Chapter 7

Results of Restructuring

7 Results of Restructuring

Results of organizational restructuring have been assessed to ensure that positive results are observed and objectives are achieved. There are several aspects that management experienced improvement within 2-3 months after associated tools and focus have been allocated. Still the improvement of some aspects could not be observed due lead-time of the structure transition and lead-time of tools development. Once the transition is passed and a proper tool has been developed, a beginning of improvement could be seen. Seven indexes of six different aspects are measured, focus allocation, quality, speed, flexibility, organizational awareness, and customer satisfaction index.

7.1 Focus Allocation

Since "too many focus" is one of the major constraints, reassessment of engineer's time-spent has been carried out 6 months after the restructuring transition. Figure 7.1 (a) to (f) demonstrates focus allocation of each focused-group. More than 50% of time-spent is expected for engineer to focus on relevant activities to primary responsibility of each focused-group, and 10-15% of focus allocation is on technical studies to master area of responsibility and to catch up future requirement.

Table 7.1 Time-spent analysis after restructuring of 6 focused-group, bolded figures are primary responsibility of each focused-group (compared against the last column, referring to figure 3.9 page 20)

Time-spent (%)	TTC	TCS	TTS	TTI	TTD	PPA	AVG-after	AVG-before
Yield Analysis	8%	3%	10%	**7%**	2%	**13%**	7%	22%
Yield Improvement	8%	9%	**15%**	**14%**	7%	**13%**	11%	11%
Test Implementation	3%	1%	**18%**	3%	11%	9%	12%	22%
UPH Improvement	2%	**10%**		**7%**	2%	4%	4%	4%
Media/Factor Ctrl.	**11%**	16%	**28%**	1%	2%	11%	11%	11%
Tester Control	**44%**	7%	4%	7%	16%	17%	18%	11%
Technical Studies	8%	11%	3%	12%	**24%**	**27%**	14%	7%
Capacity Support		**43%**					7%	4%
Development					**36%**		6%	5%
Others	16%		22%	16%		6%	10%	3%
Check Sum (100%)	100%	100%	100%	100%	100%	100%	100%	100%
Head Counts	10	7	5	7	7	6	42	42

Overall time-spent for yield analysis was significantly reduced from 22% down to 7%, it was due to appropriate focus allocation associated with leverage of analysis tools. As well as overall time-spent for test related implementation was reduced from 22% to 12%. This resulted in more time could be spent on tester control activities, capacity support, and technical studies which is almost double in all three area.

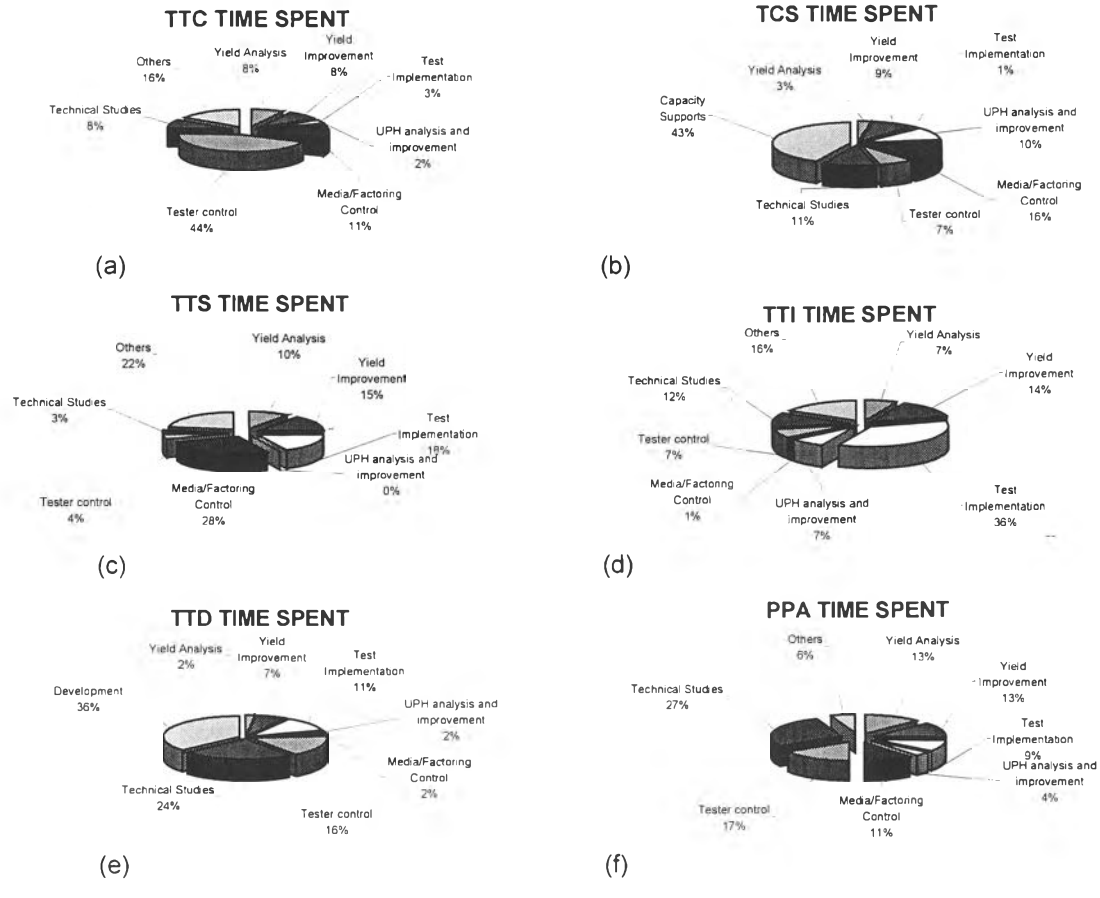


Figure 7.1 Time-spent analysis after restructuring of 6 groups, excluding EIS which has minimal impact from the change

Tester Control (TTC) engineers spend 55% of their time in tester control and 8% in technical studies, figure 7.1 (a). Capacity Support (TCS) engineers spend 53% of their time in test capacity related activities, it will be 65% if yield analysis and improvement are included, figure 7.1 (b). Test Standards (TTS) had virtually no impact from restructure, but refocusing of the functional mission made this group spend 61% of their time in

control and improvements, figure 7.1 (c). Test Implementation (TTI) engineers spend 64% of time in implementation and improvement where concentration is in test related implementation, figure 7.1 (d). Technical Development (TTD) engineers spend 60% of time in technical studies and development to enhance tester control activities, figure 7.1 (e).

Parametric yield analysis or Parametric Performance Analysis (PPA) engineers spend 53% of their time for yield analysis/improvement and technical studies while they spend another 28% on tester-related analysis, i.e. tester control, and media/factoring control, see figure 7.1 (f). There were 6 capable individuals dedicated from test engineering, with supervision of a new technical manager, have contributed significant progress in analytical system which requires test knowledge background blending with recording head fabrication knowledge.

This clearly indicated that focus of engineers have been allocated to the right area within the focused-group to support HGA manufacturing and their direct customers.

7.2 Quality Improvement

Tester to tester variation is the end monitoring of multiple tester control. Basically, tester has to provide same measuring base-line, but its complexity causes high sensitivity to both internal and external micro changes, i.e. vibration displacement in a degree of μ-inch, noise in a degree of μ-volts within a μ-second, and a μ-defect on magnetic media is a degree of 20-50 μ". Test data is collected and analyzed electronically supporting by an application from EIS. Z-score is calculated on all test parameters on each tester, based on average value from all testers (refer to 5.2.2).

A rate of z-score out (%) has been improved when focus is allocated into a focused-group, TTC. Percentage of testers that fall out of z-score of 3 (out of 3σ) was running around 30% for 6-7 months while the target was setup at 30% reduction for every 3 months. Figure 7.2 (a) indicated that the improvement was significant after 3-4 months of refocusing, figure 7.2 (b) demonstrated top 6 parameters, accounted for more than 80% of failures mode, being focused instead of focusing on more than 20 parameters while most of them has insignificant impact to manufacturing.

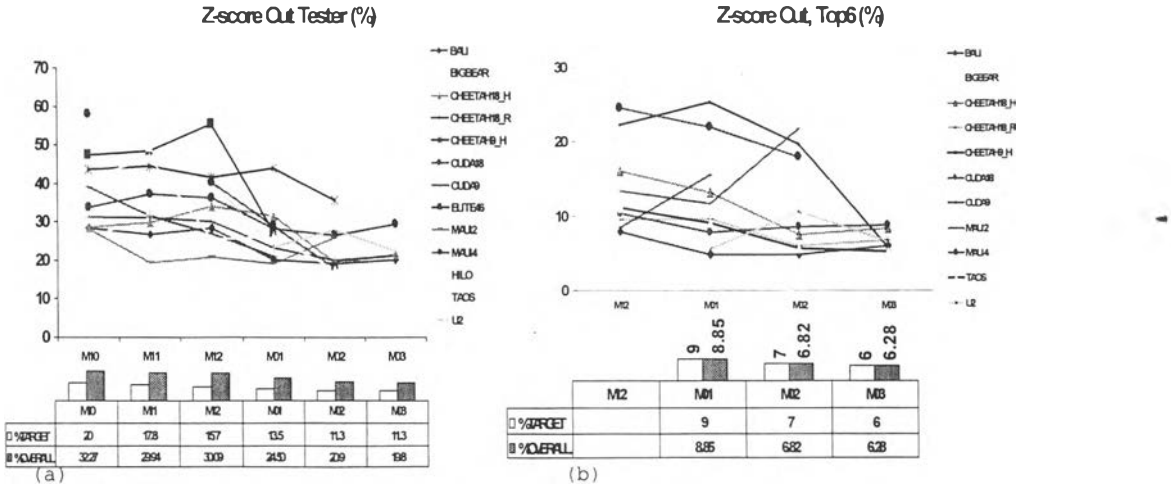


Figure 7.2 Z-score out percentage, percentage of tester that falls out the normal distribution (+/- 3 sigma)

Impact due to implementation errors ($), over 100 changes per month in HGA manufacturing and 30% of them are test related implementations (e.g. new test setup, new test specification, new test algorithm, new test software/firmware, and etc.). This type of environment always creates new technical experiences, so called 'errors', and sometimes significantly impact to manufacturing. If similar implementations have been implemented in multiple products and handled by different persons at different timeframe, a chance of error is higher than to handle by a focused-group. Figure 7.3 demonstrates error events and dollars impact due to implementation errors over time. It clearly indicated that a significant improvement has been observed when focused-group TTI has taken responsibility of qualification for all test-related implementation.

Dollar impact is calculated on all associated cost, refer to 5.2.2.

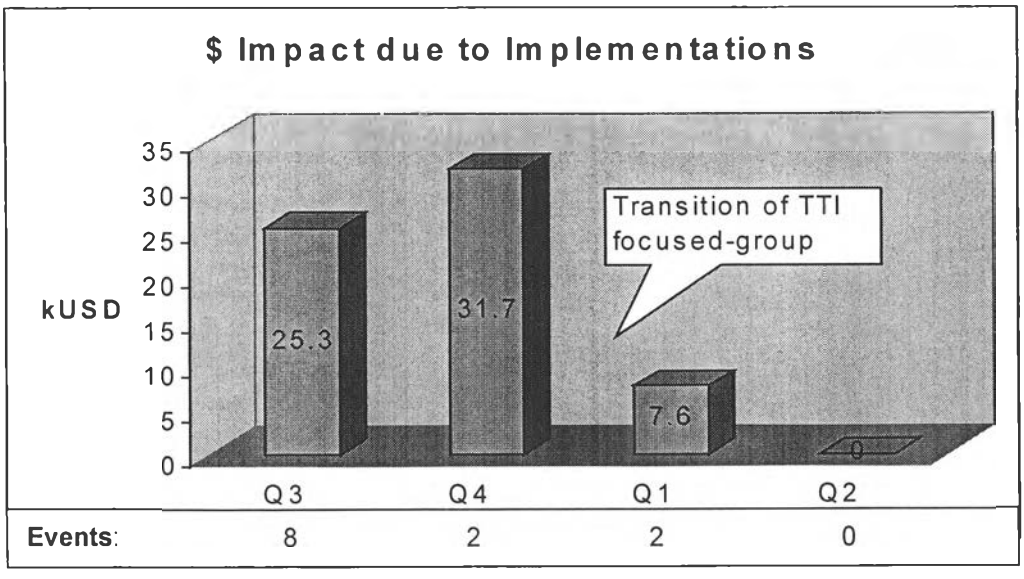


Figure 7.3 Error events and dollar impact due to test related implementation error

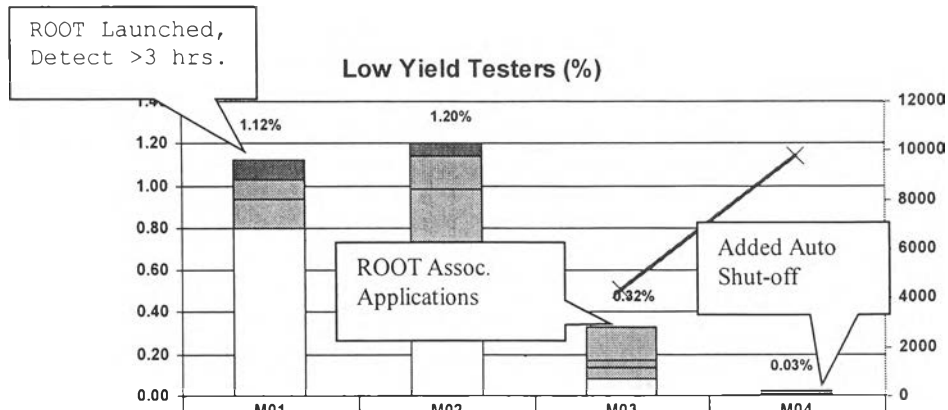
7.3 Speed Improvement

The less capable product is the more sensitivity to manufacturing. While capability of the product is being improved, speed of reaction time at manufacturing process is highly required.

Rate of abnormal testers ≥3 hrs (%) was improved from 1.16% to 0.03% as shown in Figure 7.4. Measuring events of abnormal tester is defined in 5.2.3 with a discussion on limitation of going to below 2 hours that will need new tools being developed. Abnormal testers are determined by real-time monitoring application (ROOT).

Abnormal tester reaction lead-time (hrs) was improved from 7-14 hours down to 1-2 hours because of faster delivery in updated information to frontline people, every 15-30 minutes instead of 420 minutes. With basic analysis feature, it allowed number of actions-taken from below 100 to be over 300 actions a day.

Benchmarking was done to determine yield improvement on 4 major volume products, a significant test on test yield of the same wafer indicated 0.5-1.5% yield gained.



	M01	M02	M03	M04
OTHER	0.092	0.057		
NO ACTION			0.157	0.007
TESTER	0.093	0.161	0.032	0.002
WAFER	0.137	0.253	0.051	0.012
MEDIA	0.798	0.729	0.087	0.008
ACTIONS TAKEN			4382	9765

Figure 7.4 Reaction improvement after implementation of real-time monitoring tool (ROOT) in beginning of month one

Tester Conversion (Release) Lead-time (hrs) was improved from 310 to 175 hrs, due to focused-group and leverage applications. Twenty-four hours conversion lead-time capability can be demonstrated, but there was no real requirement of that since surplus testers are available. This flexibility is reserved for accommodating short-notice build requirement changes. Table 7.2 is a model calculated with equations from 5.1.1 to understand a benefit of potential capital saving at different conversion lead-time due to actions taken.

Table 7.2 Number of Required Testers in Conversion at Different Conversion Lead-time

	Current	**Step-1**	**Step-2**	**Target**
$T_{prime\ (hrs)}$	232	135	119	20
$T_{rework\ (hrs)}$	77.5	34	8.2	1.6
$Y_{a\ (\%)}$	50	60	90	90
$T_{T\ (hrs)}$	309.5	169	127.2	21.6
$N_{TR\ (systems)}$	25	25	25	25
$N_{TC\ (systems)}$	**46**	**26**	**19**	**4**

According to table 7.2, step-1: reduce idle time approximately 50% and improve acceptance yield by 20%, step-2: add tools and applications to reduce time of major tasks. The ultimate goal is to minimize idle time by continuous working to achieve 24 hrs lead-time.

7.4 Flexibility Improvement

Flexibility of manufacturing reactions to the customer requirement is a very key factor to achieve corporate

objectives. Flexibility is not only dealing to the units demand fluctuation but also dealing with quality and cost sustaining/improving, improving flexibility of the organization to support operation is highly required. To improve flexibility with minimal impact to cost and quality is not something anyone can do without proper leveraging tools and support structure. Figure 7.5 indicated flexibility of test engineering organization in order to support manufacturing requirement near-term and long-term. The upper right graph shows tester conversions requirement, supporting product changeover in flexible manufacturing. The operation is moving toward lean manufacturing and demand-pull concept, which requires a very high level flexibility. The left-most graph shows the constraints in organization resource versus workload that indicated by number of testers. The organization could not stay healthy if appropriate tools to leverage resource capability have not been developed over the time.

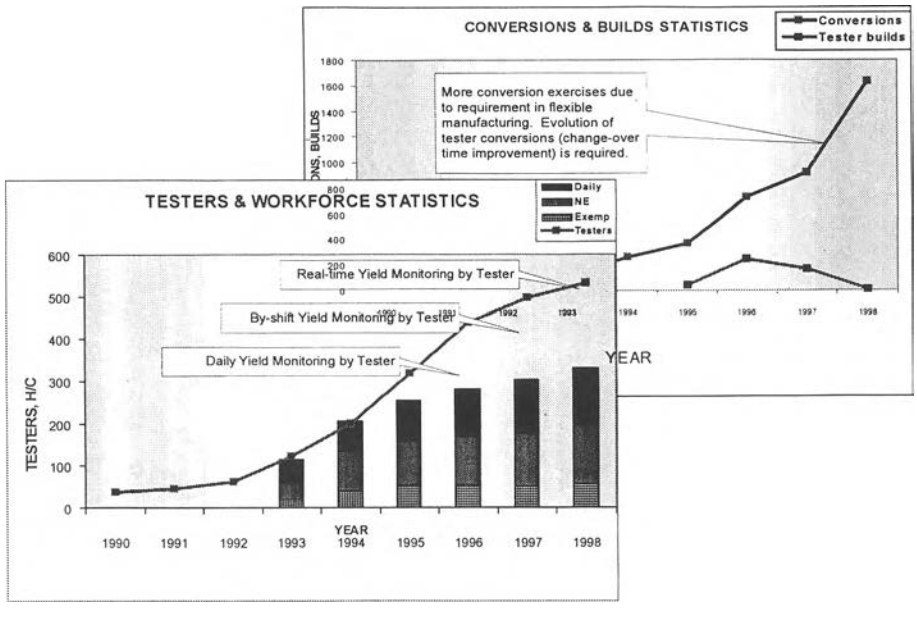


Figure 7.5 Flexibility indicators of the organization with supports structured and appropriate tools deployed

As mentioned above, cost is a constraint to increase flexibility of the organization. Management has to balance activities requirement, cost associated, and business requirement within the organization. Figure 7.6 demonstrates cost analysis of test engineering organization.

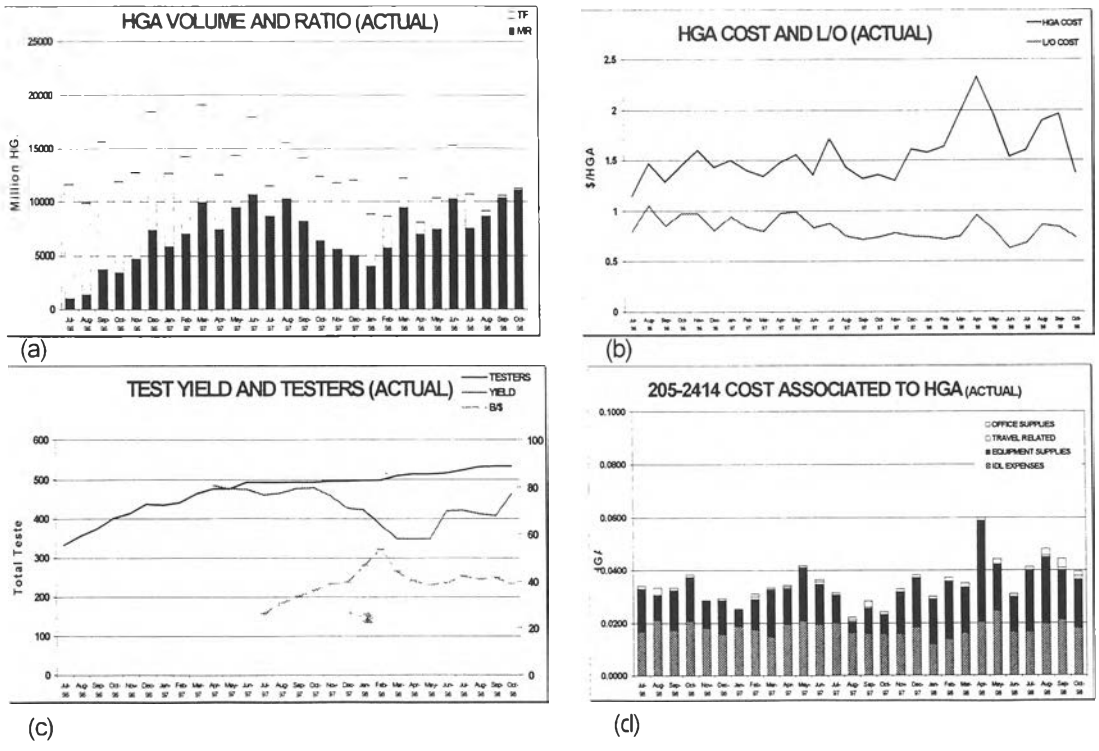


Figure 7.6 Cost control of test engineering against difficulties and changes in 1998

Figure 7.6 (a) indicates volume decreased 30% but MR ratio increase 50% in 1998. (Note: MR is magneto resistive head technology which is more complicated than normal thin film HGA, and also require sophisticated test technology.) Figure 7.6 (b) indicates operation's cost index corresponding to the volume and test yield. Figure 7.6 (c) demonstrates number of testers and fluctuation of test yield in 1998. Figure 7.6 (d) demonstrates indirect labor (IDL) cost index of test engineering, which has been regulated at 0.020 per unit HGA. An indicator that supports the right direction of restructuring and tools deployed to breakthrough resource constraint.

7.5 Organizational Awareness

What will happen to organization that operates without organizational awareness of employee? Test engineering was a large organization, which has been running without official vision and mission. Organizational directions and demands are communicated through the chain of command. This does not demonstrate professional management of one large organization with multiple technical functions.

After vision, mission, and strategy have been formulated for test engineering, objective goals setting for each focused-group seemed to be less complicated than before.

An assessment to organizational awareness of employee has been conducted and found out some facts and received positive feedback from employee on test engineering's framework, workflow, mission, and objective goals of each focused-group in the new organizational structure.

Test engineering framework has been exhibited to employee to assess awareness. There was 90% of them has no idea of how overall test engineering framework looks like, but 92% of them understand more about the organizational framework after that, 56% them said that it is more than what they thought while 4% said conversely. The level of understanding improvement is shown in figure 7.7. All of them expressed positive opinion to it with the following reasons:

- Can understand a global picture of organization.
- Can understand mutual impact with others.
- Can understand exactly what their roles are.
- Can avoid duplicating efforts.
- Can understand channels and links to others.
- It is very good for new employee.
- It is well aligned with new organizational structure.

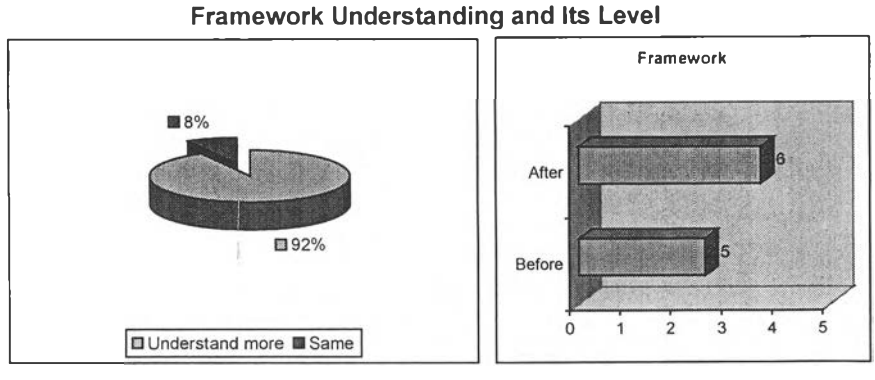


Figure 7.7 Understanding of Test Engineering's Framework and its level

Functional workflow has been shown to employee and 94% of them understand more about the cross-functional workflow Level of understanding improvement is shown in figure 7.8. All of them had positive opinion to it with the following reasons:

- Can be a useful guideline
- Good for new engineers
- Can understand well what others are doing
- It is a very important for restructuring
- Improve communications and avoid duplicating efforts

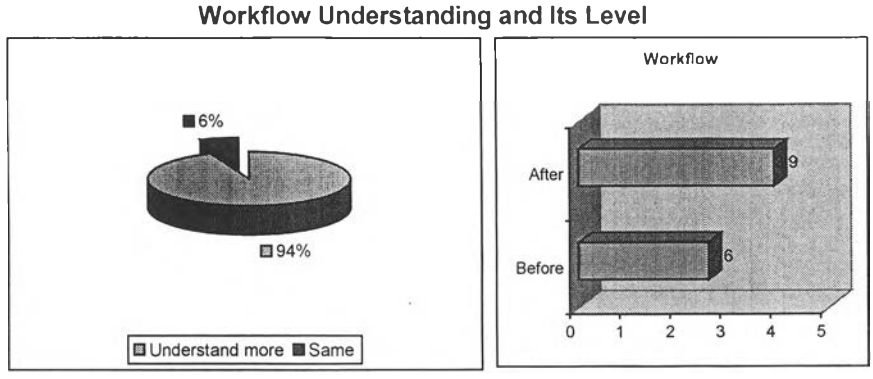


Figure 7.8 Understanding of Functional Workflow and its level

Knowing direct customers has been assessed, 45% of employee know exactly what their direct customers are, but 42% of them identified too many customers to be their direct customers, which is not a big problem, see figure 7.9.

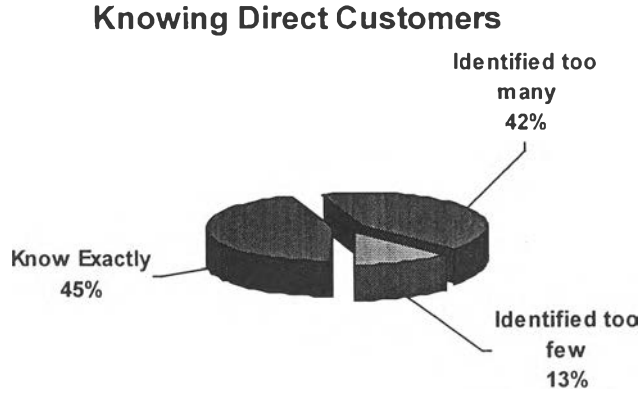


Figure 7.9 Knowing Direct Customers of the Employee

Knowing functional mission and functional goals have been assessed as well, 92% of employee said 'yes' for knowing their functional mission, but only 60% know the exact mission that stated in the organization network. Though 32% of them did not address the exact mission statement of their group but they provided statements similar to formal functional mission. All of them expressed positive opinion to the functional mission with the following reasons:

- Providing clear direction
- Providing major focus
- Can prioritize work properly
- Good reminder

All of the employees were aware of their functional objective goals, but only 80% provided the correct functional goals while the rest of them provided partial functional goals. Interestingly 69% of them felt that the goals setting was fair enough, 23% of them felt that the goals were too tough. Employee involvement in delivering goals has been assessed, there were 58% of the employee were 'very much' to 'fully involved' in delivering achievement of functional goals while 15% of them felt that was less than what they wanted it to be. It indicated that an improvement in employee motivation is required to improve mindset of some employees.

7.6 Customer Satisfaction Index

Other than quantitative measures, subjective measure as customer satisfaction is a major factor that the organization has to pay attention on it. Some technical improvements might have been made, but getting feedback from the customers will allow management to assess how effective of the execution is or how well the execution has been communicated to customers. A different approach might be required to make an improvement. A separate assessment has been conducted to receive customer feedback, figure 4.8 is referred for the metrics, a slightly improvement has been observed in customer's point of view as shown in figure 7.10.

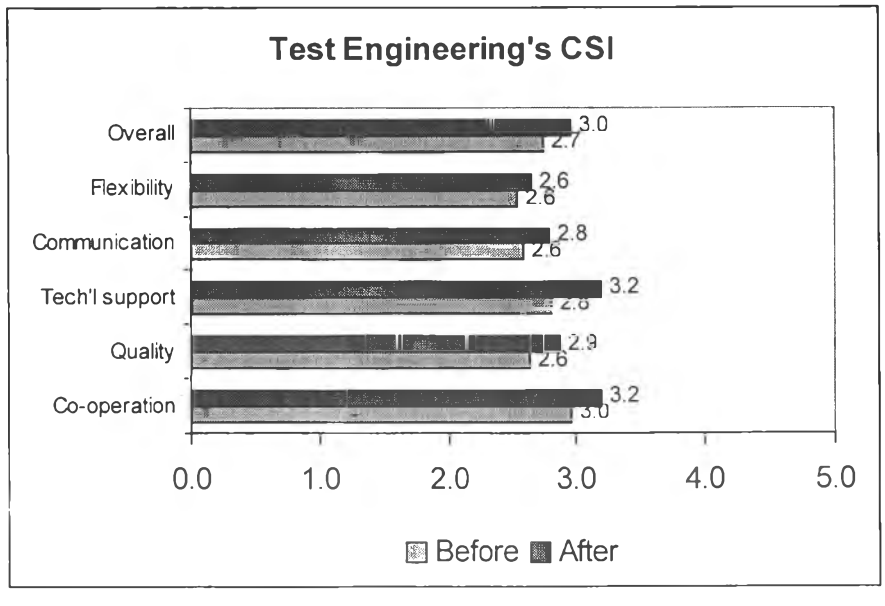


Figure 7.10 Test Engineering's CSI Comparison in 5 Areas and Overall Rating

Interestingly, customers did not feel significant improvement in "Flexibility" aspect, while the improvement can be statistically observed. Tester conversion exercise to support flexible manufacturing has been increased over 60% for the past 9 months.

Results of all aspects are summarized in table 7.3

Table 7.3 Summary of Metrics, Results from Restructuring

Aspects	Before	After	Comments
Quality			
Z-score Out (%)	32.3%	19.8%	Lean toward zero
Annual $Impact, Implements	114k	<2k	Lean toward zero
Speed			
≥ 3 hrs Abnormal Tester (%)	1.16%	0.03%	Lean toward zero
Abnormal Tester React (hrs)	7-14	1-2	Big improved, target is 0.25
Conversion Lead-time (hrs)	310	175	24 hrs capability is earned
Flexibility			
Annual Conversions per H/C	2.5	4.8	Target is 4
Testers per H/C	1.5	3.2	Target is 3
Actions taken per day	<100	>300	Significant increase
Customer Satisfaction Index			
Co-operation	3.0	3.2	Target is >4
Quality	2.6	2.9	Target is >4
Technical Support	2.8	3.2	Target is >4
Communication	2.6	2.8	Target is >4
Flexibility	2.6	2.6	Target is >4 (*)
Overall	2.7	3.0	Target is >4
Cost per HGA			
Equipment Supplies ($)	0.02	0.02	Maintained, more activities
Indirect Labor ($)	0.02	0.02	Maintained, more activities

Result of other aspect which are not in the metrics is shown in table 7.4

Table 7.4 Summary of Other Aspects, Changes due to Restructuring

Aspects	Before	After	Comments
Focus Allocation			
Major responsibility (%)	<25%	53-64%	Target is 50%
Technical Studies (%)	7%	14%	Target is 15%
Organization Awareness			
Framework (big picture)	2.5	3.6	92% understand more
Workflow (cross function)	2.6	3.9	94% understand more