Chapter 7

Results and Discussion

7.1 Detail discussion on methods and results

Various costing concepts were used in comparison in this study to calculate the actual cost of mold manufacturing, especially for the overhead costs. The methods in this study could be classified into two sides. One side was traditional job order costing concepts. Another side was activity-based costing concept. Traditional job order costing concepts were used to calculate cost of sample molds in Chapter 3 and 5. Activity-based costing concept was applied to calculate the cost of molds in Chapter 6.

Regardless of the costing concept used, the costs of mold manufacturing in this study were structured into 4 groups, namely Direct Cost, Indirect Variable Cost, Indirect Fixed Cost (mold department), and Indirect Fixed Cost (support functions). This structure was used with both traditional costing concepts and ABC concept, for the convenience in comparison of results. The results from each costing concept would be compared in 4 groups. The first group of cost, being direct cost, of a mold was simple and less important. The emphasis was on the 3 groups of indirect cost.

7.1.1 Direct Cost of the molds

Calculation of direct cost of the mold was straightforward and common between every traditional costing method as shown in Table 3-23. The major cost was the cost of direct material.

However, in Table 6-1 the ABC concept recognized the existing of mold testing activity, which also drove cost happen but in small amount. The cost occurred from this mold testing activity could be directly measured as shown in Table 3-13, and 3-14. Since, these resources were consumed directly by each individual mold. ABC system included mold testing cost as a direct expense and charged this cost directly into the mold. Therefore, in the direct cost calculation, there was no significant difference between approaches, unless a little bit more detail by the ABC system. Nevertheless, this small difference could be more important in the case that the mold testing or other direct expenses consumed much more resources than these sample molds.

7.1.2 FOH-VC of mold department

Six variable cost items included in this category were consumed variably, according to the actual usage of resources. Technically, these costs could be measured and charged directly to the mold that consumes these resources. For example, to measure the exact power cost consumed by a mold, the company might have every machine in the mold shop be equipped with a meter to measure and record the power unit (KW) consumed by each operation on each machine. Then, the mold could be charged with the exact cost of power being consumed. Likewise, other variable costs could also be measured and recorded directly by similar manners.

Unfortunately, direct costing being stated above was impossible in practice, because too much effort was needed and the benefits derived did not worth the expenses. To reach that point, the company had to invest a lot more overhead cost, both in capital investment of measuring systems and in expenses to maintain routine costing operation. In fact, the company only measured the costs used by the mold shop as a whole. For example, there was only one meter to measure the power of all over the mold shop. Therefore, tracing of cost to an operation or a mold, based on some relating indexes or bases, seemed to be an optimum alternative between cost and benefit.

Approximately, due to the data of variable cost in the Table 3-3, Power Cost contributed 70% of total variable cost. While Supplies, Tools, and Maintenance Costs contributed 20%. Another 10% were Other materials and Welfare. Apparently, the total amount of monthly variable cost was dominated by the Power Cost, and Supplies, which added up to cover 90% of variable cost.

As stated in Chapter 6.2.2, that the nature of these 6 variable costs was different and can be classified into 3 groups as in Table 6-2. Power cost, the most influential variable cost, was driven by the actual unit of electricity consumed in the mold shop. Most of the power was consumed by the machines' operation. Thus, the duration of machine operation, and the load size of the machine used, were the significant indicators in calculation of Power Cost.

The duration of power usage could be simply measured by 'machine hour' from machining report. However, 'load size' of a machine was variable along the operation. For example, hard material required more power than soft material, to machine. Rough cutting consumed power load different from finishing tasks. The value of 'load size' declared in the machine specification was only the maximum load, not the load at any interval. Therefore, the exact calculation of the power cost was quite impossible in this case.

Nevertheless, both data of 'machine hour' and 'load size' of machines could still be useful in allocation of the power cost into the mold. Calculation of machine hour weighted by load size gave a new index, named as 'power consumption factor', which helped allocation of power cost to be closer to the actual consumption.

The second group of variable cost consisted of those things used and consumed by machine running. Supplies like oil, grease, or machining tools, or even the parts of the machines that needed maintenance, were deteriorated along with the on going operation of the machines. These resources had a limitation of life-time. For example, lubrication oil needed to be changed after every 10,000 hours of operation. Thus, 'machine hour' should be a suitable indicator in allocation of these costs. A mold that occupied long time of machine hour deserved being allocated by a big portion of cost, as a result.

The last group of variable cost consisted of those things used by machine operator, or the worker while working with the machine, such as gloves, cloth, safety devices, etc. The major cost in this group, which always happens daily, came from the use of cloth and gloves. These things were mostly used and wasted when the worker had to handle or move the work manually, such as loading or unloading of the work-piece, or setting up the machine. Thus, 'number of machine setup' should be a suitable indicator in allocation of these costs. A mold with frequent machine setup tended to consume a lot of cloth and gloves as a result.

From these 3 groups of variable cost, more than 90% concerned using 'machine hour' as a significant indicator of cost consumption. Therefore, 'machine hour' should play a significant roll in allocation of variable cost of mold manufacturing.

In Table 5-6, the variable cost of two sample molds in this study was allocated based on 4 different conventional concepts. These concepts used single base as the indicator in assigning monthly variable costs into each mold. On the other hand, in Table 6-8 the concept of ABC was applied to calculate the variable cost of the same case, but by using multiple bases, which were derived from the consideration of actual activity. The results of all methods used in this study were expressed for comparison below in Table 7-1.

VC ALLOCATING METHODS	MOLD S 18	MOLD S 25
1.EXISTING SYSTEM (based on Total direct cost-YTD)	1,621.72	826.33
2.BASED ON MACHINE HOURS	5,898.51	1,551.44
3.BASED ON RAW MATERIAL	1,300.52	662.67
4.BASED ON Total Direct Cost-YTD (Modified)	1,216.29	619.75
5.ACTIVITY-BASED COSTING	5,041.65	1,427.32

TABLE 7-1 Comparison of results between 5 methods used to allocate Variable Cost of Mold department to the molds

From the table, the results of these 5 methods seemed to come out in two groups. First group was 1)the Existing System(based on Total Direct Cost-YTD), 3)the Allocation based on Raw Material, and 4)the Modified Existing System(based on Total Direct Cost-YTD). Second group was 2)the Allocation based on Machine Hour, and 5) Activity-Based Costing.

The three methods of the first group had the same deep root of allocation base, which came from the content of 'raw material'. Both the existing system, and the modified existing system used Total direct cost-YTD as the base, while another method used the raw material as the base.

In fact, Total direct cost-YTD of a mold had very close relationship with the raw material contents of a mold, because Total direct cost-YTD consisted of total raw material contents and other direct costs. Other direct costs were normally insignificant and negligible, when compared with raw material. Thus, these two allocation bases, Total direct cost-YTD and raw material cost, were almost equivalent, and gave similar results in allocation.

The variable costs from the existing system were higher than the modified system, despite using the same allocation base, Total Direct Cost-YTD. That was because the existing system allocated 100% of variable costs into the mold manufacturing, while the modified system allocated 75% of variable costs into the mold manufacturing and 25% to the mold manufacturing. Therefore, the modified system displayed the variable cost lower than the existing system by 25%.

The modified system and the raw material based system started from the same amount of variable cost, which was 75% of total variable costs, but turned out with a little different results. The raw material based method reflected a little higher cost than the modified system. That was because there was some difference between the allocation bases used, the Total direct cost-YTD and the raw material. These two values of the sample molds were identical as in Table3-7,and 3-8, but the sum values of these two allocation bases for all molds manufactured in a month were slightly different, as in Table5-4 and 5-5. The sum value of raw material cost was a little higher than the sum value of the Total direct cost-YTD.

According to the nature of six variable costs, the occurrence of cost did not significantly correlate with the content of 'raw material'. That was because material contents did not always indicate the amount of tasks done. A big mold with high material cost and being made for months in mold shop would absorb unreasonably high overhead cost when being compared with the mold that just started. Despite having little tasks in the month, the mold that was big and started before would be charged unfairly by this practice.

For example, power consumption of a mold did not depend on the value of raw material. The mold with high material cost might consume low power cost in a month, if there was no progressive task done. On the contrary, the mold with low material cost might consume high power cost in a month, if the mold was operated a lot in that month. Thus, 'raw material' cost was not an appropriate base for allocating of these variable costs, logically.

The second group of results was from 'machine hour'-base, and activity-base. According to nature of variable costs described above, the ABC method used the closest allocation bases to reflect the cost. The method traced cost based on the actual activity happened. Moreover, Needy(1993) stated that in a stable environment, ABC outperforms Traditional costing methods for all manufacturing types, and the Traditional costing methods undercosts low labor products. Thus the ABC's result was more likely to be the most reliable and accurate to indicate the actual variable cost.

Despite the ABC was more complicated and used multiple bases in allocation. The results were quite similar to the method of 'machine hour' based, although some difference of about 10-20% existed. That was because more than 90% of variable costs was driven by the drivers concerning 'machine hour'. As a result, more than 90% of multiple bases used by the ABC method also concerned "machine hour'. Therefore, using barely 'machine hour' as the single allocation base applied to all variable cost was still in the right direction, when compared to the ABC method.

Apparently, the ABC method was the most accurate, and reliable allocation method for variable cost of molds. The method reflected cost according to the actual activity, and worked in deeper detail. However, the ABC method also demanded the most efforts to approach. A lot more information and numbers were needed to be collected and arranged in calculation, comparing with other traditional methods of single base.

Therefore, as another alternative, the company might choose to allocate variable cost based on 'machine hour', which yielded similar result. The accuracy and reliability of 'machine hour'-base might be a little less than the ABC method, but the advantage was at the simplicity in calculation. Then, the 'machine hour' was selected to be the representative of traditional methods for variable cost, to be compared with the ABC method.

7.1.3 FOH-FC of mold department

There were 4 categories of fixed cost of mold department in the Table 3-4. Unlike direct cost and variable cost, which were possible to be directly related to a certain mold, fixed cost happened regardless of the actual activity. For example, depreciation and salary were paid constantly, without considering of how heavy the works were done in a month. Thus, fixed cost could not be measured to the mold directly.

The only way was to find a proper criterion to allocate the actual fixed cost of each month to the most deserving molds.

Approximately, due to the data of fixed cost in the Table 3-4, direct labor cost contributed 20% of total fixed cost. Depreciation cost of machine and system contributed 68%, while indirect labor cost contributed 12%. Another less than 1% was maintenance cost. Apparently, the total amount of monthly fixed cost (of mold department) was dominated by the depreciation and direct labor cost, which added up to cover almost 90% of fixed cost.

In fact, direct labor cost and depreciation cost could be traced to the mold relative to the resources being consumed. This was similar to the traditional costing that treated labor cost as a direct cost. For example, a mold being machined for 2 hours would be charged by the depreciation and the operator's labor cost for 2 hours. If the capacity was fully utilized, 100% of cost had the right owner. That was fine. However, the problem was at the idle cost. If some capacity, 30% for example, was left idle, who should absorb this 30% of cost?

Normally, both utilization cost and idle cost were pushed to the customer. Otherwise, the company had to absorb the cost. However, whether the idle cost was pushed to the customer or absorbed by the company, the cost should be separated between utilization cost and idle cost, for the benefit of cost controlling. Thus, the company could know the cost contribution, and control the cost better.

Traditional costing methods ignored separating idle cost from utilization cost. These methods had a whole amount of fixed cost and allocated the cost to the mold by a single allocation base, such as 'machine hour', or 'raw material'. As a result, the cost a mold received depended totally on the variation of allocation base in each month, not on the actual condition of usage.

For example, fixed cost of a mold might be different by the month of manufacturing. The mold would be cheap in the month that utilization was high, because there were many molds to share the cost. The same mold could be more expensive in the month that utilization was low, because there were few molds to share the cost. This manner made mold costing unreliable and unstable.

Besides, the accuracy of costing also depended on the suitability of allocation base used. By logic, the cost of machine and labor should be charged to a mold relative to the 'machine hour', rather than 'raw material', used by the mold. A mold of high 'raw material' cost might or might not deserve a big portion of machine depreciation and labor cost, depending on the actual activity the mold consumed. On the contrary, the correlation between 'machine hour' and the cost of labor and depreciation seemed to be obvious. A mold occupying a long 'machine hour' deserved charging by a big part of machine depreciation and labor cost, apparently.

In Table 5-10, the fixed cost of two sample molds in this study was allocated based on 4 different conventional concepts. These concepts used the single base as the indicator in assigning monthly fixed costs into each mold. On the other hand, in Table 6-15 the concept of ABC was applied to calculate the fixed cost of the same case, but by using multiple bases, which were derived from the consideration of actual activity. The results of all methods used in this study were expressed for comparison below in Table 7-2.

FC ALLOCATING METHODS	MOLD S 18	MOLD S 25
1.EXISTING SYSTEM (based on Total Direct Cost-YTD)	1,875.03	955.41
2.BASED ON MACHINE HOURS	68,577.35	18,037.32
3.BASED ON RAW MATERIAL	16,735.13	8,527.28
4.BASED ON Total Direct Cost-YTD (adjusted)	15,651.27	7,975.01
5.ACTIVITY-BASED COSTING	61,891.84	21,592.78

TABLE 7-2 Comparison of results between 5 methods used to allocate Fixed Cost of Mold department to the molds

From the Table7-2, the existing system was obviously wrong. The results were very small compared to other methods of similar or identical bases. The reason was about the policy of the company, which chose to hide 90% of cost and to allocate only 10% of cost to the mold. This method was poor in cost accountability, because the method did not cover all significant costs needed to be allocated.

The methods using 'raw material', and 'total direct cost-YTD' as a base were quite similar in results. These two methods joined the same trend. That was because the two allocation bases were from the same deep root and had close relationship to each other, similar to what was described before in the variable cost discussion. However, from the reason described above, 'raw material' was not the proper indicator for the costs in this category.

The other two methods left, based on 'machine hour' and 'activity-based costing', were similar in results. The results joined the same trend, but were different by 10-20%. That was because both methods relied considerably on the value of 'machine hour' as a significant driver. Therefore, the allocation based on 'machine hour' was selected to be the representative of traditional methods for allocation of fixed cost of mold department to the mold, to be compared with the ABC method.

The allocation based on 'machine hour' used the 'machine hour' as the single allocation base applied to all items of cost. The results were in Table5-7. On the other hand, the ABC method used multiple bases, being 'machine hour', 'labor hour', 'machine setup', and 'the number of mold', to allocate the cost. Out of the four bases, the 'machine hour' was used to allocate the biggest part, about 65%, of fixed cost of mold department for the ABC method.

Moreover, the ABC method also recognized the difference between idle cost and utilization cost. Obviously, the ABC method worked deeper in detail and assigned every cost using more appropriate base for each kind. The results of the ABC method were in Table6-15.

The ABC method was apparently better in accuracy and reliability of cost than any other methods. Moreover, the ABC also gave clearer view of information, for the objective of cost controlling. However, the approach was more complicated and needed a lot more efforts. Therefore, from the results of the two methods, the ABC method and 'machine hour' based that showed the same direction, the allocation based on 'machine hour' could be used instead of the ABC method, if lower accuracy was acceptable.

7.1.4 FOH-FC of support functions

Each support function was different in nature of work. Except the mold design function, other seven functions left did not have direct interaction with the mold. Support functions might service the mold department in overall, but did not service the individual mold. Consequently, there was no suitable single allocation base that could relate the cost from support functions direct to the mold within one stage.

The mold design function was the only exception because the service of the function went directly to a certain mold, or some works in other department. The relationship between the cost and the owner of the cost was obvious. For example, the cost of a design work could be directly charged to a specific mold, for which the work was done. Therefore, just one stage allocation was enough.

For the other seven support functions, to assign fixed cost of each function to a mold, two stages allocation was needed. Fixed cost had to be assigned to the mold department first. Then, the cost was further assigned to the mold later.

Various criteria used for first and second stage allocation were paired together as a combination. A combination meant a method, which comprised two steps, used in allocation of fixed cost of support functions to a mold. There were altogether seven combinations in this study, as listed in Table7-3. Six combinations were traditional concepts, while another one was the ABC method.

Fixed cost of support functions was the weakest point of traditional costing concepts. That was because most of the traditional concepts used only a single base to assign all the cost. Unfortunately, the nature of support functions was various.

There was no any single base that could be used appropriately with all the cost from every function. A single base used for first stage allocation, from support functions to mold department, had to well represent the level of service that all functions supplied for the mold department, which was hardly possible for just a single base.

Moreover, dealing with the two stages allocation, the traditional methods got even worse. From the paragraph above, a single base suitable for all functions was already seldom. The possibility that a combination of allocation bases could be applied suitably to all fixed cost of support functions was even lower. The concept of single base was too rigid to handle the variety of fixed cost from support functions.

On the contrary, the ABC method employed multiple bases in allocation of cost, which was flexible enough to handle the variety of various support functions, to reflect the actual portion of costs that a mold deserved. The ABC method allowed using the most suitable allocation base for every single cost item. The cost was allocated naturally, based on the activity actually happened.

For example, in first stage allocation by ABC, fixed cost of plant service was allocated to the service user department based on the area. That was because the activities or services of plant service concerned mostly with the general facility and area, so the cost was driven by the area of the service user. On the other hand, fixed cost of personnel was allocated in first stage by the ratio of man power, because the services of personnel concerned mostly with the man. Therefore, the department of large man power deserved large personnel cost. Maintenance, Stat.&Data, and Lab had nothing to do with the mold department, from 0% of service determined, so these costs were not charged to the mold department.

Besides, the continuity between first stage and second stage allocation bases was smooth, and relevant significantly to the cost item. Unlike the traditional methods, which first stage and second stage bases were not compatible at all.

The results from all methods used in this study were concluded for comparison in the Table7-3.

METHODS	FIRST STAGE ALLOCATION BASE	SECOND STAGE ALLOCATION BASE	ALLOCATION RESULT(Baht)	
			mold S 18	mold S 26
1.Existing	Weighted Average percentage of service	None	0	0
2.Table 5-11	Weighted Average percentage of service	Total Direct Cost-YTD	5,307.27	2,704.28
3.Table 5-12	Estimated percentages of services	Machine hours	18,099.12	4,760.46
4.Table 5-13	Estimated Sales ratio	Total Direct Cost-YTD	1,432.96	730.16
5.Table 5-14	Area ratio	Spread evenly throughout every mold	4,376.87	4,376.87
6.Table 5-15	Estimated man power ratio	Machine hours	46,585.97	12,253.11
7. ABC	Activity Base	Activity Base	19,156.58	11,827.53

TABLE 7-3 Comparison of results between 7 methods used to allocate Fixed Cost of support functions to the molds

From the Table7-3, no method had the same direction of result. The costs of molds reflected from different methods were different significantly. This might mean that there was no traditional method that was compatible or similar to the ABC method, unlike what happened in the variable and fixed cost of support department.

However, the only method that was selected to be the representative of traditional methods, in comparison with the ABC method, was the method number 3 in Table7-3.

The reason for selection was that the method number 3 was the only traditional method that had flexible first stage allocation base, similar to the ABC method. Estimated percentages of services shown in Table5-12, although acted as a single base, but contained various ratios inside to be applied for cost allocation of each support function, separately.

Differently, other first stage allocation bases of other traditional methods were rigid and applied only one ratio to allocate cost of all support functions. For example, the method number 4 applied a ratio of sales to allocate the cost of all functions, despite the cost of many functions had no relationship with the ratio. As described before, that applying a single base to various functions was hardly possible to get a good allocation.

Another reason for selection was that the second stage base of the method number 3 was 'machine hour', which was the same allocation base as accepted before in the former two costs, namely variable and fixed cost of mold department. Then, the traditional costing method, selected to be compared with the ABC method, for the allocation of all categories of mold cost, was based on 'machine hour'.

7.2 Overall discussion on the ABC method and the traditional methods

In traditional methods, the single allocation bases used for all items of costs were relative to the occurrence of these overhead costs in some certain aspects, or were not relevant at all. Different methods gave results in different directions. However, using a single base applied to every cost item in a group could not indicate the right proportion of resource consumed by each work.

That was because a cost item was driven by a certain cost driver, and should be indicated by a proper allocating base. Cost items in the same group might not be driven by the same cost driver. If so, these cost items should not use the same allocating base. Using a single base through out all cost might distort the correctness of cost allocation.

In this study, the most appropriate traditional method for mold costing was the allocation based on 'machine hour'. Regarding to the main activity of mold manufacturing, which mostly concerned the operation of the machines, 'machine hour' was a significant indicator for many costs. The occurring of labor cost and other cost also attached to machine's operation, because the process was capital intensive rather than labor intensive, similar to other manufacturing process in present.

Although 'machine hour' was a good allocation base for most of the cost in mold manufacturing, but not for all cost anyway. There were some parts of cost that needed to be allocated by other bases. Therefore, the ABC method also employed other suitable indicators together with the 'machine hour', as the multiple bases, to allocate the cost to a mold. The improvement from appropriate multiple bases, and working in deeper detail made the ABC method reflect the right cost structure of a mold.

In comparison, the ABC method was a tailor-made cloth that was right fit to the nature of cost occurring, while the traditional method, 'machine hour base' in this case, was only an instant cloth that was easier to approach but lower in accuracy.

To compare between the traditional job order costing and the ABC method in allocation of total mold cost, the results from the existing system, the modified existing system, the allocation based on 'machine hour', and the ABC method were listed in the Table 7-4.

From the table, the existing system gave the smallest cost of molds from two significant reasons. First, the fixed cost from support functions was neglected, and the fixed cost of mold department was hidden by 90%. Second, the method was based on 'Total direct cost-YTD', which was equivalent to 'raw material'. Then, the allocation turned out in different direction from the 'machine hour' base. As a result, the total cost of a mold allocated was too low.

Allocation method	Mold	Direct cost	FOH-VC mold department	FOH-FC mold department	FOH-FC support functions	Total
Existing system (total direct cost-YTD)	S18	26,855.00	1,621.72	1,875.12	-	30,351.84
	S25	13,683.80	826.33	955.45	-	15,465.58
Modified system (total direct cost-YTD)	S18	26,855.00	1,216.29	15,572.14	5,307.27	48,950.70
	S25	13,683.80	619.75	7,934.68	2,704.28	24,942.51
Machine hour based	S18	26,855.00	5,898.51	68,577.35	18,099.12	119,429.98
	S25	13,683.80	1,551.44	18,037.32	4,760.46	38,033.02
ABC	S18	27,141.21	5,041.65	61,891.84	19,156.58	113,231.28
	S25	13,917.54	1,427.32	21,592.78	11,827.53	48,765.17

Table 7-4 Comparison of total cost between 3 traditional methods, and the ABC method

The modified existing system used the same principle as the existing system, but was modified to be better in cost accountability. The method covered all ranges of cost that needed to be allocated. However, sharing the same allocation base as the existing system, Total Direct Cost-YTD, the allocation was in the same direction. Therefore, the total cost allocated to a mold was also too low.

Another problem from the Total Direct Cost-YTD was that there was no clear definition of how this item came. The Total Direct Cost-YTD was an specific item established by the costing system of the company to be used as the indicator in allocating the cost to a mold. Approximately, the Total Direct Cost-YTD was Total raw material used, plus other direct expenses for a mold. However, this definition could not be used for all molds. Some molds had unknown cost included in the value of Total Direct Cost-YTD, with no explanation. This indicated the shortcoming of the existing accounting system of the company, which could not clarify the correctness of the cost flew into a mold. Therefore, the Total Direct Cost-YTD was questionable since the start, and should not be used as a good cost allocation base.

The allocation based on 'machine hour' was quite in the right direction, when compared with the ABC method. These two methods joined the same trend in cost allocation. Nevertheless, there was considerable variation between methods. From this study, the total cost of a mold allocated by 'machine hour' varied from the ABC method about 5 to 20%. The exact number was not confirmed because there was not enough information. The significant number showing the variation between the two methods would exist only when the methods were applied to a considerable number of molds, which needed further times and efforts.

However, this study found that 'machine hour' base could be used instead of the ABC method for the allocation of variable and fixed cost of mold department within 10-20% variation. But, for the fixed cost of support functions, the variation was too high. Thus, the fixed cost of support functions should be allocated by the ABC method only.

Unfortunately, this study covered only two sample molds of which the information was insufficient for the comparing and examining of accuracy and reliability between mold costing methods. To do so, the costing methods of comparing had to be applied to all molds manufactured in a month, to reflect the total cost of each mold. Then the cost of every mold reflected from each method would be summed to cross check with other methods. Thus, a significant data record must be available. However, since the existing data record did not sufficient, a considerable time was needed to establish a significant data base. But, the time constraint did not allow this research to do so. Then, the accuracy and reliability were left for further research.