INSPECTION SCENARIO FOR E-KTP READER FINAL ASSEMBLY BASED ON EFFICIENT COST ASSOCIATE IN THE PRODUCTION DIVISION IN PT. ABC

FINAL PROJECT

by

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INDUSTRIAL ENGINEERING STUDY PROGRAM
INDUSTIAL ENGINEERING FACULTY
TELKOM UNIVERSITY

2016

SKENARIO INSPEKSI UNTUK PERAKITAN AKHIR E-KTP *READER* BERDASARKAN ASOSIASI BIAYA EFISIEN DI BAGIAN PRODUKSI PT. ABC

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Submitted in partial fulfillment of the requirements
for the degree of Bachelor in Industrial Engineering

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APPROVAL SHEET

The Final Project with the title of

INSPECTION SCENARIO FOR E-KTP READER FINAL ASSEMBLY BASED ON EFFICIENT COST ASSOCIATE IN THE PRODUCTION DIVISION IN PT. ABC

has been approved and passed at Final Project Presentation
as a part of fulfillment of the requirements
for the degree of Bachelor in Industrial Engineering
in School of Industrial Engineering - Telkom University

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بسم الله الرحمن الرحيم

In the Name of Allah,
the Most Beneficent, the Most Merciful

ABSTRACT

PT. ABC produces one of their electronic equipment, known as E-KTP Reader. In the production of E-KTP Reader, there are so many defect products which found at final assembly process. The main defect that usually occurs in the product are touchscreen display cracks, casing broken caused by bolt pierced, and mounting's bolts holes broken. Based on the information of the company in Operation Process Chart, there is only one inspection that implemented in whole process, which is at the end of the stage. According to the observation of taking 100 samples, PT. ABC produce 44 defect products and 56 passed products. So the percentage of defect is 44% which high enough to be allowed. A new scheme of inspection stage scenario is needed to help the company to reduce their defect products. It is necessary for the analysis of the assembly process of these products in order to design a most efficient modified inspections scenario to improve the existing scenario, which is intended to minimize the defects. There are four stages in final assembly process of E-KTP Reader. The scenarios are made from three combinations, which is inspection combination-1 (existing condition), inspection combination-2, and inspection combination-3. In combination-1, the inspection only occurs at the end of the stages. In combination-2, the inspection occurs between stage-1 and stage-2, and also at the end of the stage. In combination-3 or the last combination, the inspection occurs between stage-2 and stage-3, and also at the end of the stage. By calculating and comparison the inspection cost which is consist of cost of useless inspection and cost of rework for saving, the most efficient inspection combination can be chosen. After being compared, then PT. ABC will have a new inspection scenario stage and new Operation Process Chart to be implemented for their next project. Based on the comparison of expectation cost for each scenario, the most efficient one is combination-2, which spends cost of useless Rp 21.000,- and cost of rework for saving Rp 13.350,-. So, PT. ABC only needs to spend Rp 34.350,- as the total expectation cost for defect products. Although PT. ABC has already made solution, it does not mean they do not need some prevention methods to support the inspection activities. There are several solved prevention methods to avoid the occurrence of defect type on their product during final assembly process, which is related to increase the ability of work and also their operator's skill, and the last but important is operator's stamina.

Keywords: assembly process, locating inspection, inspection cost, E-KTP Reader.

ABSTRAK

PT. ABC memproduksi salah satu peralatan elektronik yang dikenal sebagai E-KTP *Reader*. Dalam produksi E-KTP *Reader* ditemukan begitu banyak produk cacat pada proses perakitan akhir. Cacat utama yang terjadi pada produk yaitu *touchscreen display* retak, *casing* tertembus baut, dan lubang pemasangan baut pecah. Berdasarkan informasi dari perusahaan dalam Peta Proses Operasi, inspeksi dalam proses perakitan dilaksanakan hanya satu kali, yaitu pada tahap terakhir. Dari pengamatan dengan 100 sampel, dihasilkan 44 produk cacat dan 56 produk yang lolos. Persentase cacat sebesar 44% merupakan angka yang tinggi dari batas yang diizinkan. Suatu skema skenario baru tahap pemeriksaan diperlukan oleh perusahaan untuk membantu mengurangi produk cacat. Untuk itu, perlu dilakukan analisis proses perakitan produk dalam rangka untuk merancang sebuah modifikasi skenario inspeksi yang paling efisien yang dimaksudkan untuk meminimalkan cacat produksi. Terdapat empat tahapan proses perakitan akhir E-KTP *Reader*. Skenario inspeksi dibuat dalam tiga kombinasi, yaitu skema kombinasi-1 (kondisi yang ada), skema kombinasi-2, dan skema kombinasi-3. Pada skema kombinasi-1, pemeriksaan hanya terjadi pada akhir tahap. Pada skema kombinasi-2, inspeksi dilakukan ini antara tahap 1 dan tahap 2, dan juga pada tahap terakhir. Pada skema kombinasi-3 atau kombinasi terakhir, inspeksi dilakukan antara tahap 2 dan tahap 3, dan juga pada tahap terakhir. Dengan perhitungan dan perbandingan biaya ekspektasi yang terdiri dari biaya pemeriksaan yang terbuang percuma dan biaya pengerjaan ulang yang berguna untuk penghematan, kombinasi inspeksi yang paling efisien dapat dipilih. Setelah perbandingan tersebut, PT. ABC akan memiliki skenario inspeksi baru pada Peta Proses Operasi yang dapat diterapkan untuk proyek berikutnya. Berdasarkan perbandingan biaya ekspektasi untuk setiap skenario, ditemukan bahwa yang paling efisien adalah kombinasi-2, yang menghabiskan biaya inspeksi yang terbuang percuma sebesar Rp 21.000,- dan biaya pengerjaan ulang yang berguna untuk penghematan sebesar Rp 13,350,-. Jadi, PT. ABC hanya perlu mengeluarkan Rp 34,350,- sebagai biaya total ekspektasi untuk produk cacat. Meskipun solusi inspeksi telah ditemukan, masih diperlukan pula metode-metode pencegahan untuk mendukung kegiatan inspeksi. Beberapa metode pencegahan yang diperlukan untuk menghindari terjadinya cacat produksi pada proses perakitan akhir berkaitan dengan peningkatan kemampuan kerja dan keterampilan operator, dan yang terakhir namun sangat penting adalah stamina operator.

Kata kunci: perakitan, penempatan inspeksi, biaya inspeksi, E-KTP *Reader*.

ACKNOWLEDGEMENT

Bismillahirrahmanirrahim.

Alhamdulillaahirabbil'alamiin, all praise and gratitude prayed to the presence of Allah SWT for the blessings and grace given to the author in finishing final project with the title of "**INSPECTION SCENARIO FOR E-KTP READER FINAL ASSEMBLY BASED ON EFFICIENT COST ASSOCIATE IN THE PRODUCTION DIVISION IN PT. ABC**". This final project was prepared as a form of accountability regarding Industrial Engineering student's learning outcomes for partial fulfillment of Bachelor Degree of Industrial Engineering in School of Industrial Engineering – Telkom University.

Based on the existing problems, the study will be conducted in the form of focus group discussion where the division is as follows:

1. Nur Intan Dhewanty Mayangsari discusses design of ergonomic tool specification to improve the work posture of operator in workstation of mainboard inspection in E-KTP Reader production process in PT. ABC based on rapid upper limb assesment method
2. Intan Geovani discusses work method improvement based on motion study and application of 5s in lower casing assembly of E-KTP Reader in the production department of PT. ABC
3. Nabilatushalihah R. H. discusses inspection scenario for E-KTP Reader final assembly based on efficient cost associate in the production division in PT. ABC

The author would also like to thank all those who have contributed either directly or indirectly in the process of finalizing this final project, namely:

1. Allah SWT, the One and Only. I praise Him for every greatness, blessing, and kindness that I've got from the beginning until now. Thank you for never leave, for always guide me wherever I am, for giving me so much patience to pass through all the test in this temporary world. I will always love you with

all my heart, dear Almighty. It is never enough to keep saying syukur, Alhamdulillah.

2. To Bapak Ir. Wiyono, M.T and Ibu Marina Yustiana Lubis, M.Si as our advisors, for guiding us from the very first time, especially their non-stop attention, support, and always try to give us the best solution for every problem which arises. Thank you Sir and Ma'am, for helping us finish our project and push us to the limit to finish it on time.
3. Ibu Dr. Dida Dyah Damayanti, ST, M.Eng. as the dean of School of Industrial Engineering, Ibu Dr. Ir. Luciana Andrawina, MT and Bapak Raden Rohmat Saedudin, ST, MT as vice deans, Bapak Rino Andias Anugraha, ST, MM as head of bachelor program of Industrial Engineering, and all of lecturers who I cannot mention one by one. Thank you for the your guidance during we studying in Telkom University.
4. Bapak R. W. Pantja Gelora as CEO PT. LEN Telekomunikasi, Bapak Nauzie Novryadin as Manager of Production Engineering Department at PT. LEN Industri, and also Bapak Alex Sihotang as Engineer, Bapak Aris Martin and Bapak Wage Technician at PT. LEN Industri. I would like to gratitude to all of you for giving us opportunity and guidance to carry out our case study of inspection process in the assembly of RFID Reader. And the other who I cannot mention one by one. For their hospitality, kindness, and welcoming us to do our project using data from the company. Thank you for giving us opportunity and chance to take PT. ABC's problem as our research object, and giving us permission to analyze and find the solution for the problems.
5. My beloved parent, the precious treasure in my entire life. For raising me so well, for giving me the best lessons, and for forgiving all my mistakes in every time that I did. Their soul will always be save in my deepest heart forever. You both are the reason why I try so hard to do the best in everything that I do, as hard as I could. They are extremely perfect in a simple way in my eyes, and I do love you Bapak and Ibu. You guys know I always do.

6. My thesis partner, Gea and Intan. Gea, the one who present as the reminder, full of generous, the favorite one that I always love to talk to and usually ask me to push my limit. Intan, who present as the mood booster, boost our mood with laugh and funny moment, very caring, and always help me when I have a favor. Without their supports, I could never get the extra spirit to finish all the work. Thank you guys, thank you for everything and the best understanding ever. Will be missing you both, see you on top partners.

7. David Simangunsong, the sweetest best friend, brother, and soulmate at the same time. Thank you for being my dozen pill of happiness during the whole moment, for the greatest patience to wait me finish my work, for unstoppable support, full attention, advices, jokes, and sacrifices. You will always get the special place in my heart, forever, and never be forgotten. I am beyond happy to be with you. Bunch of love for you, my dear Abang.

8. Gifta Oktavia, the very best partner ever. Thank you for being sweet, for listening all my stories from the most important until the unimportant one, for sharing so many moments in 4 years. I am so blessed and lucky to have you by my side, my love for will grow bigger and bigger every time. Let us keep support each other darling, I love you.

9. The dearest CAMIL, Suci, Nicky, Mila, Bule, Ditha, Fadiah, and Sarah. They are the best mood booster and stress-releaser during my campus life. Thank you for all those happy moments, surprises every time I had a birthday which always be so special, and for our beautiful togetherness from the very first time. Love you girls, keep build our relationship forever.

10. Geng Cupi a.k.a Manufacture Laboratory Assistant Class of 2012, Lukfi, David, Siwi, Gea, Aan, Irwan, Zamzam, Kepkep, Uzi, Dhena, Erik, and Dian. Thank you for the memorable companionship, sharing moments, and all the hardwork in the past. I could never say anything except proud of you my dear family. This family will be certainly have stronger bond in the future, Aamiin.

11. Manufacture Laboratory Assistant Class of 2013, my dearest junior, Artur, Ghea, Dwiko, Sheila, Priska, Harry, Gaby, Arini, Sarah, Zulfan, Fathur, Rega,

Ihsan, Riski, Adit, and Nita. Thank you for all the love, caring, and support. Always be strong to finish the rest of semesters, I know you guys could do it. See you guys in the next happy moments with PROSFAMS.

12. PROSFAMS Family and the one and only founding father, Pak Rino Andias Anugraha, and also Pak Yulis as our expert laborant. Thank you for giving me a gold opportunity to join this family, which is getting bigger every year hopefully. Such an honor to study all the new lessons, I wish it would be useful in the future.
13. Aisyah Widiawardhani and Raihanna Salma, the very special sweetheart that I have known for almost 6 years and always show the best loyalty from time to time. Thanks for all the supports, understanding, caring, and being there whenever I need someone to talk to and present the best shoulder to cry on. I love you both, let us stay together.
14. TI-36-04, my very beginning class from first semester until second semester. Thank you for all memories, moments, togetherness, friendship, and the wonderful groupies. It is always nice to spend my time with all of you, hope we will always be keep in touch in the future. See you guys on top.
15. TI-36-INT, my most favorite and ideal class to live in for the rest of my life, full of my loveable international friends who taught me and push me to study english better than before. The second place that I always keep in my mind as home, beside my core family. Thank you for the craziness, happiness, sharing times, companionship, friendship, etc, which I could not mention one by one because there were too many perfect moments with all of you guys. I really miss doing activites in our comfortable class, and I miss you all. Never-ending love for all of you.
16. My Kesayangan, Salsa, Sonia, Dhini. Thank you for gave me the sweet memories during Senior High School, and being my best listener whenever I need. Hope that our friendship will always be strong forever.
17. My childhood best friends, that I cannot mention them all, who never leave even once from my side since I was kid until now. I love you all to the moon

and back, thank you for the greatest love and beautiful memories that you guys gave to me. Hope our friendship will be last forever.

18. Many others I didn't mentioned, does not mean I don't appreciate the things you do for me. Thank you very much and my love spreads to all of you.

The authors recognize that there are many flaws in this final project, so criticisms, feedbacks and suggestions from the readers are highly expected. I hope this final project can be useful for the writer and the readers.

Bandung, June 2nd 2016

Nabilatushalihah R. H.

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LIST OF ABBREVIATIONS

Abbreviation	Shortened form	First Time Used on Page
E-KTP	*Kartu Tanda Penduduk Elektronik*	2
ICT	Information and Communication Technology	2
USB	Universal Serial Bus	3
OPC	Operation Process Chart	12
SAM	Secure Access Module	23
SIM	Subscriber Identification Module	24
GPIO	General Process Input Output	25
LED	Light Emiting Diode	25
PDD	Power Distribution and Dara	25
LCD	Liquid Crystal Display	38

TERMINOLOGY

Assembly	:	Component or end item compromising of a number of parts or subassemblies put together to perform a specific function, and capable of disassembly without destruction
Cost of saving for rework	:	Cost that should be saved by the company but being used for rework activity
Defect	:	A shortcoming, fault, or imperfection
E-KTP Reader	:	E-KTP Reader is a tool to read and verify the personal data stored in the E-KTP chip
Expectation cost	:	Addition of useless inspection cost and cost of saving for rework after multiplied by the probabilities
Inspection	:	An examination of a product, process, service, or installation or their design and determination of its conformity with specific requirements or, on the basis of professional judgement, with general requirements
Pneumatic	:	A branch of mechanics that deals with the mechanical properties of gases
Quality	:	The totality of features and characteristics of a product or service that bears its ability to satisfy stated or implied needs
Sample	:	A subset of population that is used to represent the entire group
Useless inspection cost	:	Cost that appears when the product which being inspected is not supposed to be inspected

CHAPTER I INTRODUCTION

I.1 Background

In producing goods or products, there are always two certain conditions either they are good or bad. According to both conditions that appear, each of them has their own criteria. The perfect product would be a win for everyone. Of course, there are no perfect products, but there have been some awfully good ones. It is always associated with the fit between products and the human user, but products also suffer from poor performance and overly high prices, unreliability, difficult maintenance, crude manufacturing, ugliness, ostentatiousness, unnecessary complexity, representation of people or places users do not like, and destruction of natural beauty and future health (James L. Adams, 2011).

All products could be improved, and everyone have evidence for this in their personal experiences. After they have used a product for a while, they become critical of its specific details and can think of ways to make it better. Whatever the situation will be in the future, product quality will be essential to business success. Increasing product quality adds to the pride and satisfaction of employees as well as the reputation of the company. Improved product quality, however, brings added value, increases competitive ability, does not necessarily add to cost, and leads to higher demand. (James L. Adams, 2011).

"Quality" means those features of products which meet customer needs and thereby provide customer satisfaction. In this sense, the meaning of quality is oriented to income. The purpose of such higher quality is to provide greater customer satisfaction and, one hope, to increase income. However, providing more and/or better quality features usually requires an investment and hence usually involves increases in costs. Higher quality in this sense usually "costs more" (Joseph M. Juran, 1999).

There is strong relationship between quality of product and inspection activities. Where, inspection activity is a critical examination of something that is directed to some predetermined goals. This inspection is to compare and determine the suitability of a product to its specifications (Thomas Telford, 1997). And followed by the quality assurance inspection which is defined as "All the planned and systematic activities implemented within the quality system that can be demonstrated to provide confidence that a product or service will fulfill requirements for quality". While quality control inspection is defined as "The operational techniques and activities used to fulfill requirements for quality" (www.qualitygurus.com).

The inspection and testing functions are key elements of the production process. Without accurate and specific criteria for determining that the manufacturing or service product meets the customer's requirements, we expose the organization to uncontrolled, inefficient, and expensive processing as well as negative perceptions from customers (criteria of bad product). These resulting performances can be minimized—if not eliminated—by preproduction and service evaluations (Joseph M. Juran, 1999).

PT. ABC is one of a company in Indonesia which producing several kinds of products such as electronic equipment for military, equipment ICT (Information & Communication Technology), electronic equipment for navigation systems, electronic equipment for railway, renewable energy and electronic equipment. But from the various types of products manufactured, one of the most request number to produce is E-KTP Reader which is include in the category of ICT equipment.

Figure I.1 E-KTP Reader

E-KTP Reader is a tool to read and verify the personal data stored in the E-KTP chip. By using the E-KTP Reader, the E-KTP card can be read and verified against the holder to provide guarantees that the card is used properly by the entitled holder. E-KTP Reader is capable of displaying the data stored in the E-KTP card on the accompanying display and verify the holder independently (standalone) without the need to connect with other devices. In addition, E-KTP Reader is able to transmit data that has been read into the PC (personal computer) via the USB connection [www.len.co.id].

Based on the E-KTP production in 2016, defect products are produced during the final assembly in PT. ABC. Some defects had been solved with changing the design or materials, but there are three main defects which still occurs independently. Every material has its own criteria to be concluded as defect product or passed product, based on specifications which set by the company. Table I.1 shows defect material and passed material from each type of defect which mostly occurs in E-KTP Reader.

Table I.1 Defect product and passed product from 3 types of defect

No.	Type of Defect	Defect Product	Passed Product
1.	Mounting Bolts's holes broken		
2.	Casing broken caused by bolt pierced		
3.	Touchscreen display cracks		

PT. ABC had already try some efforts to handle these problems, but actually never been really solve yet. Based on observation and the data from company, there is only one inspection activity which is placed in the very last stage. The observation had been done in 5 days of work, where the company sets its target to produce 20 products in a day, with 100 samples for being analyzed. From that condition, many products are not detected as defect product or rejected, and then pass to the next stage until they found those defects when the final assembly process has already finish. It makes the company produces defect product, because there is no anticipation before the defect happens. Figure I.2 describes the day-by-day defect of products in 5 days of works.

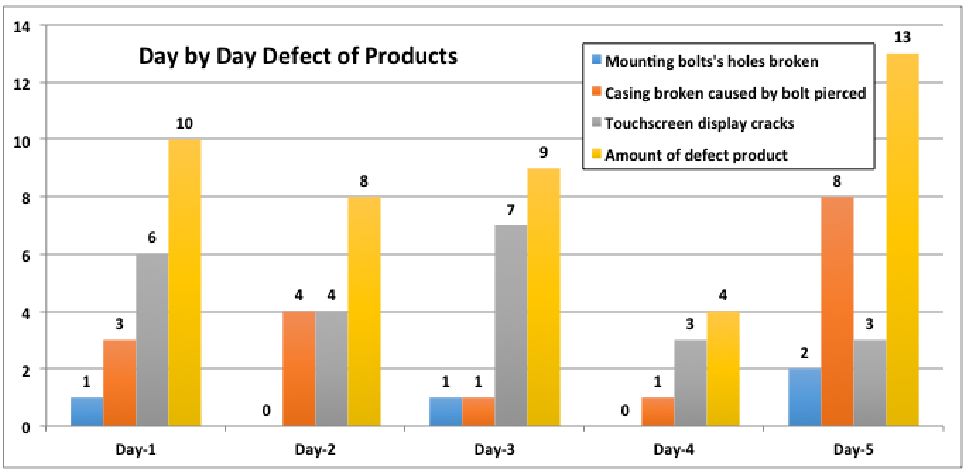


Figure I.2 Day by day defect of products in 5 days of work with 100 samples

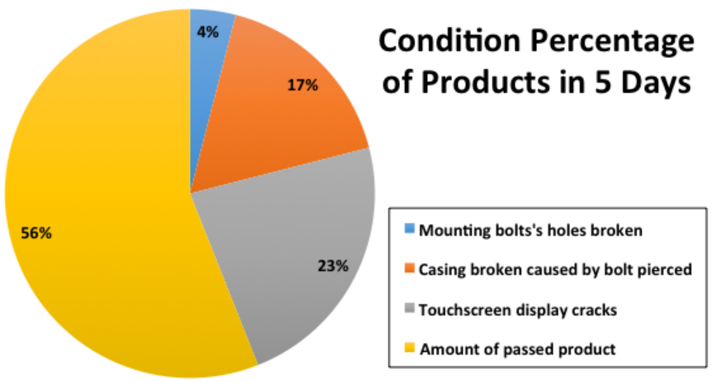


Figure I.3 Percentage condition of products in 5 days

Based on the three types of defect, the percentage condition of products in 5 days which occurs during E-KTP Reader final assembly process in 2016 is described in Figure I. 3, which shows that 44 % is defect. From these data, PT. ABC considered having problems because of the high percentage of defect.

Figure I.3 also shows that from 100 samples of E-KTP Reader product, there are 23% with type of defect touchscreen display cracks, 17% with type of defect casing broken caused by bolt pierced, and 4% with type of defect mounting bolts' holes broken. Based on the occurrence of defect, one of them is suspected caused by the lack of inspection activities at every stage of the assembly process. Ideally, to prevent possible causes of the defect type, strict inspections must be done so that the controlled process can be in accordance with the desired expectations. Before the test, the examiner must know and understand the criteria for the inspection of the item which being inspected. Inspection activities are designed to ensure that every process is already performing well, and no failures or defects could lead to other potential defects in the next process. To achieve the success of the final product with a minimal number of defects, the inspection must be done in detail and repeatedly. Irregular inspection and operator carelessness will cause damage gradually, and therefore the inspection activity at the stage-by-stage process is expected to minimize defects in the final product. It has been proven that routine scheduled inspections and preventive maintenance will guarantee the quality of products and processes. That is because if there is something undesirable happen, so the company could make the decision making whether it will be rejected or repaired, without having to disassemble the product at the final stage.

In fact, the current inspection activities conducted at PT. ABC only happens in the final stage of final assembly process from E-KTP Reader, which is after packaging process. However, on a stage-by-stage assembly process itself there are no inspection activities to ensure that every process has been done properly and to check that there are no errors or failures. Because of this, PT. ABC consumes more cost consist of cost of useless inspection and cost of saving for rework. The work done by the company in dealing with defect is a form of temporary solution when companies perform rework when the products have been marketed to consumers gets complaints that resulted PT. ABC withdraw its products to be repaired. However, efforts to improve in the short term is not yet certain to be able to lower the percentage of defects in the next production of E-KTP Reader.

In this study, the authors will analyze more about the cause of the alleged occurrence of product defects that arise in the process the assembly and forms of prevention, as well as evaluate cost associate with inspection stage scenario.

I.2 Problems Identification

Based on the background that has been described, thing that will be discussed in this study are:

1. What factors are suspected to be the causes of defective products in the production process E-KTP Reader PT. ABC?
2. How to evaluate cost associate with inspection stage scenario?

I.3 Objectives

1. Identify the causes of defective products in the final assembly process of E-KTP Reader in PT. ABC.
2. Evaluate cost associate with inspection stage scenario.

I.4 Limitations

In an effort to achieve the objectives that have been put forward, it is necessary to give restrictions on the problem, namely:

1. This research will only implement the draft proposal of the stages in final assembly that have implemented inspection activities.
2. This study will only discuss the costs associate regarding losses due to product defects which occur using inspection stage scenario.

I.5 Benefits

The benefits of research to be obtained in this study, include:

1. It is expected that the number of products that pass inspection can be increased, to meet customer demand.
2. It is expected that the process of final assembly E-KTP Reader is running correctly from the beginning to the end of stage.
3. It is expected that the company is able to minimize the inspection cost

I.6 Writing Structures

Chapter I Introduction

This chapter contains the translation of the background issues that will be discussed in this study. This chapter contains the background, problem formulation, objectives, limitations, benefits, and writing systematic. These things serve as a foundation to create a proposed improvement in the final assembly process of E-KTP Reader in PT. LEN Industry. These also serve as a foundation to prevent and eliminate the causes of defective products at each stage of assembly.

Chapter II Literature Review

This chapter contains theories relating to the methods used. This chapter also contains theories used to explain the problem in this study. Theories, concepts, methods and tools of six sigma and other supporting theories that are used to support improved planning proposals will be explained in this chapter. The purpose of this chapter provides a scientific basis which is useful as a frame of mind in the research process.

Chapter III Research Methodology

This chapter contains explanations of the troubleshooting steps used in the study to achieve the research objectives to be achieved.

The research methodology includes conceptual models and systematic problem solving that will be used in this study expected to be in accordance with expectation value theory in order to calculate expectation cost associate.

Chapter IV Data Collecting and Processing

This chapter will show the reader about the collection of data to support the course of the study and data processing being performed to obtain answers to the problem formulation formulated in Chapter I.

Chapter V Analysis

This chapter will describe the reader on data processing results analysis obtained from previous chapter. On this chapters will also be an analysis of comparative initial conditions before given proposals and conditions that have rendered the proposed fixes. In addition to this chapter will discuss how the effects of the application of the proposal.

Chapter VI Conclusion and Suggestion

This chapter will describe the summary of the study and its results as well as the suggestions for future study.

CHAPTER II
LITERATURE REVIEW

II.1 Specification of Product

A product is characterized by its properties. Product performance (from a manufacturer, consumer or regulator perspective) is closely linked to the product properties. One of the product properties is "product reliability". The product reliability and several other properties are dependent on the product specification that forms the basis for development of the product. As a result, product performances and specification are inter-linked and impact on the success of the new product development (D.N. Prabhakar Murthy; Marvin Rausand; Trond Osteras, 2008)

II.1.1 Product Properties: Attributes and Characteristics

Product properties characterize a product. They can be categorized into two groups – internal and external. The internal properties are mainly technical (e.g., the yield stress at which a component fails) and of interest to design engineers. The external properties (e.g., aesthetics, cost of operation) are of greater interest to consumers. Terms such as product features and characteristics are often used instead of product properties. According to Tara Sewich and Nair (2000):

"A distinction can be made between product characteristics and attributes. Product characteristics physically define the product and influence the formation of product attributes; product attributes define consumer perceptions and more abstract than characteristics."

Note that the internal properties correspond to product characteristics, whereas the external properties correspond to product attributes.

II.1.2 Consumer Perspective

Consumers view a product in terms of its attributes. According to Levitt (1980):

"To a potential buyer a product is a complex cluster of value satisfaction."

Day et al. (1978) state:

“Consumers seek benefits rather than products per se.”

As a result, we have the following relationship:

Attributes (Features) $\rightarrow$ Bundle of benefits $\rightarrow$ Value to the customer

A successful new product:

1. Satisfies new (for earlier unsatisfied) needs, wants or desire;
2. Possesses a performance that is superior in such need satisfactions, compared with each other products on the market.

Each new generation of a (successful) product is intended to be an improvement over the existing and earlier ones. Products are getting more complex in order to meet the growing consumer requirements and expectations. As a result, customers need to be assured that the product will perform satisfactorily over the useful life of the product. One way of providing this assurance is through product warranty. This is a service associated with the product.

II.2 Quality

Quality is a dynamic unity associated with the products, services, people, processes, and the environment meet or exceed customer expectations. Dynamic unity explains that what is considered to be quality can and often do change over time and changes in circumstances. Products, services, people, processes, and environment are critical elements of quality. It is clear that the quality is applied not only to the products and services provided, but also to the people and processes involved and the environment in which it takes place (Goetsch dan David, 2006).

1. Quality traditionally (Montgomery, 1996) is based to a view that products and services must comply with their use.

2. Quality in general (Pond, 1994) is to make a product or service that is timely, appropriate use in the environment, has a zero defect and satisfy the customers.
3. Quality (Deming, 1980) is a problem-solving to achieve continuous improvement.
4. Quality (Juran, 1986) is the compatibility with the use. Juran's approach is oriented on fulfilling the expectations of the nation.

The concept is explained by the theory of quality Juran trilogy through the definition of quality and quality trilogy. The definition of quality is defined in two quality criteria based on product features that meet customer needs and freedom from deficiencies as described in Table II. 1. [3]

Juran also formulated the concept of quality fulfillment in three aspects of the application, namely through quality planning, quality control, and quality improvement, termed the Juran Trilogy, as described in Table II. 2. [3]

Table II.1 Juran’s Two Definitions of Quality

Juran’s two definitions of quality	
Definition of Quality 1	Definition of Quality 2
Product features that meet customer needs Higher quality enables company to: Increase customer satisfaction Make products salable Meet competition Increase market share Provide sales income Secure premium prices The major effect is on sales. Usually, higher quality costs more.	**Freedom from deficiencies** Higher quality enables companies to: Reduce error rates Reduce rework, waste Reduce field failures, warranty charges Reduce customer dissatisfaction Reduce inspection, test Shorten time to put new products on the market Increase yields, capacity Improve delivery performance Major effect is on costs. Usually, higher quality costs less

Table II.2 Juran Trilogy

Juran Trilogy		
Quality planning	Quality control	Quality improvement
Establish quality goals Identify who the customers are Determine the needs of the customers Develop product features that respond to customer needs Develop processes able to produce the product features Establish process controls; transfer the plans to the operating forces	Evaluate actual performance Compare actual performance with quality goals Act on the difference	Prove the need Establish the infrastructure Identify the improvement projects Establish project teams Provide the teams with resources training, and motivation to: 1. Diagnose the causes 2. Stimulate remedies Establish controls to hold the gains

II.3 Quality Control

Engineering and quality control is an activity that is used to meet, maintain, and improve the quality of products and services (Besterfield, 2009). Quality control contains the set of activities that are used to ensure that the products or services in accordance with the specifications desired by the customer and can be done in a sustainable improvement (Montgomery, 2009).

II.4 Operation Process Chart (OPC)

Operation Process Chart (OPC) is often called the operation process map is a diagram illustrating process steps that will be experienced materials (materials) on the raw sequence of operations and inspection. From the very beginning until the final product as a whole or in parts, and also contains the information needed to analyze further, such as: time spent materials used, and the place or tool or machine that is primarily used. So in a process map operations, noting only the operations and examination alone, sometimes at the end of the process is recorded on the storage. There are four things that need to be considered / to be considered in order to obtain a good working processes through the analysis of the operation process map is an analysis of the materials, operation, inspection, and the completion time of a process. Fourth on the above, can be described as follows (Sutalaksana, 1979):

1. Ingredients

We must consider all the alternatives of the materials used, the process of settlement and tolerances such that in accordance with the functionality, reliability, service and time.

2. Operations

Dalam hal ini In this case must be considered as well as to all possible alternatives for the processing, manufacture, machining or assembly methods, along with tools and equipment used. Repairs may be done for example by eliminating, combining, changing or simplifying operations occur.

3. Inspection

In this case, we must have quality standards. An object is said to qualify the quality when compared to the standard after it turned out better or at least the same. The inspection process can be done by using sampling or one by one from all the objects are made of course the final way is executed when the amount of production a bit.

4. Time

To shorten the completion time, we consider all alternatives regarding methods, equipment and of course the use of specialized vessels.

II.5 Inspection

Inspection is an organized examination or formal evaluation exercise. In engineering, inspection involves the measurements, tests, and gages applied to certain characteristics in regard to an object or activity. The results are usually compared to specified requirements and standards for determining whether the item or activity is in line with these targets. Some inspection methods are destructive; however, inspections are usually nondestructive. Nondestructive examination (NDE), or nondestructive testing (NDT), are a number of technologies used to analyze materials for either inherent flaws (such as fractures or cracks), or damage from use (F.C. Campbell, 2013).

Visual inspection provides a means of detecting and examining a variety of surface flaws, such as corrosion, contamination, surface finish, and surface discontinuities on joints (for example, welds, seals, and solder connections). Visual inspection is also the most widely used method for detecting and examining surface cracks that are particularly important because of their relationship to structural failure mechanisms. Even when other inspection techniques are used to detect surface cracks, visual inspection often provides a useful supplement. Given the wide variety of surface flaws that may be detectable by visual examination, the use of visual inspection can encompass different techniques, depending on the product and the type of surface flaw being monitored. The methods of visual inspection involve a wide variety of equipment, ranging from examination with the naked eye to the use of interference microscopes for measuring the depth of scratches in the finish of finely polished or lapped surfaces (F.C. Campbell, 2013).

II.5.1 Variety of Inspection

There is a very wide variety of inspections, and some of them can be very country-specific (or even specific to a state or province inside a country). Some jurisdictions have inspectorates in charge of controlling compliance with legislation on official language, or gambling. However, there is a general pattern that can allow to categorize inspections into a few main classes (Florentine Blanc, 2012):

- Technical inspections focusing on compliance with, broadly speaking, “safety requirements” (understood in a very broad sense, i.e. including “safeguarding” heritage, for instance, or landscapes), and protection of consumers (including against fraud of all types): occupational safety and health, safety of equipments, buildings and premises, environmental protection, food safety and hygiene, environmental health and public hygiene, public health and drugs safety, market surveillance of non-food products, etc. These tend to be fragmented among many institutions but can be broadly grouped into 7 or 8 main "risk areas" as in the above list. There are some important differences within this category between most checks that tend to focus on "objects" that are premises, or entire businesses – and market surveillance (including part of the food safety checks) where the focus is on products.

- Tax and customs inspections – both focusing on compliance with regulations on mandatory taxes and duties, but with customs inspections focusing on products at the border (even though much of the risk analysis done there will take into account the history of compliance of the importers, so that the "business" as such is also an object of control), and tax inspections looking at an entire business entity‟s operations.

- Inspections conducted following an application for a permit, license or subsidy – these are often called by regulatory authorities "inspections requested by businesses", even though what the businesses really request is not the inspection, but the relevant approval or assistance. In some ways, these inspections are more a part of the procedure being applied for (approval, or financial assistance etc.) than really part of "enforcement" in general. However, most of the issues and reform approaches are similar to inspections "in general" (predictability and transparency, proportionality to risk, etc.).

- Indirect control, whereby the state regulatory bodies do not generally inspect businesses (or products) directly, but rather rely on private/delegated inspections or certification. Generally this involves a mechanism to approve certain entities to perform these inspections or certifications, a system of liability for these certifiers, and a supervision of these entities by the state regulator – but the regulator may also, in some cases, inspect directly the businesses or products that have been privately inspected or certified, as a kind of "reality check" (this is what happens for many types of goods in modern market surveillance systems). Even though this kind of system is very specific, and generally studied separately as part of the work on "technical regulations", many aspects and issues are common with regulatory enforcement and inspections in general (risk analyzis, transparency, proportionality, credibility of sanctions and liability, etc.).

II.5.2 Inspection Cost

The type of costs that are usually understood as being directly related to inspections are the following:

- Preparation time, if any, when inspections are announced in advance – including time to retrieve or prepare specific documentation
- Inspection time: time spent with inspectors by staff or management of the business, during which they were not able to perform other work
- Follow up time, if any, for all activities directly resulting from the inspection – preparing papers, going to government offices, or any other administrative task

There are some "grey areas" in the burden broadly related to inspections, where it is not clear cut whether this really is "administrative burden", and whether it is primarily "inspections-related" – in particular (Florentine Blanc, 2012):

- Costs directly or indirectly related to testing or physical inspection conducted as part of the broader inspection system.
- Turnover, profit or value-added losses due to inspections (during inspection itself or as a result of inspector"s decision).
- Monetary (or other) sanctions imposed as a result of inspections findings.
- Costs of putting the business in compliance following the inspection's findings and inspector's improvement notice.

II.6 Criteria of Good Product

The perfect product would be a win for everyone. Of course, there are no perfect products, but there have been some awfully good ones. It is always associated with the fit between products and the human user, but products also suffer from poor performance and overly high prices, unreliability, difficult maintenance, crude manufacturing, ugliness, ostentatiousness, unnecessary complexity, representation of people or places users do not like, and destruction of natural beauty and future health (James L. Adams, 2011).

II.7 Quality Cost

Juran defined four broad categories of quality costs, which can be used to evaluate the firm's costs related to quality. Such information is valuable to quality improvement. The four quality costs are listed as follows (Juran and Gryna, 1993):

1. Internal failure costs (scrap, rework, failure analysis, etc.), associated with defects found prior to transfer of the product to the customer;

2. External failure costs (warranty charges, complaint adjustment, returned material, allowances, etc.), associated with defects found after product is shipped to the customer;

3. Appraisal costs (incoming, in-process, and final inspection and testing, product quality audits, maintaining accuracy of testing equipment, etc.), incurred in determining the degree of conformance to quality requirements;

4. Prevention costs (quality planning, new product review, quality audits, supplier quality evaluation, training, etc.), incurred in keeping failure and appraisal costs to a minimum.

II.8 Expected Value

In a probability distribution, the weighted average of possible values of a random variable, with weights given by their respective theoretical probabilities, is known as the expected value, usually represented by $E(x)$.

The expected value informs about what to expect in an experiment "in the long run", after many trials. In most of the cases, there could be no such value in the sample space.

The weighted average formula for expected value is given by multiplying each possible value for the random variable by the probability that the random variable takes that value, and summing all these products. It can be written as:

$$E(x)=\sum x_i * P(x_i)$$

Where x_i covers all possible values for the random variable, and $P(x_i)$ is the respective theoretical probability. $E(x)$ is also called as mean of the probability distribution because it tells what to expect in the "*long run*"- that is, after many trials (www.hotmath.com).

CHAPTER III
RESEARCH METHODOLOGY

This chapter will discuss the use of research methodology comprising the steps of research and data needs for research. The research methodology is basically a scientific way to get data with a specific purpose and usefulness. Using the methodology of the study, the research activity is expected this will be a rational, empirical, and systematically in order to achieve the objectives of the study. In this study, only Analyze and Improve that will be discussed.

III.1 Conceptual Model

Before doing research, to get the desired results it is advisable to make a conceptual model of research beforehand. The conceptual model to describe and represent the entire understanding of the variables, and the relationship between these variables. The conceptual model in this study is described in Figure III.1.

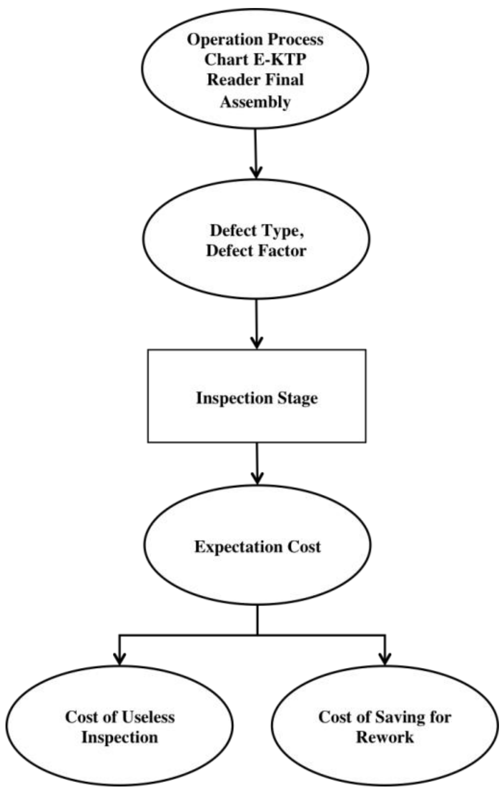


Figure III.1 Conceptual Model Research

Based on Figure III.1, the data which is supporting this research is mainly Operation Process Chart. After analyzing the whole stage and the information in the Operation Process Chart, then continue to take the data include the types of defects that mostly occur in the product. Then, each type of defect recorded on how many products are experiencing the kind of disability of defect. After that, calculate the expectation costs of inspection, where the data required is the useless inspection cost and rework costs that could be saved. Then make a model of a combination of inspection scenario activity to determine which combination of inspection is the best and most efficient for PT. ABC to be applied, in terms of the most minimum of expectations cost related to inspection. The expectation cost consist of useless inspection cost and cost of saving for rework. Then after analyzing, the results of this analysis are also equipped with the proposed improvements, which aim is to help minimize the causes of the problems that occur PT. ABC during the final assembly process takes place.

III.2 Problem Solving Systematics

In this problem solving systematics will be explained the steps for solving the existing problems. The steps will be used to conduct the optimal solution to the existing problems could be solved. The problem solving systematics could be seen on Figure III.2. In outline, the problem solving systematics could be divided into four major steps, there are Data Collecting, Analysis, Evaluation, and Conclusion Phase.

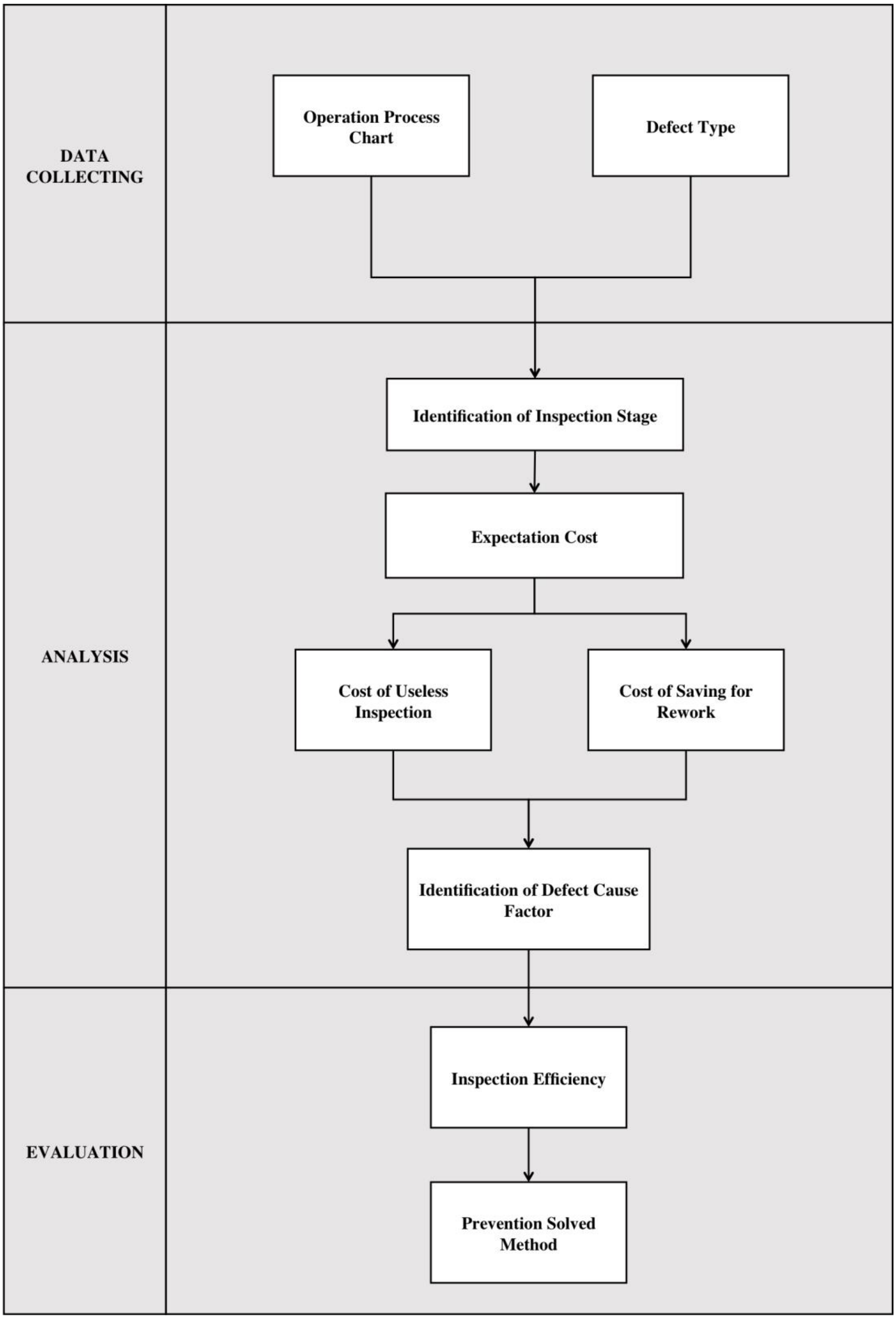


Figure III.2 Problem Solving Systematics

III.2.1 Data Collecting Phase

Data Collection process done by collecting all of the data needed in research. The data needed includes:

1. Operation Process Chart

   Operation Process Chart is used to know and learn the whole process of E-KTP Reader final assembly in PT. ABC
2. Defect Type

   Defect type is used to know what type of defect which usually occurs when PT. ABC doing final assembly of E-KTP Reader product

III.2.2 Analysis

This stage start with analyzing the inspection stage, that is made to a better understanding in making of inspection combination. The inspection combinations made with considering which stage that needs to be inspected. The method that used to calculate the expectation cost is using expected value formulation. The expectation value formula is $E(x)=\sum x_i*P(x_i)$, which is calculated from amount of multiplication of probability of the outcome and the number of outcome. To calculate expectation cost for efficient inspection, there are two costs needed which are the cost of useless inspection which occurs when the product that does not need to be inspected is being inspected, and the cost of saving for rework which means that cost is actually could be saved for the company but being used to rework the defect product. The formula to calculate useless inspection cost P_{00}*Inspection Cost, where P_{00} is the probability of good product (wihout any defect). The formula to calculate the cost of saving for rework P_{10}*Cost of saving for rework added with P_{01}*Cost of saving for rework. Then calculate the total expectation cost which is addition of cost of useless and cost of saving for rework . After that also identify the defect cause factor to find the solution.

III.2.3 Evaluation

III.2.3.1 Inspection Efficiency

Inspection Efficiency is used to know which is the most efficient cost of inspection to use for PT. ABC, by comparing each cost for each combination.

This proposal is to help the company reduces their defect product and also save their money for another things or goods.

III.2.3.2 Solve Prevention Method

Solve Prevention Method is used to prevent defect type which is occurs during final assembly of E-KTP Reader, based on observation and the information from PT. ABC in accordance with the most appropriate solution.

BAB IV DATA COLLECTING AND PROCESSING

In this chapter will discuss the processing of the data that supports the work in this study correspond to the tools used.

IV.1 Collecting Data

IV.1.1 Profile of the Company

PT. ABC is one of the State Owned Enterprises engaged in the field of professional electronics and engineering in other engineering fields. Now PT. ABC has been developing business and products in the field of electronics for industry and infrastructure, and has demonstrated experience in the field of broadcasting, telecommunications infrastructure networks, signal system trains, power electronics systems, solar power generation, E-KTP Reader, and electronics for defense land, sea, and air. As a company that is professionally managed and organized, PT. ABC has the vision and mission as follows:

Vision : **Being a world-class electronics company**

Mission : **Improving the welfare of stakeholders through innovative electronic products industry and infrastructure**

The quality policy of PT. ABC is committed to continuously provide products that satisfy and delight customers. To fulfill this commitment, the company made efforts to improve continuously in terms of:

- Order fulfillment on time
- Improved product quality
- Increase employee competency
- Improved accuracy and speed the flow of information and documentation

From some products manufactured by PT. ABC, E-KTP Reader product is a product that is the subject of research. Where products are manufactured with the same process steps and entirely uniform.

IV.1.2 E-KTP Reader Product

In general, the main functions of E-KTP Reader is (www.len.co.id):

1. Do data reading of E-KTP data which includes profile (name, place, birthdate, address, etc.), photo, and signature.
2. Doing verification that the E-KTP card is truly belongs the related person, with do left or right index finger scanning using finger print scanner in the E-KTP Reader.

The architecture of E-KTP Reader is pictured in Figure IV.1.

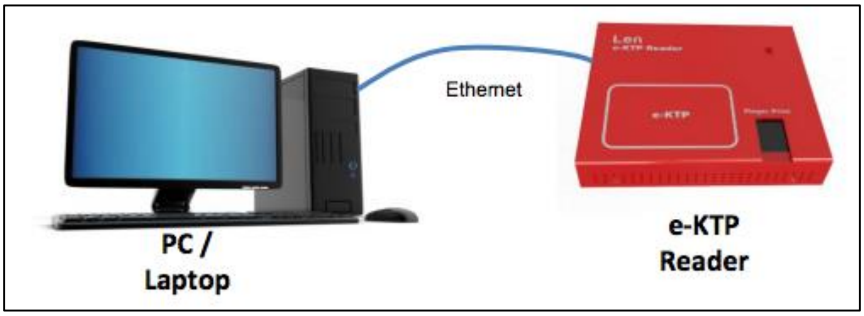


Figure IV.1 Architecture of E-KTP Reader

E-KTP Reader consist of three main components, as described in Figure IV.2, namely:

1. Contactless card reader which completed by SAM slot
2. Finger print scanner
3. Main Board

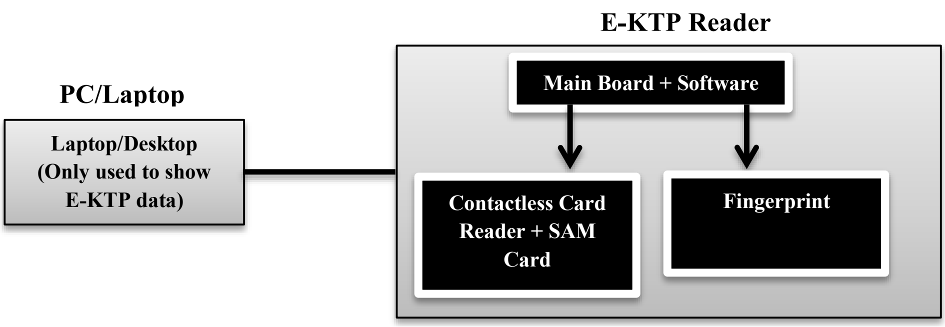


Figure IV.2 Blok Diagram E-KTP Reader

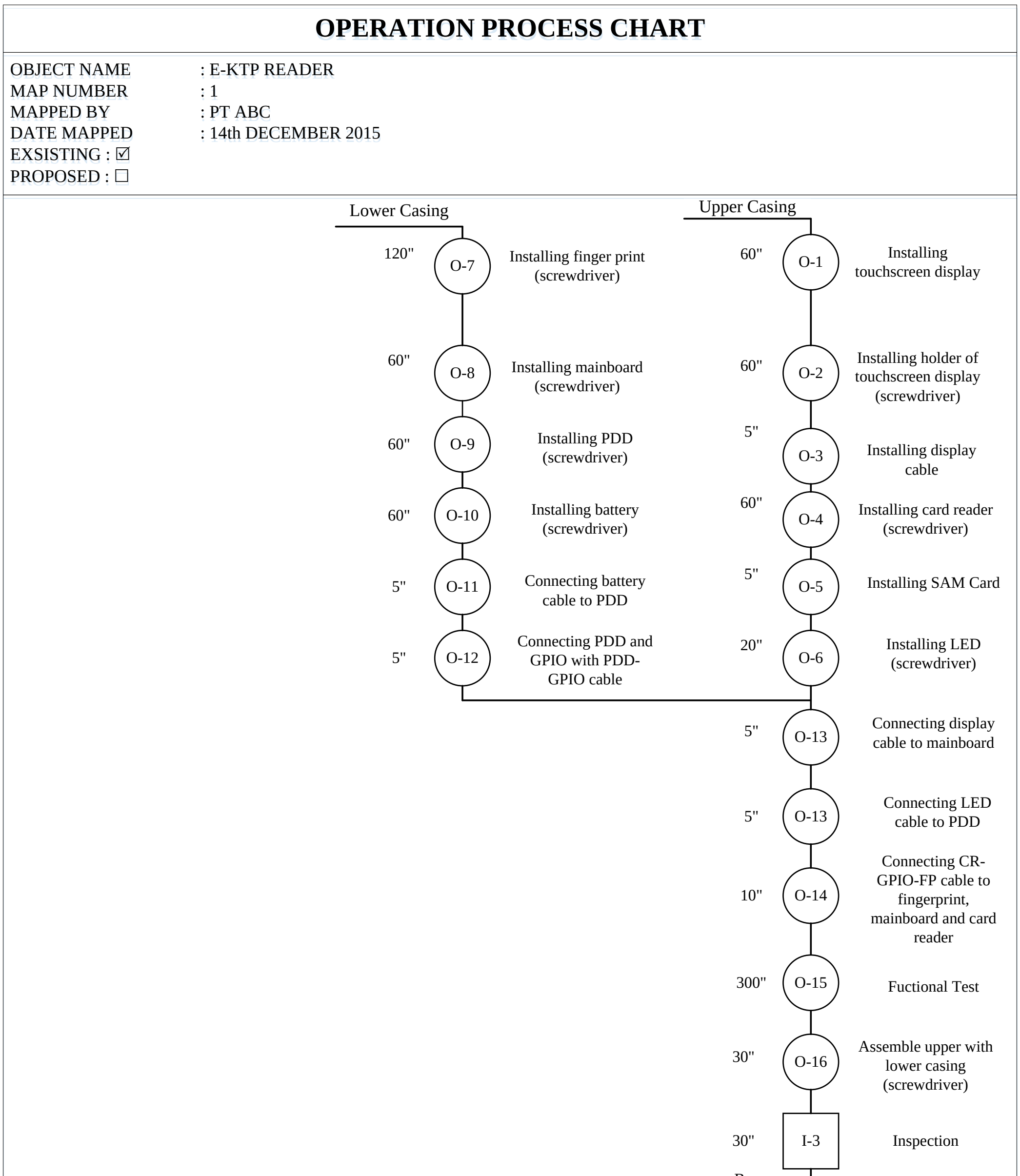
The whole of processing and data processing are happened in E-KTP Reader. PC / Laptop Client only serves to display the data. SAM (Secure Access Module) is a chip in the contact card format that stores cryptographic keys needed to read the E-KTP Reader. Without SAM, the E-KTP card can not be read. SAM is physically similar to a mobile phone SIM card. SAM card is inserted into a slot in the card reader.

After analyzed in chapter I about the type of defects which mainly occurs in the E-KTP Reader Final Assembly, in this chapter, the cause factor is being identified and also the efforts that had been done so far by PT. ABC (temporary solution) as described in Table IV. 1.

Table IV.1 Defect Cause Factor

No.	Type of Defect	Cause of Defect	Efforts that had been done by Company
1	Mounting Bolts's holes broken	Because operator uses pneumatic when installing the bolt, so the pressure all equalized and cannot be set manually	Operator should be more careful when installing the bolt using pneumatic
2	Casing broken caused by bolt pierced	There is an error when installing the bolt, bolt size does not fit so the bolt penetrates the casing and it damages	Operator should know the type of bolt’s differentiation to avoid error
3	Touchscreen display cracks	The pressure when installing the touchscreen display is too hard	Operator should be more careful when pressing toucscreen display to the casing

IV.1.3 Operation Process Chart and Stages of E-KTP Reader Final Assembly



SUMMARY		
EVENT	AMOUNT	TIME (SEC)
○	17	1110
□	1	30
TOTAL		1140

Figure IV.3 Operation Process Chart of Final Assembly E-KTP Reader

From the description of the final assembly OPC E-KTP Reader in Figure IV.3 which has been observed, it is known that the visual inspection is only done once at the end of the process (I-2). Inspection (I-1) is only a function test whether the tool which contains data that has been assembled can be read or not, by using software to detect the authenticity of the E-KTP Reader. Based on the information if it is divided into several stages , it can be seen in Figure IV.4.

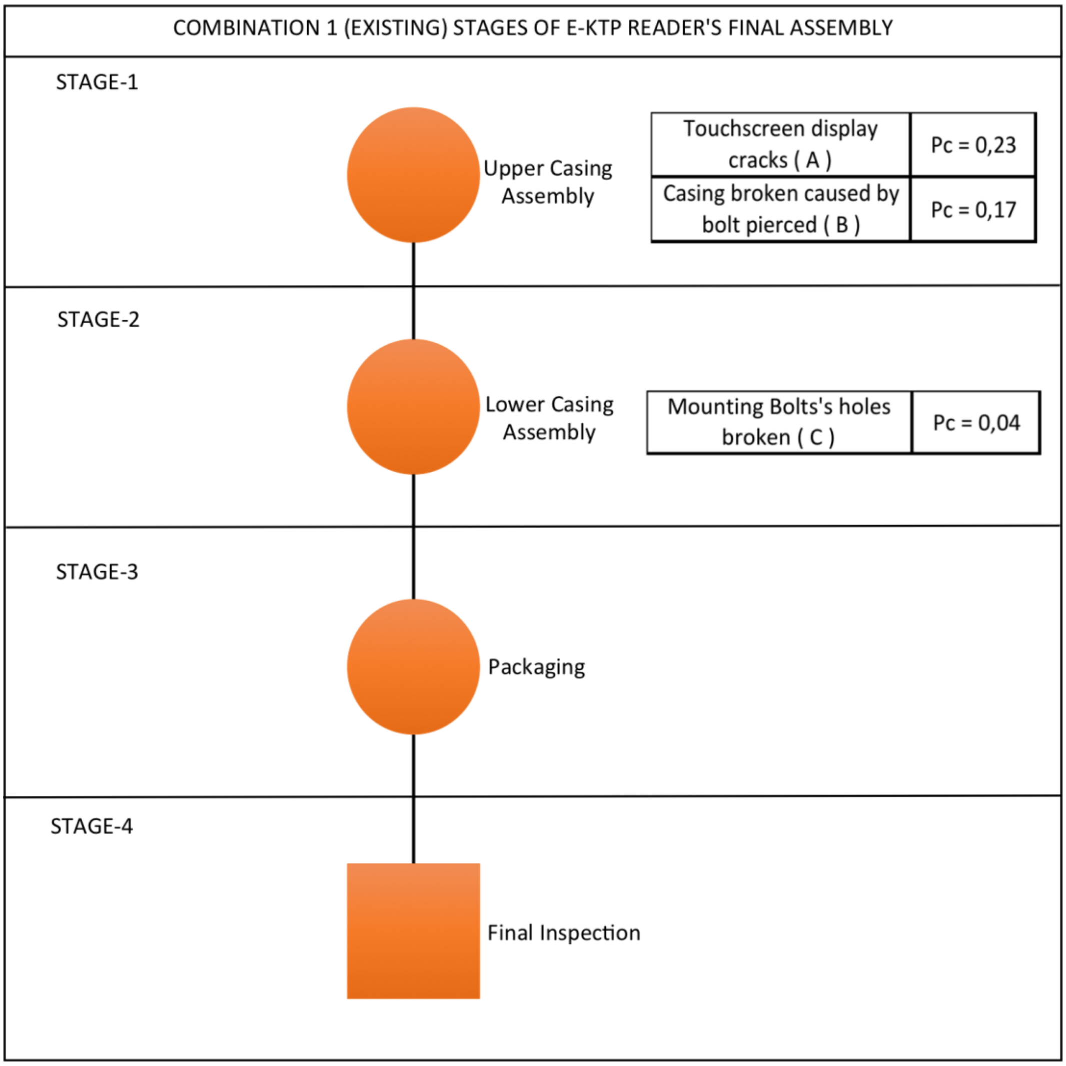


Figure IV.4 Existing Stage of E-KTP Reader's Final Assembly

Based on data in the existing stage, it can be indicated that the lack of inspection activities is what has been causing PT. ABC produces E-KTP Reader with disabilities or defect condition. Because the inspection is only done at the end of the stage, the better the chance for company to produce defective product is even greater. It will disadvantages PT. ABC if the solution is not immediately found, because the manufacture of defective products is a waste and failure costs will be arises because the product is already irreversible. Despite the application of cannibal rework (overlap), still material will be wasted if the disability suffered severe and difficult to be repaired.

IV.1.4 Data Processing from Final Assembly of E-KTP Reader

Based on the existing Operation Process Chart, note that the inspection process is only done once in the last stage to final assembly. The condition causes disability products in the previous qualifying stage and the newly discovered defects in the inspection time until the last stage. PT. ABC requires inspection activities on the stage of the process has indicated the chances of a defect, the defect type touchscreen display cracks (A), the caused by broken casing bolt pierced (B), and mounting bolts holes is broken (C). But the application of inspection activities should be considered carefully and efficiently. So inspection scenario will be made on each of these combinations to find the most efficient expectation cost that will be proposed to PT. ABC. The proposal is expected to reduce the number of defective products, and minimizing the cost of failure caused by defective products which are produced. Testing the inspection considered combination in terms of cost, where the data of the cost are as follows:

Table IV.2 Inspection Cost for Each Stage

INSPECTION COST	
NAME	**COST**
I_{C1} (Stage 1)	Rp 15.000,-
I_{C2} (Stage 2)	Rp 25.000,-
I_{C4} (Stage 4)	Rp 45.000,-

In table IV.2, there are several inspection cost in each stage namely I_{C1}, I_{C2}, and I_{C4}. There is no I_{C3}, because in the third stage which is packaging are not found any type of main defect occurs. So inspection does not needed in this stage, in order to avoid cost of useless inspection comes out.

Table IV.3 Cost of Rework for Saving in Stage-1

COST OF REWORK FOR SAVING in STAGE-1	
NAME	**COST**
R_{A1}	Rp 505.000,-
R_{B1}	Rp 700.000,-

Based on table IV.3, there are two cost which produced by PT. ABC in the first stage namely R_{A1} and R_{B1}. R_{A1} means cost that actually could be saved by the company but used to rework the product with defect type A, which is "touchscreen display cracks", when occurs in stage 1. R_{B1} means cost that actually could be saved by the company but used to rework the product with defect type B, which is "casing broken caused by bolt pierced", when occurs in stage-1.

Table IV.4 Cost of Rework for Saving in Stage-2

COST OF REWORK FOR SAVING in STAGE-2	
NAME	**COST**
R_{A2}	Rp 600.000,-
R_{B2}	Rp 750.000,-
R_{C2}	Rp 510.000,-

Based on table IV.4, there are three cost which produced by PT. ABC in the second stage namely R_{A2}, R_{B2}, and R_{C2}. R_{A2} means cost that actually could be saved by the company but used to rework the product with defect type A, which is "touchscreen display cracks", when occurs in stage-2. R_{B2} means cost that actually could be saved by the company but used to rework the product with defect type B, which is "casing broken caused by bolt pierced", when occurs stage-2. The addition is R_{C2}, which means cost that actually could be saved by the company but used to rework the product with defect type C "mounting bolts' holes broken", when occurs in stage-2. For adding information, defect type C starts to occur in stage-2 which is lower casing assembly of E-KTP Reader.

Table IV.5 Cost of Rework for Saving in Stage-4

COST OF REWORK FOR SAVING in STAGE 4	
NAME	**COST**
R_{A4}	Rp 670.000,-
R_{B4}	Rp 815.000,-
R_{C4}	Rp 600.000,-

Based on table IV.4, there are three cost which produced by PT. ABC in the second stage namely R_{A4}, R_{B4}, and R_{C4}. R_{A4} means cost that actually could be saved by the company but used to rework the product with defect type A, which is "touchscreen display cracks", when occurs in stage 4. R_{B4} means cost that actually could be saved by the company but used to rework the product with defect type B, which is "casing broken caused by bolt pierced", when occurs stage 4. R_{C2} means cost that actually could be saved by the company but used to rework the product with defect type C "mounting bolts' holes broken", when occurs in stage-4.

- **Combination-1 (Existing Condition)**

		C		
		0	**1**	
AB	**0**	**56**	**0**	**56**
	1	**40**	**4**	**44**
		96	**4**	**100**

Figure IV.5 Inspection Combination-1

In combination-1 inspections (existing condition) of a one-time inspection in the last stage of the process of final assembly E-KTP Reader. Here are the data of the number of defective products and escapes products, where the number of products that are not have type of defect AB and C is 56 units. For products that are not have type of defect AB but have the defect type C is 0 units. For products that have type of defect AB but not have defective type C is 40 units. And for the products that have both type of defect AB and C is 4 units.

From the existing condition, it can be calculated how much costs arising from the initial stage to the final stage.

+ Cost of Useless Inspection $= P(x_i)*x_i$

$= P_{00}$ * Inspection Cost

$= P_{00} * IC_4$

= 0,56 * Rp 45.000

= Rp 25.200,-

- Cost of Rework Saving $= P(x_i)*x_i$

$= P_{10}\ (R_{A4} + R_{B4} + R_{C4})$

$P_{01}\ (R_{A4} + R_{B4} + R_{C4})$ +

0,44 (Rp 670.000 + Rp 815.000 + Rp 600.000)

0,04 (Rp 670.000 + Rp 815.000 + Rp 600.000) +

Rp 294.800 + Rp 358.600 + Rp 264.000

Rp 26.800 + Rp 32.600 + Rp 24.000 +

Rp 917.400

Rp 83.400 +

Rp 1.000.800,-

Expectation of Inspection Cost = (Cost of Useless Inspection) + (Cost of Rework Saving)

Expectation of Inspection Cost = Rp 25.200,- + Rp 1.000.800,-

= Rp 1.026.000,-

Thus, the expectation associated costs of inspection for the combination-1 (existing condition) is Rp 1.026.000,-.

➢ **Combination-2**

		B		
		0	1	
A	0	70	7	77
	1	13	10	23
		83	17	100

Figure IV.6 Inspection Combination-2

In combination-2 inspections, the inspection location is placed between stage-1 and stage-2, also in the end of the last stage. Here are the data of the number of defective products and escapes products, where the number of products that are not have type of defect A and B is 70 units. For products that are not have type of defect A but have the defect type B is 7 units. For products that have type of defect A but not have defective type B is 13 units. And for the products that have both type of defect A and B is 10 units.

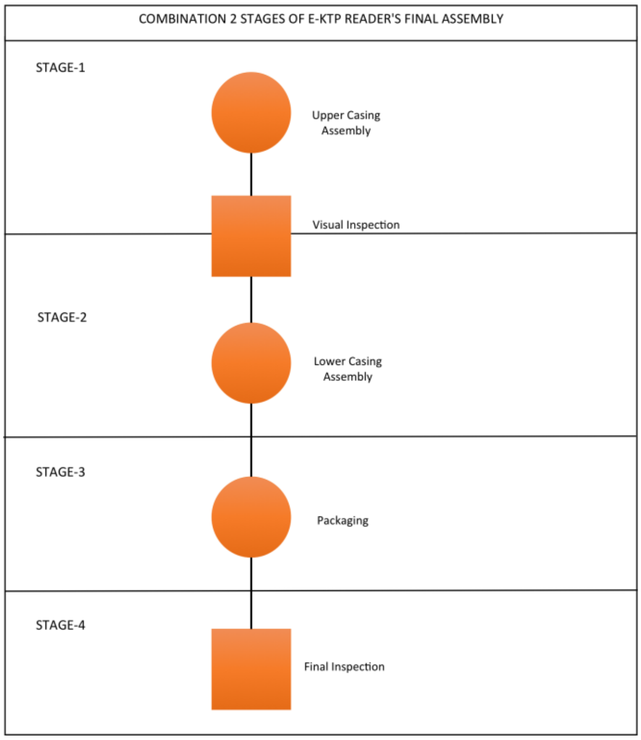


Figure IV.7 Combination-2 Stages of E-KTP Reader Final Assembly

The costs arising from the initial stage to the final stage is:

+ Cost of Useless Inspection $= P(x_i)*x_i$

$= P_{00}$ * Inspection Cost

$= P_{00} * (IC_1 + IC_2)$

= 0,70 * (Rp 15.000 + Rp 25.000)

= 0,70 * Rp 30.000

= Rp 21.000

- Cost of Rework Saving $= P(x_i)*x_i$

$= P_{10}\ (R_{A2} - R_{A1})$

$P_{01}\ (R_{B2} - R_{B1})$ +

0,23 (Rp 600.000 – Rp 505.000)

0,17 (Rp 750.000 – Rp 700.000) +

Rp 138.000 – Rp 116.150

Rp 127.500 – Rp 119.000 +

Rp 21.850

Rp 8.500 +

Rp 13.350,-

Expectation of Inspection Cost = (Cost of Useless Inspection) + (Cost of Rework Saving)

Expectation of Inspection Cost = Rp 21.000 + Rp13.350,-

= Rp 34.350,-

Thus, the expectation associated costs of inspection for the combination-2 is Rp 34.350,-.

- **Combination-3**

		C		
		0	1	
AB	0	60	0	60
	1	36	4	40
		96	4	100

Figure IV.8 Inspection Combination-3

In combination-3 inspections, the inspection location is placed between stage-2 and stage-3, also in the end of the last stage. Here are the data of the number of defective products and escapes products, where the number of products that are not have type of defect AB and C is 60 units. For products that are not have type of defect AB but have the defect type C is 0 units. For products that have type of defect AB but not have defective type C is 36 units. And for the products that have both type of defect AB and C is 4 units.

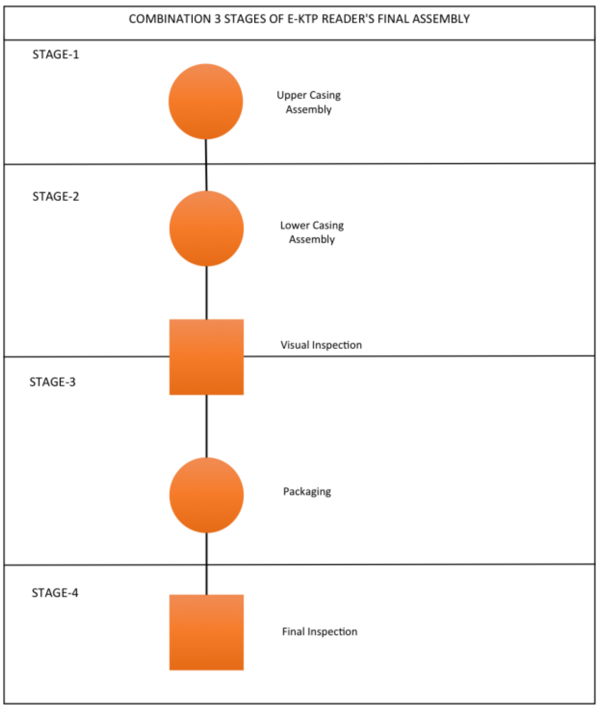


Figure IV.9 Combination-3 Stages of E-KTP Reader Final Assembly

The costs arising from the initial stage to the final stage is:

+ Cost of Useless Inspection $= P(x_i)*x_i$

$= P_{00}$ * Inspection Cost

$= P_{00} * (IC_1 + IC_2)$

= 0,60 * (Rp 15.000 + Rp 25.000)

= 0,60 * Rp 30.000

= Rp 18.000,-

- Cost of Rework Saving $= P(x_i)*x_i$

$= P_{10}\ ((R_{A2} - R_{A1}) + R_{C2})$

$P_{01}\ ((R_{B2} - R_{B1}) + R_{C2})$ +

0,40 ((Rp 600.000 – Rp 505.000) + Rp 510.000)

0,04 ((Rp 750.000 – Rp 700.000) + Rp 510.000) +

0,40 (Rp 95.000 + Rp 510.000)

0,04 (Rp 50.000 + Rp 510.000) +

Rp 38.000 + Rp 204.000

Rp 2.000 + Rp 20.400 +

Rp 242.000

Rp 22.400 +

Rp 264.400,-

Expectation of Inspection Cost = (Cost of Useless Inspection) + (Cost of Rework Saving)

Expectation of Inspection Cost = Rp 18.000 + Rp 264.400,-

= Rp 282.400,-

Thus, the expectation associated costs of inspection for the combination-3 is Rp 282.400,-.

CHAPTER V ANALYSIS

From the results of data collection and data processing in chapter IV, testing was performed in three combinations to determine the most efficient combination of inspection. Efficient question is which produces the minimum disability or defect and costs associated inspections minimum expectations anyway. In terms of cost calculations, then the PT. ABC for each of the combinations have to find what is the cost associated expectations inspection. These costs are sought in order to avoid the escape of defective products in the process of final assembly, where the types of defects that occur there are three types, namely touchscreen display cracks (A), the caused by broken casing bolt pierced (B), and mounting bolts holes is broken (C). To search for expectations cost related to inspection, useless inspection cost (i) and rework cost for saving (j).

V.1 Proposal for New Inspection Scenario with Efficient Cost Associate

In combination-1 (existing conditions), PT. ABC has useless inspection cost that is Rp 25.200,- and rework cost saving of Rp 1.000.800,-. Then we got the expected results related costs of inspection on a combination of 1, Rp 1.026.000,-. In combination-2, PT. ABC has useless inspection cost that is Rp 21.000,- and rework cost saving of Rp 13.350,-. Then we got the expected results related costs of inspection on a combination of two of Rp 34.350,-. In combination-3, PT. ABC has useless inspection cost that is Rp 18.000,- and rework cost saving of Rp 264.400,-. Then we got the expected results related charges three inspections on a combination of Rp 282.400,-.

Table V.1 Rank of Minimum Expection Cost

Scenario	Useless Inspection Cost	Rework Cost Saving	Expectation Cost	Rank of Minimum Cost
Combination-1	25.200,-	1.000.800,-	1.026.000,-	III
Combination-2	21.000,-	13.350,-	34.350,-	I
Combination-3	18.000,-	264.400,-	282.400,-	II

Based on calculations as resumed in tabel V.1, it could be concluded that the inspections by the combination-2 is more efficient than the other combinations, because the expectation cost related to inspection is the smallest. So PT. ABC may be considered implementing combination-2 on the final assembly E-KTP Reader in the future.

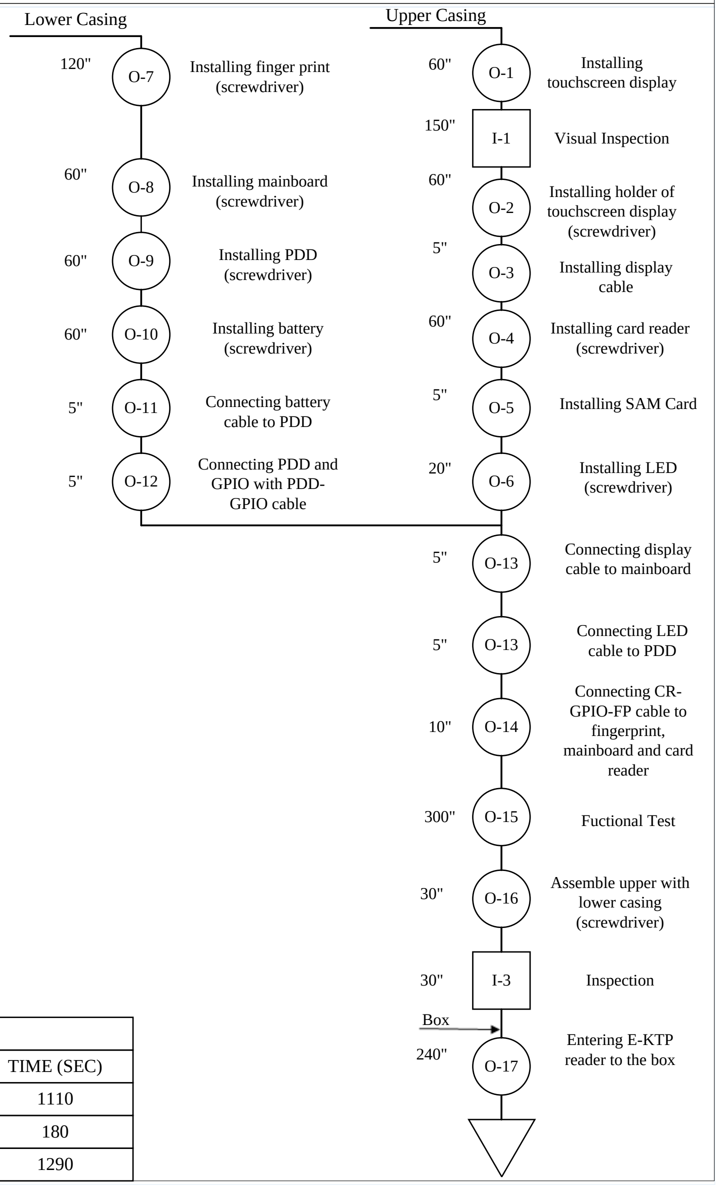
V.2 Proposal for Operation Process Chart Final Assembly of E-KTP Reader

With a proposal that has been made, the new Operation Process Chart for the final assembly of products E-KTP Reader turned into as shown in figure V.2.

With the application of a combination-2, PT. ABC has two times inspection activities in the final stages of E-TKP Reader final assembly. The first inspection (visual inspection) will be done after installing touchscreen display for 3 minutes in the first stage, which is Upper Casing Assembly. The second inspection (visual inspection) will be done at the last stage of the process of final assembly for 5 minutes to make sure the E-KTP Reader product is in a good shape in terms of visual look and packaging, and ready to be marketed.

OPERATION PROCESS CHART

OBJECT NAME : E-KTP READER
MAP NUMBER : 1
MAPPED BY : PT ABC
DATE MAPPED : 14th DECEMBER 2015
EXSISTING : ☐
PROPOSED : ☑



SUMMARY		
EVENT	AMOUNT	TIME (SEC)
◯	17	1110
☐	2	180
TOTAL		1290

Figure V.1 Proposed Operation Process Chart Final Assembly of E-KTP Reader

V.3 Prevention to Minimize Product Defect

Table V.2 Solved Prevention Method

No.	Type of Defect	Preventive Action	Support Tools
1.	Mounting Bolts's holes broken	PT. ABC provides training for operators to use pneumatic mounting screws. The training focused on the operator's ability to locate the screws during installation, so that the pressure which has been set default will not make the mounting hole bolt broke.	Training, Bolts, and Pneumatic
2.	Casing broken caused by bolt pierced	PT. ABC separating screws length and short in different containers, thereby minimizing operator errors when assembling the upper casing and lower casing.	Container to put different size of bolts
3.	Touchscreen display cracks	PT. ABC implements training for installation of the LCD screen display to the operator, so that when they are installing the LCD screen display to the upper casing, the pressure can be adjusted. Avoid emphasizing too hard .	Training, LCD Screen Display, Upper Casing

Although it has been doing inspections on the application of a combination of final assembly E-KTP Reader, PT. ABC still had to take steps to prevent that three types of defects, which are mounting bolts 's holes broken, broken casing the caused by bolt pierced, and touchscreen display cracks did not appear. The third types of disabilities have the same cause, namely the operator negligence. With given some prevention efforts, the expected number of disability products can be minimized, so that inspection activities will one day be eliminated. Not all eliminated, but only at some critical stages that require inspection activity. Table V.I shows prevention action for each type of defect that want to be proposed to PT. ABC.

CHAPTER VI CONCLUSION AND SUGGESTION

VI.1 Conclusion

1. Based on the comparison of inspection cost for each scenario, the most efficient one is combination-2, which spends cost of useless Rp 21.000,- and cost of rework for saving Rp 13.350,-. So, PT. ABC only needs to spend Rp 34.350,- as the total inspection cost for defect products.
2. Identifying the causes of defective products in the final assembly process of E-KTP Reader in PT. ABC, based on data and information of the company which is Operation Process Chart. The defect which are found in the stage is identified in order to know when those defects occurs during the final assembly process. From the discovery of the defective product, then the scenario inspection made at each stage which is being indicated that defects will be happen.
3. The evaluation of cost association is calculated from inspection stage scenario proposed, that can be used to see the probability of placing inspection location in several combinations that are made. The cost associate is calculated after the defect analysis, then the company will know the most efficient placement of inspection by using a calculation of cost expectations which are consist of useless inspection cost and saving cost that used for rework.

VI.2 Suggestion

1. Even after making a new inspection scenario, the defect will be occurs if there is no prevention method to avoid the occurrence of defect product. So, the company should be concern to do the prevention action in order to minimize product defect in final assembly process.
2. PT. ABC is suggested to be implemented the new inspection scenario, in order to consumes minimum expectation cost for E-KTP Reader final assembly.
3. Although PT. ABC has already made solution, it does not mean they do not need some prevention methods to support the inspection activities. There are several solved prevention methods to avoid the occurrence of defect type on

their product during final assembly process, which is related to increase the ability of work and also their operator's skill, and the last but important is operator's stamina.

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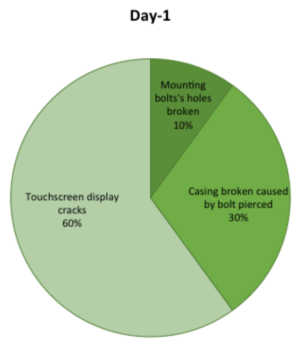
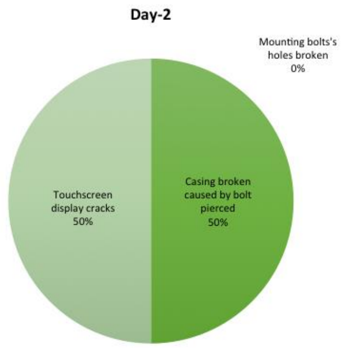
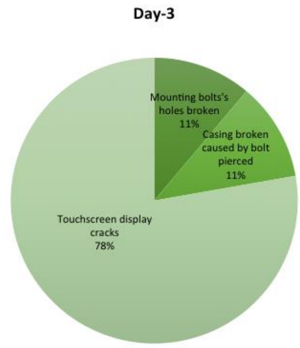
APPENDIX A

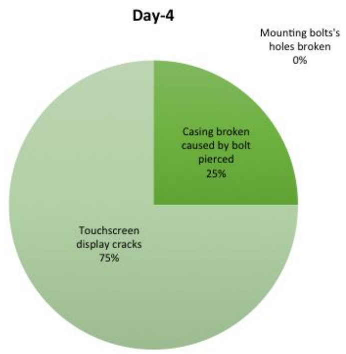
The number of defects and the proportion of 100 samples of products E-KTP in one week (5 working days)

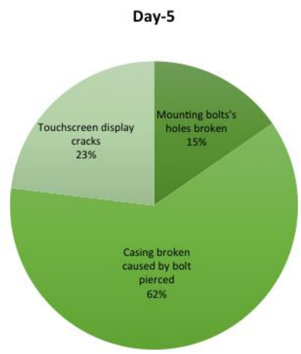
No.	Type of Deffect	Day-1	Day-2	Day-3	Day-4	Day-5	in 5 Days	
1	Mounting bolts's holes broken	1	0	1	0	2	4	4%
2	Casing broken caused by bolt pierced	3	4	1	1	8	17	17%
3	Touchscreen display cracks	6	4	7	3	3	23	23%
	Amount of defect product	**10**	**8**	**9**	**4**	**13**	**44**	**44%**
	Amount of passed product	**10**	**12**	**11**	**16**	**7**	**56**	**56%**
	Total Amount of Product	**20**	**20**	**20**	**20**	**20**	**100**	**100%**

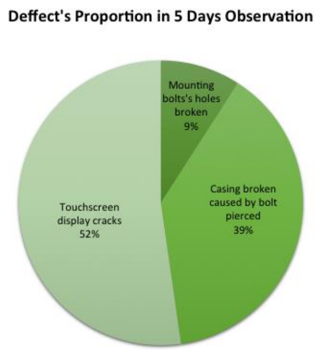












APPENDIX B

Amount of Defect Product for Each Inspection Scenario by taking 100 product samples

COMBINATION-1 (existing condition) for 100 products			
No.	**Type of Defect**	**Amount of Defect**	**Defect in Number**
1	Defect type AB	IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII	40
2	Defect type C	-	0
3	Defect type AB and C	IIII	4
4	No defect found	IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII I	56
Total Amount of Product			100

COMBINATION-2 for 100 products			
No.	**Type of Defect**	**Amount of Defect**	**Defect in Number**
1	Defect type A	IIIII IIIII III	13
2	Defect type B	IIIII II	7
3	Defect type A and B	IIIII IIIII	10
4	No defect found	IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII	70
Total Amount of Product			100

COMBINATION-3 for 100 products			
No.	**Type of Defect**	**Amount of Defect**	**Defect in Number**
1	Defect type AB	IIIII IIIII IIIII IIIII IIIII IIIII IIIII I	36
2	Defect type C	-	0
3	Defect type AB and C	IIII	4
4	No defect found	IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII IIIII	60
Total Amount of Product			100