CHAPTER 3

METHODOLOGY AND COST CALCULATION

A retrospective survey was conducted searching for information and parameters related to input costs in 1997 in order to estimate unit cost for both OPD and IPD in Nakloeung district hospital.

3.1 Data Collection

Field visit was made to collect the data during 2 weeks from 28th January till 10th February 1998. However, the data obtained from that district is insufficient, in this instance we obtained information from Provincial Health Director, Ministry of Health as well as German Health Project.

The information and parameters requested to collect which are showed in Appendix A can be described as follows:

-Information on population element: number of population in the district. The population coverage in the district needs to know in order to estimate the number of visits for OPD and number of patients in IPD in case of absence of accurate information about the volume of activities in each ward for OPD and IPD.

-Information on infrastructure and organization of the hospital such as organization chart, number of services or divisions under OPD and IPD, number of divisions in the hospital, number of different kind of health staff in each division, square meters of each division in order to allocate the cost.

-Information on epidemiological elements is useful for unit cost estimation in each ward. These information are the number of visits in OPD for one year, number of patient day in each division under IPD for one year, number of X-ray test for one year, number of laboratory tests for one year, average length of stay in IPD.

-Information on macroeconomic parameters are domestic rate of inflation, domestic interest rate, exchange rate between national currency and US dollar in 1997, life time of asset in order to calculate capital cost.

-Information on cost, capital and recurrent, of each division. All of expenditures spent for year 1997.

-Information on activity of the staff requested to collect is the working hour per day in each service, working day per week, responsibility or duty of the staff in order to do cost assignment which they share with other cost center to avoid overestimation or under estimation for any ward.

3.2 Conceptual Framework

This study proposed to estimate the cost per visit for OPD and cost per patient day for IPD utilizing 1997 data.

Every health facility in Cambodia either health center or district hospital the OPD always separate into 2 parts, infant and adult consultation. Considering the charge of these 2 parts the charge for infant is usually cheaper than the charge for adult because of less time for consultation and less drug using.

The conceptual framework of the unit cost estimation for OPD presented in Figure 3.1. This figure showed the cost per visit by wards, infant and adult. The infant cost per visit is the amount getting after dividing the total cost in infant unit by the number of infant visits. The approach to get adult cost per visit is similarly with the approach to calculate cost per visit in infant unit, total cost in adult unit divided by the number of adult visits.

In this study, due to lack of information about the number of visit in each unit, infant and adult, the total number of visits in whole OPD was assumed to calculate the unit cost per OPD. Then we get the average unit cost for OPD. It means that there is not different between the cost per visit for adult and infant.

Figure 3.1: Conceptual Framework of Unit Cost for Outpatient Department
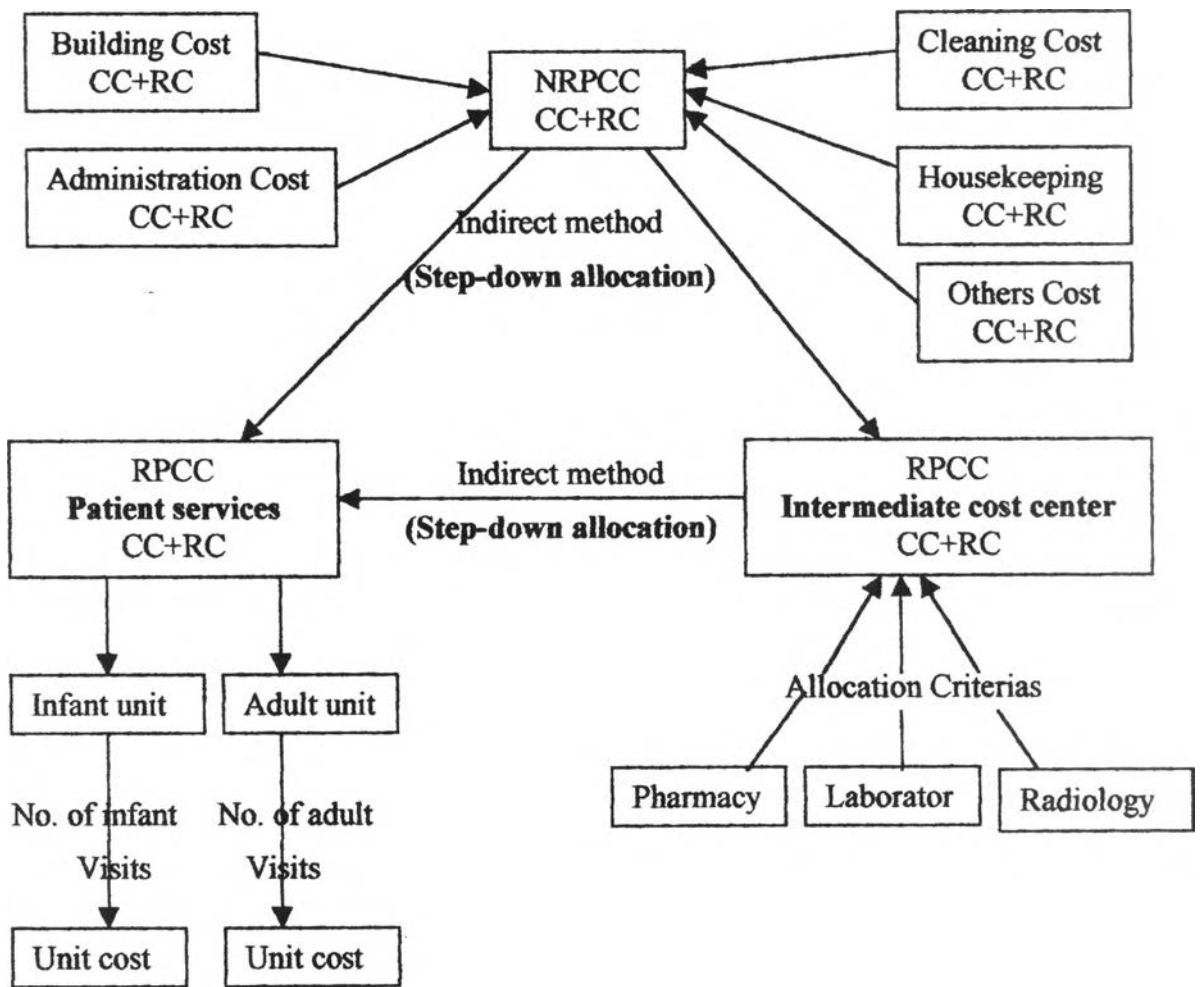
The in-patient department is in general divided into 5 divisions, general medicine, pediatric, gyneco-obstetric, surgery with bloc operation and emergency. The charge in IPD varies from division to division depending on serious or minor of diseases and with or without complications.

The conceptual framework presented for inpatient unit cost is in the Figure 3.2 below. This figure showed the cost per patient day in each ward. The cost per patient day in each division is the total cost in each division divided by the number of patient day in each division. However this study can not calculate the unit cost by ward, only describe the procedure of the estimation, because of the shortage of information about the number of patient in each ward and also the average length of stay in each ward.

Figure 3.2: Conceptual Framework of Unit Cost for In-patient Department
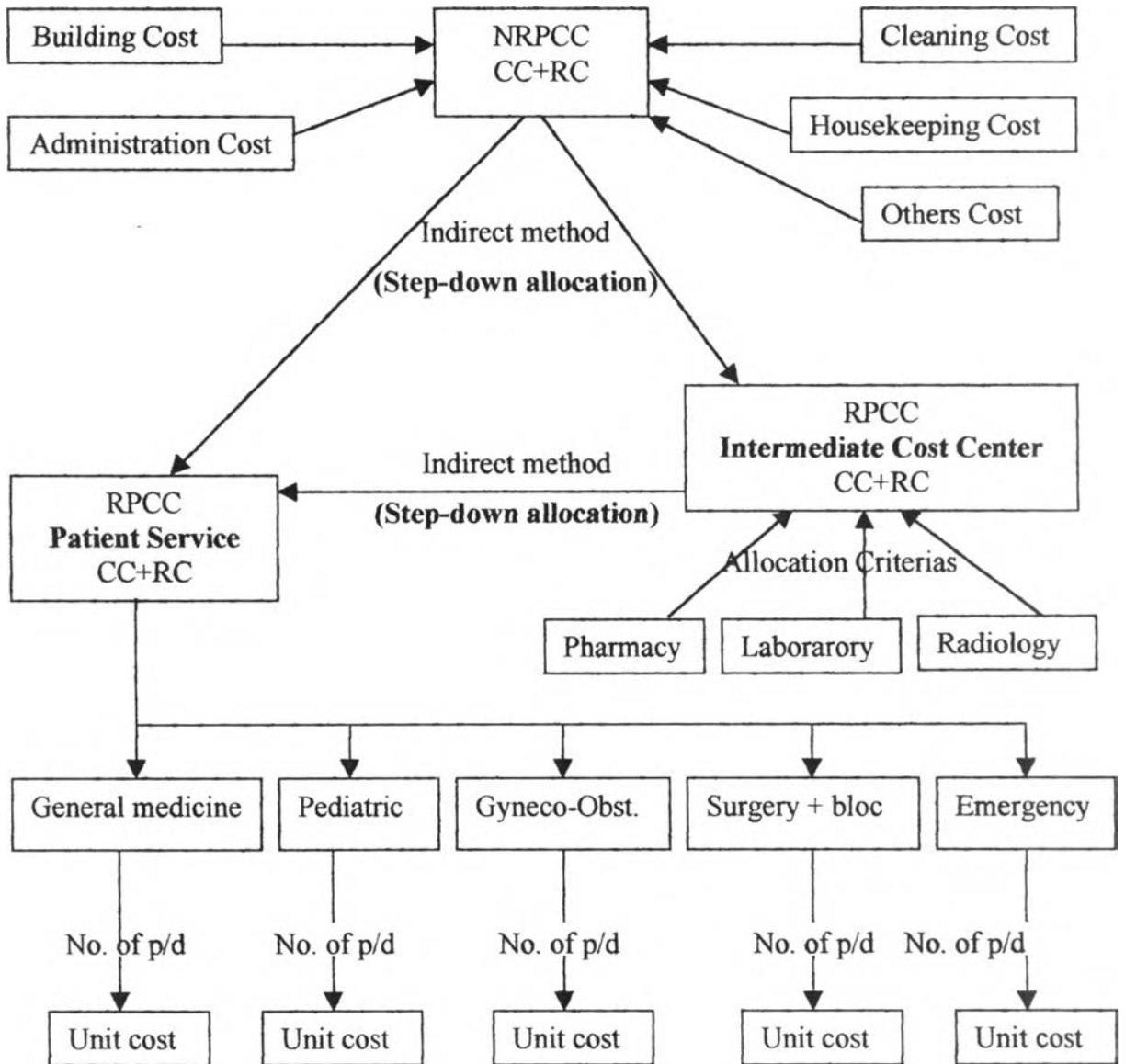
3.3 Data Analysis

3.3.1 Cost Classification

To estimate a health care program's costs, classification of their component is necessary (Creese and Parker, 1993).

Costs by activity: are those costs reflected to the kind of activity or function for which the resources are used (Creese and Parker, 1993). The total cost of a health facility is the sum of the costs incurred by all the departments of the health facility.

In order to calculate the share of each department, service or activity in the total cost of the health facility, a distinction must be made between direct and indirect costs (Carrin and Elvo, 1995).

-Directs costs

Direct costs are those costs clearly associated with, or physically traceable to, a specific cost objective or cost center. They are easy to identify and straightforward in calculation.

Direct costs were defined in relation to a given activity. For example, patient service, namely outpatient service and inpatient service. Example: the cost of pediatric medical equipment is a direct cost in the pediatric service alone. The drugs consumed by a patient are direct costs in the treatment of that patient (Carrin and Elvo, 1995).

In this study there are 2 divisions in outpatient department, pediatric and adult. The inpatient department consists of five divisions, pediatric, gynico-obstetric, emergency, surgery and general medicine.

-Indirect costs

Indirect costs are those costs in which share to more than one cost objective or cost center.

These costs were defined as costs of goods and services used for several activities or by several departments of the health facilities. They are more difficult to identify rather than direct costs. Example: administrative service work for every service in the health facility.

Costs by inputs, capital and recurrent:

-Capital costs

Capital costs are the costs of any resource, input or expenditure whose benefit last for more than one year (Philips and others, 1993). Example: the cost of building, the cost of major medical equipment.

-Recurrent costs

Recurrent costs are those costs that do not use more than one year. For example, drug cost, minor medical equipment use for running health facility. This study divided recurrent costs into 2 groups that are material costs and labor costs.

Costs by cost center:

-Revenue producing costs center (RPCC)

Revenue producing costs center are defined as the costs of health care services that are reimbursed directly by the patient to the hospital for inpatient and outpatient activities. This study divided it into two types of cost center, intermediate cost center and patient service cost center.

Patient service: these costs center are responsible for direct patient services. It separated into two parts, outpatient and inpatient.

Intermediate costs: these costs are responsible for auxiliary services to patient service but arrange as separate services. It consists of 3 branches, laboratory, pharmacy, and radiology.

-Non-Revenue producing cost center (NRPCC)

Non-Revenue producing costs center are defined as those costs that are reimbursed indirectly by the patient to the hospital such as administrative costs, housekeeping costs etc.

3.3.2 Step-down Method:

The procedure of step-down method is to reallocate indirect costs to final cost center based on allocation criteria (Sephard and others, 1997). Although several methods of varying complexity and accuracy are available for allocating service center costs to revenue centers, the step-down method is the most commonly used (Anthony and Young, 1994). In this approach, the unit cost will include overhead and intermediate costs incurred in producing an admission, day or visit, not just direct costs (Zaman and others, 1993). Indirect costs will include all costs which could not be allocated directly to final cost center at an earlier stage.

The order of step-down analysis is basically that resources flowed are " one way", and that one can therefore make use of this in choosing the step-down sequence.

For example, the Table 3.1 below presents flowing among overhead costs to intermediate cost center and final cost center. The first row shows that the administration cost center serves all others, so it should be allocated first. It means that the administration cost gives up its place to distribute to all others cost center, does not receive any cost in return. The second row shows the cleaning cost served the pharmacy and outpatient cost centers without receiving any cost in return from pharmacy and outpatient. The third row presents the pharmacy cost, intermediate cost center, served the outpatient cost center where is the final cost center and does not get any cost in return from outpatient cost center.

Table 3.1: The Approach of Step-down Allocation

Department	Administration	Cleaning	Pharmacy	Outpatient
Administration	....	X	X	X
Cleaning		....	X	X
Pharmacy			....	X
Outpatient				X

Source: Analysis of hospital costs, a manual for managers (1997)

3.3.3 Allocation Criteria or Allocation Basis:

Some study called allocation criteria (Pirom and others, 1991) and some called allocation basis (Sephard and others, 1997). But between these two are the same meaning.

Allocation criteria or allocation basis is the rule which is intended to reflect whatever factors determine each department's use of the indirect cost center, overhead, intermediate or general. Building cost, for example, always allocate through wards based on department floor area. Cleaning services are also often

allocated according to each department's floor area. Most of the studies allocate laundry costs among wards based on the percentage distribution of total patient days in each ward, since patients who stay longer use more laundry service (Sephard and others, 1997). The number of air-conditioning units would be a good predictor of water and electricity costs, percentage distribution of air-conditioning units (Weaver and others, 1994). Most of the analysts try to estimate actual use for X-ray and lab. Estimation of actual use involves gathering data on each department's share of utilization at the ancillary cost center, intermediate cost center, during a simple period (Sephard and others, 1997). However, a manual for facility administrators and policymakers " unit cost analysis study" the number of admissions proved to be a good approximation (RAND Cooperation, 1992).

Knowledge of your own hospital may lead you to devise an allocation basis which predicts costs accurately, even if it not been used elsewhere (Sephard and others, 1997). For example, Weaver, the author of the Niger study learned that patients in private wards received were served better food, so that it would be incorrect to allocate kitchen cost simply based on the number of bed-days. Instead, he used a weighting scheme in which one day in a private room was equivalent to several days in the general ward. This above example shows the importance of the judgement and creativity that the person doing costing may bring from specific knowledge of the hospital or the local situation.

Table 3.2 showed a summary of the bases for allocating various types of overhead costs in previous studies. This table copied from a study of hospital costing in 1997 by Sephard Donald.

Table 3.3 showed a summary of the allocation bases in this study for allocating of overhead and intermediate costs to final cost center, OPD and IPD.

Table 3.2: Summary of the Bases used for Allocating Various Types of Overhead Cost to Final Cost Centers in Previous Studies

Study	Laundry	Kitchen food	Maintenance	Domestic	Transportation	Cleaning	Administration	Utils	Water	Electricity	Phone	Fuel	Security
Malawi	D	D	F	F	A	-	DC	-	-	-	-	-	-
Papua	D	D	DC	-	-	F	DC	-	-	-	-	-	-
St.Lucia	D	D	F	F	-	-	DC	-	-	-	-	-	-
Dominican	A	D	F	-	-	F	DC	-	-	-	-	-	-
Niger	-	-	-	-	-	-	P	-	AC	AC	P	P	-
Tuvalu	NS	NS	NS	NS	NS	NS	PC	NS	NS	NS	P	P	NS
Jamaica	D	D	DC	DC	DC	DC	DC	DC	-	-	-	-	-
Algeria	P	P	P	P	-	-	P	-	-	-	-	-	-
Lesotho	D	PC	PC	-	PC	-	PC	-	-	-	-	-	PC
Sierra Leone	D	D	F	-	-	-	DC	-	-	-	-	-	F
Ecuador	A	D/P	P	-	-	P	P	-	-	-	-	-	-
Gambia	D	D	F	-	-	-	P	-	F	F	F	-	-
Egypt	A		DC	-	DC	-	-	-	-	-	-	-	DC
Russia	D	D	F	-	DC	F	P	-	-	-	-	-	-

Source: Analysis of Hospital Costs, a Manual for Managers (1997)

KEY: A= estimated actual use
AC= air conditioning units
B= beds
D= days of care
DC= direct cost
F= floor area
P= personnel
PC= personnel cost
T= telephones
NS= not specified
-   = not identified as a separate cost center

Table 3.3: Summary of the Bases for Allocating Overhead and Intermediate Costs to Final Cost Centers

No	Cost center	Direct costs	Allocations criteria
	NRPCC		
1	Building	Capital + recurrent	Square feet
2	Administration	-	Salary
3	Cleaning	-	Square feet
4	Guard	-	Square feet
5	Reunion and training	-	Number of staff
	RPCC		
	1-Intermediate cost center		
1	Pharmacy	-	Time spent for drug distribution
2	Laboratory	-	Number of laboratory test
3	Radiology	-	Number of radiology test
	2-Patient services		
1	Outpatient	-	Number of visits
2	Inpatient	-	Number of patient day

3.3.4 Annual Capital Cost Calculation

In this study, annual capital cost calculation was modified from a methodological study for health care costs calculation and cost recovery by Carrin and Elvo (1995). The detailed explanation of annual capital cost calculation by Carrin and Elvo was presented in Chapter 2, section 2.3. In case of Cambodian country, inflation rate was 9% (MOC, 1997) and fixed-term interest rate was 10.20% (NBOC, 1997) so that the formulas is:

$$C_n = C_0 (1+i)^n$$

C_n is the amount of money to purchase the new asset, i is inflation and n is the life of asset.

P_1 = amount of patient charge in year 1

P_2 = amount of patient charge in year 2

...

P_n = amount of patient charge in year n

Assume that:

$$P_2 = P_1(1+i)$$

$$P_3 = P_1(1+i)^2$$

...

$$P_n = P_1(1+i)^{n-1}$$

But in terms of economics costs the opportunity costs must be taken into consideration. So if we save P_1, P_2, ... P_n in the bank to get interest rate till the end of the lifetime of asset the interest rate occurs successively as below:

$$C_0 (1+i)^n = P_1 (1+r)^{n-1} + P_2 (1+r)^{n-2} + ... + P_n \quad (1)$$

r = interest rate

Divide (1) by $(1+r)^n$

$$\Rightarrow C_0 (1+i)^n/(1+r)^n = P_1/(1+r) + P_2/(1+r)^2 + ... + P_n/(1+r)^n \quad (2)$$

Replace $P_2=P_1(1+i)$, $P_3=P_1(1+i)^2$, ..., $P_n=P_1(1+i)^{n-1}$ into (2) =>

$$C_0\{(1+i)/(1+r)\}^n = P_1/(1+r) + P_1(1+i)/(1+r)^2 + ... + P_1/(1+r)\{(1+i)/(1+r)\}^{n-1}$$

$$= P_1/(1+r)\{1+\{(1+i)/(1+r)\} + ... +\{(1+i)/(1+r)\}^{n-1}\}$$

$$= P_1/(1+r)\{\{1-\{(1+i)/(1+r)\}^n\}/1-\{(1+i)/(1+r)\}\}$$

$$= P_1\{1-\{(1+i)/(1+r)\}^n\}/(r-i)$$

$$\Rightarrow P_1= C_0(r-i)\{(1+i)/(1+r)\}^n/ \{1-\{(1+i)/(1+r)\}^n\}$$

For example, one microscope was $1000 with 10 years of life, 9% of inflation rate and 10% of interest rate:

$$P_1=1000(0.1-0.09)\{(1+0.09)/(1+0.1)^{10}/\{1-(1+0.09)/(1+0.1)^{10}$$

$$=\$104.54$$

$104.54 is the amount to charge the patients in order to buy the microscope in the first year. In Chapter 2 (section 2.3) Sephard annual microscope cost was $115.95. Compare the method for calculation annual capital cost by Sephard to this study, the Sephard calculation is over estimation. The same Chapter 2 (section 2.3) Carrin and Elvo annual microscope cost, if inflation rate and interest rate were different, was lower or higher ($100.40 to $119.42). However, if inflation rate and interest rate

were equal the price of that microscope was been $109. Due to the Nakloeung district hospital establishes the charge for outpatient and inpatient departments in order only to generate the revenue to recover the inputs cost, mainly capital costs when their life finishes, overestimation or underestimation is not appropriate for price setting.

3.4-Steps of Unit Cost Estimation

Step 1 Determined the cost data into direct costs and indirect costs and grouped them into cost center, revenue producing costs center and non-revenue producing costs center.

Step 2 Converted foreign currency to local currency for both capital and recurrent costs which are purchased in foreign currency. Exchange rate used in this calculation was $1 equal to 2700riels in 1997. Tables A.1 and A.2 in Appendix A showed all conversions of capital costs and recurrent costs of each division from foreign currency to local currency.

Step 3 Assigned costs which indirect cost distributed into appropriate cost centers.

Due to the director, vice director and some staff of the district hospital responded for two or three different services their salary and bonus necessitated to allocate to cost centers where they shared with. The drug cost also, some part especially injection drugs kept using for inpatient department only and major part, swallow up drugs, arranged for outpatient and inpatient together. In this case the assignment of costs sharing together was taken into consideration by estimation how many percentage used in OPD and IPD. Tables A.3, A.4, A.5 and A.6 in Appendix A showed the assignment of salary and bonus, salary and bonus for each division, assignment of drug cost and detailed drug costs respectively.

Step 4 Calculated annual capital costs for all divisions in the hospital. To calculate the investment costs of an asset the necessary information need to be known are:

-The life of asset

-The domestic rate of inflation

-The interest rate at which the money saved annually is invested in the bank

Because of the building and major medical equipment last for more than one year, they suffer continually wear and tear. As a result of this wear and tear, the lifetime of the equipment is over and it must be renewed. So that to determine this wear and tear happening annually and how much needs to be set annually in order to be ensured the replacement the formulas in section 3.3.4 will be used. The detailed computation of capital costs in Nakleung district hospital showed in Table A.7, Appendix A.

Step 5 Converted all recurrent costs of all divisions in the hospital to their present values (1997 to 1998 values) as follows:

$$P = P_0 (1+i)$$

i is inflation

For example maintenance cost for building was 205000riels in 1997 and inflation rate was 9% so the present value (1998) is 223450riels {(205000 x (1+ 0.09)}.

The detailed computation showed in Table A.2, Appendix A.

Step 6 Added capital and recurrent costs together for all units in the hospital except for pharmacy unit. Because of drug cost is separated already to serve properly OPD and IPD as shown in Table 3.4, page 24.

Step 7 Allocated non-revenue producing costs center (NRPCC), indirect costs, into revenue producing costs center (RPCC) by using step down method (Shephard and others, 1997) on the basis of allocation criteria or allocation bases that showed in Table 3.5, pages 25 and 26.

Step 8 Allocated intermediate costs to both outpatient and inpatient departments using step down method based on allocation bases, Table 3.6 (page 27).

Step 9 Computed cost per visit in OPD by dividing the annual total costs of OPD by the number of visits per year, Table 3.7 (page 28). For the number of visits we estimated it by using the rate of contact by inhabitants per year multiplied by the population coverage at Nakloeung district.

Step 10 Computed cost per patient day in inpatient department by dividing the annual total costs of IPD by the number of patient days per year, Table 3.7 (page 28). For the number of patient we estimated in this study by using rate of hospitalization

Table 3.4: Total Cost (capital+recurrent) of all divisions in the district hospital

Costs center	Capital costs (riel)	Recurrent costs (riel)	Labor costs (riel)	Subtotal (riel)
I-NRPCC				
1-Building	22839498	223450	0	23062948
2-Administration	62028314	12874960	3607682	78510956
3-Cleaning	0	1200417	200560	1400977
4-Guard	230313	262472	841044	1333829
5-Reunion and training	679423	44145	0	723568
6-Kitchen	771703	7891055	100280	8763038
7-Laundry	0	340625	200560	541185
II-RPCC				
A-Intermediate Cost center				
1-Pharmacy	1000954	31065	1641104	2673123
2-Laboratory	2882908	1913139	1282276	6078323
3-Radiology	3321457	2205885	364060	5891402
B-Patient service				
a-Outpatient				
1-Consultation	997645	82698	1503851	2584195
2-Drug		103575795		103575795
b-Inpatient				
1-General medecine	1529590	311987	3083130	4924708
2-Pediatric	1516737	191854	2385094	4093686
3-Emergency and surgery	7173124	612968	5372392	13158484
4-Gyneco-obstetric	2229576	278349	2999462	5507387
5-Drug		95819144		95819144
	107201242	**227860009**	**23581496**	**358642747**

Table 3.5 : Step- down Allocation of the Baseline Scenario from NRPCC to RPCC

No	Division	Direct costs	Allo.basis (square feet)	Building distributed	Total adm.cost (direct+indirect)	Allo. basis (salary)	Administration distributed	Total clea.cost (direct+indirect)	Allo.basis (squ.feet)	Clean.cost distributed
	NRPCC									
1	Building	**23062948**	1856.81							
2	Administration	78510956	330.81	4108904	**82619860**					
3	Cleaning	1400977	7.8	96882		200560	829598	**2327457**		
4	Guard	1333829	46.57	578434		841044	3478902		46.57	71394
5	Reunion and training	723568	48.88	607126		0	0		48.88	74935
	RPCC									
	Intermediate cost center									
1	Pharmacy	2673123	30.75	381938		1641104	6788277		30.75	47141
2	Laboratory	6078323	46.58	578558		1282276	5304018		46.58	71409
3	Radiology	5891402	41.6	516703		364060	1505901		41.6	63774
	Patient services									
	Outpatient									
1	Consultation	2584195	246.28	3058979		1503851	6220543		246.28	377556
	Inpatient									
1	General medecine	4924708	157.5	1956266		3083130	12753088		157.5	241453
2	Pediatric	4093686	157.5	1956266		2385094	9865724		157.5	241453
3	Emergency and surgery	13158484	472.3	5866314		5372392	22222410		472.3	724053
4	Gyneco-obstetric	5507387	222.44	2762869		2999462	12407001		222.44	341009
5	Kitchen	8763038	40	496829		100280	414799		40	61321
6	Laundry	541185	7.8	96882		200560	829598		7.8	11958
Total			**1856.81**	**23062948**		**19973814**	**82619860**		**1518.2**	**2327457**

Distributed the cost of building (ovehead cost) to all cost centers in the district hospital by allocation basis (square feet). Due to building cost does not have any any indirect cost, so we allocated it directly to others cost center. Firsly, we divided it with the total number of square feet in the district hospital then multiplied with the total of square feet in each division to get the cost of building for each division.

Distributed the cost of administration (supporting cost center) to others cost center by allocation basis (salary). Firstly we summed up direct cost of administration with indirect cost (building cost just allocated). Secondly we divided the result from summation by total salary of the personnel of the district hospital excluding salary of the administrators Then multiplied the result just got from division with total salary in each division to get the cost of administration supported for each division.

And we allocated one by one, others cost from non-revenue producing cost center, to final cost center by followed stepdown method that we already explained

Table 3.5 (Continued)

No	Divisions	Direct costs	Building distribute	Administra. distribute	Clean.cos distribute	Total guard (direct+indi	Allo.basis square feet	Guard cost distribute	Tot.reunion direct+indi	Allo.basis # of staff	Reunion cots distribute
NRPCC											
4	Guard	1333829	578434	3478902	71394	**5462558**					
5	Reunion and training	723568	607126	0	74935		48.88	181438	**1587067**		
RPCC											
Intermediate cost center											
1	Pharmacy	2673123	381938	6788277	47141		30.75	114141		5	118438
2	Laboratory	6078323	578558	5304018	71409		46.58	172901		4	94750
3	Radiology	5891402	516703	1505901	63774		41.6	154415		1	23688
Patient services											
	Outpatient										
1	Consultation	2584195	3058979	6220543	377556		246.28	914169		8	189500
	Inpatient										
1	General medecine	4924708	1956266	12753088	241453		157.5	584626		9	213188
2	Pediatric	4093686	1956266	9865724	241453		157.5	584626		7	165813
3	Emergency and sur	13158484	5866314	22222410	724053		472.3	1753135		16	379001
4	Gyneco-obstetric	5507387	2762869	12407001	341009		222.44	825677		10	236876
5	Kitchen	8763038	496829	414799	61321		40	148476		3	71063
6	Laundry	541185	96882	829598	11958		7.8	28953		4	94750
Total							1471.63	**5462558**			**1587066.621**

Allocated the total cots of guard service (supporting cost) to others cost center by square feet (allocation basis).
Allocated the total cots of reunion and training (supporting cost) to others cost center by number of personnel (allocation basis).

Table 3.6 : Step-down Allocation of the Baseline Scenario from IC to FCC

No	Divisions	Direct costs	Building distribute	Adminis. distribute	Cleaning distribute	Guard distribute	Reunion distribute	Subtotal (direct+indir.)	Allo.basis			Pharmacy distribute	Laboratory distribute	Radiology distribute
									# of lab.te	# of x-ray te	Time			
Intermediate costs center														
1	Pharmacy	2673123	381938	6788277	47141	114141	118438	**10123057.7**						
2	Laboratory	6078323	578558	5304018	71409	172901	94750	**12299958.6**						
3	Radiology	5891402	516703	1505901	63774	154415	23688	**8155883.02**						
Patient services														
1	Outpatient								18009	981	1	1687176	9536744	3459110
2	Inpatient								5218	1332	5	8435881	2763215	4696773
									23227	2313	6	**10123058**	**12299959**	**8155883**

1-Summed up direct cost in each division of intermediate cost center with indirect cost (building, administration, cleaning, guard and reunion) and divided by allocation basis. Allocation basis of pharmacy division is time for distribution drugs to outpatient and inpatient department. Because of inpatient department consists of 5 divisions higher than outpatient department so we estimated that the pharmacy services served inpatient department 5 times more than outpatient department.

Allocation basis of laboratory division is number of test. Because of new equipment just supplied at the end of the year1997 but previous time that laboratory could do only simple test and the charge per test was the same price from one test to each others and we used the record 1997 tests.

Allocation basis of rodiology division is also number of test. Because of new equipment just supplied at the end of the year1997 but we used the record 1997 tests and that radiology service could do only radiography test no ultrasonore neither complex tests. So we assumed that the price per each test is similar to.

2-After division by the allocation basis we multiplied the unit cost of pharmacy, laboratory, radiology with time, labo.test and radio.test respectively.

Table 3.7 : Unit Cost of the Baseline Scenario for both Outpatient and In-patient Department

No	Department	Direct cost	Building distribute	Admin. distribute	Clean.cost distribute	Guard distribute	Reunion distribute	Pharmacy distribute	Laboratory distribute	Radiology distribute	Drug cost	Total cost	Volume	Unit cost (Riels)
	Outpatient													
1	Consultation	2584195	3058979	6220543	377556	914169	189500	1687176	9536744	3459110	103575795	**131603768**	60142	**2188**
	Inpatient													
1	General medecine	4924708	1956266	12753088	241453	584626	213188							
2	Pediatric	4093686	1956266	9865724	241453	584626	165813							
3	Emergency and surgery	13158484	5866314	22222410	724053	1753135	379001							
4	Gyneco-obstetric	5507387	2762869	12407001	341009	825677	236876							
5	Kitchen	8763038	496829	414799	61321	148476	71063							
6	Laundry	541185	96882	829598	11958	28953	94750							
	Subtotal costs in IPD	36988488	13135426	58492620	1621248	3925493	1160691	8435881	2763215	4696773	95819144	**227038979**	20111	**11289**

After allocation all of sharing cost such as overhead and supporting costs center (NRPCC) by stepdown method (appendix 6 and 7) to the final
cost center, now we can find out the unit cost for outpatient and inpatient by:
Firstly, we summed up all direct and indirect costs (building,administration,cleaning, training, pharmacy, laboratory and radiology) in each
final cost center (outpatient and inpatient). Secondly we divided the total cost in each final cost center by number of unit.
The number of units in outpatient department is the number of visits and the number of units in inpatient department is the number of patient days.
Here due to the time constraint for data collection that we could not get exactly the number of visits as well as the number of inpatient days, so
we assumed as follows:

   1-For number of visits, by multiplying the rate of contact by inhabitants per year into population coverage at that district.

   2-For number of patient days, 2 steps of multiplication. First step, multiplied the rate for hospitalization by inhabitant into population coverage
   at that district. Second step, multiplied the number of patient into average hospitalization length.

Population coverage at that district in 1996 was 167481 with growth rate in 1997 27 per 1000 of people so
the population coverage in 1997 was: 167481+(167481*26/1000)=171835,506people

   the number of visits=171835.506*0.35=60142.42

   the number of inpatient=171835.506*0.015=2578,338

   The number of patient days=2578,338*7.8=201111.036

by inhabitant per year multiplied by the population coverage at Nakloeung district. Then multiplied the number of patient into average length of stay in that district hospital that is 7.8 days.

Step 11 Allocated separately between capital and recurrent cost to find out how many percentage of unit cost got from capital in recurrent costs, see Tables A.8 and A.9 in Appendix A. Table 3.8, page 30, presented the unit capital cost and recurrent cost separately for OPD and IPD.

Step 12 Calculated the unit cost for OPD and IPD if the volume of activities increases, Table 3.9 (page 31). Because of the committee of the district expected that if Nakloeung district hospital set up the charge appropriately and reasonable the number of visits and in-patients will be increased. In this case we assumed that if the number of visits and in-patient days increase 20% how sensitivity react between the unit cost before and after the volume increases 20%. If the number of visits or the number of patient days increases the unit capital cost will be decreased, because of capital equipment can serve many visits and many patients. On the contrary the unit recurrent cost will be unchanged, because of the recurrent asset such as drugs or seringes can consume only one visit or one patient. When the number of activities increases 20% the number of visits and the number of patient days will be:

Number of visits: 60142 + (60142 x 20%) = 72170 visits

Number of inpatient days: 20111+(20111 x 20%) = 24133 inpatient days

Table 3.8 : Unit Capital Cost and Unit Recurrent Cost of the Baseline Scenario

Capital unit cost for both outpatient and inpatient department

No	Department	Direct costs	Building distribute	Admin. distribute	Clean.cost distribute	Guard distribute	Reunion distribute	Pharmacy distribute	Laboratory distribute	Radiology distribute	Total cost	Volume	Unit cost (Riel)
	Outpatient												
1	Consultation	997645	3029341	4976549	123227	604078	170151	1167849	6142154	2197823	**19408817**	60142	**323**
	Inpatient												
1	General medecine	1529590	1937312	10202705	78806	386318	191420						
2	Pediatric	1516737	1937312	7892761	78806	386318	148882						
3	Emergency and surgery	7173124	5809477	17778337	236317	1158462	340303						
4	Gyneco-obstetric	2229576	2736100	9925829	111299	545603	212689						
5	Kitchen	771703	492016	331847	20014	98112	63807						
6	Laundry	0	95943	663694	3903	19132	85076						
	Subtotal costs in IPD	13220730	13008161	46795172	529144	2593945	1042177	5839243	1779652	2984200	**87792424**	20111	**4365**

Recurrent unit cost (excluding labor cost) for both outpatient and inpatient department

No	Department	Direct costs	Building distribute	Admin. distribute	Clean.cost distribute	Guard distribute	Reunion distribute	Pharmacy distribute	Laboratory distribute	Radiology distribute	Drugs costs	Total cost	Volume	Unit cost (Riel)
	Outpatient													
1	Consultation	82698	29638	972368	215918	142703	14472	191617	2188736	1063989	103575795	**108477933**	60142	**1804**
	Inpatient													
1	General medecine	311987	18954	1993506	138083	91261	16281							
2	Pediatric	191854	18954	1542166	138083	91261	12663							
3	Emergency and surgery	612968	56837	3473709	414074	273666	28944							
4	Gyneco-obstetric	278349	26769	1939407	195017	128889	18090							
5	Kitchen	7891055	4814	64840	35069	23177	5427							
6	Laundry	340625	939	129679	6838	4520	7236							
	Subtotal costs in IPD	9626839	127265	9143307	927165	612774	88642	958084	634173	1444683	95819144	**119382075**	20111	**5936**

For outpatient, cost per visit that we already found in appendix 8 was 2188riels. It was from unit capital cost plus unit recurrent cost. Now unit capital cost is 323riels and unit recurrent cost is 1804riels excluding unit labor cost. So the labor cost per visit is 61riels (2188-(323+1804)).

For inpatiennt, cost per patient day was found already in appendix 8 (11289riels). It was from capital plus recurrent cost per patient day. Now the capital cost per patient day is 4365riels and the recurrent cost per patient day excluding labor cost is 5936riels. So the labor cost per patient day is 988riels (11289-(4365+5936)).

Table 3.9: Unit Cost for OPD and IPD when Demand Increases 20% before Giving Incentive to the Personnel

No	Items cost		Costs (riel)
1	OPD		
	Unit capital cost	19,408,817 : 72,170 =	269
	Unit recurrent cost	108,477,933 : 60,142 =	1,804
	Unit labor cost	2188 - (323+1804) =	61
	Total		**2,134**
2	IPD		
	Unit capital cost	87,792,424 : 24,133 =	3,638
	Unit recurrent cost	119,382,075 : 20,111 =	5,936
	Unit labor cost	11,289 - (4,365+5,936) =	988
	Total		**10,562**

Actually all the physicians and other staffs of the hospital are getting salary from Government that is insufficient to cover their basic need. Most of them work only 4 to 5 hours per day. Some of them used public working hours and public facilities to serve private patient or catch the patient who comes to visit at that district hospital for their own profit without any records and take the money to their pocket, reported by the first vice director of the district hospital.

In order to ameliorate this situation and to run the hospital better than previous time, the committee of the hospital want to supplement salary by giving incentive to the personnel with increasing working hours and controlling their activities to serve the increase number of OPD and IPD patients. There are several public hospitals in the city already gave incentive to their personnel as well as the laboratory routine in the National Institute of Public Health where is under supported by German Health project. That laboratory composes of many levels of personnel like Nakloeung district hospital, doctor, medical assistant, lab technician, nurse, ancillary, cleaner etc. By getting this experience the committee of that district hospital want to supplement incentive the same amount as that laboratory provided to their staff. Table B.1 in Appendix B showed the incentive for each level of personnel got each month at the routine laboratory in National Institute of Public Health.

Step13 Computed the new cost per visit for OPD and new cost per patient day for IPD after adding incentive by changing the parameter, salary and bonus including incentive, to get the new scenario as sensitivity analysis.

-Tables A.10 and A.11 in Appendix A showed the reassignment of labor costs and new salary for each division respectively.

-Table A.12, Appendix A, showed the new recurrent costs in the district hospital.

-Table A.13, Appendix A presented the new total cost in the district hospital

-Table A.14, Appendix A showed the new scenario of step down allocation from NRPCC to RPCC.

-Table A.15 showed the new scenario of step down allocation from intermediate cost center to final cost center.

-Table 3.10, next page, showed the new scenario of computation unit cost for both OPD and IPD.

Table 3.10 : Unit Cost for both Outpatient and In-patient Department after Adding Incentive to the Personnel

No	Department	Direct costs	Building distribute	Admin. distribute	Cleaning distribute	Guard distribute	Reunion distribute	Pharmacy distribute	Laboratory distribute	Radiology distribute	Drug cost	Total cost	Volume	Unit cost (Riels)
	Outpatient													
1	Consultation	6298915	3058979	7425974	906213	1026329	204686	2280456	11362012	3758936	103575794	**139898294**	60142	**2326**
	Inpatient													
1	General medecine	10836868	1956266	12800207	579538	656353	230273							
2	Pediatric	8697846	1956266	9945638	579538	656353	179101							
3	Emergency and surgery	24211084	5866314	23372598	1737878	1968228	409373							
4	Gyneco-obstetric	11131787	2762869	12271668	818492	926980	255858							
5	Kitchen	9547838	496829	1259460	147184	166693	76758							
6	Laundry	2110785	96882	2518920	28701	32505	102343							
	Subtotal costs in IPD	66101430	13135426	62168492	3891331	4407112.3	1253705	11402279	3292075	5103876	95819143.7	**266574870**	20111	**13255**

Step 14 Recalculated the unit cost per visit for OPD and unit cost per patient day for IPD after adding incentive to the personnel when the volume of activities increases 20%. The approach of recalculation presented in Table 3.11.

Table 3.11: Unit Cost for OPD and IPD when Demand Increases 20% after Giving Incentive to the Personnel

No	Items cost		Costs (riel)
1	OPD		
	Unit capital cost	19,408,817 : 72,170 =	269
	Unit recurrent cost	108,477,933 : 60,142 =	1,804
	Unit labor cost	2,326 - (323 + 1,804) =	199
	Total		**2,272**
2	IPD		
	Unit capital cost	87,792,424 : 24,133 =	3,638
	Unit recurrent cost	119,382,075 : 20,111 =	5,936
	Unit labor cost	13,255 - (4,365 +5,936)	2,954
	Total		**12,528**

Step15 Made comparison between the unit cost for OPD and IPD before giving incentive to the personnel to the unit cost of new scenarios in order to know what is the variation among them.

Assume the unit cost before giving incentive to the personnel to be a baseline scenario in order to compare with the 3 new unit cost of 3 new scenarios.

-The first scenario is the unit cost for OPD and IPD when the volume of activities increases 20% before giving incentive to the personnel.

-The second scenario is the unit cost for OPD and IPD after giving incentive to the personnel.

-The third is the unit cost for OPD and IPD when the volume of activities increases 20% after giving incentive to the personnel.

Table 3.12 showed the variation of unit cost for both OPD and IPD before giving incentive to the personnel and before demand increases to the unit cost of the new 3 scenarios.

Table 3.12: Sensitivity Analysis, Variance among Scenarios

No	Scenarios	Unit cost (riel)	Variation (riel)	Variation ($)
1	OPD			
	Before giving incentive	2,188		
1	Volume increases 20% without incentive	2,134	2,134-2,188=-54	0.02
2	After giving incentive	2,326	2,326-2188=138	0.05
3	Volume increases 20% with incentive	2,272	2272-2188=84	0.03
2	IPD			
	Before giving incentive	11,289		
1	Volume increases 20% without incentive	10,562	10,562-11,289=-727	0.26
2	After giving incentive	13,255	13,255-11,289=1966	0.73
3	Volume increases 20% with incentive	12,528	12528-11289=1239	0.46