CHAPTER IV

ASSIGNING RESORUCE COSTS TO FINAL COST OBJECTS

Once activities within business process have been identified in previous chapter, the next step in developing the ABC system is to trace the flow of costs from resources to final cost objects, the vertical cost assignment view. This step is separated into two steps. The first step is assigning resource costs to activities. Then, assigning activity costs to final cost object is the second step. However, cost elements captured from general ledger and profit & loss account, are too detailed. The cost assignment is unable to perform with these cost elements. It is necessary to organize these cost elements into appropriate groups in order to support cost assignment.

4.1 Identify Organizational Cost Structure

Identifying organizational cost structure requires setting the scope of cost data. As mentioned, the scope of this study is entire organization. The scope of cost data, therefore, will include all expenses and depreciation but not all kinds of tax expense. Time interval for collecting cost data is between Jun to Nov 2005.

Various cost elements from P&L account and general ledger can be organized into 15 cost groups. Those are direct materials, indirect materials, tools $ equipments, maintenance, electricity, water, salary, direct labour, fringe benefits, travelling, fuel, office accessories, miscellaneous, communication, and depreciation cost as shown in figure 4.1. These 15 costs will be reorganized into appropriate form in order to support performing cost assignment.

Figure 4.1 Organizational Cost Structure

4.1.1 Direct Material

In casting work, direct material can be separated into three major categories. The first is metal and chemical composition. This category is major components for making two different type of casting materials, FC and FCD. The second is silica sand and sand composition. These materials are major components for making sand mould. Finally, the last material is resin sand, which is a major component for making core. The table 4.1 represents total direct material cost from June to November 2005.

Direct Materials	Baht
Metal and Chemical compositions for FC	17,759,620
Metal and Chemical compositions for FCD	3,266,477
Sand and Sand Compositions for AMF	2,706,214
Sand and Sand Compositions for FD1	47,432
Sand and Sand Compositions for FD2	20,328
Resin Sand	260,330
Total	**24,060,400**

Table 4.1 Direct Material Costs from Jun – Nov 2005

4.1.2 Indirect Materials

Indirect materials are materials that are not directly combined in products but they are needed in manufacturing process. For example, strainer (512-13) is used to reduce speed of melted metal poured to sand mould. Table 4.2 shows the group of indirect material cost from Jun to Nov 2005.

Code	Materials	Total	Code	Materials	Total
501-07	Slag Top-C	169,680	512-26	Argon Gas	74,800
512-01	Concrete D-10	14,700	512-27	LPG Gas	323,538
512-02	Concrete 15	127,995	512-28	Rust Oil	34,397
512-03	Cement	1,380	512-29	Automatic Transmission Fluid	2,692
512-04	Miga	11,880	512-30	Lubricant	9,268
512-05	Long Minitip	76,700	512-31	Brake Fluid	852
512-06	Short Minitip	253,440	512-32	Powder	1,500
512-07	Slag Tool	76,479	512-33	Grinding Paper	27,000
512-08	Square Brick 2"	738	512-34	Wheel Cutter	5,940
512-09	Square Brick 3"	4,429	512-35	Cutter 14"	0
512-10	Brick 3"	702	512-36	Cutter 16"	35,775
512-11	Separol Quick Mix 80	0	512-37	Cutter 7"	1,822
512-12	Separol Quick Mix	153,750	512-38	Grinding Ball	385,200
512-13	Strainer	444,900	512-39	Mounted Flap Wheel	840
512-14	Grease	8,706	512-40	Die Grinder A12	20,400
512-15	Ceramic Foam	102,300	512-41	Die Grinder W229	14,640
512-16	Character 0-9	17,925	512-42	Die Grinder W230	0
512-17	Character A-Z	15,938	512-43	Grinding Wheel 10"	18,095
512-18	Dust Filter Type1	0	512-44	Grinding Wheel 12"	0

512-19	Dust Filter Type2	0	512-45	Grinding Wheel 18"	211,950
512-20	Kerosene	56,116	512-46	Grinding Wheel 8"	0
512-21	Hydraulic Oil	34,500	512-47	Silkote 90	45,000
512-22	Iron Brush	7,200	512-48	Gear Lubricant 220	8,000
512-23	Pattern Repair	700	512-49	Silica Lining Grade 80	82,000
512-24	Co2	9,234	512-52	Square Brick 1.5	2,059
512-25	O2	5,467	512-53	Cutter 4"	363
			512-54	Slag Top-C	169,680
				Total	**2,900,988**

Table 4.2 Indirect Material Costs from Jun – Nov 2005

4.1.3 Tools & Equipments and Maintenance

Mostly, machines need to change spare parts when time is come or when they are no longer to use. In addition, some machines require maintenance from outside companies. Table below shows tools & equipments and maintenance expenses from Jun – Nov 2005.

Items	Jun	Jul	Aug	Sep	Oct	Nov	Total
Tools & Equipments	328,647	370,091	501,602	443,058	297,278	261,251	**2,201,928**
Maintenance	38,710	45,535	97,770	75,415	10,085	248,520	**516,035**
Total	**367,357**	**415,626**	**599,372**	**518,473**	**307,363**	**509,771**	**2,717,963**

Table 4.3 Tools & Equipments and Maintenance Costs

4.1.4 Electricity

Electricity	Jun	Jul	Aug	Sep	Oct	Nov	Total
Units	520,000	535,640	513,220	496,320	485,840	490,210	**3,041,230**
Baht	1,363,215	1,344,300	1,356,018	1,328,857	1,337,020	1,349,371	**8,078,782**

Table 4.4 Electricity Cost from Jun to Nov 2005

Table 4.4 represents electricity cost and power units (KW.HR) consumed by the company from Jun to Nov 2005. Electricity cost is divided into 2 categories, which are manufacturing and non-manufacturing electricity cost. The first is provided to manufacturing area, and the second is provided to three areas in the company. Those are centre office, QA&ENG office, and dormitory. How much each area consumes electricity cost is calculated by using the power unit that each area consumes. In order to measure power unit, it requires Kilowatt Hours Meter. However, there is only dormitory area having such meter. Thus, it is necessary to estimate power unit of the remainders. The way to estimate needs to identify firstly the power (KW) of equipments or machines in each area, secondly how long they operate within a day, and finally how many day they operate. The power unit of each area is derived by multiple of those three factors.

The estimation of power units of each area illustrates in table 4.5. Note that, power units in manufacturing area can be calculated by subtracting total power units with power unit in dormitory, centre office, and QA&ENG office. The outcome of estimation is percentage of usage, which is used to calculate electricity cost of each area. Table 4.6 shows electricity cost in each area. The first three electricity costs, which is non-manufacturing electricity cost, will be combined with man power cost. This will be explained in man power cost section.

Area	Equipments	KW	Hr./Day	No. of Working Days (Jun – Nov)	Power Units (KW.HR)	% Usage
Centre Office	Air Condition	5.25				
	Light	0.90	8	156	9,547	0.31
	Computer and etc.	1.50				
QA&ENG Office	Air Condition	2.25				
	Light	0.30	24	170	15,300	0.50
	Computer and etc.	1.20				
Dormitory	-	-	-	-	14,304	0.47
Manufacturing	-	-	-	-	3,002,079	98.71
				Total	**3,041,230.00**	**100.00**

Table 4.5 Estimation of Electricity Cost in each area

Area	% Usage	Baht
Centre Office	0.31	25,361
QA&ENG Office	0.50	40,643
Dormitory	0.47	37,997
Manufacturing	98.71	7,974,780
Total	**100.00**	**8,078,782**

Table 4.6 Electricity cost in each area

4.1.5 Water

The total water cost from Jun – Nov is shown in table 4.7. Similar to electricity, the consumption of water within the company can be divided into two different areas, which are manufacturing and non-manufacturing area. Unfortunately, there are no water meters to measure water consumption of both areas. Therefore, it is necessary to estimate water consumption of both areas. This can be done by interviewing experienced people. By interviewing, the company approximately consumes water about 24 m^3 per day, which contributes to manufacturing and non-manufacturing area by 15 m^3 and 9 m^3 or 62.5% and 37.5% respectively. Thus, water cost distributed to both areas is 52,906 and 31,744 baht as shown in table 4.8. Water cost distributed to non-manufacturing area will be combined with man power cost in next section.

Jun	Jul	Aug	Sep	Oct	Nov	Total
7,000	7,700	18,600	28,700	8,400	14,250	**84,650**

Table 4.7 Water cost from Jun – Nov 2005

Areas	% Usage	Baht
Manufacturing	62.50	52,906
Non-Manufacturing	37.50	31,744
Total	**100.00**	**84,650**

Table 4.8 Water cost distribution

4.1.6 Man Power

Man power is divided into salary and direct labour cost. Man power cost will be combined with non-manufacturing electricity and water, fringe benefit, communication, and office accessory cost. The former of this section will explain the details of salary and direct labour. The latter will explain combining man power cost with those five costs.

4.1.6.1. Salaries

To describe this cost group, it is necessary to refer organizational structure of the company (Table). Persons in top management level are share holder. They have no responsibility within company. Thus, they do not get any payment. The middle management level consists of two persons. One is General Manager and the other is Plant Manager. Definitely, these two persons are salaried. In staff level, there are 9 people salaried. They are Chief Production Department, Chief Moulding Division, Chief Melting Division, Chief Grinding Division, Assts. Chief Engineering Department, Assts. Chief QA Department, and Administrative staff 1, 2, and 3. Table 4.9 represents their salary costs from Jun – Nov 2005.

Salary	Total (Jun – Nov)
General Manager	295,223
Asst. Plant Manager	156,000
Chief Production Department	87,453
Chief Moulding Division	71,926

Chief Melting Division	75,672
Chief Grinding Division	90,733
Asst. Chief Engineering Department	65,896
Asst. Chief QA. Department	57,774
Sale/Purchase Staff	82,800
Accounting Staff	46,000
Human Resource Staff	38,400
Total	**1,067,877**

Table 4.9 Salary Cost from Jun – Nov 2005

4.1.6.2. Direct Labours

According to organizational structure, besides people gets pay as salary, there are groups of people who get pay as wages. These groups of people can be separated into 9 groups as shown in table 4.10. The classification bases on function they operate in.

Groups	No. of Persons	Jun	Jul	Aug	Sep	Oct	Nov	Total
Melting	14	111,307	111,081	106,581	96,693	101,116	108,038	634,816
Moulding (AMF)	9	70,629	61,554	57,195	66,374	64,233	72,379	392,364
Moulding (FD)	7	60,874	69,674	61,694	74,119	80,397	81,657	428,415
Core	4	23,960	25,741	29,045	16,690	30,379	27,838	153,653
Grinding	32	208,884	224,011	203,176	197,327	242,365	214,369	1,290,132
QC.	7	36,940	34,970	39,335	32,321	43,081	38,721	225,368
QA.	4	32,133	29,400	28,253	27,983	28,031	29,644	175,444
Maintenance	4	34,382	31,028	30,981	28,833	27,747	31,313	184,284
Driver	5	38,780	34,057	35,719	32,510	38,440	35,511	215,017
Total	**86**	**617,889**	**621,516**	**591,979**	**572,850**	**655,789**	**639,470**	**3,699,493**

Table 4.10 Direct Labour Costs from Jun – Nov 2005

4.1.6.3. Combining man power cost with the five costs

As mentioned above, there are five costs combined with man power cost. Those are fringe benefit, non-manufacturing electricity, non-manufacturing water, communication, and office accessory cost. These five costs are assigned to each person as shown in table 4.11. To whom costs are distributed represents by "*".

		No. of Persons	Fringe Benefit	Non-Manufacturing Electricity			Water	Communication	Office Accessories
				Centre Office	QA&ENG Office	Dormitory			
Salaries	General Mgr.	1	*	*			*	*	*
	Asst. Plant Mgr.	1	*	*			*	*	*
	Chief Prod. Dept.	1	*			*	*		
	Chief Moulding Div.	1	*			*	*		
	Chief Melting Div.	1	*			*	*		
	Chief Grinding Div.	1	*		*		*	*	*
	Asst. Chief Eng Dept.	1	*		*	*	*	*	*
	Asst. Chief QA. Dept.	1	*		*	*	*	*	*
	Sale/Purchase Staff	1	*	*			*	*	*
	Accounting Staff	1	*	*			*	*	*
	Human Resource Staff	1	*	*			*	*	*
Wages	Melting	14	*			*	*		
	Moulding (AMF)	9	*			*	*		
	Moulding (FD)	7	*			*	*		
	Core	4	*			*	*		
	Grinding	32	*			*	*		
	QC.	7	*			*	*		
	QA.	4	*		*	*	*		*
	Maintenance	4	*			*	*		
	Driver	5	*			*	*		
	Total	**97**	**97**	**5**	**7**	**91**	**97**	**8**	**8**

Table 4.11 Distribution of the five costs

4.1.6.3.1. Fringe Benefits

Fringe benefits are such as uniform suit, social insurance, hospital fee, security, etc. Table 4.12 illustrates fringe benefit cost from Jun – Nov 2005. It is appropriate to approximate all persons within the company getting fringe benefits equally. Therefore, fringe benefit cost is distributed to each person at 307,624/97 = 3,171 baht/person.

Month	Baht
June	45,992
July	88,151
August	41,475
September	44,309
October	44,285
November	43,412
Total	**307,624**

Table 4.12 Fringe Benefit Cost from Jun – Nov 2005

4.1.6.3.2. Non-Manufacturing Electricity

According to table 4.5, non-manufacturing electricity costs, which are distributed to central office, QA&ENG office, and dormitory area, are 25,361, 40,643, and 37,997 baht respectively. The number of people working in these 3 areas is 5, 7, and 91 people regarding to table 4.11. It could be said that people working in each area consume each electricity cost at the same proportion. Therefore, electricity cost rates of each area are 25,361/5 = 5,072 Baht/Person, 40,463/7 = 5,806 Baht/Person, and 37,997/95 = 418 Baht/Person respectively.

4.1.6.3.3. Non-Manufacturing Water

As mentioned in water cost section, non-manufacturing water cost from Jun – Nov 2005 is 31,743 Baht. It is appropriate to approximate that all persons within the company consume water equally. Thus, non-manufacturing water cost is distributed to each person at 31,744/97 = 327 baht/person.

4.1.6.3.4. Communication

This cost includes phone, fax and internet expense. Table 4.13 shows communication cost from Jun – Nov 2005. Generally, persons consuming this cost are those who work in central and QA&ENG office. Approximately, they consume this cost at the same rate. Thus, this cost is distributed to each person at 32,636/8 = 4,080 baht/person.

4.1.6.3.5. Office Accessories

Office accessories are such as paper, printer and copy machine ink, files, etc. Table 4.13 shows office accessory cost from Jun – Nov 2005. Similar to communication cost, there are only persons working in central and QA&ENG office consuming this cost. Normally, they use the accessories at the same proportion. Therefore, it can conclude that each person consumes this cost at 76,956/12 = 6,413 baht/person.

	Jun	Jul	Aug	Sep	Oct	Nov	Total
Communication	4,651.33	6,231.73	4,841.53	4,611.81	7,600.21	4,699.87	32,636
Office Accessories	5,400	25,841	14,337	8,678	17,625	5,075	76,956

Table 4.13 Communication and Office accessories costs from June – Nov 2005

In summary, man power cost will be combined with those five costs as shown in table 4.14.

		No. of Persons	Baht	Fringe Benefit (3,171 Baht/Person)	Non-Manufacturing Electricity: Centre Office (5,072 Baht/Person)	Non-Manufacturing Electricity: QA&ENG Office (5,806 Baht/Person)	Non-Manufacturing Electricity: Dormitory (418 Baht/Person)	Non-Manufacturing Water (327 Baht/Person)	Communication (4,080 Bat/Person)	Office Accessories (6,413 Baht/Person)	Total (Baht)
Salaries	General Mgr.	1	295,223	3,171	5,072	0	0	327	4,080	6,413	314,286
	Asst. Plant Mgr.	1	156,000	3,171	5,072	0	0	327	4,080	6,413	175,063
	Prod. Dept. Mgr.	1	87,453	3,171	0	0	418	327	0	0	91,369
	Chief Moulding Div.	1	71,926	3,171	0	0	418	327	0	0	75,842
	Chief Melting Div.	1	75,672	3,171	0	0	418	327	0	0	79,588
	Chief Grinding Div.	1	90,733	3,171	0	5,806	0	327	4,080	6,413	110,530
	Asst. Chief Eng Dept.	1	65,896	3,171	0	5,806	418	327	4,080	6,413	86,111
	Asst. Chief QA. Dept.	1	57,774	3,171	0	5,806	418	327	4,080	6,413	77,989
	Administrative Staff 1	1	82,800	3,171	5,072	0	0	327	4,080	6,413	101,863
	Administrative Staff 2	1	46,000	3,171	5,072	0	0	327	4,080	6,413	65,063
	Administrative Staff 3	1	38,400	3,171	5,072	0	0	327	4,080	6,413	57,463
Wages	Melting	14	634,816	44,399	0	0	5,846	4,582	0	0	689,643
	Moulding (AMF)	9	392,364	28,542	0	0	3,758	2,945	0	0	427,610
	Moulding (FD)	7	428,415	22,200	0	0	2,923	2,291	0	0	455,828
	Core	4	153,653	12,686	0	0	1,670	1,309	0	0	169,318
	Grinding	32	1,290,132	101,484	0	0	13,362	10,472	0	0	1,415,450
	QC.	7	225,368	22,200	0	0	2,923	2,291	0	0	252,781
	QA.	4	175,444	12,686	0	23,225	1,670	1,309	0	25,652	239,985
	Maintenance	4	184,284	12,686	0	0	1,670	1,309	0	0	199,949
	Driver	5	215,017	15,857	0	0	2,088	1,636	0	0	234,598
Total		**97**	**4,767,370**	**307,624**	**25,361**	**40,643**	**37,997**	**31,744**	**32,636**	**76,956**	**5,320,331**

Table 4.14 Total Man Power Cost

4.1.7 Transportation Expenses

Transportation expense consists of travelling expenses and fuel. Travelling expenses are such as express way fees, car insurance, maintenance, etc. Fuel is consumed by trucks and forklifts in order to deliver products and move materials in the company respectively. Transportation expense from Jun – Nov 2005 are illustrated in table 4.15.

Transportation Expenses	Jun	Jul	Aug	Sep	Oct	Nov	Total
Travelling Expenses	11,561	31,348	10,887	107,997	23,759	24,529	**210,081**
Fuel	46,492	62,385	101,447	72,317	92,273	73,442	**448,355**

Table 4.15 Travelling and Fuel Expenses from Jun – Nov 2005

4.1.8 Miscellaneous Expenses

All expenses unable to be grouped into any cost group described above will be grouped into miscellaneous expense. These expenses are such as technical assistance, accounting consultant, water system installation, entertainment, fees, etc. Miscellaneous Expense from Jun to Nov 2005 is shown in table 4.16.

Jun	Jul	Aug	Sep	Oct	Nov	Total
95,986	118,339	191,850	248,866	108,975	24,385	**788,401**

Table 4.16 Miscellaneous Cost from Jun – Nov 2005

4.1.9 Depreciation

Fixed assets brought to calculate deprecation will include buildings, office accessories, vehicles, machines and tools & equipments. Total deprecation from 1 Jan to 31 Dec 2005 is 3,948,129. Note that, this study will not consider the time when fixed assets are bought or built, but all fixed assets are assumed to exist from the beginning of year 2005. Therefore, depreciation from Jun to Nov 2005 is approximately (3,948,129/12)*6 = 1,974,064 Baht as shown in table 4.17.

Fixed Assets	Baht
Buildings	478,661
Office Accessories	9,665
Vehicles	99,059
Machines and Tools & Equipments	3,360,744
Total (12 Months)	**3,948,129**
Total (6 Months)	**1,974,064**

Table 4.17 Depreciation from Jun – Nov 2005

In summary, the final cost groups that are appropriate to perform cost assignment are shown in figure 4.2. The total cost is 24,060,400 + 2,900,988 + 2,717,963 + 7,974,780 + 52,906 + 1,235,169 + 4,085,162 + 788,401 + 658,436 + 1,974,064 = **22,387,869** Baht. The next step is to assign theses cost groups to activities identified from previous chapter.

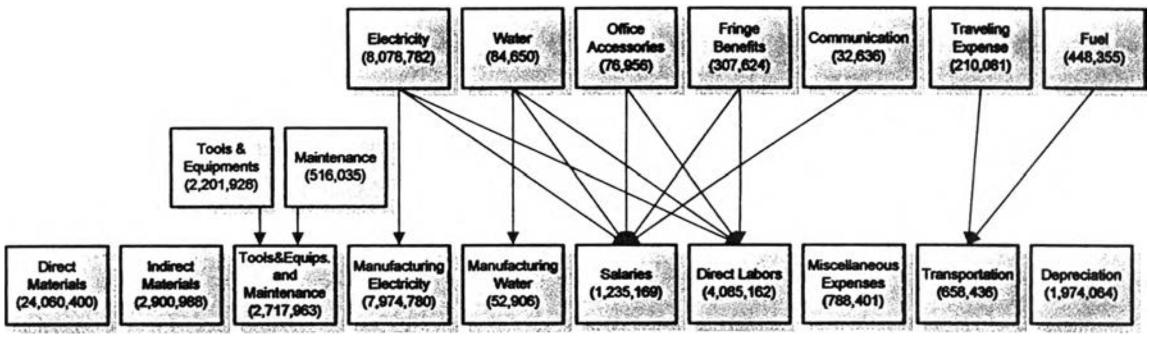

Figure 4.2 Final Cost Groups

4.2 Assigning Resource Costs to Activities

In this section, 10 cost groups organized in previous section will be assigned to activities. The assignment can be done through three different ways. Those are direct charging, estimation, and arbitrary allocation.

It is apparent that cost groups that can be assigned to activities by direct charging are indirect materials, tools & equipments and maintenance. The remainders, which are manufacturing electricity, manufacturing water, salary, direct labour, and transportation, will be allocated to activities by estimation. Note that, miscellaneous and depreciation (788,401 and 1,974,064 Baht) costs are the expenses that are not required by any activity in process. Thus, they will not be assigned to activities, but they will be combined to infrastructure sustaining activity costs later on.

4.2.1 Indirect Materials

According to section 4.1.2, indirect material costs are 2,900,988 Baht. These costs will be assigned to activities by direct charging as shown in table 4.18.

Act. ID	Code	Jun	Jul	Aug	Sep	Oct	Nov	Total
A22	512-23	0	700	0	0	0	0	**1,540**
	512-39	180	0	540	0	120	0	
A2313	501-07	24,360	29,120	26,880	28,560	28,280	32,480	**322,859**
	512-05	15,600	23,400	19,500	1,300	1,300	15,600	
	512-07	21,167	13,000	11,628	6,264	14,400	10,020	
A2314	512-26	9,800	12,500	12,500	15,000	15,000	10,000	**101,800**
	512-33	3,000	9,000	3,000	0	3,000	9,000	
A2315	512-24	1,701	972	1,701	1,701	1,701	1,458	**9,234**
A232	512-27	19,098	16,851	25,464	32,953	38,195	29,208	**161,769**
A2332	512-16	0	9,750	6,825	0	1,350	0	**33,863**
	512-17	0	9,563	6,225	0	150	0	
A2334	512-12	33,750	22,500	22,500	33,750	18,750	22,500	**798,766**

	512-13	76,000	79,400	76,100	78,100	59,400	75,900	
	512-15	46,500	0	9,300	18,600	9,300	18,600	
	512-20	10,703	10,815	11,594	11,974	5,778	5,252	
	512-21	0	0	13,800	6,900	6,900	6,900	
	512-22	0	7,200	0	0	0	0	
A2341	512-32	600	0	0	300	300	300	**1,500**
A2351	512-06	42,240	42,240	31,680	63,360	31,680	42,240	**415,209**
	512-27	19,098	16,851	25,464	32,953	38,195	29,208	
A2361	512-38	57,600	66,000	60,600	70,200	76,800	54,000	**385,200**
A23631	512-45	41,850	33,750	37,800	24,300	36,450	37,800	**211,950**
A23632	512-43	2,820	2,350	2,115	2,820	3,055	4,935	**24,035**
	512-34	0	0	1,320	1,980	1,650	990	
A23633	512-35	2,385	4,240	3,975	7,950	7,950	9,275	**35,775**
A23634	512-37	318	184	340	260	260	460	**2,185**
	512-53	0	0	297	0	0	66	
A23635	512-40	4,250	5,950	2,550	2,040	3,740	1,870	**35,040**
	512-41	1,620	1,620	1,620	1,860	3,960	3,960	
A4.1	512-49	12,000	12,800	6,400	18,400	6,400	26,000	**290,882**
	512-01	0	0	0	0	14,700	0	
	512-02	18,285	25,440	16,695	23,055	21,465	23,055	
	512-03	160	240	400	80	320	180	
	512-04	5,760	2,880	1,440	0	900	900	
	512-08	0	738	0	0	0	0	
	512-09	0	0	3,799	0	629	0	
	512-10	0	0	145	0	508	48	
	512-47	0	15,000	0	30,000	0	0	
	512-52	0	47	233	171	1,101	509	
A4.2	512-14	1,512	1,512	0	2,727	1,215	1,739	**16,706**
	512-48	8,000	0	0	0	0	0	
A4.4	512-25	1,009	925	1,178	505	1,009	841	**5,467**
A5	512-28	6,879	6,879	0	6,879	6,879	6,879	**47,209**
	512-29	628	897	90	718	179	179	
	512-30	1,760	1,508	1,800	1,500	1,500	1,200	
	512-31	213	213	213	0	107	107	
							Total	**2,900,988**

Table 4.18 Assigning Indirect Material Costs to Activities

4.2.2 Tools & Equipments and Maintenance

Regarding to section 4.1.3, tools & equipments and maintenance expenses is 2,657,883 Baht. The assignment of these expenses to activities can be done by direct charging. Table 4.19 shows cost assignment of these costs to concerned activities.

Act. ID	Jun	Jul	Aug	Sep	Oct	Nov	Total
A22				139,657	15,420		**155,077**
A2313	35,300	32,700	104,300	19,000	0	203,150	**394,450**
A2314	12,698	0	0				**12,698**
A2333	8,027	38,053	33,676	19,730	4,525	14,771	**118,781**
A2334	133,327	90,825	244,221	171,077	35,842	130,258	**805,549**
A2351	0	0	8,968				**8,968**

A2352	0	12,000	26,200				**38,200**
A2361	8,709	29,366	6,657	6,005	2,262	3,136	**56,134**
A23631	3,577	3,713	6,314	5,730	4,525	6,271	**30,129**
A23632	5,366	5,569	9,471	8,594	6,787	9,407	**45,193**
A2364	16,200	3,821	0	0	16,200	5,414	**41,636**
A241	0	0	4,250	0	0	27,750	**32,000**
A25	14,700	34,520	1,000	0	4,550	20,970	**75,740**
A4.4	109,454	165,060	154,316	148,682	217,253	88,643	**883,407**
A5	20,000	0	0				**20,000**
Total	**367,357**	**415,626**	**599,372**	**518,473**	**307,363**	**509,771**	**2,717,963**

Table 4.19 Assigning Tools & Equipments and Maintenance Costs to Activities

4.2.3 Manufacturing Electricity

According to section 4.14, manufacturing electricity cost is 7,974,780 Baht. This cost will be assigned to concerned activities. The concept of assigning this cost to activities is similar to that of assigning electricity cost to manufacturing and non-manufacturing area within the company. The concept requires estimation of power units (KW.HR) consumed by machines in each activity. Table 4.20 represents the estimation of power units consumed by activities. Note that, time interval for estimation is considered within 24 hours due to the company operates both day and night shift.

ID	Activity	Machine	Power (KW)	Cycle Time (HR.)	Power Units (KW.HR)/Cycle	No. of Cycle Time /24 HR.	Power Units (KW.HR)/24 HR.	Total Power Units (KW.HR)	Usage (%)
A2313	Melt metal	Electrical Furnace			550.00	24	13,200	13,200	75.89
A2314	Check Chemical Composition	Spectrometer	1.23	24.00	29.57	1	30	30	0.17
A232	Make Core	Air Rotary Pump (5%)	5.55	12.00	66.60	1	67	67	0.38
A2333	Mix Sand (AMF)	Mix Muller	60.00	0.06	3.60	130	468		0.00
		Sand Composition Belt	1.50	0.25	0.38	130	49		0.00
		Returned Sand Belt	3.75	1.00	3.75	130	488	1,004	5.77
A2334	Make AMF Sand Mould	Moulding M/C	30.00	0.50	15.00	24	360		0.00
		Cooling Pump	0.75	20.00	15.00	1	15		0.00
		Green Sand Belt	45.00	0.83	37.50	24	900		0.00
		Dust Collector	22.50	20.00	450.00	1	450		0.00
		Air Rotary Pump (80%)	88.80	0.25	22.20	24	533	2,258	12.98
A2341	Mix Sand (FD)	Mix Muller (50hp)	37.50	0.05	1.88	15	28	28	0.16
A2342	Make FD1 Sand Mould	Air Rotary Pump (7%)	7.77	6.00	46.62	1	47	47	0.27
A2343	Make FD2 Sand Mould	Air Rotary Pump (3%)	3.33	6.00	19.98	1	20	20	0.11
A2361	Shot Blast and Inspect Appearance	Shot Blast M/C (9hp*2)	13.50	0.33	4.50	72	324	324	1.86
A23631	Grind 18"	Grinder 18" M/C (5hp*3)	11.25	12.00	135.00	1	135	135	0.78
A23632	Grind 12"	Grinder 12" M/C (3hp*4)	9.00	12.00	108.00	1	108	108	0.62
A23633	Grind 16"	Angle Grinder 16" (3hp*4)	9.00	12.00	108.00	1	108	108	0.62
A23635	Grind Hole	Air Rotary Pump (5%)	5.55	12.00	66.60	1	67	67	0.38
							Total	**17,395**	**100.00**

Table 4.20 Assigning Manufacturing Electricity Cost to Activities

Regarding to table above, the fourth column, Power (KW), represents electrical power required by machines in activities. The fifth column, Cycle Time (HR.), represents how long machines operate in one cycle. Thus, power units consumed within a cycle (KW.HR/Cycle) is calculated by multiplying power (KW.) with Cycle Time (HR). This represents in column six. In seventh column, it represents the number of cycle time machines operate within 24 hours. The total power units consumed within 24 hours represent in column eight. This can be calculated by multiplying Power Units/Cycle with Number of Cycle time/24 HR. Finally, the last column represents percentage of power consumption consumed in each activity. As a result, manufacturing electricity cost incurred in each activity is shown in table 4.21.

ID	Activity	Usage (%)	Baht
A2313	Melt metal	75.89	6,051,731
A2314	Check Chemical Composition	0.17	13,556
A232	Make Core	0.38	30,534
A2333	Mix Sand	5.77	460,413
A2334	Make AMF Sand Mould	12.98	1,035,121
A2341	Mix Sand (FD)	0.16	12,894
A2342	Make FD1 Sand Mould	0.27	21,374
A2343	Make FD2 Sand Mould	0.11	9,160
A2361	Shot Blast and Inspect Appearance	1.86	148,542
A23631	Grind 18"	0.78	61,893
A23632	Grind 12"	0.62	49,514
A23633	Grind 16"	0.62	49,514
A23635	Grind Hole	0.38	30,534
	Total	100.00	7,974,780

Table 4.21 Manufacturing Electricity cost assigned to Activities

4.2.4 Manufacturing Water

Regarding to section 4.15, water consumption in manufacturing area is 15 m^3 and its cost is 52,906 Baht. Assigning this cost to activities requires estimation of water consumption consumed by activities during day and night shift. By interviewing experienced people, water is consumed by major four activities. Those are A1313, A1323, A1326, and A13281. How much each activity consumes water and water cost distributed in each activity are shown in table 4.22.

Act. ID	Activities	M³	%	Baht
A2313	Melt metal	10.50	70.00	37,034
A2333	Mix Sand	1.50	10.00	5,291
A2334	Make Sand Mould	2.85	19.00	10,052
A2341	Mix Sand (FD)	0.15	1.00	529
	Total	15.00	100.00	52,906

Table 4.22 Assigning Manufacturing Water Cost to Activities

4.2.5 Man power

4.2.5.1. Salaries

There are 11 people who are salaried. Assigning salary cost to activities needs to estimate how much each person puts efforts on activities. This can be done through Time-Effort Input Sheet as shown in table 4.23. Data such as who get involve in and how much they put efforts on activities can be acquired by interviewing those people. As a result, salary costs distributed to activities are shown in table 4.24.

Act. ID	General MGR.	Asst. Plant MGR.	Chief Prod. Dept.	Chief Melting Div.	Chief Moulding Div.	Chief Finishing Div.	Asst. Chief Eng Dept.	Asst. Chief QA Dept.	Sale/Purchase Staff	Accounting Staff	HR. Staff
A111										10.00	
A112									5.00		
A113										10.00	
A114									15.00		
A121									20.00		
A122									15.00		
A123									5.00		
A131									20.00		20.00
A132									20.00		
A133										70.00	
A14	5.00									10.00	50.00
A21	25.00										
A22	5.00	40.00	15.00				90.00	10.00			
A2313				30.00							
A242								10.00			
A243	10.00	10.00	10.00	10.00	10.00	10.00	10.00	40.00			
A244								40.00			
A25						40.00					30.00
A3.1	5.00	15.00		45.00							
A3.2	5.00	15.00	30.00		45.00						
A3.3	5.00	10.00				50.00					
A3.4	5.00	10.00	20.00								
A3.5	35.00	0.00									
A4.1				15.00							
A4.2			25.00		45.00						
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 4.23 Time-Effort Input Sheet

Act. ID	General MGR.	Ast. Plant MGR.	Chief Prod. Dept.	Chief Melting Div.	Chief Moulding Div.	Chief Finishing Div.	Asst. Chief Eng. Dept.	Asst. Chief QA Dept.	Sale/Purchase Staff	Accounting Staff	HR. Staff	Total
A111	0	0	0	0	0	0	0	0	0	6,506	0	6,506
A112	0	0	0	0	0	0	0	0	5,093	0	0	5,093
A113	0	0	0	0	0	0	0	0	0	6,506	0	6,506
A114	0	0	0	0	0	0	0	0	15,280	0	0	15,280
A121	0	0	0	0	0	0	0	0	20,373	0	0	20,373
A122	0	0	0	0	0	0	0	0	15,280	0	0	15,280
A123	0	0	0	0	0	0	0	0	5,093	0	0	5,093
A131	0	0	0	0	0	0	0	0	20,373	0	11,493	31,865
A132	0	0	0	0	0	0	0	0	20,373	0	0	20,373
A133	0	0	0	0	0	0	0	0	0	45,544	0	45,544
A14	15,714	0	0	0	0	0	0	0	0	6,506	28,732	50,952
A21	78,571	0	0	0	0	0	0	0	0	0	0	78,571
A22	15,714	70,025	13,705	0	0	0	77,500	7,799	0	0	0	184,744
A2313	0	0	0	23,876	0	0	0	0	0	0	0	23,876
A242	0	0	0	0	0	0	0	7,799	0	0	0	7,799
A243	31,429	17,506	9,137	7,959	7,584	11,053	8,611	31,196	0	0	0	124,475
A244	0	0	0	0	0	0	0	31,196	0	0	0	31,196
A25	0	0	0	0	0	44,212	0	0	0	0	17,239	61,451
A3.1	15,714	26,260	0	35,815	0	0	0	0	0	0	0	77,788
A3.2	15,714	26,260	27,411	0	34,129	0	0	0	0	0	0	103,514
A3.3	15,714	17,506	0	0	0	55,265	0	0	0	0	0	88,486
A3.4	15,714	17,506	18,274	0	0	0	0	0	0	0	0	51,494
A3.5	110,000	0	0	0	0	0	0	0	0	0	0	110,000
A4.1	0	0	0	11,938	0	0	0	0	0	0	0	11,938
A4.2	0	0	22,842	0	34,129	0	0	0	0	0	0	56,971
Total	**314,286**	**175,063**	**91,369**	**79,588**	**75,842**	**110,530**	**86,111**	**77,989**	**101,863**	**65,063**	**57,463**	**1,235,169**

Table 4.24 Assigning Salary costs to Activities

4.2.5.2. Direct Labours

Before assigning direct labour costs to activities, it is important to know that direct labours are divided to 2 groups. The first group is people who are responsible for single task, and the second is those who are responsible for multi tasks. Therefore, assigning costs of 2 groups of people will be different as follow.

4.2.5.2.1. Assigning single task direct labour costs to activities

Groups of people responsible for single task are such as core, grinding, QC, and driver group. Regarding to section 4.1.6.3, total costs of each group are 169,318, 1,415,450, 252,781, and 234,598 Baht, and the number of people of each group is 4, 32, 7, and 5 respectively. Who and how many person is involved in which activity is determined in table 4.25 (left-side). Due to wage rate of people in these group is slightly different and time-efforts of each person put in each activity is nearly same, it is appropriate to assume that each person in each group gains wage at the same rate.

As a result, from Jun – Nov 2005, each person in core, grinding, QC, and driver group will approximately gain wage at (169,318/4) = 42,329 Baht/person, (1,415,450/32) = 44,233 Baht/Person, (252,781/7) = 36,112 Baht/Person, and (234,598/5 = 46,920 Baht/Person) respectively. Therefore, costs of single task direct labour are distributed to activities in relation to the number of people in each activity as shown in table 4.25.

	No. of People				Single Task Direct Labour Costs			
Act No.	Core	Grinding	QC	Driver	Core (42,329 Baht/Person)	Grinding (44,233 Baht/Person)	QC (36,112 Baht/Person)	Driver (46,920 Baht/Person)
A232	4				169,318	0	0	0
A2352		4			0	176,931	0	0
A2354		2			0	88,466	0	0
A2361		6			0	265,397	0	0
A2362			2		0	0	72,223	0
A23631		5			0	221,164	0	0
A23632		7			0	309,630	0	0
A23633		4			0	176,931	0	0
A23634		1			0	44,233	0	0
A23635		3			0	132,698	0	0
A2364			4		0	0	144,446	0
A241			1		0	0	36,112	0
A25				3	0	0	0	140,759
A5				2	0	0	0	93,839
Total	**4**	**32**	**7**	**5**	**169,318**	**1,415,450**	**252,781**	**234,598**

Table 4.25 Assigning Single Task Direct Labour Costs to Activities

4.2.5.2.2. Assigning multi tasks direct labour costs to activities

Groups of people responsible for multi tasks are such as melting, moulding (AMF), moulding (FD), and maintenance. Regarding to section 4.1.6.3, their total costs are 687457, 426204, 454735, and 199324 Baht respectively. People in these groups can work various activities not only within their own activities but also across to other functions. In addition, they can work interchangeably. Therefore, assigning these costs to activities requires estimation of time-efforts put on activities during day and night shift. By interviewing people these groups, time-efforts of each group put on activities and cost of each group distributed to activities are illustrated in table 4.26.

Act No.	Melting	Moulding (AMF)	Moulding (FD)	Maintenance	QA	Melting	Moulding (AMF)	Moulding (FD)	Maintenance	QA
A113	0.00	0.00	0.00	0.00	10.00	0	0	0	0	23,999
A2311	3.00	0.00	0.00	0.00	0.00	20,689	0	0	0	0
A2312	10.00	0.00	0.00	0.00	0.00	68,964	0	0	0	0
A2313	50.00	0.00	0.00	0.00	0.00	344,821	0	0	0	0
A2314	3.00	0.00	0.00	0.00	40.00	20,689	0	0	0	95,994
A2315	23.00	0.00	0.00	0.00	0.00	158,618	0	0	0	0
A2331	0.00	3.00	0.00	0.00	0.00	0	12,828	0	0	0
A2332	0.00	4.00	0.00	0.00	0.00	0	17,104	0	0	0
A2333	0.00	18.00	0.00	0.00	0.00	0	76,970	0	0	0
A2334	0.00	60.00	0.00	0.00	0.00	0	256,566	0	0	0
A2341	0.00	0.00	10.00	0.00	0.00	0	0	45,583	0	0
A2342	0.00	0.00	65.00	0.00	0.00	0	0	296,288	0	0
A2343	0.00	0.00	15.00	0.00	0.00	0	0	68,374	0	0
A2351	7.00	0.00	0.00	0.00	0.00	48,275	0	0	0	0
A2333	1.00	0.00	10.00	0.00	0.00	6,896	0	45,583	0	0
A2353	0.00	0.00	0.00	0.00	40.00	0	0	0	0	95,994
A242	0.00	0.00	0.00	0.00	10.00	0	0	0	0	23,999
A4.1	3.00	0.00	0.00	0.00	0.00	20,689	0	0	0	0
A4.2	0.00	15.00	0.00	30.00	0.00	0	64,141	0	59,985	0
A4.3	0.00	0.00	0.00	40.00	0.00	0	0	0	79,980	0
A4.4	0.00	0.00	0.00	30.00	0.00	0	0	0	59,985	0
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**689,643**	**427,610**	**455,828**	**199,949**	**239,985**

Table 4.26 Assigning Multi Tasks Direct Labour Costs to Activities

As a result, the total man power cost including single task and multi tasks direct labour is shown in table 4.27.

Act. ID	Melting	Moulding_EVE	Moulding_FD	Maintenance	QA	Core	Grinding	QC	Driver	Total DL Cost
A113	0	0	0	0	23,999	0	0	0	0	23,999
A2311	20,689	0	0	0	0	0	0	0	0	20,689
A2312	68,964	0	0	0	0	0	0	0	0	68,964
A2313	344,821	0	0	0	0	0	0	0	0	344,821
A2314	20,689	0	0	0	95,994	0	0	0	0	116,683
A2315	158,618	0	0	0	0	0	0	0	0	158,618
A232	0	0	0	0	0	169,318	0	0	0	169,318
A2331	0	12,828	0	0	0	0	0	0	0	12,828
A2332	0	17,104	0	0	0	0	0	0	0	17,104
A2333	0	76,970	0	0	0	0	0	0	0	76,970
A2334	0	256,566	0	0	0	0	0	0	0	256,566
A2341	0	0	45,583	0	0	0	0	0	0	45,583
A2342	0	0	296,288	0	0	0	0	0	0	296,288
A2343	0	0	68,374	0	0	0	0	0	0	68,374
A2351	48,275	0	0	0	0	0	0	0	0	48,275
A2352	0	0	0	0	0	0	176,931	0	0	176,931
A2353	6,896	0	45,583	0	0	0	0	0	0	52,479
A2354	0	0	0	0	0	0	88,466	0	0	88,466
A2361	0	0	0	0	0	0	265,397	0	0	265,397
A2362	0	0	0	0	0	0	0	72,223	0	72,223
A23631	0	0	0	0	0	0	221,164	0	0	221,164
A23632	0	0	0	0	0	0	309,630	0	0	309,630
A23633	0	0	0	0	0	0	176,931	0	0	176,931
A23634	0	0	0	0	0	0	44,233	0	0	44,233
A23635	0	0	0	0	0	0	132,698	0	0	132,698
A2364	0	0	0	0	0	0	0	144,446	0	144,446
A241	0	0	0	0	95,994	0	0	36,112	0	132,106
A242	0	0	0	0	23,999	0	0	0	0	23,999
A25	0	0	0	0	0	0	0	0	140,759	140,759
A4.1	20,689	0	0	0	0	0	0	0	0	20,689
A4.2	0	64,141	0	59,985	0	0	0	0	0	124,126
A4.3	0	0	0	79,980	0	0	0	0	0	79,980
A4.4	0	0	0	59,985	0	0	0	0	0	59,985
A5	0	0	0	0	0	0	0	0	93,839	93,839
Total	**689,643**	**427,610**	**455,828**	**199,949**	**239,985**	**169,318**	**1,415,450**	**252,781**	**234,598**	**4,085,162**

Table 4.27 Assigning Man power cost to activities

4.2.6 Transportation Expenses

Regarding to section 4.1.7, transportation expenses consists of travelling expenses and fuel. There is only one activity consuming travelling expenses. It is "Deliver Products", A25. Thus, 100% of this expense will be assigned to such activity. Fuel is consumed by two activities, which are "Deliver Products" (A25) and "Perform Handling Materials" (A5). There are trucks and forklifts used in A25 and A5 respectively. Thus, in order to assign fuel cost to those 2 activities, it is necessary to estimate fuel consumption of trucks and forklifts. By interviewing drivers, fuel consumption of trucks and forklifts is approximately about or 70% and 30% respectively. As a result, costs of fuel distributed to trucks and forklifts are represented in table 4.28.

Act ID.	Travelling Expenses	Fuel	Travelling Expenses (Baht)	Fuel (Baht)	Total (Baht)
A25	100.00	70.00	210,081	313,849	523,930
A5	0.00	30.00	0	134,507	134,507
Total	**100.00**	**100.00**	**210,081**	**448,355**	**658,436**

Table 4.28 Assigning Transportation Expenses to Activities

In summary, all costs assigned to activities will be combined together in order to calculate total cost of each activity as shown in table 4.29. Figure 4.3 shows cost flow model from resource costs to activities.

Act. ID	Indirect Materials	Tools &Equips and Maintenance	Electricity	Water	Direct Labour	Salary	Transportation	Activity Cost
A1								**246,864**
A11								57,384
A111					0	6,506		6,506
A112					0	5,093		5,093
A113					23,999	6,506		30,505
A114					0	15,280		15,280
A12								40,745
A121					0	20,373		20,373
A122					0	15,280		15,280
A123					0	5,093		5,093
A13								97,782
A131					0	31,865		31,865
A132					0	20,373		20,373
A133					0	45,544		45,544
A14						50,952		50,952
A2								**17,108,448**
A21						78,571		78,571
A22	1,540	155,077			0	184,744		341,361
A23								15,535,063
A231								7,683,910
A2311					13,793	0		13,793
A2312					68,964	0		68,964
A2313	322,859	394,450	6,051,731	37,034	344,821	23,876		7,174,772
A2314	101,800	12,698	13,556		123,580	0		251,634
A2315	9,234				165,514	0		174,748

A232	161,769		30,534		169,318	0		361,620
A233								3,631,304
A2331					12,828	0		12,828
A2332	33,863				12,828	0		46,691
A2333		118,781	460,413	5,291	81,246	0		665,731
A2334	798,766	805,549	1,035,121	10,052	256,566	0		2,906,054
A234								455,703
A2341	1,500		12,894	529	45,583	0		60,506
A2342			21,374		296,288	0		317,662
A2343			9,160		68,374	0		77,534
A235								828,528
A2351	415,209	8,968			48,275	0		472,452
A2352		38,200			176,931	0		215,131
A2353					52,479	0		52,479
A2354					88,466	0		88,466
A236								2,573,997
A2361	385,200	56,134	148,542		265,397	0		855,274
A2362					72,223	0		72,223
A2363								1,460,418
A23631	211,950	30,129	61,893		221,164	0		525,136
A23632	24,035	45,193	49,514		309,630	0		428,372
A23633	35,775		49,514		176,931	0		262,220
A23634	2,185				44,233	0		46,418
A23635	35,040		30,534		132,698	0		198,272
A2364		41,636			144,446	0		186,082
A24								351,573
A241		32,000			132,106	0		164,106
A242					23,999	7,799		31,797
A243					0	124,475		124,475
A244					0	31,196		31,196
A25		75,740			140,759	61,451	523,930	801,879
A3								**431,282**
A3.1					0	77,788		77,788
A3.2					0	103,514		103,514
A3.3					0	88,486		88,486
A3.4					0	51,494		51,494
A3.5					0	110,000		110,000
A4								**1,543,255**
A4.1	290,882				13,793	11,938		316,613
A4.2	16,706				124,126	56,971		197,803
A4.3					79,980	0		79,980
A4.4	5,467	883,407	0	0	59,985	0		948,859
A5	**47,209**	**20,000**			**93,839**	**0**	**134,507**	**295,555**
Total	**2,900,988**	**2,717,963**	**7,974,780**	**52,906**	**4,085,162**	**1,235,169**	**658,436**	**19,625,404**

Table 4.29 Assigning Resource Costs to Activities

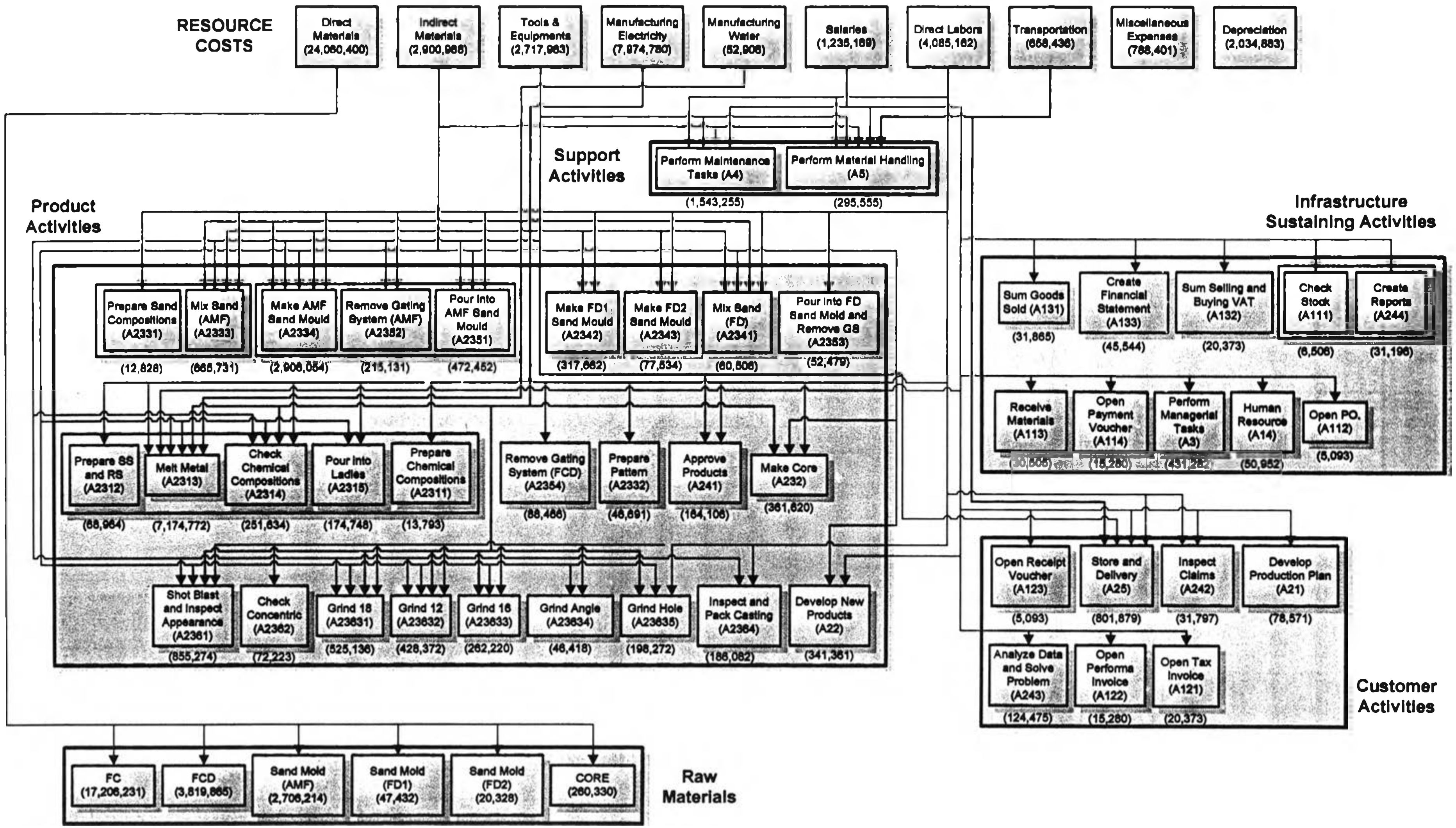

Figure 4.3 Cost Flow Model from Resources to Activities

However, it should recognize that support activities, A4 and A5, are not directly consumed by cost objects. Rather, they are consumed by other activities. Therefore, it is necessary to assign support activity costs to the activities before assigning activity costs to cost objects is performed. The assignment of support activity costs to other activities will be explained in next section.

4.3 Assigning Support Activity Costs to other Activities

Due to support activities consisting of performing maintenance tasks (A4) and material handling (A5) activity do not directly benefits to cost objects but to other activities, their costs will be assigned to such activities instead of cost objects. Assigning both A4 and A5 cost can be done by estimating time-efforts of each team spent in activities.

Performing maintenance tasks are provided to 4 parts, which are melting, moulding, finishing process, and infrastructure sustaining. Melting team is responsible for maintaining machines and equipments used in melting process (A4.1), and maintenance team will responsible for maintaining those used in moulding process (A4.2), finishing process (A4.3) and infrastructure (A4.4). It should recognize that cost of maintaining infrastructure activity (A4.4) is not required by product and customer activities. This cost, 948,859 Baht, will not be assigned to any product and customer activities, but they will be combined with infrastructure sustaining activity costs. For performing material handling task (A5), driver team is in charge.

As a result, by interviewing people in maintenance and driver team, percentage of time-efforts spent in each activity and total support costs allocated to each activity are shown in table 4.30. These support costs will be combined to activity costs as shown in table 4.31, and figure 4.4 illustrates cost flow model from support activity costs to product and customer activities. Note that, the total support cost is 889,951 Baht due to 948,859 baht is assigned to infrastructure sustaining.

	Teams					Teams					
	Melt.	Maintenance			Driver	Melt.	Maintenance			Driver	
Act. ID	A4.1 Melting	A4.2 Moulding	A4.3 Finishing	A4.4 Infrastructure	A5 Material Handling	A4.1 Melting	A4.2 Moulding	A4.3 Finishing	A4.4 Infrastructure	A5 Material Handling	Support Costs
A113					15.00	0	0	0	0	44,333	44,333
A2311					5.00	0	0	0	0	14,778	14,778
A2312					5.00	0	0	0	0	14,778	14,778
A2313	100.00					316,613	0	0	0	0	316,613
A232					5.00	0	0	0	0	14,778	14,778
A2331		30.00				0	59,341	0	0	0	59,341
A2333		50.00				0	98,902	0	0	0	98,902
A2334		10.00				0	19,780	0	0	0	19,780
A2341		10.00				0	19,780	0	0	0	19,780
A2352					5.00	0	0	0	0	14,778	14,778
A2353					15.00	0	0	0	0	44,333	44,333
A2354					5.00	0	0	0	0	14,778	14,778
A2361			50.00		5.00	0	0	39,990	0	14,778	54,768
A23631			20.00		3.00	0	0	15,996	0	8,867	24,863
A23632			20.00		3.00	0	0	15,996	0	8,867	24,863
A23633			10.00		3.00	0	0	7,998	0	8,867	16,865
A23634					3.00	0	0	0	0	8,867	8,867
A23635					3.00	0	0	0	0	8,867	8,867
A2364					5.00	0	0	0	0	14,778	14,778
A25					20.00	0	0	0	0	59,111	59,111
Infrastructure Sustaining				100.00		0	0	0	948,859	0	948,859
	100.00	**100.00**	**100.00**	**100.00**	**100.00**	**316,613**	**197,803**	**79,980**	**948,859**	**295,555**	**1,838,810**

Table 4.30 Assigning Support Costs to Activities

Act ID	Act Type	Rank	Activity Cost	Support Costs	Total Activity Cost
A1			**246,864**		**291,197**
A11			**57,384**		**101,717**
A111	Sustaining	3	6,506		6,506
A112	Sustaining	3	5,093		5,093
A113	Sustaining	3	30,505	44,333	74,838
A114	Sustaining	3	15,280		15,280
A12			**40,745**		**40,745**
A121	Customer	3	20,373		20,373
A122	Customer	3	15,280		15,280
A123	Customer	3	5,093		5,093
A13			**97,782**		**97,782**
A131	Sustaining	3	31,865		31,865
A132	Sustaining	3	20,373		20,373
A133	Sustaining	3	45,544		45,544
A14	Sustaining	3	50,952		50,952
A2			**17,108,448**		**17,954,066**
A21	Customer	3	78,571		78,571
A22	Product	2	341,361		341,361
A23			**15,535,063**		**16,321,570**
A231			**7,683,910**		**8,030,079**
A2311	Product	3	13,793	14,778	28,571
A2312	Product	3	68,964	14,778	83,742
A2313	Product	1	7,174,772	316,613	7,491,385
A2314	Product	1	251,634		251,634
A2315	Product	1	174,748		174,748
A232	Product	1	361,620	19,780	381,401
A233			**3,631,304**		**3,804,324**
A2331	Product	3	12,828	14,778	27,606
A2332	Product	3	46,691		46,691
A2333	Product	1	665,731	59,341	725,072
A2334	Product	1	2,906,054	98,902	3,004,956
A234			**455,703**		**475,483**
A2341	Product	1	60,506	19,780	80,287
A2342	Product	1	317,662		317,662
A2343	Product	1	77,534		77,534
A235			**828,528**		**902,417**
A2351	Product	1	472,452		472,452
A2352	Product	2	215,131	14,778	229,909
A2353	Product	1	52,479	44,333	96,813
A2354	Product	2	88,466	14,778	103,243
A236			**2,573,997**		**2,727,866**
A2361	Product	2	855,274	54,768	910,041
A2362	Product	3	72,223		72,223
A2363			**1,460,418**		**1,544,741**
A23631	Product	2	525,136	24,863	549,998
A23632	Product	2	428,372	24,863	453,235
A23633	Product	2	262,220	16,865	279,085
A23634	Product	2	46,418	8,867	55,284
A23635	Product	2	198,272	8,867	207,139
A2364	Product	3	186,082	14,778	200,860
A24			**351,573**		**351,573**
A241	Product	2	164,106		164,106
A242	Customer	4	31,797		31,797
A243	Customer	4	124,475		124,475
A244	Sustaining	3	31,196		31,196
A25	Customer	3	801,879	59,111	860,991
A3	**Sustaining**	3	**431,282**		**431,282**
	Total		**17,786,594**	**889,951**	**18,676,545**

Table 4.31 Total Activity Costs

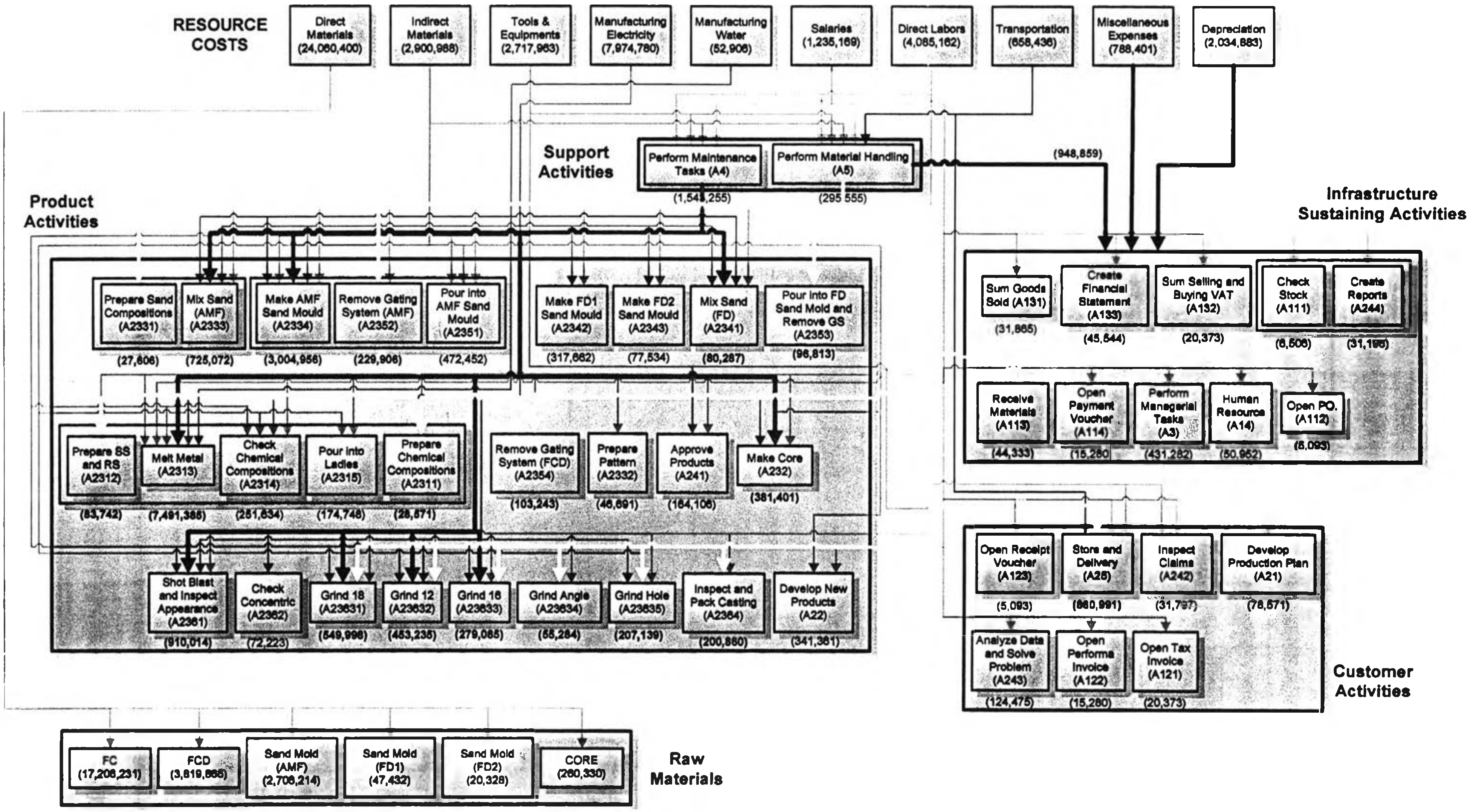

Figure 4.4 Cost Flow Model from Support Activity Costs to other activities

In summary, all resource costs have been traced to product, customer, and infrastructure sustaining activities. Total costs of each group are 16,827,036, 1,136,579, and 712,930 Baht respectively. Note that, infrastructure sustaining activity costs have to be combined with depreciation (1,974,064), miscellaneous (788,401 Baht), and maintaining infrastructure activity (A4.4) (948,859 Baht) costs. Thus, the total infrastructure sustaining activity cost is 4,424,254 Baht.

Summation of these three costs is **22,387,869** Baht, which is exactly the same number of total resource costs as describe in section. It indicates that no costs can be created or destroyed. Rather they are distributed to the appropriate locations. Figure 4.5 illustrates the percentage of costs accumulated in each activity group. It indicates that 75% of total costs are provided to product activities. 20% and 5% of total costs are provided to infrastructure sustaining and customer activities.

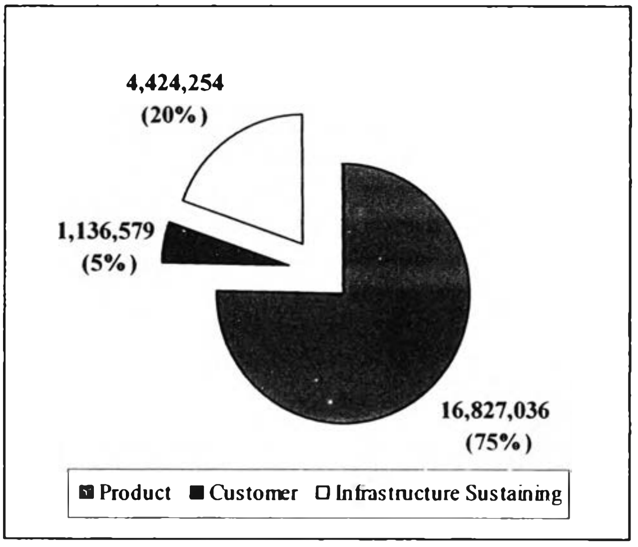

Figure 4.5 Cost of each activity group

At this point, it can conclude that the step of assigning resource costs to activities is accomplished. The next step in developing cost flow model is to assign activity costs to cost objects. This step will be described in next section.

4.4 Assigning Activity Costs to Cost Objects

In this section, total activity costs calculated from previous section will be assigned to cost objects. Assigning activity costs to cost objects can be done through activity cost driver. Activity cost drivers measure the frequency and intensity of the demands placed on activities by cost objects. On the other hand, activity cost drivers trace and reassign activity costs to their cost objects in direct proportion to the objects' consumption of the activity.

The criteria to identify activity cost drivers should consider what causes differences in the level of effort in the activity. In addition, it should realize that cost drivers should ideally be discretely measurable in quantity (in order to determine activity cost rate) and traceable to unique cost objects. The number of activity cost drivers is also important. It should consider the trade off between the effort to collect extra data, accuracy, and the amount of precision the end-users needs for decision making. The activity cost driver of each activity is listed in table 4.32.

Act. ID	Activities	Act. Type	Activity Cost Driver
A1	**Perform Administrative Process**		
A11	Perform Purchasing Process		
A111	Check Stock	Sustaining	# of Weeks
A112	Open PO.	Sustaining	# of Purchase Order
A113	Receive Materials	Sustaining	# of Incoming Materials
A114	Open Payment Voucher	Sustaining	# of Payment Voucher
A12	Perform Selling Process		
A121	Open Tax Invoice	Customer	# of Invoice
A122	Open Performa Invoice	Customer	# of Performa Invoice
A123	Open Receipt Voucher	Customer	# of Receipt Voucher
A13	Perform Accounting Process		
A131	Sum Goods Sold	Sustaining	# of Months
A132	Sum Buying and Selling VAT	Sustaining	# of Months
A133	Create Financial Statement	Sustaining	# of Months
A14	Perform Human Resource Process	Sustaining	# of Working hours
A2	**Perform Manufacturing Process**		
A21	Develop Production Plan	Customer	# of Plan
A22	Develop New Products	Product	# of New products
A23	Perform Production Process		
A231	Perform Melting Process		
A2311	Prepare Chemical Compositions	Product	# of Charge
A2312	Prepare SS and RS	Product	# of Charge
A2313	Melt metal	Product	# of Charge
A2314	Check chemical compositions	Product	# of Charge
A2315	Pour into Ladles	Product	# of Charge
A232	Make Core	Product	# of Weight
A233	Perform Moulding Process		
A2331	Prepare Sand Compositions	Product	# of Mix (AMF)
A2332	Prepare Pattern	Product	# of Plan
A2333	Mix Sand (AMF)	Product	# of Mix (AMF)
A2334	Make AMF Sand Mould	Product	# of AMF Sand Mould
A234	Perform Moulding Process (FD)		

A2341	Mix Sand (FD)	Product	# of Mix (FD)
A2342	Make FD1 Sand Mould	Product	# of FD1 Sand Mould
A2343	Make FD2 Sand Mould	Product	# of FD2 Sand Mould
A235	Perform Pouring Process		
A2351	Pour into AMF Sand Mould	Product	# of AMF Sand Mould
A2352	Remove Gating System (AMF)	Product	# of AMF Sand Mould
A2353	Pour into FD Sand Mould and Remove GS	Product	# of FD Sand Mould
A2354	Remove Gating System (FCD)	Product	# of Sand Mould (FCD)
A236	Perform Finishing Process		
A2361	Shot Blast and Inspect Appearance	Product	# of Shot Times
A2362	Check Concentric	Product	# of Pieces
A2363	Grind In-gate and Parting line		
A23631	Grind 18"	Product	# of Machine HR.
A23632	Grind 12"	Product	# of Machine HR.
A23633	Grind 16"	Product	# of Machine HR.
A23634	Grind Angle	Product	# of Machine HR.
A23635	Grind Hole	Product	# of Machine HR.
A2364	Inspect and Pack Casting	Product	# of Working HR.
A24	Perform Quality Assurance Process		
A241	Approve Product	Product	# of Lots Approved
A242	Inspect Claims	Customer	# of Incoming Claims
A243	Analyze Data and Solve Problems	Customer	# of Complaints
A244	Create Reports	Sustaining	# of Weeks
A25	Deliver Product	Customer	# of Working HR.
A3	**Perform Managerial Tasks**	**Sustaining**	

Table 4.32 Activity Cost Driver List

Next paragraphs will describe assigning activity costs to cost objects through these activity cost drivers. In this study, cost objects are divided into 2 categories. Those are product and customer cost objects. Thus, cost assignment from activity costs to cost objects is divided into assigning product activity costs to product cost objects and assigning customer activity costs to customer cost objects.

4.4.1 Assigning Product Activity Costs to Product Cost Objects

This cost assignment requires the output quantity data of each activity cost driver to determine cost driver rate. The data can be captured mostly from operational data such as melting, moulding, finishing, and QA reports. The cost driver rate is calculated by dividing activity costs by its output quantity (Cost Driver Rate = Activity Costs/Output Quantity). Table 4.33 shows activity cost drivers, output quantity, and activity cost rate of each product activity. The data of some output quantity are shown in appendix A. There are 27 product activities. Activities having the same activity cost driver will be grouped together. Note that, direct labour cost is separated from total activity costs. Therefore, cost driver rate will be divided to direct labour cost rate and rate. Both can be calculated as Direct labour Cost Rate = Direct labour Cost/Output Quantity and Activity Cost Rate = Activity Cost/Output Quantity.

Act. ID	Activity Cost Driver	Output Quantity (C)	Total Activity Costs		Cost Driver Rate	
			(A) DL Costs (Baht)	(B) Act Costs (Baht)	(A/C) DL Cost Rate (Baht/Unit)	(B/C) Act Cost Rate (Baht/Unit)
A22	Develop New Product	10	0	341,361	0.00	34,136.08
A2311		3,941	13,793	14,778	3.50	3.75
A2312		3,941	68,964	14,778	17.50	3.75
A2313	# of Charge	3,941	344,821	7,146,564	87.50	1,813.39
A2314		3,941	123,580	128,054	31.36	32.49
A2315		3,941	165,514	9,234	42.00	2.34
A232	# of Core Weight	66,517	169,318	212,083	2.55	3.19
A2331	# of Mix (AMF)	21,970	12,828	14,778	0.58	0.67
A2333		21,970	81,246	643,826	3.70	29.30
A2334		217,275	256,566	2,748,390	1.18	12.65
A2351	# of Sand Mould (AMF)	217,275	48,275	424,177	0.22	1.95
A2352		217,275	176,931	52,978	0.81	0.24
A2332	# of Plan	1,331	12,828	33,863	9.64	25.44
A2341	# of Mix (FD)	2,590	45,583	34,704	17.60	13.40
A2342	# of Sand Mould (FD1)	43,552	296,288	21,374	6.80	0.49
A2343	# of Sand Mould (FD2)	1,526	68,374	9,160	44.81	6.00
A2353	# of Sand Mould (FD)	45,078	52,479	44,333	1.16	0.98
A2354	# of Sand Mould (FCD)	14,679	88,466	14,778	6.03	1.01
A2361	# of Shot Times	10,200	265,397	644,644	26.02	63.20
A2362	# of Pieces	167,081	72,223	0	0.43226	0.00000
A23631	# of Machine HR.	9,098,120	221,164	328,834	0.02431	0.03614
A23632	# of Machine HR.	10,336,490	309,630	143,605	0.02996	0.01389
A23633	# of Machine HR.	13,537,149	176,931	102,154	0.01307	0.00755
A23634	# of Machine HR.	915,600	44,233	11,052	0.04831	0.01207
A23635	# of Machine HR.	3,807,635	132,698	74,440	0.03485	0.01955
A2364	# of Direct Labour Hours	713,525	144,446	56,413	0.20244	0.07906
A241	# of Lots Approved	1,136	132,106	32,000	116.29	28.17
		Total	**3,524,684**	**13,302,352**		

Table 4.33 Product Activity Cost Rate

Determining consumption of the activities by cost objects can be done by multiplying cost driver rate with the demand placed on activities required by cost objects. The demand placed on activities is called activity output. Thus, in each activity, consumption of direct labour cost of each product is calculated by multiplying its direct labour cost rate with its activity output. Similarly, in each activity, consumption of activity cost of each product is calculated by multiplying its activity cost rate with its activity output. From Jun to Nov 2005, there are over a hundred products produced by the company. In this study, only five products will be described as examples. They are Flywheel ZE1, HUB KD, Slider, Body10DJ150, and Flange Air. Table 4.34 and 4.35 represent the consumption of product activities by these products.

Act. ID	Activity Cost Driver	Cost Driver Rate		No. of Activity Output			Flywheel ZE1		HUB KD		Slider	
		Dl Cost Rate (Baht/Unit)	Act Cost Rate (Baht/Unit)	Flywheel ZE1	HUB KD	Slider	DL. Cost (Baht)	Act. Cost (Baht)	DL. Cost (Baht)	Act. Cost (Baht)	DL. Cost (Baht)	Act. Cost (Baht)
A22	# of New Product	0.00	34,136.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2311	# of Charge	3.50	3.75	1,246.50	562.00	194.50	4,362.55	4,674.06	1,966.91	2,107.36	680.72	729.33
A2312		17.50	3.75	1,246.50	562.00	194.50	21,812.73	4,674.06	9,834.54	2,107.36	3,403.59	729.33
A2313		87.50	1,813.39	1,246.50	562.00	194.50	109,063.64	2,260,388.63	49,172.69	1,019,124.28	17,017.95	352,704.04
A2314		31.36	32.49	1,246.50	562.00	194.50	39,087.10	40,502.20	17,622.91	18,260.92	6,099.03	6,319.84
A2315		42.00	2.34	1,246.50	562.00	194.50	52,350.55	2,920.50	23,602.89	1,316.75	8,168.62	455.71
A232	# of Core Weight	2.55	3.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2331	# of Mix (AMF)	0.58	0.67	7,335.00	3,431.00	1,385.00	4,282.91	4,933.77	2,003.36	2,307.81	808.70	931.60
A2333		3.70	29.30	7,335.00	3,431.00	1,385.00	27,125.09	214,950.51	12,687.96	100,544.68	5,121.78	40,587.11
A2334	# of AMF Sand Mould	1.18	12.65	72,468.00	33,903.00	13,686.00	85,572.72	916,673.85	40,033.83	428,851.27	16,160.90	173,119.15
A2351		0.22	1.95	72,468.00	33,903.00	13,686.00	16,101.22	141,476.24	7,532.70	66,187.41	3,040.81	26,718.60
A2352		0.81	0.24	72,468.00	33,903.00	13,686.00	59,012.10	17,669.74	27,607.87	8,266.51	11,144.78	3,337.03
A2332	# of Plan	9.64	25.44	228.00	220.00	63.00	2,197.48	5,800.64	2,120.38	5,597.11	607.20	1,602.81
A2341	# of Mix (FD)	17.60	13.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2342	# of FD1 Sand Mould	6.80	0.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2343	# of FD2 Sand Mould	44.81	6.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2353	# of Sand Mould (FD)	1.16	0.98	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2354	# of Sand Mould (FCD)	6.03	1.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2361	# of Shot Times	26.02	63.20	2,516.00	980.28	368.00	65,464.57	159,012.30	25,506.12	61,953.93	9,575.10	23,257.76
A2362	# of Pieces	0.43226	0.00000	0.00	118,363.00	0.00	0.00	0.00	51,164.16	0.00	0.00	0.00
A23631	# of Machine HR.	0.02431	0.03614	2,829,420.00	2,367,260.00	0.00	68,779.71	102,263.98	57,545.17	85,560.09	0.00	0.00
A23632	# of Machine HR.	0.02996	0.01389	0.00	0.00	8,722,440.00	0.00	0.00	0.00	0.00	261,280.82	121,181.05
A23633	# of Machine HR.	0.01307	0.00755	2,829,420.00	0.00	0.00	36,980.67	21,351.31	0.00	0.00	0.00	0.00
A23634	# of Machine HR.	0.04831	0.01207	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A23635	# of Machine HR.	0.03485	0.01955	0.00	2,367,260.00	0.00	0.00	0.00	82,500.48	46,280.63	0.00	0.00
A2364	# of Direct Labour Hours	0.20244	0.07906	188,628.00	118,363.00	193,832.00	38,185.98	14,913.48	23,961.48	9,358.12	39,239.48	15,324.92
A241	# of Lots Approved	116.29	28.17	231.00	220.00	63.00	26,863.06	6,507.04	25,583.86	6,197.18	7,326.29	1,774.65
						Total	657,242.07	3,918,712.30	460,447.33	1,864,021.38	389,675.76	768,772.92

Table 4.34 Consumption of product activities by Flywheel ZE1, HUB KD, and Slider

Act. ID	Activity Cost Driver	Cost Driver Rate		No. of Activity Output		Body 10DJ150		Flange Air	
		DI Cost Rate (Baht/Unit)	Act Cost Rate (Baht/Unit)	Body10DJ150	Flange Air	DL. Cost (Baht)	Act. Cost (Baht)	DL. Cost (Baht)	Act. Cost (Baht)
A22	# of New Product	0.00	34,136.08	0.00	0.00	0.00	0.00	0.00	0.00
A2311		3.50	3.75	17.50	37.50	61.25	65.62	131.24	140.62
A2312		17.50	3.75	17.50	37.50	306.24	65.62	65.62	140.62
A2313	# of Charge	87.50	1,813.39	17.50	37.50	1,531.18	31,734.30	31,734.30	68,002.06
A2314		31.36	32.49	17.50	37.50	548.76	568.62	568.62	1,218.48
A2315		42.00	2.34	17.50	37.50	734.97	41.00	41.00	87.86
A232	# of Core Weight	2.55	3.19	1,213.63	2,989.98	3,089.27	3,869.54	3,869.54	9,533.24
A2331	# of Mix (AMF)	0.58	0.67	102.00	226.00	59.56	68.61	68.61	152.02
A2333		3.70	29.30	102.00	226.00	377.20	2,989.09	2,989.09	6,622.88
A2334		1.18	12.65	1,003.00	2,228.00	1,184.38	12,687.31	12,687.31	28,182.77
A2351	# of AMF Sand Mould	0.22	1.95	1,003.00	2,228.00	222.85	1,958.11	1,958.11	4,349.63
A2352		0.81	0.24	1,003.00	2,228.00	816.76	244.56	244.56	543.25
A2332	# of Plan	9.64	25.44	20.00	35.00	192.76	508.83	508.83	890.45
A2341	# of Mix (FD)	17.60	13.40	0.00	0.00	0.00	0.00	0.00	0.00
A2342	# of FD1 Sand Mould	6.80	0.49	0.00	0.00	0.00	0.00	0.00	0.00
A2343	# of FD2 Sand Mould	44.81	6.00	0.00	0.00	0.00	0.00	0.00	0.00
A2353	# of Sand Mould (FD)	1.16	0.98	0.00	0.00	0.00	0.00	0.00	0.00
A2354	# of Sand Mould (FCD)	6.03	1.01	0.00	0.00	0.00	0.00	0.00	0.00
A2361	# of Shot Times	26.02	63.20	17.28	57.86	449.70	1,092.31	1,092.31	3,656.94
A2362	# of Pieces	0.43226	0.00000	0.00	0.00	0.00	0.00	0.00	0.00
A23631	# of Machine HR.	0.02431	0.03614	13,860.00	0.00	336.92	500.94	500.94	0.00
A23632	# of Machine HR.	0.02996	0.01389	0.00	133,110.00	0.00	0.00	0.00	1,849.30
A23633	# of Machine HR.	0.01307	0.00755	267,960.00	1,331,100.00	3,502.25	2,022.07	2,022.07	10,044.72
A23634	# of Machine HR.	0.04831	0.01207	0.00	0.00	0.00	0.00	0.00	0.00
A23635	# of Machine HR.	0.03485	0.01955	0.00	532,440.00	0.00	0.00	0.00	10,409.36
A2364	# of Direct Labour Hours	0.20244	0.07906	924.00	4,437.00	187.06	73.05	73.05	350.80
A241	# of Lots Approved	116.29	28.17	20.00	35.00	2,325.81	563.38	563.38	985.92
					Total	**15,926.90**	**59,052.98**	**59,118.60**	**147,160.91**

Table 4.35 Consumption of product activities by Body10DJ150 and Flange Air

Cost incurred in those five products can be summarized in proportion between direct labour and activity cost as shown in table 4.36. The table indicates that different product requires different level of effort in labour and product activity.

	Flywheel ZE1	HUB KD	Slider	[illegible]	Flange Air
DL Cost	657,242	460,447	389,676	15,927	59,119
Product Act. Cost	3,918,712	1,864,021	768,773	59,053	147,161
Total Cost	4,575,954	2,324,469	1,158,449	74,980	206,280
DL Cost (%)	14.36	19.81	33.64	21.24	28.66
Product Act. Cost (%)	85.64	80.19	66.36	78.76	71.34
Total Cost (%)	100.00	100.00	100.00	100.00	100.00

Table 4.36 Direct Labour and Activity Cost built up by the products

4.4.2 Assigning Customer Activity Costs to Customer Cost Objects

There are 7 customer activities. Similar to previous section, assigning customer activity costs to customer cost objects requires collecting the output quantity of activity cost drivers in order to determine cost driver rate. Cost driver rate is calculated by dividing Total Activity Cost by Output Quantity as shown in table 4.37. Note that, direct labour costs are not separated from total activity costs due to the amount between direct labour and activity costs is significant different.

Act. ID	Activity	Activity Cost Driver	(A) Total Activity Cost (Baht)	(C) Output Quantity (Unit)	(A/C) Cost Driver Rate (Baht/Unit)
A121	Open Tax Invoice	# of Invoice	20,373	1,062.00	19.18
A122	Open Performa Invoice	# of Performa Invoice	15,280	83.00	184.09
A123	Open Receipt Voucher	# of Receipt Voucher	5,093	83.00	61.36
A21	Develop Production Plan	# of Plan	78,571	1,328.00	59.17
A243	Analyze Data and Solve Problems	# of Customer Complaints	124,475	30.00	4,149.15
A242	Inspect Claims	# of Incoming Claims	31,797	33.00	236.33
A25	Deliver Products	# of Distances (%)	860,991	100.00	7,202.32
		Total	**1,136,579**		

Table 4.37 Cost driver rate of each customer activities

There are about 20 customers the company provides products to. In this study, 4 customers are described as examples. Table 4.38 shows the consumption of customer activities by customer cost objects.

Act. ID	Cost Driver Rate (Baht/Unit)	No. of Activity Output SBM	KITZ	KKC	AI	Cost (Baht) SBM	KITZ	KKC	AI
A121	19.18	214.00	250.00	16.00	121.00	4,105.23	4,795.83	306.93	2,321.18
A122	184.09	6.00	6.00	6.00	6.00	1,104.54	1,104.54	1,104.54	1,104.54
A123	61.36	6.00	6.00	6.00	6.00	368.18	368.18	368.18	368.18
A21	59.17	779.00	165.00	63.00	83.00	46,089.75	9,762.27	3,727.41	4,910.72
A243	4,149.15	12.00	6.00	3.00	2.00	49,789.83	24,894.92	12,447.46	8,298.31
A242	236.33	24.00	4.00	0.00	1.00	5,671.92	945.32	0.00	236.33
A25	7,202.32	71.00	4.86	6.88	1.82	511,364.54	35,003.26	49,551.94	13,108.22
					Total	618,494.00	76,874.32	67,506.47	30,347.48

Table 4.38 Consumption of customer activities by customer cost objects

In summary, it is apparent that ABC provides insights of how the diversity and variation of products or customers can be detected and translated into how they uniquely consume activity costs. This capability is not available in traditional or current costing system. However, gaining such information is not enough for this study. The objective is to build more accurate costing system. Consequently, the study will go forward to determine cost constructed in the level of product unit.

4.4.3 Product Costing

Product unit cost is calculated by dividing total cost by units of product produced as shown in figure 4.6. Total cost of each product is constructed with product activity cost, direct labour cost, customer activity cost, direct material cost, and infrastructure sustaining activity cost. The first two have already discussed in section 4.41. The last three requires three more cost assignments. Those are assigning customer cost objects, direct material costs, and infrastructure sustaining activity costs to product cost objects. Each cost assignment is described as follow. The same five products will be used as examples.

$$\text{Each Product's Unit Cost} = \frac{\boxed{\text{Product Activity Cost}} + \boxed{\text{Direct Labour Cost}} + \boxed{\text{Customer Activity Cost}} + \boxed{\text{Direct Materials Cost}} + \boxed{\text{Infrastructure Sustaining Activity Cost}}}{\text{Units of product produced}}$$

Figure 4.6 Product unit cost calculations

4.4.3.1. Assigning customer cost objects to product cost objects

Similar to previous cost assignment, the way to assign customer cost objects to product cost objects can be done through a cost driver. Also, such a cost driver should be quantifiable and link product to customer cost objects. It could be said that the level in each customer cost put on their own products varies in relation to the number of ladles. Thus, this requires determining each customer cost per ladle (customer cost rate). The calculation of customer cost rate is shown in table 4.39. Each customer cost rate is used to determine customer cost distributed to their own product as shown table 4.40.

Customer	(A) Customer Costs	(B) Output Quantity (Ladles)	(A/B) Customer Cost Rate (Baht/Ladle)
SBM	618,494.00	5,883	105.13
KITZ	76,874.32	456	168.58
KKC	67,506.47	389	173.54
AI	30,347.48	186	163.16

Table 4.39 Customer cost rate (Baht/Ladle)

Customer	Product	Cost Rate (Baht/Ladle)	No. of Output (Ladles)	Total Cost (Baht)
SBM	ZE1	105.13	2,493	262,095
	HUB KD	105.13	1,124	118,169
KKC	Slider	173.54	389	67,506
KITZ	Body 10DJ149	168.58	35	5,900
AI	Flange Air	163.16	75	12,237

Table 4.40 Assigning customer costs to the products

4.4.3.2. Assigning direct material costs to product cost objects

Regarding to section 4.1.1, direct materials are classified into three groups such as metal and chemical compositions, sand and sand compositions, and shell sand. Metal and chemical compositions can be further divided into those used for producing Ferro Carbon (FC) and Ferro Carbon Ductile (FCD). Sand and sand composition can also be further divided into those used in AMF, FD1, and FD2 moulding line.

4.4.3.2.1. Assigning metal and chemical composition costs to products

Different products require different quantity of metal and chemical composition. Determining how much the quantity of metal and chemical compositions required by each product can be done through number of ladle. Metal and chemical compositions are divided to those for FC and FCD. Cost of each is 17,759,620 and 3,266,477 Baht regarding to section 4.1.1. From Jun – Nov 2005, the number of ladle used to produce FC and FCD are 6,802 and 1,081 ladles. Thus, metal and chemical composition cost per ladle (Cost Rate) for FC and FCD are represented in table 4.41. Table 4.42 represents metal and chemical composition cost assigned to the five products.

	(A) Material Cost (Baht)	(B) Output Quantity (Ladles)	(A/B) Cost Rate (Baht/Ladle)
Metal and Chemical Composition for FC	17,759,620	6,802	2,610.94
Metal and Chemical Composition for FCD	3,266,477	1,081	3,021.72
Total	21,026,096	7,883	

Table 4.41 Metal and chemical composition cost per ladle for FC and FCD

Materials	Products	(A) Cost Rate (Baht/Ladle)	(B) No. of Output (Ladles)	(A*B) Total Cost (Baht)
FC	ZE1	2,610.94	2,493	6,509,075
FC	HUB KD	2,610.94	1,124	2,934,697
FC	Slider	2,610.94	389	1,015,656
FCD	Body 10DJ150	3,021.72	35	105,760
FC	Flange Air	2,610.94	75	195,821

Table 4.42 Metal and Chemical composition costs required by the products.

4.4.3.2.2. Assigning sand and sand compositions to products

Sand and sand compositions are provided to AMF, FD1, and FD2 moulding line. Regarding to section 4.1.1, their costs are 2,706,241, 47,432, and 20,328 Baht respectively. It is appropriate to assume that the quantity of sand and sand composition in each moulding line varies in relation to the number of sand mould produced in each moulding line. Table 4.43 represents cost per sand mould in each moulding line. Table 4.44 represents the cost required by these 5 products.

Moulding Line	(A) Material Cost (Baht)	(B) Output Quantity (Mould)	(A/B) Cost Rate (Baht/Mould)
AMF	2,706,214	217,275	12.46
FD1	47,432	43,552	1.09
FD2	20,328	1,526	13.32
Total	2,773,974		

Table 4.43 Cost per Sand mould

Moulding Line	Products	(B) Cost Rate (Baht/Mould)	(A) No. of Output (Mould)	(A*B) Total Cost (Baht)
AMF	ZE1	12.46	72,468	902,607
	HUB KD	12.46	33,903	422,270
	Slider	12.46	13,686	170,463
	Body 10DJ150	12.46	1,003	12,493
	Flange Air	12.46	2,228	27,750

Table 4.44 Sand cost required by the products

4.4.3.2.3. Assigning shell sand cost to products

Different products require different quantity of resin sand. The variable determined the quantity of resin sand required by each product is weight of resin sand. From Jun – Nov 2005, the company bought resin sand at 3.91 Baht/Kg. The products requiring resin sand are only Body 10DJ150 and Flange Air. Thus, cost of resin sand required by these products is shown in table 4.45.

Products	(A) No. of Output (Kg)	(B) Cost Rate (Baht/Kg)	(A*B) Total Cost (Baht)
Body 10DJ150	1,213.63	3.91	4,750
Flange Air	2,989.98	3.91	11,702

Table 4.45 Resin sand cost distributed to the products

4.4.3.3. Assigning Infrastructure Sustaining costs to product cost objects

As described previously, infrastructure sustaining costs including depreciation and maintaining infrastructure activity costs are 4,424,254 Baht. It could be said that assigning this cost to products can be done through the time required by producing the products. Time can approximately represent in term of number of ladle. The higher number of ladle is produced, the longer time is required. According to table 4.39, the total number of ladle is 7883 ladles. Thus, business sustaining costs per ladle is 4,424,254/7883 = 561.24 baht/ladle. Table 4.46 represents the number of ladle required by each product and infrastructure sustaining costs distributed to each product.

Product	(B) Cost Rate (Baht/Ladle)	(A) No. of Output (Ladle)	(A*B) Total Cost (Baht)
ZE1	561.24	2,493	1,399,171
HUB KD	561.24	1,124	630,834
Slider	561.24	389	218,322
Body 10DJ150	561.24	35	19,643
Flange Air	561.24	75	42,093

Table 4.46 Infrastructure Sustaining Costs distributed to the products

Finally, all costs are traced from resources to final cost objects. Figure 4.7 illustrates cost flow model from resources to final cost objects.

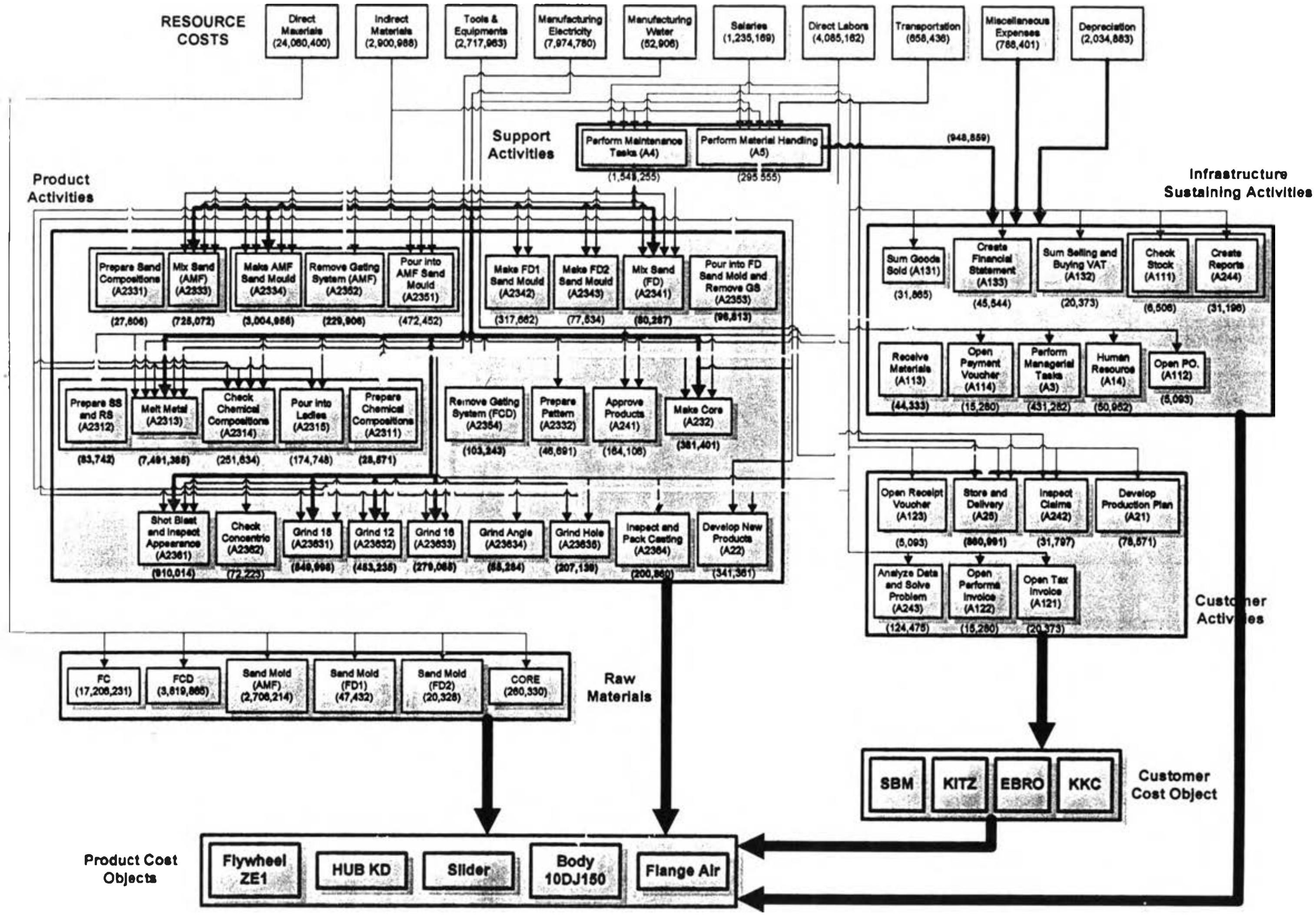

Figure 4.7 Cost Flow Model from Resources to Final Cost Objects

As a result, all costs are gathered to determine the total cost of each product. Table 4.47 shows the cost structure of those five products. The table represents each product's unit cost calculated by dividing total cost by number of product produced. These numbers are extracted from defects and claims. In addition, the table compares between sale price and cost of each product to determine which products the company profits or loses. Interestingly, the company did lose in HUB KD and Flange Air about 10.85% and 29.77% respectively. Table 4.48 and figure 4.8 represent each product cost structure in percentage. It reveals how diversity and variation in product creates different cost structure.

Cost	Flywheel ZE1	HUB KD	Slider	Body10DJ150	Flange Air
Metal and Chemical compositions	6,509,075	2,934,697	1,015,656	105,760	195,821
Sand and Sand compositions	902,607	422,270	170,463	12,493	27,750
Resin Sand	0	0	0	4,750	11,702
Direct Labour	657,242	460,447	389,676	15,927	59,119
Product Activity	3,918,712	1,864,021	768,773	59,053	147,161
Customer Activity	262,095	118,169	67,506	5,900	12,237
Business sustaining	1,399,171	630,834	218,322	19,643	42,093
Total Cost (A)	**13,648,903**	**6,430,439**	**2,630,396**	**223,526**	**495,882**
Number of product produced (B)	186,487	110,117	193,054	890	4,367
Cost/Unit (A/B), (C)	73.19	58.40	13.63	251.15	113.55
Sale/Unit (D)	87.76	52.06	17.85	260	79.75
Profit/Loss (D-C)/C*100	**19.91**	**-10.85**	**31.01**	**3.52**	-29.77

Table 4.47 Product Cost Structure

Cost	Flywheel ZE1	HUB KD	Slider	Body10DJ150	Flange Air
Metal and Chemical compositions	47.69	45.64	38.61	47.31	39.49
Sand and Sand compositions	6.61	6.57	6.48	5.59	5.60
Resin Sand	0.00	0.00	0.00	2.12	2.36
Direct Labour Cost	4.82	7.16	14.81	7.13	11.92
Product Activity Cost	28.71	28.99	29.23	26.42	29.68
Customer Cost	1.92	1.84	2.57	2.64	2.47
Business sustaining Cost	10.25	9.81	8.30	8.79	8.49
Total Cost	100.00	100.00	100.00	100.00	100.00

Table 4.48 Percentage of Product Cost Structure

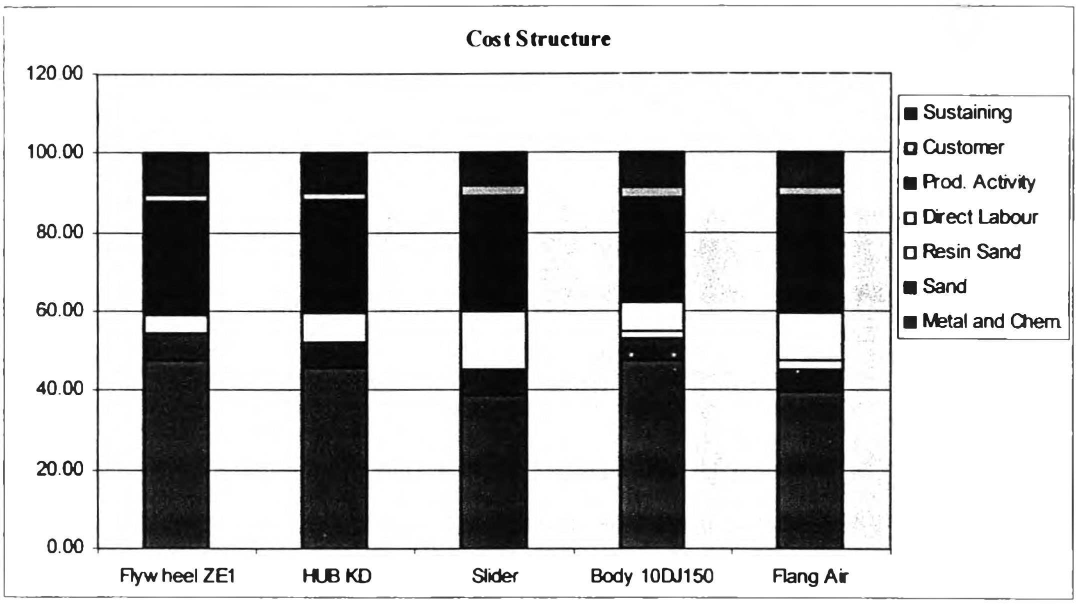

Figure 4.8 Cost Structure in percentage of the products

In conclusion, this chapter performs vertical cost assignment of CAM-I Cross. It reveals how resources and activities relate to cost objects. Costs are traced from resources to final cost objects by two cost assignments, assigning resource costs to activity and then reassigning activity costs to cost objects. The cost assignment view provides useful information of how diversity and variation in product and customer impact to product cost structure. It provides more reliable picture of cost structure. This allows management to understand what high-cost activities are, which product profit or lose, what product and customer channel should focus, etc, and also allows management to identify opportunities for improvement. This information is not available in the company current costing system. Consequently, it can conclude that, at this point, the first objective of this study, developing more reliable and accurate costing system, is accomplished.