CHAPTER I
INTRODUCTION

1.1 Background

The rapid development of information and communication technology encourages the increasing need for high-speed internet services. This condition has a direct impact on the growth of the number of internet service customers, especially in Fiber to the Home (FTTH) services. Based on previous research, along with the increasing number of customers, telecommunication service providers are required to be able to manage customer data and monitor customer growth accurately and continuously to support service capacity planning and service quality improvement [1]. Therefore, monitoring customer growth is an important aspect in strategic decision-making in telecommunications companies.

However, in practice, customer data management and customer growth monitoring are still mostly done using spreadsheet media. Previous research has shown that the use of spreadsheet-based manual systems in data management causes various obstacles, such as recording errors, low data security levels, and limited access to data in real time [2]. In addition, the use of spreadsheets also has weaknesses in terms of data security because there are no clear restrictions on access rights, so that data has the potential to be accessed or manipulated by unauthorized parties. The risk of data loss can also occur if there is damage to the hardware used [3]. This condition has the potential to hinder the analysis and decision-making process, especially in service capacity planning and improving the quality of customer service.

Furthermore, if customer growth is not monitored and analyzed continuously, companies have the potential to experience inaccuracies in service capacity planning. Without an integrated prediction system, companies tend to be reactive, i.e. making capacity adjustments after a surge in demand or a decrease in service quality. Previous research results show that the absence of historical data-based monitoring and prediction systems causes decision-making to be made after problems occur, resulting in a decrease in operational efficiency and service effectiveness [4].

To support a more proactive planning process, a time series forecasting method is needed that is able to utilize historical customer data as the basis for predicting future

customer growth. Various forecasting methods have been developed and used in various studies, where each method has different characteristics, levels of complexity, and predictive capabilities [5]. Therefore, the selection of forecasting methods needs to be adjusted to the research objectives, data characteristics, and system implementation needs so that the predictive results obtained can support the decision-making process effectively [6].

The Exponential Smoothing method is one of the time series forecasting techniques that is widely used because it has a relatively simple, efficient, and easy calculation process to implement into a system [7]. This method has several variants, namely Single Exponential Smoothing (SES), Double Exponential Smoothing (DES), and Triple Exponential Smoothing (TES) or Holt-Winters. Each method has different usage characteristics. SES is generally used on data dominated by level components with relatively stable fluctuations [8], DES is used on data that has trend tendencies, whereas Holt-Winters is used on data that has trend and seasonal components simultaneously [9].

Although there are more complex methods such as DES and Holt-Winters, the choice of forecasting methods is not based on the level of complexity or novelty of the method, but on the suitability of the method to the characteristics of the data, the research objectives, and the needs of the system implementation [8]. Comparative research conducted by showed that SES produced a better level of accuracy than DES and Holt-Winters in certain cases. However, the study also concluded that more complex methods do not necessarily result in a better level of accuracy in every case and that method selection should consider a balance between accuracy, model complexity, and ability to represent data patterns [10].

On the other hand, research comparing SES, DES, and TES in the analysis of the realization of the Medan City Budget showed that TES produced the smallest MAPE value of 0.12%, while SES and DES were 12% and 14%, respectively. These results show that the performance of the forecasting method is strongly influenced by the data patterns used, so a more complex method is not always the most appropriate choice for all research cases [11].

Based on the results of preliminary observations of historical FTTH customer growth data in this study, the number of subscribers shows a relatively gradual increase trend with not too large fluctuations and no significant seasonal patterns were found

during the observation period. In addition, this study does not focus on the comparative study of various forecasting methods, but on the development of a monitoring system with web-based customer growth predictions that are able to support the decision-making process more proactively. Therefore, the Single Exponential Smoothing method was chosen because it is considered to be able to provide a good level of accuracy based on previous research, has low computational complexity, is easy to integrate into a web-based system, and is in accordance with the needs of the system implementation developed.

In the development of customer growth monitoring and prediction systems, a system development approach is needed that is able to accommodate various needs in an integrated manner, ranging from customer data management, customer growth monitoring, data visualization, prediction processes, to information presentation to support decision-making. Therefore, a development method is needed that not only focuses on application development, but is also able to analyze the interconnectedness between parts of the system so that the resulting solution is in accordance with the needs [12].

If the relationship between these components is not analyzed from the initial stage, the integration between data management, monitoring, prediction, accuracy evaluation, and information presentation processes has the potential to not run optimally, making it difficult for the system to meet the needs of users as a whole. Therefore, a development method that is able to analyze the relationship between components from the analysis stage is needed so that the system development process runs in a structured manner [13].

Some system development methods, such as waterfall, are commonly used in systems with needs that have been fully defined from the initial stage, while prototyping is more suitable for development oriented to the implementation of specific needs or algorithms [14]. In contrast to these two methods, the Framework for the Application of Systems Thinking (FAST) applies the concept of systems thinking, which is analyzing problems, user needs, and relationships between system components before implementation. These characteristics make FAST suitable for this study because the developed system integrates various interrelated functions [15] [16].

The selection of FAST is also supported by previous research that shows that this framework is able to help the process of analyzing system characteristics, identifying user needs, and designing features in a more structured manner. In addition, the implementation of FAST has been shown to increase the effectiveness of data development and management on built systems [17]. Therefore, FAST was chosen in this study not only because of its function as a system development method, but also because of its ability to analyze the relationships between system components so that the development process can be carried out in a more structured manner and produce a monitoring and prediction system that suits user needs.

Based on this description, this study develops a web-based FTTH customer growth monitoring and prediction system by applying the FAST approach and the Single Exponential Smoothing method. The novelty of this research lies in the development of a web-based FTTH customer growth monitoring and prediction system that integrates customer data management, customer growth monitoring, prediction using Single Exponential Smoothing, accuracy evaluation using MAPE, and developed using the FAST approach in one integrated system in the case study of PT Telkom Akses Banjarmasin.

1.2 Problem Formulation

Based on the background that has been described, the formulation of the problem in this study is as follows:

1. How to design and develop a web-based FTTH customer growth monitoring and prediction system using the Framework for the Application of Systems Thinking (FAST) approach?
2. How to apply the Single Exponential Smoothing algorithm to predict customer growth based on historical customer data?

1.3 Research Objectives

This study aims to create a monitoring system with customer growth prediction using the FAST approach and single exponential smoothing algorithm (Case Study: PT. Telkom Access Banjarmasin).

1.4 Research Benefits

1. For Companies (PT Telkom Akses Banjarmasin)

   This research is expected to facilitate the process of monitoring customer growth more accurately and efficiently through an integrated system. In addition, the developed system is able to provide predictive information on the number of customers in the future, so that it can help companies in planning network capacity in a more targeted and data-based manner.
2. For Academics and Researchers

   This research is expected to be a reference in the development of a web-based information system that is integrated with forecasting methods, especially the *Single Exponential Smoothing* method, to predict customer growth. In addition, this research also contributes to the development of scientific studies related to monitoring and prediction systems in the field of telecommunication networks.
3. For the Author

   This research provides experience and learning in designing, implementing, and testing web-based information systems in a structured manner. In addition, this study also improves the author's understanding in applying forecasting methods to real cases, especially in predicting customer growth in the telecommunications sector.

1.5 Problem Limitations

In order for this research to be more directed and not deviate from the goals that have been set, the limitations of the problems in this study are as follows:

1. This study only discusses the monitoring of customer growth predictions at PT Telkom Akses Banjarmasin, without discussing the technical aspects of the network in detail such as the configuration of OLT devices or the quality of network signals.
2. The data used in this study is historical FTTH customer data available in a certain period and region accessed by the Helpdesk team at PT. Telkom Access Banjarmasin, and does not include external factors outside of the data, such as company policies, economic conditions, or marketing strategies.

3. The system developed is in the form of a web-based application that functions to manage customer data, monitor customer growth, and display the results of customer growth predictions.
4. The prediction method used in this study is Single Exponential Smoothing, and does not discuss or compare in depth with other forecasting methods outside of supporting discussions.
5. The measurement of the accuracy of prediction results is carried out using Mean Absolute Percentage Error (MAPE), without using other forecast error evaluation methods.
6. The system development approach used in this study is limited to the Framework for the Application of Systems Thinking (FAST), which includes the stages of problem identification, needs analysis, system design, system development, and evaluation.
7. This research is focused on system function and predictive outcomes, so it does not discuss system security aspects in depth such as advanced encryption or special security testing.