

# **CHAPTER III**

## **RESEARCH METHODOLOGY**

### **Research Design**

This research is a descriptive study to calculate the unit cost of out-patient and in-patient services of Maharaj Nakhon Si Thammarat hospital. It is a prospective study in the fiscal year 2003 between July 1 – December 31, 2003.

### **Conceptual Framework**

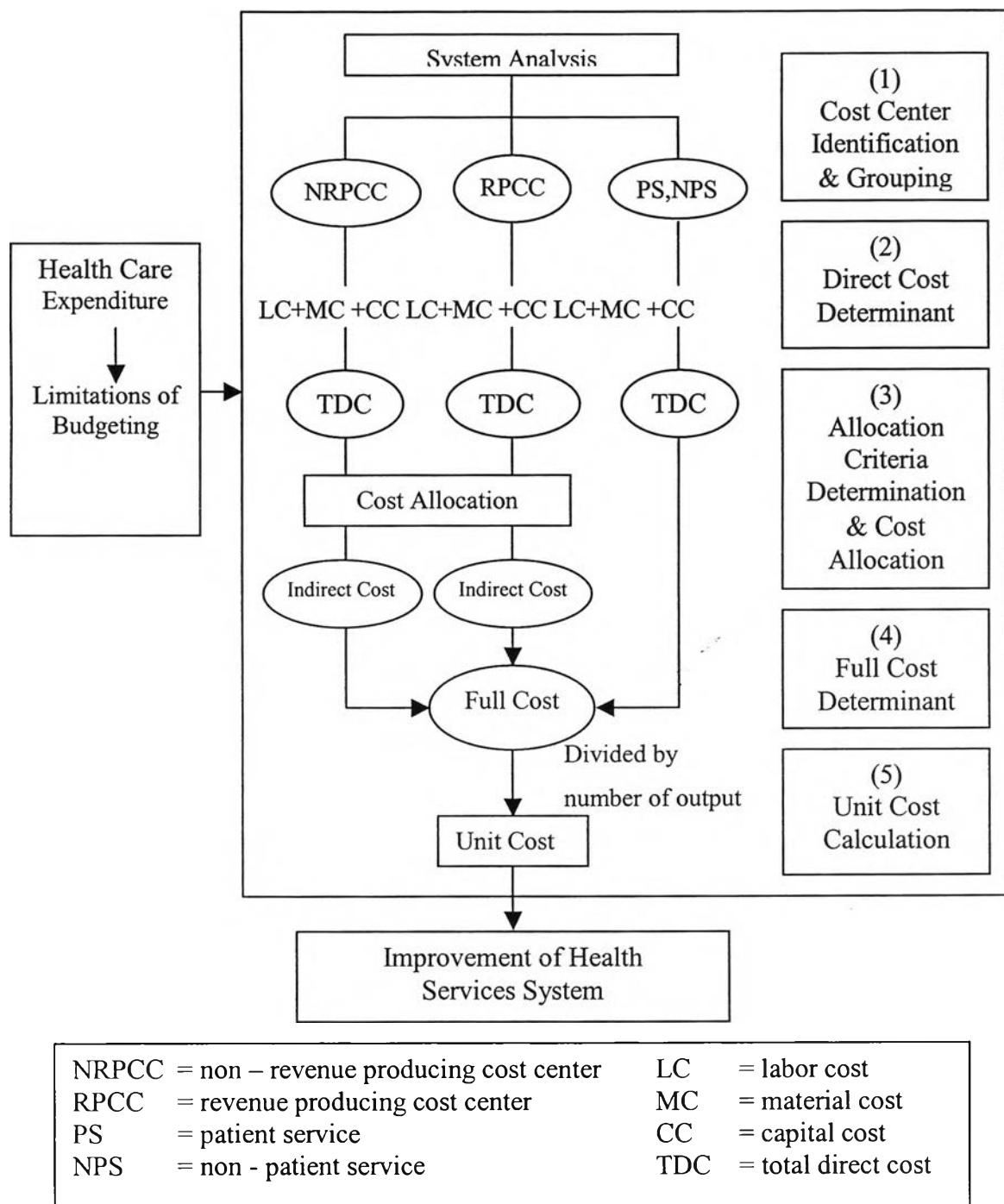
The cost and unit cost of out-patient and in-patient services of Maharaj Nakhon Si Thammarat hospital in this research has been analyzed from the health service provider perspective only. The researcher has determined the study process as following.

Study the consequence/effect of the health system reform and the change in new budget allocation method, which effect to the hospital's operation. Analyze the unit cost of patient service as following.

1. Study and analyze the hospital system structure and budgetary and non-budgetary management structure.
2. Identify each department as a cost center by its function and actual association/relation in service providing and supporting which classified into 4 different cost center group;

- 2.1 Non - Revenue Producing Cost Center (NRPCC)
  - 2.2 Revenue Producing Cost Center (RPCC)
  - 2.3 Patient Service Area (PS)
  - 2.4 Non – Patient Service Area (NPS)
3. Study the total direct cost which consisting of labor cost, material cost and capital cost of each cost center
  4. Allocate the cost of non-revenue producing cost center (NRPCC) and revenue producing cost center (RPCC) which considered as a transient cost center (TCCs) to the absorbing cost center (ACCs). The absorbing cost centers include the patient service and non-patient service area. This allocated cost is called the indirect cost of absorbing cost center. In this study, the unit cost will be calculated by using the simultaneous equation method.
  5. Calculate the unit cost of Maharaj Nakhon Si Thammarat hospital to analyze the result and measure relative efficiencies of health service amongst the different hospitals and to guide policy and efficient management of limited hospital resources for best quality health care services to the hospital administrator.

From the above mentioned process, the conceptual framework can be illustrated as the figure below



**Figure 10:** Conceptual Framework of Unit Cost of Out – Patient and In – Patient Services of Maharaj Nakhon Si Thammarat Hospital

## **Research Methodology**

### **Population**

The target population in this research comprises of labor cost, material cost, and capital cost of all departments, which related to the out-patient and in-patient services at Maharaj Nakhon Si Thammarat hospital. In accordance with the agreed determination criteria, all departments had been determined into 82 cost centers in total which consisting of 18 non-revenue producing cost centers, 15 revenue producing cost centers, 46 patient service areas which refer to out-patient and in-patient service, and 3 non-patient service areas.

### **Data Collecting Instruments**

Data has been collected through two sets of data collecting forms that designed by the researcher. The data collecting forms are as follow:

1. Cost Data Collecting form
  - 1.1 Labor Cost Form
  - 1.2 Time Spent of Personnel who work in several functions Form
  - 1.3 Material Cost Form
  - 1.4 Utility Expenditure Form
  - 1.5 Depreciation Cost of Equipment Survey Form
  - 1.6 Depreciation Cost of Building and Facility Survey Form
2. Data Collecting of Output of Out - Patient and In - Patient

### **Instrument Validity**

The content validity has been verified by

1. Explaining the data collecting forms, which designed by the researcher to the data collector to assure that the data collected in response to what the researcher expected. Revising the form accordingly in order to get the data properly.
2. Using the revised form to collect data and see if the data gathering is corresponded to what is expected.

### **Data Collection**

#### 1. Preparation Stage

- 1.1 Submit the requisition for the approval to the Director of Maharaj Nakhon Si Thammarat hospital to conduct the research
- 1.2 Incorporate with the Cost Analysis Committee to explain the research objectives to all departments at Maharaj Nakhon Si Thammarat hospital and seek for their cooperation in providing and recording data in the survey form.
- 1.3 Analyze the hospital health system in respect the organization structure, patient service process and study the major disbursement cost center such as material supply and pharmacy in order to identify and group cost centers by their functions and service which relating to each other. The cost centers can be classified into four distinct groups as follow;

- 1) Cost center group which cost center code begins with “A” is Non-Revenue Producing Cost Center. The cost center in this group normally provide administrative work and support to other cost centers without imposing any charge directly to the patient. This group consists of 18 cost centers. Examples include General Administration, Nursing Administration Office, Health System Development, Finance, Accounting, Material and Maintenance.
- 2) Cost center group which cost center code begins with “B” is Revenue Producing Cost Center. It refers to the group of cost center, which provide various kinds of medical services, which comprise disease diagnosis and treatment. This service will be charged directly to the patient. This group consists of 15 units, for instance, Radiology, Laboratory, Pharmacy, Operating Theater and Delivery Room.
- 3) Cost center group, which the cost center code begins with “C” is Patient Service Area, which refers to out -patient Service particularly. This group consists of 21 cost centers altogether. In addition, cost center group, which the code begins with “D” is also Patient Service Area but it refers to In-Patient Service. This group comprises 25 cost centers.
- 4) Cost center group which the cost center code begins with “E” is Non Patient Service Area. This group will provide the healthcare service such as Health Education and Human Resource Development activity. This group consists of 3 units, which are Social Medical Unit, Health Education & Public Relation Unit and Medical Education Center.

**Table 2:** Cost Center of Maharaj Nakhon Si Thammarat Hospital

<b>Code</b>	<b>Cost Center</b>	<b>Code</b>	<b>Cost Center</b>
A01	General Administration	B01	Out-patient Pharmacy
A02	Budget	B02	In-patient Pharmacy
A03	Finance	B03	Oxygen Supply Center
A04	Accounting	B04	Laboratory and Pathology
A05	Revenue Collection	B05	Blood Bank
A06	Nursing Administration Office	B06	Radiology
A07	Health System Development Unit, Library	B07	Physiotherapy
A08	Quality Assurance Center	B08	Activity Therapy
A09	Medical Registry and Statistics	B09	Maintenance and Design Equipment for Disable
A10	Computer Maintenance Center	B10	Alternative Medical
A11	Maintenance Center	B11	Anaesthetic
A12	Medical Equipment Maintenance Center	B12	Operating Theatre (Large/Small)
A13	Office of OPD Service	B13	Delivery Room
A14	Laundry and Seamstress	B14	Cardiology
A15	Central Supply & Facility and IC Office	B15	Electrocardiogram and Electroencephalogram Unit
A16	Dietetics		
A17	Supply and Equipment		
A18	Procurement and Pharmaceutical product		

**Table 2 : (Cont.) Cost Center of Maharaj Nakhon Si Thammarat Hospital**

<b>Code</b>	<b>Cost Center</b>	<b>Code</b>	<b>Cost Center</b>
C01	OPD- Antenatal Care	D01	Postnatal Ward
C02	OPD- Gynecology and Family Planning	D02	Gynecology Ward
C03	OPD- Surgery	D03	Male Surgery Ward 1
C04	OPD- Urological Surgery	D04	Male Surgery Ward No. 2
C05	OPD -Orthopedics	D05	Female Surgery Ward
C06	OPD- Medical	D06	Male Orthopedic Ward
C07	OPD- Pediatrics	D07	Female Orthopedic Ward
C08	OPD- Ophthalmology	D08	Medical Ward No.1 (Male & Female)
C09	OPD- Otorhinolaryngology	D09	Medical Ward No. 2
C10	OPD- Specialty Medical Clinic and Psychiatric	D10	Medical ward No. 3
C11	OPD- Social Security	D11	Medical ward No. 4 (Private Section)
C12	OPD- Part time Clinic	D12	Pediatrics Ward No.1
C13	OPD- Part time Clinic (Dentistry)	D13	Pediatrics Ward No. 2
C14	Accidental and Emergency, Forensic medicine and Cradle Service	D14	Newborn Ward No. 1
C15	Treatment Room- Injection	D15	Newborn Ward No. 2
C16	Hemodialysis	D16	Eye Ear Nose Throat Ward
C17	Dentistry	D17	Sick Monk Ward
C18	Children Health Clinic	D18	ICU Ward No.1
C19	Annual Medical Check-Up Clinic	D19	ICU Ward No. 2
C20	Counseling Service Room	D20	Private Section Ward : Limpichart-Thungcar Habor
C21	OPD- Rehabilitative Medical	D21	Private Section Ward - Children
		D22	Private Section Ward No. 2
E01	Social Medical Unit	D23	Private Section Ward No. 4
E02	Health Education Unit	D24	Private Section Ward No.5
E03	Medical Education Center	D25	Private Section Ward : Chalerm Phrabaramree (2nd Fl.)



## 2. Operating Stage

The data collecting process can be shown as below.

- 2.1 Gathering the total direct cost (TDC) of each cost center, which consists of Labor Cost (LC), Material Cost and Capital Cost (CC) through the designed survey form.

### **Labor Cost**

Labor Cost consists of Salary, Position Allowance, Medical Fee, Child Relief Allowance, Housing Allowance and Seminar/ Meeting Allowance and etc. To calculate the labor cost of Maharaj Nakhon Si Thammarat hospital, the researcher firstly consult with the concerning staffs in all involving cost centers to make the list of personnel and then check the correctness with human resource department. After that, gather the data about salary, position allowance, overtime/shift allowance and etc from the Finance and Accounting department through the Labor Cost Data Collection Form. In case any personnel are absent from work due to the special assignment, further study or maternity leave, their labor cost will not be included in the cost calculation, as they have no contribution to the production of the hospital between the study period. In contrast, labor cost of the personnel who are assigned to work temporarily on hospital project or new hired staffs will be used in the cost calculation. Nevertheless, the cost data that can be gathered as per cost center, such as overtime allowance, will not be allocated or broken down per head. For the personnel who work in several cost centers, such as, physician, nurse or other hospital personnel, their labor cost will be allocated according to the actual working hour they work in each cost center.

### **Material Cost**

According to the cost data from the main disbursement units in the hospital, material cost can be classified into three primary groups, which consist of

- 1) Material that can be requisitioned from Material & Maintenance department. Examples of material are office supply, construction equipment, maintenance material, science and medical equipment and pharmaceutical products.
- 2) Drug and non-drug products that can be requisitioned from Pharmacy Department. This also includes the medical and science equipment that used in Radiology and Laboratory.
- 3) Utility cost of the hospital consists of electricity, water supply, postage charge, phone and other telecommunication cost.

### **Capital Cost**

Capital cost of the hospital consists of the annual depreciation cost of the building and equipment. This study used "Straight Line Method" to calculate the depreciation according to the equipment total life. The depreciation cost criteria used basing on the Central Account Department. The total life of the building is taken at 20 years old. The data of equipment's depreciation cost gathered through recording the essential data in the equipment survey form comprising the equipment name, date purchased, cost center and total life.

In case of the data collection of the building depreciation cost, it will be conducted through the survey basing on the Hospital Master Plan. All buildings in the

hospital will be surveyed and the information concerning the building name, price, first year utilization will be gathered. Then the area usage of each cost center will be calculated accordingly. The common usage area, for instance, pathway, corridor, rest area and toilet, will not be included in the analysis since they get distributed proportionally to the actual usage areas automatically.

In case the area is utilized by several cost centers, the proportion of time spent by each cost center will be taken into consideration. Furthermore, for some cost centers that have operation unit in several buildings, the depreciation cost of all the buildings will be included.

2.2 Allocation Criteria Determining: allocation criteria of the Non-Revenue Producing Cost Center (NRPCC) and Revenue Producing Cost Center (RPCC) is designed to allocate the cost from one cost center to other cost centers. To find the unit cost, it needs to allocate all cost of transient cost centers to the absorbing cost center. This study selects to use the following criteria.

**Table 3: Cost Allocation Criteria**

<b>Code</b>	<b>Cost Center</b>	<b>Cost Allocation Criteria</b>	<b>Detail</b>
A 01	General Administration	Number of Personnel	Cost center with greater number of personnel will receive more allocation
A 02	Budget	Number of Personnel	Cost center with greater number of personnel will receive more allocation
A 03	Finance	Number of Personnel	Cost center with greater number of personnel will receive more allocation
A 04	Accounting	Number of Personnel	Cost center with greater number of personnel will receive more allocation
A 05	Revenue Collection	Number of Patient	Cost center with greater number of patients will receive more allocation
A 06	Nursing Administration Office	Number of Personnel in Nursing Administration Office service	Cost center with higher number of personnel will receive more allocation
A 07	Health System Development Unit, Library	Number of Personnel	Service must be provided to all personnel
A 08	Quality Assurance Center	Number of Personnel	Cost center with greater number of personnel will receive more allocation
A 09	Medical Registry and Statistics	Number of Patient, Number of Out-patient Visit, Number of In-patient multiply by 2	Support both In-patient and Out-patient, but In-patient will receive twice as much attention
A 10	Computer Maintenance Center	Number of computer	Cost center with more computers will need more service
A 11	Maintenance Center	Number of repair	Cost center with more maintenance request, will need more service

**Table 3: (Cont.) Cost Allocation Criteria**

<b>Code</b>	<b>Cost Center</b>	<b>Cost Allocation Criteria</b>	<b>Detail</b>
A 12	Medical Equipment Maintenance Center	Maintenance expense	Cost center with higher maintenance expense will receive higher allocation
A 13	Office of OPD Service	Number of Out-patient	Cost center with greater number of patients will receive more allocation
A 14	Laundry and Seamstress	Quantity of clean clothes in kg.	Cost center with higher usage of clothes will need to use more service
A 15	Central Supply & Facility and IC Office	Quantity disbursed to each cost center	Cost center with greater number of patient will use more service
A 16	Dietetics	Quantity of meal , Private Section ward *2 VIP Section ward *3	Cost center with greater number of patient will use more service
A 17	Supply and Equipment	Cost of material in each cost center	Higher material cost will result in more service
A 18	Procurement and Pharmaceutical product	Cost per requisition form	More allocation will be given to cost center with greater number of patients
B 01	Out-patient Pharmacy	Cost of drug and non- drug product as per prescription	More allocation for cost center with greater number of patients
B 02	In-patient Pharmacy	Cost of drug and non- drug product as per prescription	More allocation for cost center with greater number of patient
B 03	Oxygen Supply Center	Cost of service by each cost center	More allocation for center with higher number of patient came to use the service
B 04	Laboratory and Pathology	Cost of Material as per request	More allocation for cost center with greater number of patients
B 05	Blood Bank	Cost of Material as per pack of blood given	More allocation for cost center with greater number of patients.

**Table 3: (Cont.) Cost Allocation Criteria**

<b>Code</b>	<b>Cost Center</b>	<b>Cost Allocation Criteria</b>	<b>Detail</b>
B 06	Radiology	Service charge	More allocation for cost center with greater number of patients.
B 07	Physiotherapy	Number of service	More allocation for cost center with greater number of patients.
B 08	Activity Therapy	Number of service	More allocation for cost center with greater number of patients.
B 09	Maintenance and design equipment for disable	Number of service	More allocation for cost center with greater number of patients.
B 10	Alternative Medical	Number of service	More allocation for cost center with greater number of patients.
B 11	Anaesthetic	Anaesthetic Service Charge	Service is given to specific patient as requested. Allocation will be given to those requested only.
B 12	Operating Theatre (Large/Small)	Service Charge	Allocation for those who get the operating service
B 13	Delivery Room	Service Charge	Allocation for those who get the delivery service
B 14	Cardiology Unit	Service Charge by each cost center	More allocation for cost center with greater number of patients.
B 15	Electrocardiogram and Electro-encephalogram Unit	Service Charge	More allocation for cost center with greater number of patients.

## Data Analysis

This study used simultaneous equation method to analyze the cost data. Linear equation and allocation matrix are also used to solve the reciprocal service allocation problem through Microsoft Excel program. The study made use of the International Health Policy Program: IHPP, which consists of the following steps.

1. Data Preparation
  - 1.1 Data Coding
  - 1.2 Content Validation
2. Full Cost Analysis

After the direct cost and cost allocation criteria of each cost center were determined, the simultaneous equation method of allocation was used to compute the indirect cost of the absorbing cost centers which allocated from the transient cost center. The calculation steps can be summarized as follow:

- 2.1 Distribute the cost of the cost centers, which code name begin with “A” and “B” to other cost center according to the service association or allocation criteria. Use the straight-line equation to transform to matrix in order to find the full cost of all transient cost centers that distributed to each other. So, the matrix equation is obtained as follow:

$$[ B ] = [ A ] [ X ]$$

B is the total direct cost of the Transient Cost Center

A is the Coefficients of cost allocation

X is the full cost of the Transient Cost Center allocated among each other

Using Microsoft excel to calculate the structure of coefficient matrix [ A ] and the constant matrix [ B ]

- 2.2 Take Coefficients A in 1.2.1 to find the Inverse matrix of [ A ] by using Microsoft excel to form a new equation

$$[ X ] = [ A ]^{-1} [ B ]$$

- 2.3 Take the Inverse matrix multiply by B to get the full cost of transient cost center which it distributed among each other before allocate to the absorbing cost center. Since the service and support in each cost center are associated each other.

- 2.4 Calculate the actual full cost of the absorbing cost center

$$\text{Full Cost} = \text{Direct cost} + \text{Indirect cost}$$

- 2.5 Calculate the unit cost of out-patient and in-patient services of Maharaj Nakhon Si Thammarat Hospital

$$\text{Unit Cost of Out-Patient Service} = \frac{\text{Full cost of the Out-Patient Service}}{\text{Number of Out Patient Visit}}$$

$$\text{Unit Cost of In-Patient Service} = \frac{\text{Full cost of the In-Patient Service}}{\text{Number of In-Patients Case or Patient day}}$$

### **Statistic Method Used in the analysis**

Descriptive statistic technique is used to describe the type of data, which are amount, percentage, ratio, proportion and average.