Chapter 6

Information System Evaluation

6. Information System Model Development Result

The information system models for HGA performance test was developed to cover three approaches; monitoring, diagnosing and analysis. They provide information to facilitate organization and improve HGA product performance. In addition, this model contains standard report to improve communications among concerned people to refer to the same topics and details.

The results have been measured to make sure positive results and improvement occurs in HGA operation area. There are several aspects of improvement obtained from this model even though there are some limitations of the tools according to complex structure of HGA, HGA testing and several variables contribute indirectly. Six aspects have been measured, quality aspect, time improvement, speed improvement, flexibility improvement, error improvement and user comments.

6.1 Quality aspect

6.1.1 Yield improvement

Yield is the baseline in measuring the quality aspect of HGA operation, which also contributes directly to the productivity of manufacturing. Management focuses this because it is a key factor of corporate goal achievement.

Yield relates directly with cost which management has responsibility. It has been used in competing the performance among sites which the higher the yield, the lower the cost.

The flexibility of organization can be also improved according to work focus allocation.

Figure 6.1 shows yield improvement obtained after the low yield testers were fixed. Cost is saved $2168 or 78,000 baht from volume built 238,805 HGAs of 5 working day with 0.45% improvement average.

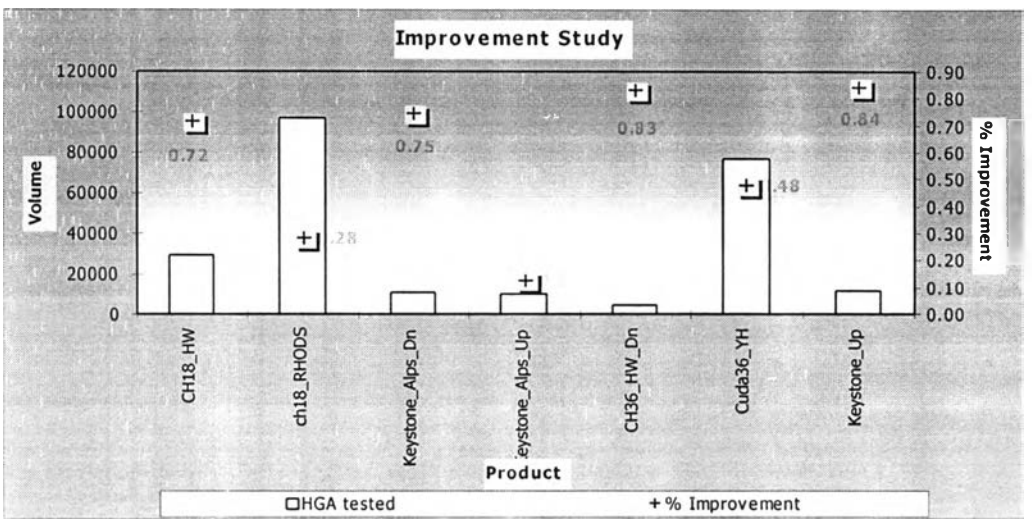
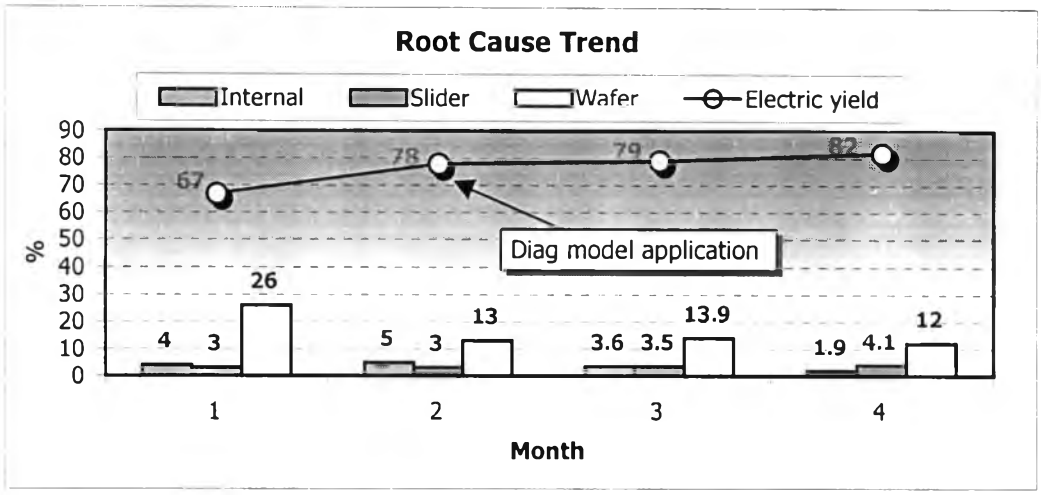


Figure 6.1 Improvement(%) contributed from diagnosing & monitoring model; average was 0.45%

6.1.2 Effect analysis

Effect analysis has been computed by analysis the electric test failures of major volume products at 80% of total volume in HGA operation. The root causes can be categorized into internal and external causes. Both internal and external causes tend to reduce down after implementation of information system models. Faster feed back and corrective actions to the responsible persons within HGA operation or to the slider and wafer plants, is obtained. However, the slider-related portion seems to maintain which require further work in this area. See figure 6.2.



MTH	1	2	3	4
Volume (%)	na	76.4	78.1	71
Electric yield	67	78	79	82
Electric fall out	33	22	21	18
Internal	4	5	3.6	1.9
Slider	3	3	3.5	4.1
Wafer	26	13	13.9	12

Figure 6.2 Effect analysis

As shown in figure 6.3, the primary portion of internal problem is either tester or tester association related, tends to drop down because of faster feedback and action.

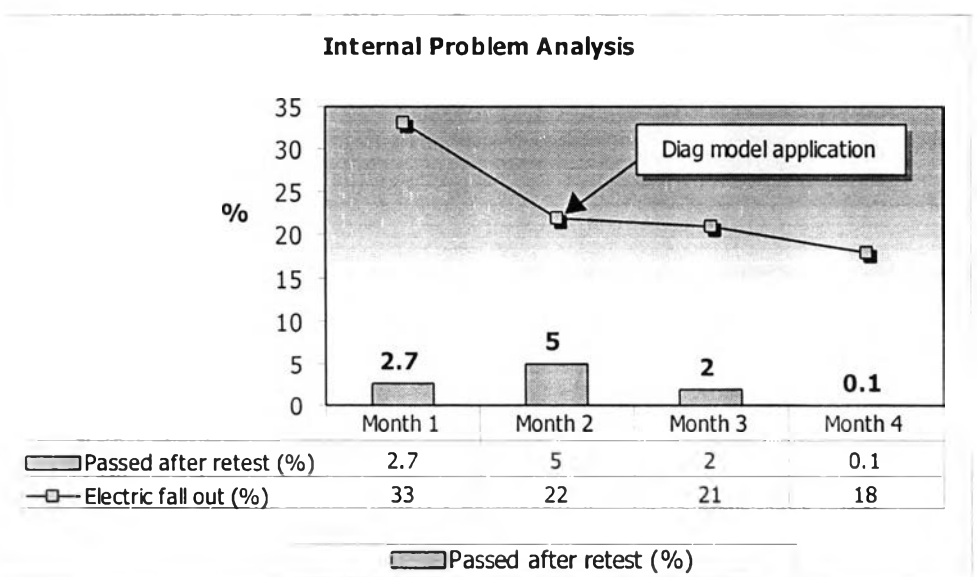


Figure 6.3 Internal cause analysis

6.2 Time Improvement

Primary activities that process and test engineers spend of their times are yield analysis and yield improvement which is 50% of their times. However, there are other routine activities that must followed up such as tester control & monitoring, technical development, product improvement, clearing action due to customer feedback, special assigned tasks from management and so on.

Time-spent for information preparation of HGA performance is significant improved for 252 minutes after implementation of the analysis tools. As demonstrated in figure 6.4, one high volume built product has been studied, it was built over 100,000 HGAs a day. This resulted in more time spent in yield analysis according to more contributors from testers, assembly cell and wafers.

Item	Description	Shiftly		Daily		Grand Total
		quantity	Minutes	quantity	Minutes	avg time (minutes)
1	Internal / External Analysis	4049	8	10016	13	21
2	Yield by wafer	127907	16	428843	47	63
3	Yield by cell	127002	29	380863	27	56
4	Yield by tester	127133	19	367568	52	70
5	Overall yield and paramtrics	122283	13	277551	21	34
6	Evaluation	27417	3	51029	6	9
	Total time consumed (minutes)		87		165	252

Figure 6.4 Time spent in manipulating information

6.3 Speed Improvement

The information system models is developed to support timely manner action approach especially the diagnosing & monitoring model. The front line people can monitor the HGA yield and react to problems rapidly. However, it is difficult to indicate the root cause of abnormal yields, which apparently may be contributed by poor performing wafer that flow through the test process, fluctuation within same wafer lot, noise, vibration, etc. Therefore, there are no tools can identify

problems effectively. However, a system is being developed and studied as directed from the corporate group to trigger events upstream to drive. This requires a lot of support from different functional groups especially design engineers from several divisions; wafer fabrication, slider machining, test engineering (design center group) and drive. This will be the next generation model. The timeline is unclear at this time. Consequently, the diagnosing & monitoring model is used in determining and trigger at a certain level by applying the same quad comparison concept in triggering event to minimize the yield loss opportunity and fasten action taken. Figure 6.5, illustrates how the model identifies the root cause when the low yield event is triggered.

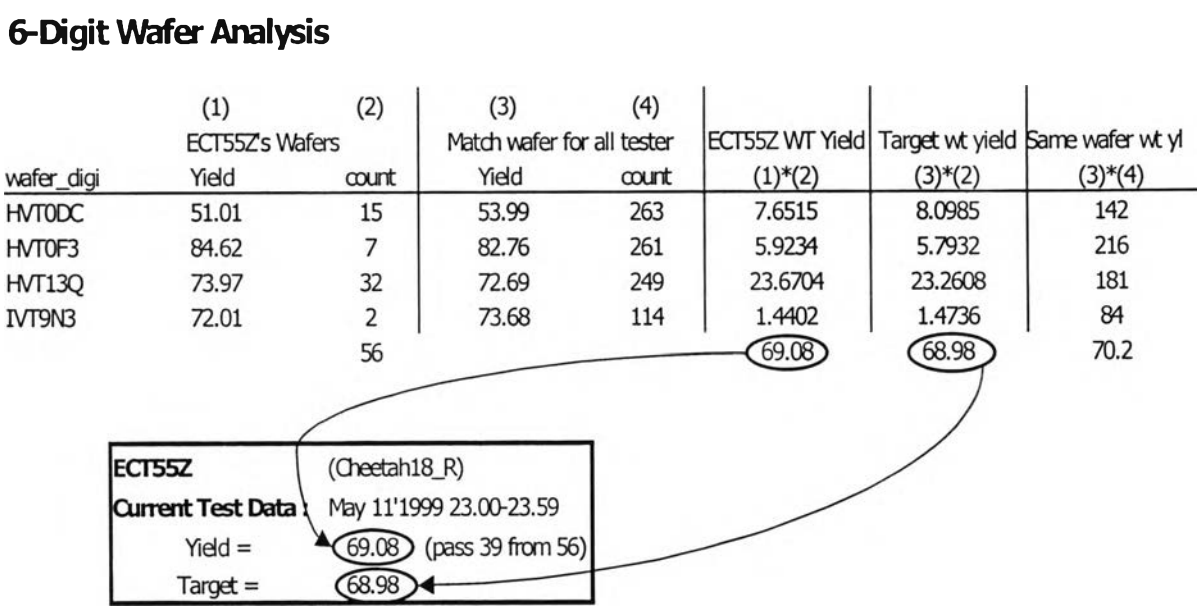


Figure 6.5 Troubleshooting by diagnosing & monitoring model

To measure the speed of action taken, it counts the number of testers with low yield 2 or 3 hours consecutively whereas the low yield is defined from yield lower than target yield. This technique will show the speed in taking action; the higher the number, the lower the speed. That means the higher the events of low yield testers allowed more than 2 - 3 hours. However, two-hour triggering is selected to let more data flows to

support same quad analysis approach. Figure 6.6, shows how to measure the low yield percentage above two hours. The bottom picture, figure 6.6 shows the trend of low yield testers above two hours have been recorded.

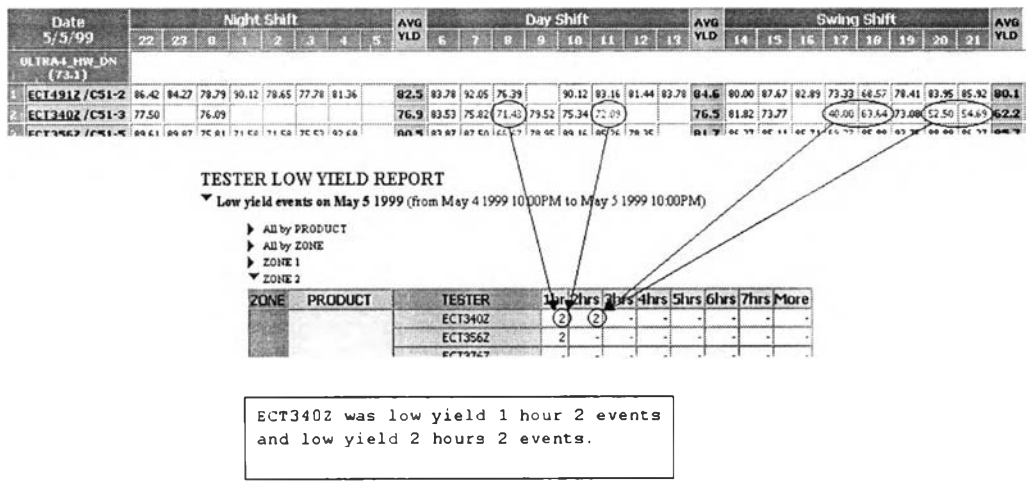


Figure 6.6 (a) Count the event of low yield testers higher or equal to one 1 hour

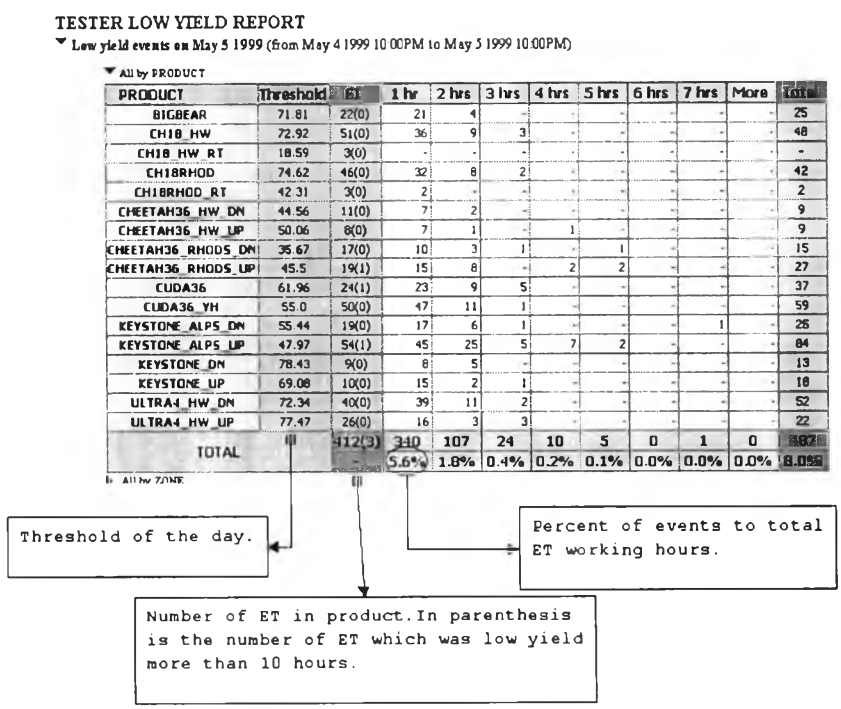


Figure 6.6 (b) Summary report of events of low yield tester equal or higher than 1 hour

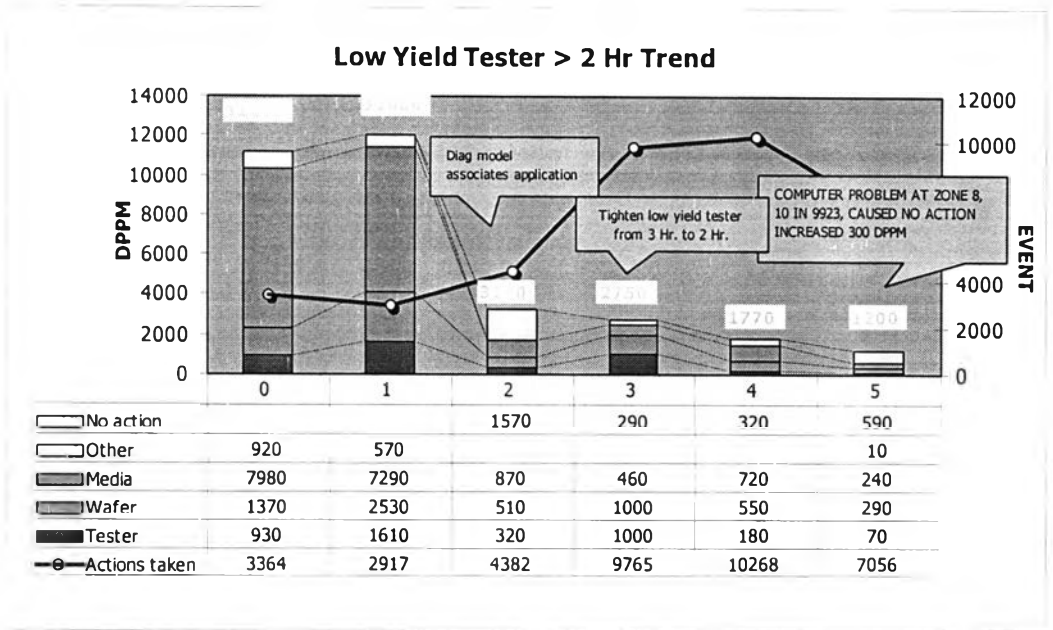
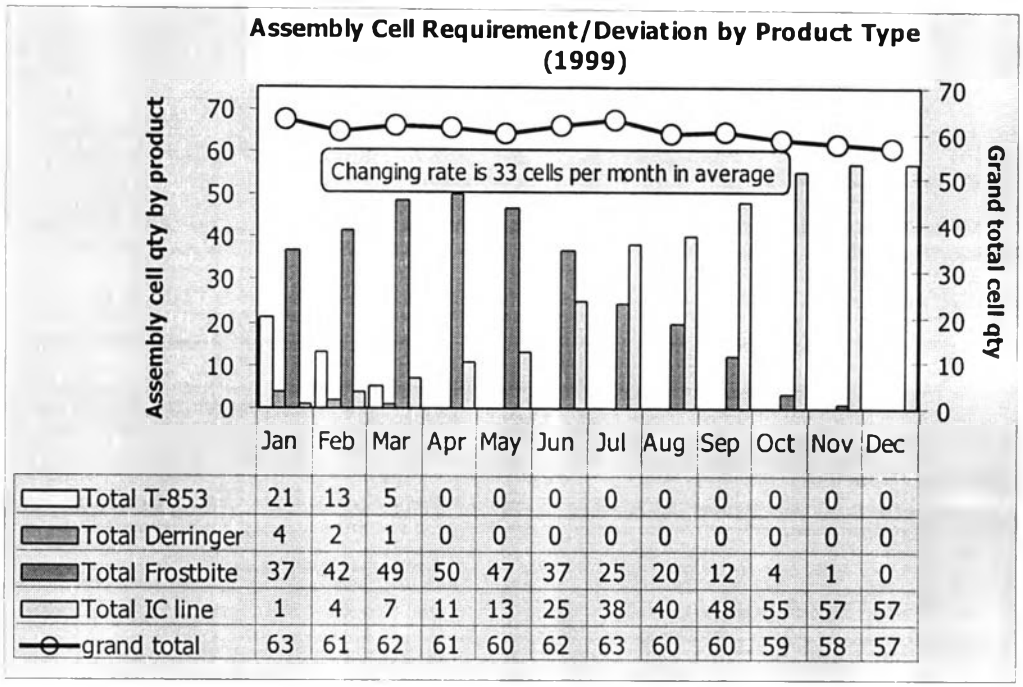


Figure 6.6 (c) Low yield tester > 2 Hr. trend

6.4 Flexibility Aspect

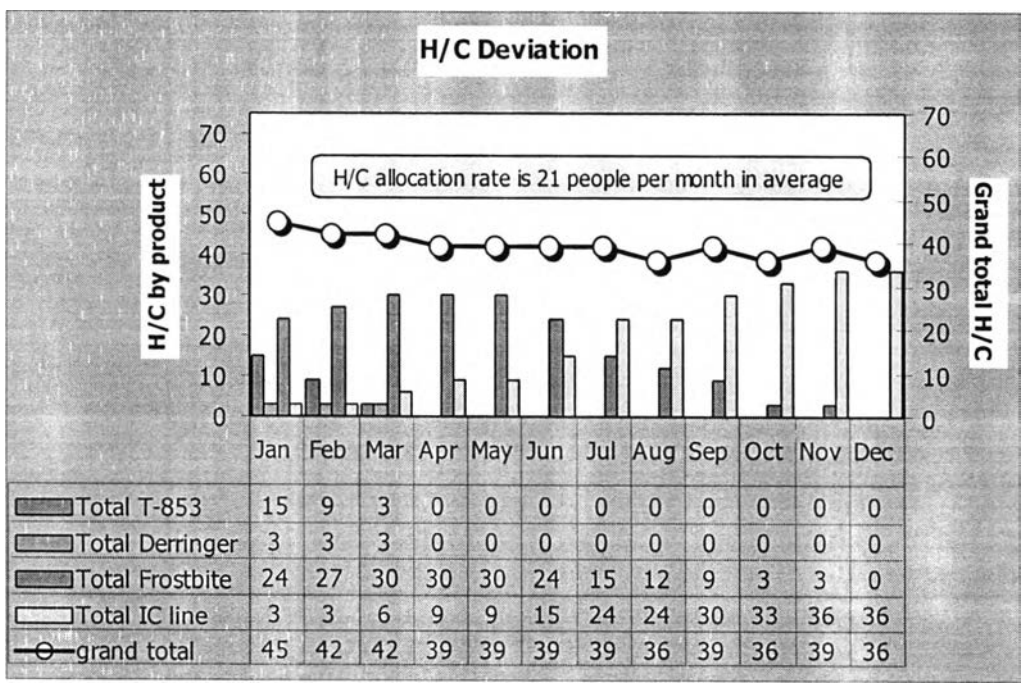
In massive volume manufacturing with dynamic changes of product life cycle, customer requirement and high competitiveness, it is very important to focus on the flexibility aspect such as product change, facility and organization including human resources.

Quantity of assembly cell is the good indicator in planning resources and facility that may increase or decrease per market demand. While the assembly cell number keeps changing, the resource will be affected. As shown in figure 6.7 (a), the assembly cell are changed with the rate of 33 cells per month affects the allocated headcount 21 people a month as shown in figure 6.7 (b).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total T-853	21	13	5	0	0	0	0	0	0	0	0	0
Total Derringer	4	2	1	0	0	0	0	0	0	0	0	0
Total Frostbite	37	42	49	50	47	37	25	20	12	4	1	0
Total IC line	1	4	7	11	13	25	38	40	48	55	57	57
grand total	63	61	62	61	60	62	63	60	60	59	58	57

Figure 6.7 (a) The assembly cell deviation in year 1999; changing rate 33 cells per month average



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total T-853	15	9	3	0	0	0	0	0	0	0	0	0
Total Derringer	3	3	3	0	0	0	0	0	0	0	0	0
Total Frostbite	24	27	30	30	30	24	15	12	9	3	3	0
Total IC line	3	3	6	9	9	15	24	24	30	33	36	36
grand total	45	42	42	39	39	39	39	36	39	36	39	36

Figure 6.7 (b) Headcount allocation rate according to product movement in figure 6.7 (a)

Basically, flexibility is related to human resource either its capability or quantity. To improve the resource capability, the flexibility of that organization must also be improved. The model developed is dealing with improving the capability of human resources with standard methods provided in solving problems at a certain level. In addition, the headcount can be allocated to support in other work areas as required since the developed tool already serves for accommodation necessary information. Figure 6.8 shows headcount allocation to support other work areas, which were used, for manipulating information before develop models. Figure 6.9 shows one of the constraints in engineering organization resource versus workload, which implied by quantity of assembly cells to be supported. It is more flexible in workload after develop models since the activities has to be balanced as required by management.

Section	Headcount to allocate
Test Engineering	3
Process Engineering	7
Quality Assurance	3

Figure 6.8 Headcount used for crunching data are allocated to other work area after develop models

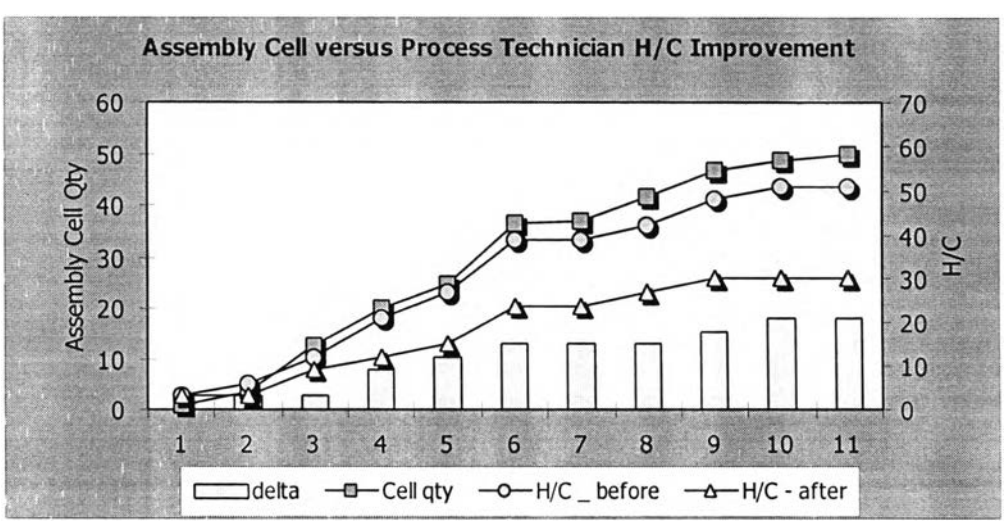


Figure 6.9 Headcount reduction improvement

6.5 Error Improvement

The errors were measured by comparing the conventional and new system with the manual record to ensure that there was no impact after the implementation. Cheetah 18 product was an example of the measurement as described in figure 6.10, which showed slightly difference of errors obtained among three methods.

Record Accuracy Comparison

	Manual Record			Manual Crunching Record			Automatic system Record			Manual Crunching Accuracy			Automatic system Accuracy		
										%IN Error	%Out Error	%Yld error	%IN Error	%Out Error	%Yld error
DAY	IN	OUT	YLD	IN	OUT	YLD	IN	OUT	YLD	(MC/MR)	(MC/MR)	(MC/MR)	(AS/MR)	(AS/MR)	(AS/MR)
1	120887	108738	90.0	119049	107704	90.5	120887	108738	90.0	-1.5	-1.0	0.6	0.0	0.0	0.0
2	125612	113950	90.7	125625	112585	89.6	127814	113898	89.1	0.0	-1.2	-1.2	1.8	0.0	-1.8
3	107349	96615	90.0	107349	95786	89.2	108274	98574	88.5	0.0	-0.9	-0.9	1.8	0.1	-1.7
4	109713	98263	90.5	108697	97501	89.7	111069	[illegible]	88.8	-0.9	-1.8	-0.9	1.3	-0.6	-1.8
5	109811	99239	90.4	109808	98410	89.6	111366	[illegible]	89.1	0.0	-0.8	-0.8	1.4	0.0	-1.4
6	110294	99165	89.9	110293	98117	89.0	112185	99165	88.4	0.0	-1.1	-1.1	1.7	0.0	-1.7
7	109725	96104	87.6	107537	94934	88.3	109725	96104	87.6	-2.0	-1.2	0.8	0.0	0.0	0.0
8	119058	104184	87.5	116519	102583	88.0	119058	104184	87.5	-2.1	-1.5	0.6	0.0	0.0	0.0
9	120252	103248	85.9	117045	101396	86.6	120252	103248	85.9	-2.7	-1.8	0.9	0.0	0.0	0.0
									AVERAGE	-1.0	-1.2	-0.2	0.9	-0.1	-0.9

Figure 6.10 Error measurement

6.6 Users' Comments

Users' comment is the major measurement that must be accessed to measure the level of users' satisfaction. Their feed back leads to the improvement of the tools, which may require a different approach. An assessment has been performed to receive users' comments, high score has been observed in users' view in figure 6.1.

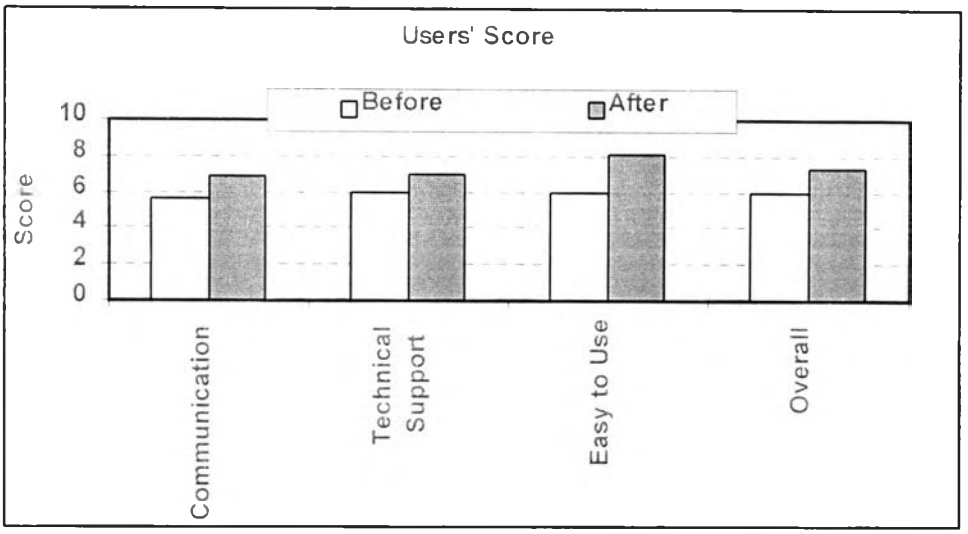


Figure 6.11 Users'score

From all above items, the advantages of developing models can be summarized as the following table in figure 6.12

Summary of benefits obtained from information system development

Item	Description	Improvement	Remark
1	Quality aspect : yield improvement - Tester contribution	0.40%	2.7% to 2.3%
2	Time improvement (minutes)	252	
3	Speed improvement - Low yield tester > 2 Hr. (DPPM) - Take corrective action (times)	9,352 4,727	11,600 to 2,248 3,141 to 7,868
4	Flexibility - Ratio of assembly cell per Headcount - Assembly cell conversion per headco - Headcount allocation	2 0.6 13	3:1 to 5:1 0.99 to 1.6 work changed

note The above measurement is number in month average

Figure 6.12 Advantage from developing models