CHAPTER I INTRODUCTION

I.1 Research Background

Manufacturing became a capital-intensive operation in the early part of the 20th century. A hierarchical system of mass production has substituted more small batches and make-to-order manufacturing of goods. The 1920s was a turning point. With increased household income in North America and Europe, large-scale household appliances and motor vehicles were produced (Benhabib, 2003). Manufacturing is an important commercial activity carried out by companies that sell products to customers. The form of the processing carried out by a company depends on the type of commodity it provides. Let us discuss this partnership by analyzing the manufacturing industries and the goods they produce (Groover, 2010).

The manufacturing world is not separated by machines. The machine is a valuable entity that is very important to run the production system in manufacturing. Machines have an important role in running production, without machinery, the raw material will not be a product. According to Walsh and Cormier (2006), in machining, there are machining processes such as drilling, milling, sawing, and many others. One of them is the turning process, turning is the procedure used to create existing cylindrical shapes, generally with a one-point cutting tool, by removing material. Boring is mainly an internal adjustment for the creation of internal forms. The through rotating machines are engine lathes, single spindle automatic lathes, horizontal-turret lathes, automatic screw machines, Swiss-type automatic screw machines, multiple-spindle automatic bar and chucking machines, and computer-controlled automatic turning centers.

Every factory and company must avoid the production that has defects product that will become reject items which will harm the company both in terms of material and cost. A defect is linked to a quality feature that fails to meet certain standards. In addition, this fact may lead to the unacceptable (or defective) accuracy of one or more defects in a product or service (Amitava, 2016).

There are various kinds of defects that exist in the product, one of which is surface roughness. Surface roughness is a commonly used product quality index and is a technical prerequisite for mechanical products in most cases. For the functional behavior of a part, the achievement of desired surface quality is of great importance. On the other hand, a simple solution is almost impossible to achieve by the process-dependent existence of the surface roughness formation mechanism together with the many uncontrollable factors that influence related phenomena (Benardos and Vosniakos, 2003).

A product has features that define their quality in relation to customer expectations or specifications. In these attributes, the performance of a material is calculated (Ross, 1996). In selecting competing products and services, quality has become one of the most important factors for consumers. Whether it is individual, industrial, retail, banks, financial institutions or military advocacy programs. The understanding and enhancement of quality are therefore key factors that contribute to business success, growth and increased competitiveness (Montgomery, 1985).

The quality of the products can be seen from a number of aspects, one of which is surface roughness. According to Ribeiro et al. (2017), the value of the machined surface is measured by the surface roughness of the machined component, which is the most important quality characteristic. Nonetheless, the application of optimization techniques could be an interesting solution for reducing the number of variations of experimental experiments. Each combination of cutting parameters can result in different surface roughness and tool life. Nonetheless, it is very difficult to define the best combination that gives lower surface roughness and total tool life for many different parameters to monitor with multiple levels for each one. For the manufacturing industry, surface quality, tool life, and production costs are the most important features in a certain combination of machining parameters.

According to Roy (2010), Figure I.1 displays the conventional method and the loss function view of Taguchi. The graph shows the loss function in order to deviate from an ideal or goal value of a particular design parameter. Here is the objective value or the most desirable value of the considered variable. This parameter could be a vital aspect, material color, surface finish or any other function contributing to the customers.

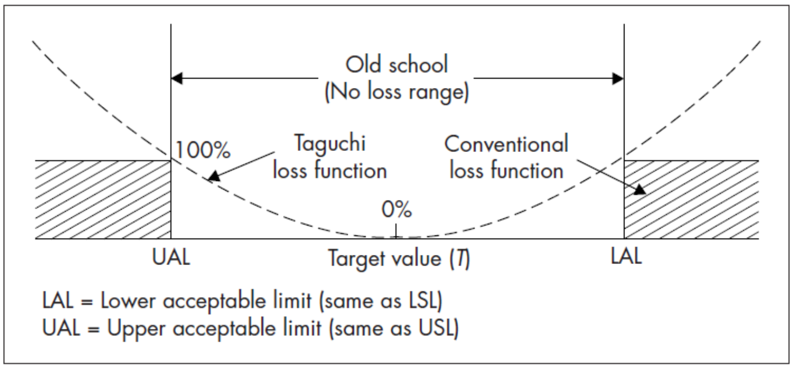

Figure I.1 Taguchi and conventional loss functions

UAL and LAL describe in Figure I.1 the upper and lower acceptable limits of design parameters. The product is typically theoretically suitable if the parameter value is within UAL to LAL limits. Nonetheless, the functional failure happens 100% outside of the cross-country limits as shown, and this element is either discarded, reworked or saved. This effort is made to monitor the production process in order to maintain the product within acceptable limits. This function is continuous in Figure I.1, as shown in the dotted line. If development parameters differ from ideal or target quality, product performance begins to be affected. High customer satisfaction will be achieved by producing products that consistently exceed the target price. It may be worth noting that Taguchi causes more than 100 percent damage to a customer. If the entire system fails or a system fails catastrophically, such cases may occur. Therefore, the unique feature of Taguchi's quality control philosophy is to reduce the gap around the target value (Roy, 2010).

In Figure I.2, it is shown a manual turning lathe in the Telkom University manufacturing building

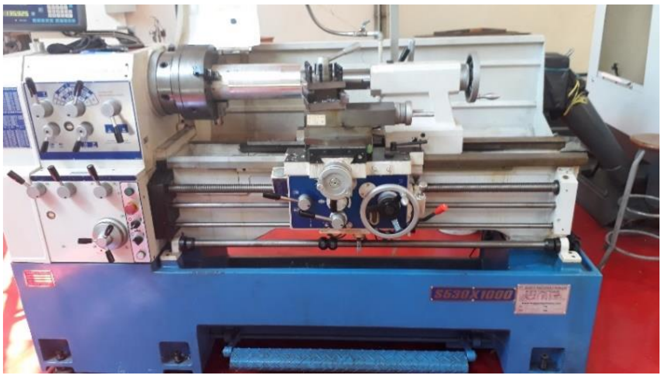

Figure I.2 S530 X 1000 Lathe in Manufacturing Building at Telkom University

In this study, the experiment using the Taguchi method to minimize surface roughness for C45 Steel in the turning process. The machines used are in the manufacturing building, Telkom University. Taguchi Method using several cutting parameters from S530 x 1000 lathe which parameters will be carried out experiments to optimize the cutting parameters in minimizing surface roughness.

I.2 Problem Formulation

The problem to be discussed in this project is how to determine the optimal level of cutting parameters in the turning process on the S530 X 1000 Lathe as to minimize surface roughness on C45 Steel?

I.3 Research Objectives

The objective of this research is finding the optimum condition of cutting parameters in S530 X 1000 lathe in order to minimize the surface roughness. The way to get the optimum conditions is by optimizing the cutting parameters so as to produce the smallest roughness possible from several experiments conducted.

I.4 Research Limitation

1. Minitab 18 as processing statistical data software.
2. Solidworks 2015 as CAD software.
3. The workpiece material is C45 Steel.
4. The output is this research is to determine the optimal choice of experiments to minimize the surface roughness of the workpieces.

I.5 Benefits of Research

1. As research for Telkom University to make improvements on S530 X 1000 Lathe.
2. By implementing the automation system on S530 X 1000 Lathe, an operator can produce quality products and reduce defective products.
3. As an input for the industry, specifically in the process of turning on manual lathe machines.
4. As learning material for students and readers about machining.

I.6 Writing Systematics

The systematics of writing in this study are:

Chapter I Introduction

This chapter contains an explanation of the background of this research. Furthermore, from the background of this problem a problem definition, research objectives, research limitation and benefits of the research.

Chapter II Literature Review

This chapter contains explanations and explanations related to this research to support research in developing scientific assignments. Literature studies obtained come from books, journals, and previous research.

Chapter III Research Method

This chapter explains the outline of the research from start to finish which is described visually as a conceptual model. Then, there is systematic problem solving contains stages of how researchers do problem-solving which contain the process of research.

Chapter IV Collecting and Data Processing

In the data, the processing chapter contains data needed to meet research requirements. In data processing, data processing occurs from the data that has been collected and then produce experimental results that will be considered to find the optimal experiment

Chapter V Analysis

This chapter contains the analysis of research based on the Taguchi experimental results using the ANOVA test and signal to noise ratio. From all the experimental results, one optimal experiment was chosen to minimize surface roughness.

Chapter VI Conclusion

This chapter contains a summary of the result of an experiment that used Taguchi method to find the optimal result of several experiments that took a variable of parameters n S530 X 1000 Lathe to be optimized in order to minimize or reduce the surface roughness.