CHAPTER I INTRODUCTION

I.1 Research Background

The plantation sector plays an important role in economic activity in Indonesia, one of the main plantation commodities is tea (Badan Pusat Statistik, 2015). Manufacturing companies located in the tea plantation sector are PT. Perkebunan Nusantara VIII located on Jl. Raya Tangkuban Perahu Ciater, Subang, West Java. Tea produced by PT. Perkebunan Nusantara VIII one of them is black Orthodox tea. In meeting the market demand, the tea produced must meet the standards and quality of consumers, so as to compete with other companies. Therefore, the need for quality control. PT. Perkebunan Nusantara VIII still uses manual quality testing process, that is by organoleptic test such as visual inspection and aroma by trained evaluation officer. The process done manually will take a lot of time and the results are not necessarily accurate (Suprijanto et al., 2011). Based on the observation, the quality testing process is done twice, ie at PT. Perkebunan Nusantara Ciater VIII and at the Head Office of PT. Perkebunan Nusantara Ciater Sindang Sirna. Testing at Head Office aims to verify the quality of tea that has been tested at PT. Perkebunan Nusantara Ciater VIII. Figure I.1 shows the level of quality rating error on the aspects of appearance, liquor, and infusion. The error rate is calculated based on the assessment result between PT. Perkebunan Nusantara VIII Ciater and Head Office of PT. Perkebunan Nusantara Sindang Sirna which has a difference.

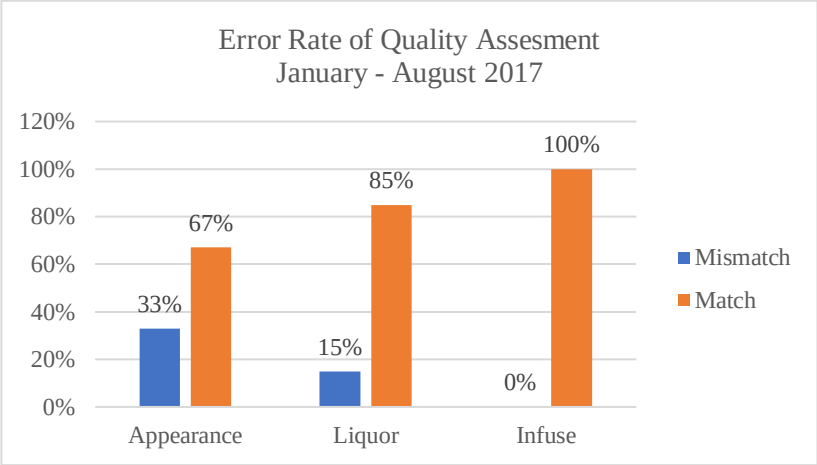

Figure I. 1 Graph Error Rate of 3 Dimension Assessment Period January - August 2017 (PT. Perkebunan Nusantara VIII, 2017)

Based on the graph above, it can be seen that the highest rating error rate is in the apperance aspect with a total of 33%. Aspect of appearance one of the most important indices during tea quality evaluation (Dong et al., 2017). So this research focuses on appearance aspect. PT. Perkebunan Nusantara VIII casts into four groups of orthodox black tea produced, namely Leafy Grade, Type I, Type II, and Type III. Based on company data in 2017, orthodox black tea is successfully in production reached 1883.23 tons. Type I is the largest production with a percentage of 51% of total production. Presente Total orthodox black tea production in 2017 can be seen in Figure I.2.

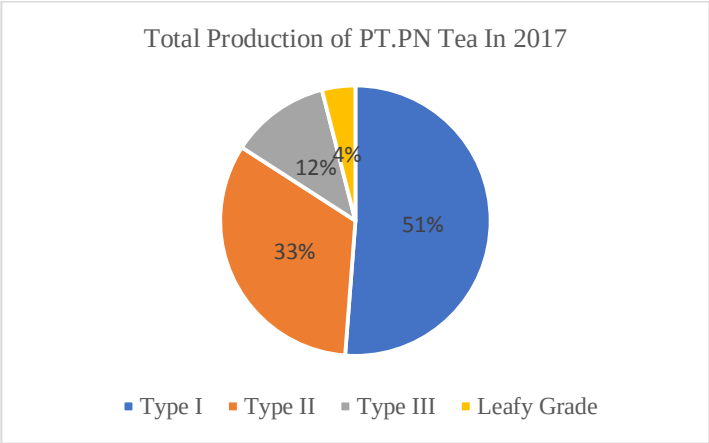

Figure I. 2 Total orthodox black tea production by 2017 (PT. Perkebunan Nusantara VIII, 2017)

Types of orthodox black tea belonging to the Type I group at PT. Perkebunan Nusantara VIII, namely BOP, BOPF, BT, Dust, PF, and BP. Of the various types of tea contained in Type I, BT tea (Broken Tea) is the most widely produced tea with 35% percentage of total 1004.6 tons in 2017. Human vision can distinguish almost similar colors, but the color of tea is difficult to distinguish specifically, humans describe color as qualitative, and it is difficult to accurately, objectively and accurately color (Chen et al., 2008). Standard color assessment at PT. Perkebunan Nusantara VIII follows the standards of a British black tea manufacturer, named Lipton. Lipton standard consists of 5 classes of lip 1, lip 2, lip 3, lip 4, and lip 5. The higher the level on the lip class, the darker the color of the dry tea. Table I.1 shows the quantitative value of the lipton class.

Table I. 1 Lipton Value Range (PT. Perkebunan Nusantara VIII, 2017)

Class	Score
Lip 1	1-8
Lip 2	9-16
Lip 3	17-25
Lip 4	26-34
Lip 5	35-42
Lip 6	43-50

Standards not only determine acceptable quality, but also determine what is not accepted (Megaw, 1979). Inaccuracy in the assessment may affect the results of tea quality inspection. Table I.3 shows the difference between the inspection of the appearance of the same type of tea at 2 different locations. Inspection conducted at PT. Perkebunan Nusantara VIII Ciater and PTPN Sindang Sirna Head Office in January 2017.

Table I. 2 Comparison of Tea Assessment Based on Appearance in January 2017 (PT. Perkebunan Nusantara VIII, 2017)

Type	Ciater	Sindang Sirna
BOP I	30	28
BOP	29	27
BOPF	29	29
BT	25	27
BP	24	29
BTII	30	27
PF II	17	15
DUST II	17	16
DUST III	16	16
FANN II	16	15

Based on the above table, it can be seen that there are differences in valuation between PT. Perkebunan Nusantara VIII Ciater and Head Office of Sindang Sirna. Particle quality assessment BT and BP have different assessments so that the particles are in different classes. From the assessment by PT. Plantation of Nusantara VIII Ciater BT particles has a value of 29 and is classified on Lip 3, while the assessment by Head Office Sindang Sirna BT particles has a value of 35 and is classified into Lip 4. Differences in valuation may result in company losses. The Figure I.3 shows the difference in sales between Lip 2 and Lip 4.

Figure I. 3 Difference in Sales Amount Based on Quality Period January - July 2017 USD / Chop) (PT. Perkebunan Nusantara VIII, 2017)

Based on the above graph, the sales difference between lip 2 and lip 4 reaches 6500 dollars for 250000 kg. Details of price per month can be seen in Table I.3. Tea is sold in chop units that weigh 40 kg / sak.

Table I. 3 Price Based on Quality (PT. Perkebunan Nusantara VIII, 2017)

Period	Price (USD/kg)		Kg	Price		Gap
	Lip3	Lip4		Lip3	Lip4	
January	$ 0.0167	$ 0.0214	250000	$ 16,700	$ 21,400	$ 4,700
February	$ 0.0161	$ 0.0226		$ 16,100	$ 22,600	$ 6,500
March	$ 0.0195	$ 0.0207		$ 19,500	$ 20,700	$ 1,200
April	$ 0.0226	$ 0.0248		$ 22,600	$ 24,800	$ 2,200
May	$ 0.0100	$ 0.0110		$ 10,000	$ 11,000	$ 1,000
Juny	$ 0.0095	$ 0.0117		$ 9,500	$ 11,700	$ 2,200
July	$ 0.0104	$ 0.0109		$ 10,400	$ 10,900	$ 500

The price difference is caused by an objective quality judgment and errors in quality categorization. Therefore, a consistent quality testing system is required and can perform objective assessments. The development of image processing technology can assist in optimizing the inspection process. The use of automated image processing technology can reduce human error in the quality inspection process (Shadika., 2017).

The SVM method has been widely used in previous studies. Setiawan (2015) used the SVM method to classify and analyze metal inscriptions between brown and green brown and brown scratches and plates and measure the AUC (Area Under

Curve) and accuracy level on the image inscription classification based on GLRLM texture feature extraction (Gray Level Run Length Matrix). The accuracy level obtained was 73.33% in brown patina and 79.17% in green patina. The study is still using offline and not yet integrated system, so it needs a system improvement in subsequent research to generate automated identification system using integrated software and hardware.

Research conducted by Ghosh (2010) with the title Pattern classification of fabric defects using support vector machines examines the classification of types of fabric defects using image processing, with GLCM as the method of extracting that will be input in Support Vector Machines. The classification of types of fabric defects using SVM in this study yielded 98% accuracy.

Research by Firman (2017) under the title Detection of Kualias Cheese Using Discrete Wavelet Transform Method (DWT) Classification Support Vector Machines In Digital Imagery examines the quality of cheeses based on the color and texture segmentation of cheddar cheese by using digital image processing. The result of this final project got the best accuracy value of 97.9167% and computation time 0.0702s by using characteristic extraction based on texture and color on DWT method with first order parameter on SVM.

This research focuses on tea quality classification using Support Vector Machine (SVM) method by replacing human vision function into digital image processing. Referring to previous research and background problems, this research is focused on the implementation of orthodox orthodox black tea quality classification automation system using SVM method.

I.2 Problem Indentification

The problem formulation will be taken as research material this last task is:

1. How to design automated system for orthodox black tea classification process using Support Vector Machine method?
2. How to determine the level of accuracy in the classification process of orthodox black tea?

I.3 Research Objective

Based on the formulation of the problem above can be determined the purpose of this final task research:

1. To design automation system for orthodox black tea classification process using Support Vector Machine method.
2. To determine the level of accuracy in the orthodox black tea classification..

I.4 Research Boundaries

Restrictions on the issue of research this is the final assignment :

1. This study is only used for the classification of orthodox black tea with BT type and the aspect used for the classification is the apperance aspect.
2. Color classification consists of 3 types of quality categories, namely lipton 2, lipton 4 and uncategorized with the number of training samples of 300 images.
3. Uncategorized training input data is an empty tea tray with dominant color of white.
4. The classification method used for black tea classification is the Support Vector Machine method with Gausian algorithm.
5. The tea classification system uses MATLAB 2017 software for image processing and classification, CX-Programmer for Ladder PLC programming, and Wonderware InTouch to design HM.
6. Method to analyze compared with black tea Indonesian National Standard (SNI) 01-1902-1995.

I.5 Benefit of Research

The research benefits of this discussion are :

1. Classification programs using Image Processing-based SVM can be used to classify other types of tea.
2. The results of the analysis of the research can be utilized to complement the process of standardization of black tea in PTPN VIII Ciater.
3. Can increase knowledge about image processing and automation system.

I.6 Writing Systematics

This research is described by systemic writing as follows :

Chapter I **Introduction**

This chapter contains the background of the problem, problem formulation, problem definition, writing method and systematic writing.

Chapter II **Literature Review**

This chapter discusses the basic theories and literature that support the implementation of this final project. The literature study on the theory used in this research is a tea leaf quality inspection system consisting of Programmable Logic Controller, Human Machine Interface Interface, Support vector machine and image processing using MATLAB.

Chapter III **Research Methodology**

This chapter contains research methods used to explain the problems that occur in research include the conceptual model of research and systematic problem solving which is the stage of problem resolution that will produce a conclusion that answers the purpose of research.

Chapter IV **System Design**

This chapter contains the data needed to design a tea quality classification using the Support Vector Machine method, design programs on Programmable Logic Controller (PLC), design Human Machine Interface (HMI) and the necessary data. Based on the data and designs created then will be done simulation on the prototype.

Chapter V **Result and Analysis**

This chapter contains the system analysis that has been done from the design automation system for black tea quality control. Describes analytical designs such as Human

Machine Interface, Graphical User Interface, PLC program, Image Processing, Support Vector Machine and experimental results.

Chapter VI **Conclution and Suggestion**

This chapter contains the conclusions of designing the automation of black tea quality classification at PT. Perkebunan Nusantara as well as recommendations of suggestions related to the design of systems that have been made.