CHAPTER 4

RESEARCH METHODOLOGY

4.1 Study Design

The study is a retrospective descriptive study.

4.2 Data Collection

Data were collected from the Faculty of Medicine departments and the King Chulalongkorn Hospital as shown in table 4.1. There are 2 types of data to be collected:

Primary data: Come from the observation and questionnaires interview the medical doctors, and for the contribution of their work to the teaching of medical students.

Secondary data: This type of data was collected from several units concerned : Faculty-the Secretariat Office, Division of Finance, Division of Logistic, Division of Policy and Planning, Division of Building and Transport and King Chulalongkorn Hospital - Hospital Administration Office.

The data and sources of collection are summarized in table 4.1 .

Table 4.1 List of data and sources required in this study

Data	Source
<u>Faculty</u> Labor (Fringe benefit) Labor Cost (Salary) Material Cost Capital Cost	 Finance Division Personnel Division Logistic Division Building Division
<u>Hospital</u> Labor Cost Material Cost Capital Cost	 Hospital Administration Office Hospital Administration Office Hospital Administration Office

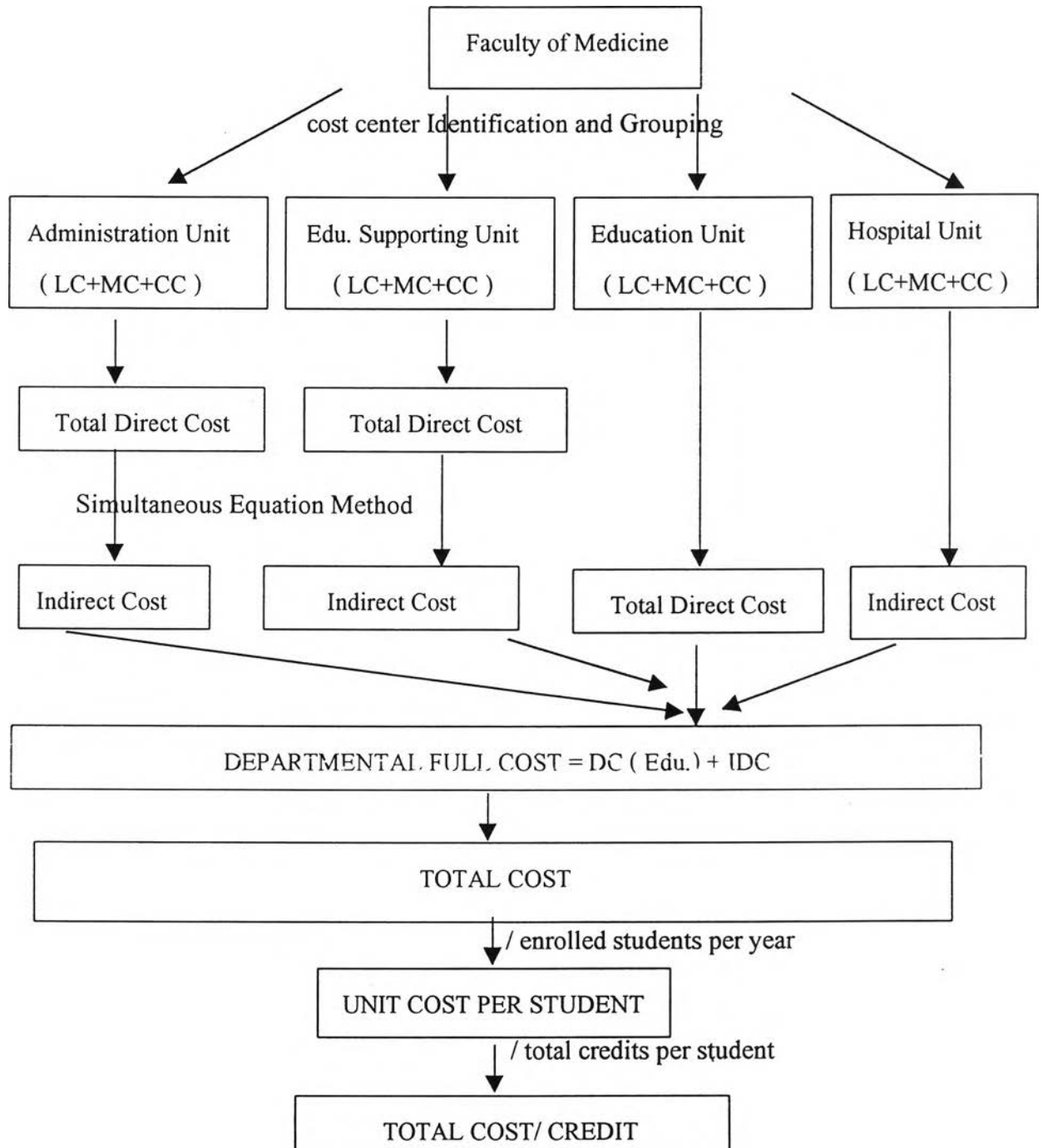Figure 4.1 Student tracks and data collection diagram
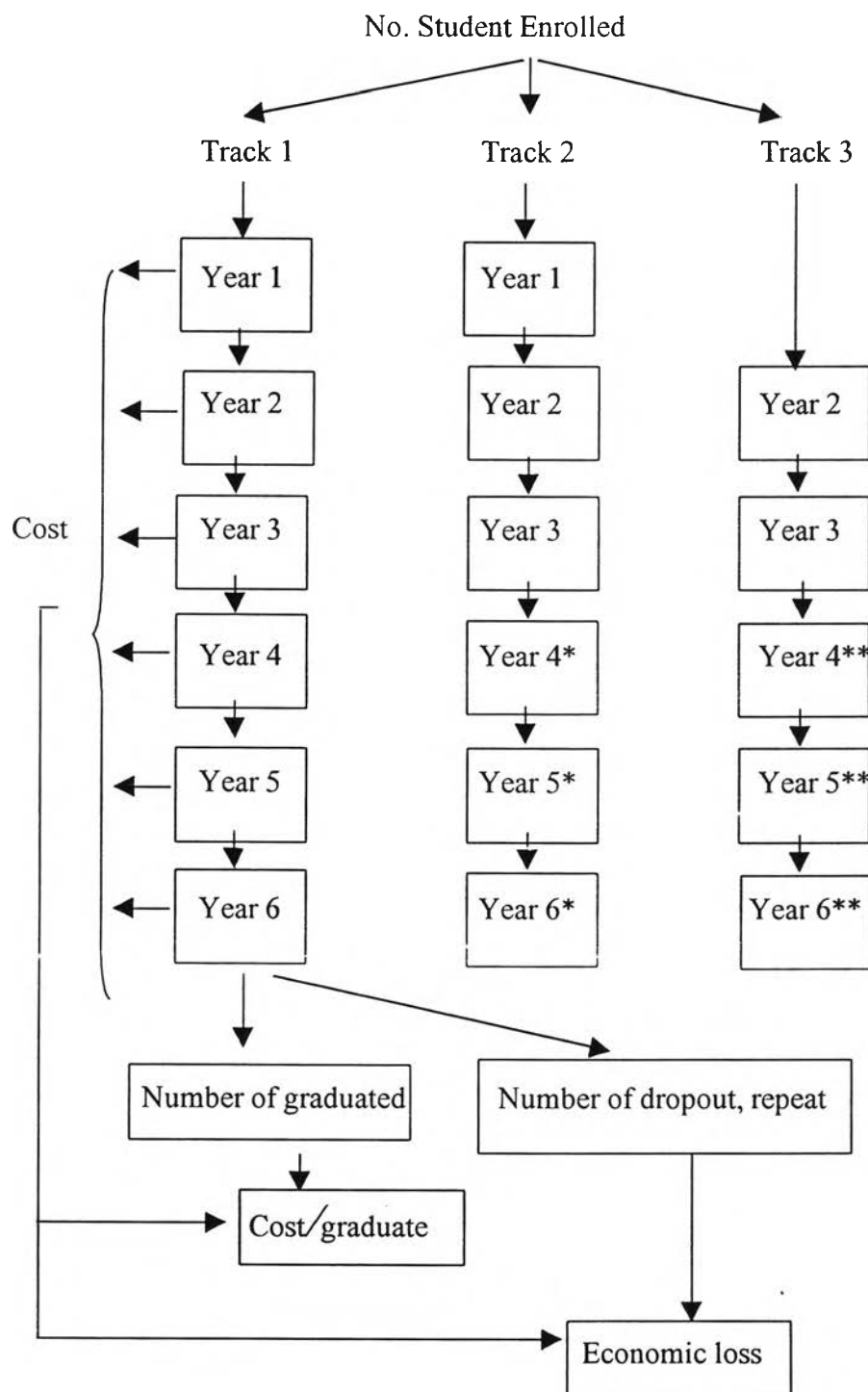
*   Study at Cholburi Hospital and Jantaburi Hospital

**   Study at Bhumiphon Hospital

Conceptual Frame Work

Figure 4.2 Conceptual FrameWork


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                        ┌─────────────────────┐
                        │  Faculty of Medicine │
                        └─────────────────────┘
              cost center Identification and Grouping

┌──────────────────┐ ┌──────────────────┐ ┌──────────────────┐ ┌──────────────────┐
│ Administration   │ │ Edu. Supporting  │ │ Education Unit   │ │ Hospital Unit    │
│ Unit             │ │ Unit             │ │                  │ │                  │
│ ( LC+MC+CC )     │ │ ( LC+MC+CC )     │ │ ( LC+MC+CC )     │ │ ( LC+MC+CC )     │
└──────────────────┘ └──────────────────┘ └──────────────────┘ └──────────────────┘

┌──────────────────┐ ┌──────────────────┐
│ Total Direct Cost│ │ Total Direct Cost│
└──────────────────┘ └──────────────────┘

   Simultaneous Equation Method

┌──────────────┐ ┌──────────────┐ ┌──────────────────┐ ┌──────────────┐
│ Indirect Cost│ │ Indirect Cost│ │ Total Direct Cost│ │ Indirect Cost│
└──────────────┘ └──────────────┘ └──────────────────┘ └──────────────┘

┌──────────────────────────────────────────────────────────────────┐
│       DEPARTMENTAL FULL COST = DC ( Edu.) + IDC                    │
└──────────────────────────────────────────────────────────────────┘

┌──────────────────────────────────────────────────────────────────┐
│                          TOTAL COST                               │
└──────────────────────────────────────────────────────────────────┘
                / enrolled students per year

┌──────────────────────────────┐
│    UNIT COST PER STUDENT      │
└──────────────────────────────┘
                / total credits per student

┌──────────────────────────────┐
│      TOTAL COST/ CREDIT       │
└──────────────────────────────┘
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LC = Labor Cost   DC = Direct Cost   CC = Capital Cost

MC = Material Cost   IDC = Indirect Cost

4.3 Population and Sample

The population: medical schools Faculty of Medicine, Chulalongkorn University, was purposively selected.

4.4 Analysis of cost of education, there were 4 steps as follow:

- Cost center identification and grouping

- Direct cost determination of each cost center

- Indirect cost allocation

- Unit cost calculation.

The details of each step were:

1. Cost center identification and grouping to be 4 groups

- Administration unit

- Education supporting unit

- Education unit

- Curative unit

2. Direct cost determination of each cost center

The total cost was the summation of the labor cost, material cost and capital cost.

- labor cost: salary, overtime allowance, medical allowance etc.

- material cost: the material each cost center used, electricity water telephone expense and the maintenance cost.

- capital cost: the equipment and building cost, using the depreciation formula (Blaug, M.1971) in calculation.

Cost analysis

To estimate the cost of using a building and equipment, the formulas after Mark Blaug (1971) was applied :

$$R = \frac{C \times r}{(1+r)^t - 1} + C \times r$$

where   R :   Cost per year

C :   Building Cost on the day it was built

r :   Interest rate, here we use 5% as the fixed interest

rate in the year 2000

t :   Useful life, the equipment was 5 years

The building cost for this study, because of the depreciation and cost on the day it was built could not be obtained (for most building was unit more than 30 years), so I used the area each cost center used to calculate the capital cost. Using the rent rate applied by the Asset Mangement Office, Chulalongkorn University for Samyan Commercial Building at a rate of 1,200 Baht/ Squaremeter/year without calculation the land value. While the capital cost of the King Chulalongkorn Hospital the area rent were not included.

Allocation criteria

The cost allocation criteria for the administration and education supporting units that will be as table 3.2 which will be used in the simultaneous equation method for cost allocation to all the education centers-the departments.

Table 4.2   Allocation basis used in the study of Faculty cost

Cost Center	Criteria	Reason
Secertariat office	Personnel of each cost center	Cost allocate to each cost center is related to the number of personnel
Division of Adiministration	Personnel of each cost center	Cost allocate to each cost center is related to the number of personnel
Division of Building & Transport	Area used of each cost center	Cost allocation to each cost center is related to the area used
Division of Finance	Personnel of each cost Center	Cost allocate to each cost center is related to the number of personnel
Division of Logistic	Equipment and material cost of each cost center	Cost allocation to each cost center is related to the material and equipment they used
Division of Policy & Planning	Personnel of each cost center	Cost allocate to each cost center is related to the number of personnel
Division of cademic & Research	Personnel of each cost center	Cost allocate to each cost center is related to the number of personnel
Library	Personnel of each cost center	Cost allocate to each cost center is related to the number of personnel
Division of Education Service	Personnel of each cost center	Cost allocate to each cost center is related to the number of personnel
Computer Unit	Personnel of each cost center	Cost allocate to each cost center is related to the number of personnel

Simultaneous Equation Method

This study used this method in calculating allocated cost from Administration and Education Supporting Unit to the Education unit, it is regarded as the most accurate cost allocation method.

The steps are as :

First step : Create the full cost equation of transient cost center (details of each cost center and apportation coefficient are in appendix I) .

$$TC1 = a010TC1 + a0201TC2 - a0301TC3 + a0401TC4 \ldots\ldots\ldots + a2901TC29 + a3001TC30 + a3101TC31 + C1$$

$$TC2 = a0102TC1 + a0202TC2 + a0302TC3 + ac402TC4 \ldots\ldots\ldots + a2902TC29 + a3001TC30 + a3102\ TC31 + C2$$

$$TC30 = a0130TC1 + a0230TC2 + a0330TC3 + a0430TC4 \ldots\ldots\ldots + a2930TC29 + a3030TC30 + a3031TC31 + C30$$

$$TC31 = a0131TC1 + a0231TC2 + a0331TC3 + a0431TC4 \ldots\ldots\ldots + a2931TC31 + a3031TC31 + a03131TC31 + C31$$

TC1:the indirect cost allocated to the cost center 1

TC2:the indirect cost allocated to the cost center 2

TC3:the indirect cost allocated to the cost center 3

TC4:the indirect cost allocated to the cost center 4

C1: the direct cost of the cost center 1

C2: the direct cost of the cost center 2

C3: the direct cost of the cost center 3

C4: the direct cost of the cost center 4

Second step : Arrange equation by putting the number on the right hand side.

- a0101) TC1 – a0201TC2 – a0301TC3 – a0401TC4 .... - a2901TC29 – a3001TC30 - a3101TC31 = C1

- a0102TC1 + (1-a0202)TC2 – a0302TC3 – 90402TC4 .... – a2901TC29 – a3001TC30 – a3102TC31 = C2

-a0130TC1 – a0230TC2 – a0330TC3 – a0430TC4 .... – a2930TC29 + (1- a3030TC30) – a3030TC31 = C30

-a0131TC1 – a0231TC2 – a0331TC3 – a04031TC4 .... - a2931TC31 – a3031TC31 + (1 – a3131)TC31 = c31

3rd step : Adjust an equation to be matrix : [x] [A] = [B]

(details of apportation coefficient matrix is in appendix I)

$$[X] = \begin{bmatrix} Tc1 \\ Tc2 \\ Tc3 \\ \text{``} \\ \text{``} \\ Tc31 \end{bmatrix}$$

[A] =

0.983607	-0.01639	-0.0037	-0.01639		0	0	0	0	0
-0.0255	0.974499	-0.0037	-0.0255		0	0	0	0	0
-0.01275	-0.01275	0.996296	-0.01275		0	0	0	0	0
-0.02732	-0.02732	-0.00963	-0.02732		0	0	1	0	0
-0.03461	-0.03461	-0.02002	-0.03461		0	0	0	1	0
-0.02914	-0.02914	-0.01686	-0.02914		0	0	0	0	1

$$[B] = \begin{bmatrix} C1 \\ C2 \\ C3 \\ " \\ " \\ C31 \end{bmatrix}$$

4th step : Inverse matrix : $[x] = [A]^{-1} [B]$

(details of apportation coefficient inverse matrix is in appendix I)

$$[X] = \begin{bmatrix} Tc1 \\ Tc2 \\ Tc3 \\ " \\ " \\ Tc31 \end{bmatrix}$$

$[A]^{-1} =$

1.019226	0.019226	0.005194	....	0	0	0	0	0	0
0.029877	1.029877	0.006012	....	0	0	0	0	0	0
0.014966	0.014966	1.004867	....	0	0	0	0	0	0
⋮	⋮	⋮		⋮	⋮	⋮	⋮	⋮	⋮
0.032164	0.032164	0.012155	....	0	0	0	1	0	0
0.040866	0.040866	0.02326	....	0	0	0	0	1	0
0.034403	0.034403	0.019581	....	0	0	0	0	0	1

$$[B] = \begin{bmatrix} C1 \\ C2 \\ C3 \\ \text{``} \\ \text{``} \\ C31 \end{bmatrix}$$

5th step : Solve an equation by using spreadsheet program to find [X] to be indirect cost allocated to related Departments (Ci).

4.5 Data Analysis

Cost Calculation, Determination

Hospital cost

Hospital cost was allocated to each Department with related inpatient and outpatient activities (appendix III). We used 10% to allocate its cost to related Department. which is calculated from teaching proportion of the teaching staffs, fellows and residents in form A400 (appendix III).

The total Hospital cost was calculated by :

$$TCh = \sum_{j=1}^{n} [Cwj \times 0.1]$$

(j = inpatient and outpatient ward that medical student attended while study in Department j as listed in appendix III)

Where TCh : total cost of Hospital cost

Cwj : total cost of inpatient and outpatient ward j

The total cost of Department

The total cost of each Department was calculated by :

$$TCdj = Cd + Cwj \times 0.1$$

Where TCdj : total cost of Department j

Cd : total faculty cost of Department j

Cwj : total cost of inpatient and outpatient ward j

The total cost of medical student

The total cost of medical student were calculated by :

$$TCms = TCy1 + \sum_{j=1}^{n} TCd$$

Where TCms : Total cost of producing medical student

TCy1 : Total cost of producing medical student year 1

TCdj : Total cost of Department j

TCs = TCms / Average number of student enrolled per year

Where TCs : Unit cost of a medical student

TCsch = TCs /Cr

Where TCsch : cost per student credit hour

Cr : total credits of one medical student in 6 years course

The cost of producing premedicine students (year 1) we used the data from previous study (Pinijasak S,1991). She estimated the cost of producing an engineer for the first year in Chulalongkorn University, which the curriculum also studied in the

Faculty of Science, Political Science, Language Institute, Arts the cost/SCH was 843 Baht and adjusted with inflation rate 30% that was 1,096 Baht (data from CPI, Department of Domestic Commerce, Ministry of Commerce).

We calculated the cost by multiplying credits that student studied in year 1 by the 1,096 Baht to be the total cost of year 1.

Cost of producing student in year 2 to year 6

Cost of producing student in year 2 to year 6 the cost were collected from the Departments which related to teaching curricular and overhead cost centers.

The total cost of medical student year 2 to year 6 were calculated by:

$$TCyi = \sum_{i=2}^{n} [TCdj \times Cij/Nj]$$

$$(i=2,3,4,5,6)$$

Where TCyi : total cost of producing student year i

TCdj : total cost of Department j teaching student year i

Cij : total credits of Department j teaching student year i

Nj : total credits of Department j teaching student year 2-6

Economic loss from the drop out or delayed

The analysis of cost of production as mentioned above is the cost calculated without adjusting the economic loss from the drop out or delayed of students. To adjust this factor we have to add the drop out ratio and the average of study years to assigned study year ratio to the formulas.

To estimate the cost per graduate with the calculation of the dropout and repeat medical student, we used formula after Mark Blaud as follow:

$$TCg \quad = \quad TCs \times [Y/N] \times [1/(1-d)]$$

Where TCs : Unit cost of medical student

TCg : Unit cost of medical graduate

Y : Number of average study years

N : Number of assigned study year (6 years)

d : Proportion of drop out students

Indirect Cost of Student (opportunity cost)

The indirect cost of students is the opportunity cost or income foregone from going study in the university. This indirect cost was calculated by using data from Report of the labor force survey whole Kingdom round 3: August 2000 (National Statistical Office and Office of the Prime Minister 2001).

The income that one should gain was calculated by assuming he go to work in his own situation that is male or female, aged 19 – 25, Bangkok Metropolis, North, Southern, Central or Northeastern Region for home, complete secondary school. The distribution to each sector is as the average. And adjusted by the rate of unemployed then should be the opportunity cost.

To estimate the indirect cost of students we used formula as follow:

$$TCopp = \sum_{i=1}^{n} [Inci \times [1-U]]$$

(i = medical student number 1 to number 907)

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TCopp : Indirect cost or opportunity cost or income foregone of medical students

Inci : Average income calculated from student age, home address, complete secondary school of medical student i (using data from Report of the labor force survey whole Kingdom Round 3 : August 2000, National Statistical Office and Office of the Prince Minister)

U : Unemployment rate

Sensitivity Analysis

We used the different type of labor cost when increased by 70% to estimate the unit cost, in case of the autonomous university that the labor cost have to increase.

From the preliminary discussion of the autonomous university, the change in salary may be increased by 70%.

The increase of salary in the autonomous universities. This is because of the employment contrack, which will be signed in a short term (nowadays the civil servants are permanent contrack), the efficiency and productivity improvement and appraisal, the decrease in fringe benefits.

The cost that was difficult to estimate, the capital cost : building and land which we use the area used by each cost center, a rent rate was applied (using the rent rate of Asset Management Office Chulalongkorn University for Samyan Commercial Building as reference), while the land was not accounted. This could cause the estimation to be under estimate. If we should correct this underestimation, we may include the land value in the capital cost.