	3	5	5	5	4	4	4
5	4	3	4	3	3	5	4	4
6	3	4	4	3	5	5	3	5
7	4	4	5	5	5	5	4	4
8	4	3	3	3	4	5	5	4
9	4	4	4	5	3	5	4	4
10	5	4	3	4	5	5	4	4
11	2	4	5	5	4	5	5	4
12	2	3	5	4	5	5	4	4
13	3	5	5	5	3	5	3	4
14	4	2	4	4	5	4	3	4
15	5	3	5	5	4	3	5	5
16	4	4	4	5	5	5	4	4
17	4	3	5	3	3	5	4	4
18	3	4	4	4	3	4	5	4
19	4	4	3	5	4	5	4	4
20	5	4	4	5	5	5	5	4
21	4	3	5	4	4	5	4	4
22	5	4	4	5	3	3	3	4
23	2	5	4	4	5	4	4	4
24	3	2	4	5	4	5	5	4
25	2	4	5	4	4	5	5	3
26	4	5	4	5	5	5	5	3
27	3	4	3	5	3	5	4	4
28	4	3	4	5	4	5	4	4
29	5	3	5	5	4	4	4	4
30	4	4	3	4	4	5	5	3
<b>Total</b>	<b>110</b>	<b>108</b>	<b>126</b>	<b>138</b>	<b>123</b>	<b>139</b>	<b>127</b>	<b>120</b>
<b>Mean</b>	<b>3.7</b>	<b>3.6</b>	<b>4.2</b>	<b>4.6</b>	<b>4.1</b>	<b>4.6</b>	<b>4.3</b>	<b>4.0</b>
<b>Mean Mean</b>	<b>4.1</b>							
<b>SD</b>								

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย



APPENDIX F

ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย

## F-1: WORK ORDER FORM

ใบสั่งซ่อม  
WORK ORDER  
สำเนาคอนโทรล

JOB NO. :  
TOP NO. :  
DATE :  
TIME :

CUSTOMER NAME

TEL

MODEL (รุ่น)				กำหนดซ่อมเสร็จ				ที่ปรึกษาช่างบริการ	
				วันที่		เวลา			
CHASSIS NO. (เลขตัวถัง)			COLOR (สี)		REG. NO. (ทะเบียน)		MILEAGE (เลขไมล์)		DELIVERY DATE (วันส่งมอบรถ)
Fuel	RADIO	TAPE CASSETTE	TV	COMPACT DISK	SERVICE BOOK	SPARE WHEEL	JACK	TOOLS	อะไหล่สิ้นเปลือง
<b>LINE NO.</b> ลำดับ		<b>SERVICE ITEMS</b> รายการที่สั่งซ่อม							
<div style="text-align: center;">  <p style="font-size: 2em; color: purple; opacity: 0.5;">ศูนย์วิทยธรพยากร</p> <p style="font-size: 2em; color: purple; opacity: 0.5;">กรุงเทพมหานคร</p> <p style="font-size: 2em; color: purple; opacity: 0.5;">โรงเรียนมหาวชิตรายาลัย</p> </div> <p style="font-size: 0.8em; margin-top: 10px;">เบ็ดเตล็ด แบบชิ้นล่างของ แบบชิ้นเคมรถ</p>									

### F-2: ORDERING PARTS FORM

PENTEX TEL: 0-2712-1629-30, 0-2712-2889-000 FAX: 0-2392-0449

## ใบสั่งซื้อไหล

เลขที่ NO.

ใบสั่งงานที่ JOB NO.	หมายเลขเครื่อง CHASSIS NO.	ทะเบียนรถยนต์ REGISTER NO.	รุ่น MODEL	วันที่ DATE	
ITEM	สถานที่เก็บ BIN LOCATION	หมายเลขเครื่องไหล PART NO.	ชื่อรายการสินค้า PART NAME	จำนวน QTY	หมายเหตุ
01					
02					
03					
04					
05					
06					
07					
08					
09					
10					
11					
12					

รับอะไหล่โดย.....

ผู้โอนข้อมูล	ผู้จัด	ตรวจสอบ	ผู้จ่าย	ช่างผู้เบิก

บัญชี (ACCOUNT)

FR-SP-019 REV.00

จุฬาลงกรณ์มหาวิทยาลัย

4539 A0018

**F-3: RECEIPT FORM**

L

**ใบเสร็จรับเงิน**  
(ไม่ใช่ใบกำกับภาษี)

เอกสารออกเป็นชุด

เลขที่ NO.
------------

	รหัสลูกค้า CUS. CODE	เลขที่ใบสั่ง ORD. NO.	เลขที่อ้างอิง REF. NO.	วันที่ DATE
	โทรศัพท์ TELEPHONE		ประเภทการสั่ง ORD. TYPE	กำหนดชำระ TERMS

ลำดับ ITEM	สถานที่เก็บ BIN LOCATION	ชนิดหมายเลขชิ้น PART NO.	ชื่อรายการสินค้า PART NAME	จำนวน QTY.	ราคาหน่วย UNIT PRICE	ส่วนลด DISC%	จำนวนเงิน AMOUNT	หมายเหตุ REMARKS
01								
02								
03								
04								
05								
06								
07								
08								
09								
10								
11								
12								

ผู้จัด	ตรวจสอบ	ผู้มอบอำนาจ	ได้รับของในสภาพเรียบร้อยโดย		ผู้รับเงิน
		(ผู้จ่าย)	(ขนส่ง)	(ผู้รับของ)	

ยอดรวม TOTAL	
ภาษีมูลค่าเพิ่ม VALUE ADDED TAX	
รวมยอดสุทธิ TOTAL NET	

เงินสด     เครดิตการ์ด

เลขที่ \_\_\_\_\_ วันที่ \_\_\_\_\_

(1) ลูกค้า (CUSTOMER)

ผู้จัดการ

## BIOGRAPHY

Mr. Vitaya U-varit was born in Bangkok, 1979. In 2002, he earned a bachelor's degree in Civil Engineering from Sirindhorn International Institute of Technology, Thammasat University. With determination, he converted his field study to Engineering Management for which he participated in the joint Master's degree programmed at the Regional Centre for Manufacturing Systems Engineering. It is a joint academic programmed run by Chulalongkorn University and the University of Warwick, UK.



ศูนย์วิทยทรัพยากร  
จุฬาลงกรณ์มหาวิทยาลัย