# CHAPTER 1

# INTRODUCTION

## 1.1 Background

Clean water is essential for daily life and water supply is the utility that the Government should provide to the people. Established as a state enterprise, the responsibilities of the Metropolitan Waterworks Authority is as follows:

1. To explore and locate raw water sources; and procure raw water for waterworks purposes.
2. To produce, distribute and sell water supply in the Bangkok, Nonthaburi and Samut Prakarn Provinces.
3. To operate other businesses that are beneficial to the organization.

As a state enterprise and a public monopoly, MWA has to improve both its efficiency and quality of services to approach customer's satisfaction. At the moment, the number of customers and the water demand are increasing continuously according to the increasing of customers both residential and industrial sectors. Whilst there are limited sources of not only quantity but also the water quality. Therefore water demand forecasting must be done accurately.

## 1.2 Current Situation

Water demand forecast is the very important data for the MWA. Many departments use it for many purposes. It plays an important role in planning from the raw water procurement to the treated water distribution. Figure 1.1 presents the departments that use water demand forecast for their purposes.

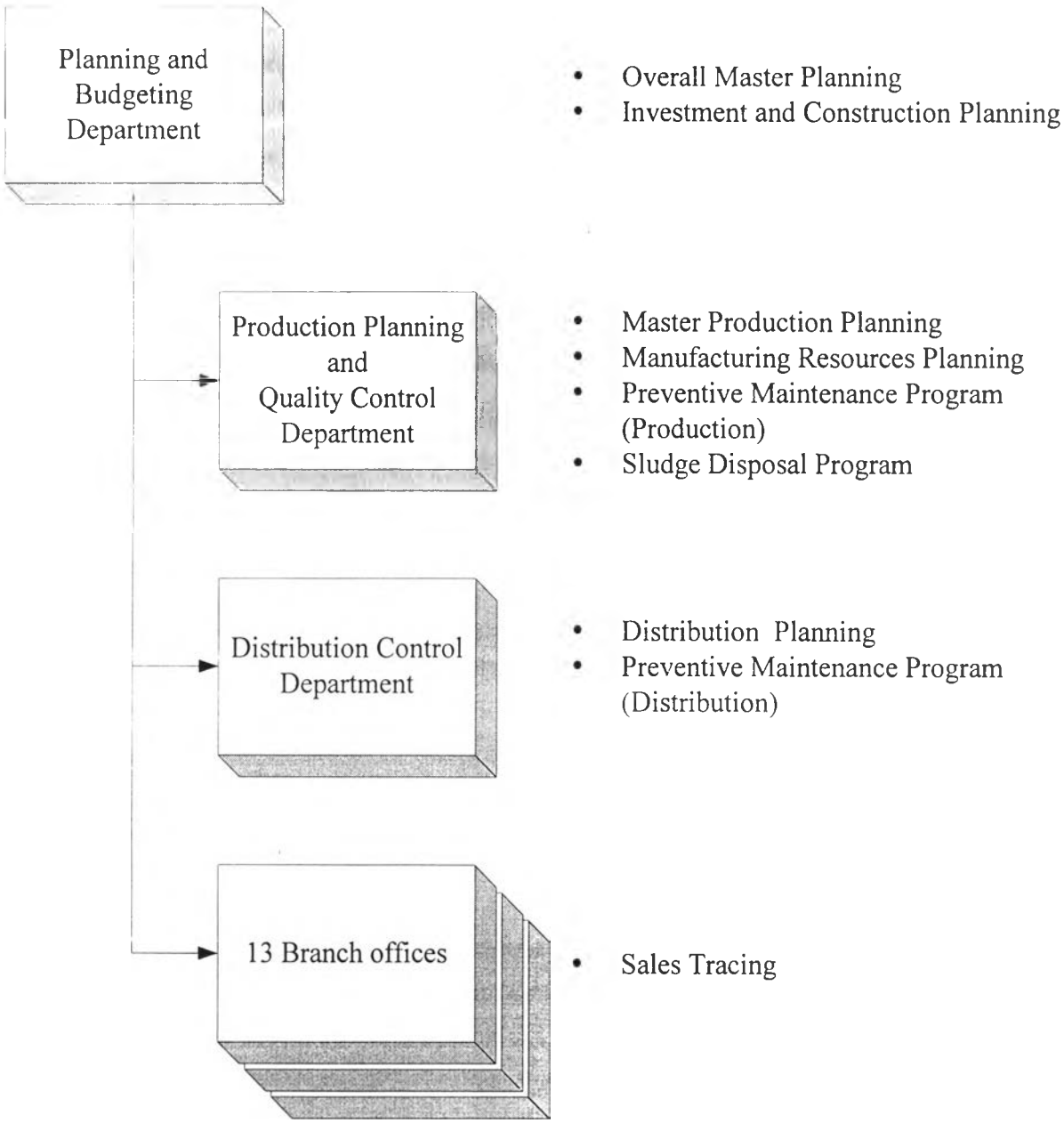


***Figure 1.1**: The uses of Water Demand Forecast*

Firstly, the department that is responsible to forecast water demand is the Planning and Budgeting Department. Water demand is used here as one of many important factors to be analyzed when creating and reviewing the master production plan and construction expansion plan for the MWA.

Then water demand forecasted by Planning and Budgeting Department will be reported to Production Planning and Control Department, Distribution Control Department and the 13 Branches offices. At Production Planning and Control

Department, water demand forecast is used here to create production planning and manufacturing resource planning for all water treatment plants. Chemical procurement and Preventive Maintenance Program for water treatment system is then created. At the Distribution Control Department, water demand forecast is used to create the water distribution plan, the resource planning, and the distribution system expansion plan. At the Branch offices, the water demand forecast is set as the target of water sales. It helps the officer to trace whether the amount of sales meets the target or not. From the various uses of water demand forecast mentioned here, water demand forecasting should be done accurately. Appropriate forecasting techniques should be employed. The traditional method that the Production Planning and Quality Control Department is using now is the accrual moving average technique which is one of the various Time series techniques.

## 1.3 Statement of the Problems

The results of the accrual moving average method usually give high inaccuracy that leads to inefficient planning, lower quality of services and unsatisfactory outcomes.

For the forecasting of water demand to be more accurate, several techniques should be introduced. Artificial neural network is introduced here as one of the alternatives.

## 1.4 Objective of the Research

The objective of this research is to study and compare the performance of the existing forecasting method with that of the artificial neural network.

## 1.5 Scope of the Research

This research will be based on the following assumptions:

1 This research focuses on the water demand of the MWA's customers in the responsible area.
2 The data to be used in this research covers the period between the Fiscal Year 1993 – 2000 and the first sixth months of the Fiscal Year 2001.

## 1.6 Research Methodology

1 Study the related literature: production planning, forecasting and artificial neural network.
2 Design artificial neural network models for water demand forecasting. Select the appropriate input and output variables.
3 Train and test the network with various parameters such as different sets of input and different numbers of neurons in the network in order to obtain the result with the minimum errors
4 Compare the result from the existing method and the result from the artificial neural network.
5 Discussion and conclusion.
6 Write final report.

## 1.7 Expected Benefits

Accurate water demand forecast is expected from the artificial neural network. The accurate forecast can be beneficial for managerial purposes such as master planning, budgeting and production resource planning. This study also can lead to further study such as forecasting water losses and chemical dosage.

## 1.8 Organization of the Thesis

Chapter I introduces the general information of this thesis such as background, current situation, statement of problems, objective of the research, scope of the research, research methodology, and expected benefits.

Chapter II introduces the artificial neural network theory, i.e. definitions, network structure, backpropagation, and the application of artificial neural network and literature surveys.

Chapter III covers theory on forecasting technique, i.e. methodology, calculation, and forecasting result.

Chapter IV covers water demand forecasting using the artificial neural network and the comparison.

Chapter V provides conclusion and recommendations.