ANALYSIS OF CUSTOMER SATISFACTION AND PROPOSED IMPROVEMENTS IN THE INDONESIAN DIGITAL HOME (INDIHOME) FIBER INTERNET SERVICE INDUSTRY USING SERVQUAL AND TRIZ CONTRADICTION MATRIX METHODS

Thesis

Submitted to International Program
Department of Industrial Engineering
The Requirements for the Degree of
Sarjana Teknik Industri
at
Universitas Islam Indonesia

By
Nazila Syarafina Rismhandani (16522201)

INTERNATIONAL PROGRAM
DEPARTMENT OF INDUSTRIAL ENGINEERING
UNIVERSITAS ISLAM INDONESIA
YOGYAKARTA
2020

STATEMENT SHEET

STATEMENT SHEET

For the sake of Allah, I declare that the final project entitled "Analysis of Customer Satisfaction and Proposed Improvements in The Indonesian Digital Home (IndiHome) Fiber Internet Service Industry Using Servqual and TRIZ Contradiction Matrix Methods" is the result of my own work, except for the excerpt and summary that I have include with the source. If in the future my confession is proven to be untrue and violates the legal regulations in writing and intellectual property rights, then I am ready to withdraw the certificate that I have received by the Islamic University of Indonesia.

Yogyakarta, December 15th, 2020

Nazila Syarafina Rismhandani

16 522 201

THESIS APPROVAL OF SUPERVISOR

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THESIS

By

Name : Nazila Syarafina Rismhandani

Student Number : 16522201

Yogyakarta, February 2021

Supervisor

(Dr. Ir. Elisa Kusrini, M.T., CPIM., CSCP.)

THESIS APPROVAL OF EXAMINATION COMMITTEE

ANALYSIS OF CUSTOMER SATISFACTION AND PROPOSED IMPROVEMENTS IN THE INDONESIAN DIGITAL HOME (INDIHOME) FIBER INTERNET SERVICE INDUSTRY USING SERVQUAL AND TRIZ CONTRADICTION MATRIX METHODS

By

Name : Nazila Syarafina Rismhandani

Student Number : 16522201

Was defended before Examination Committee in Partial Fulfillment of the requirement for the bachelor degree of Industrial Engineering Department

Universitas Islam Indonesia

Examination Committee

Dr. Ir. Elisa Kusrini, M.T., CPIM., CSCP.	
Examination Committee Chair	
Dr. Taufiq Immawan, S.T., M.M.	
Member I	
Risdiyono, S.T., M.Eng., Ph.D.	
Member II	

Acknowledged by,

Head of Department – Industrial Engineering

Faculty of Industrial Technology

Universitas Islam Indonesia

(Dr. Taufiq Immawan, S.T., M.M.)

PREFACE

Assalamualaikum Wr. Wb.

Alhamdulillah, and gratitude is presented to Allah, which has always granted His grace, strength, and blessing so the author could complete the undergraduate thesis.

This thesis is dedicated to all of the students, especially in the Industrial Engineering Department as one of the collections concerning knowledge development. Therefore, the author would like to thank those who have been constantly sending supports and motivation in the making of this undergraduate thesis. The author would like to thank:

1. My beloved father (Alm. Ir.H.Muhammad Hasyim), mother (Dra.Hj.Riris Yunianingrum), sisters (Nurul Amalina Rismhandani and Fairuzi Nisrina Rismhandani), and other families for the prayer, support, and morals.
2. Mr. Dr. Taufiq Immawan, ST., M.M. as the Head of Industrial Engineering Department Universitas Islam Indonesia and thesis examiner with constructive criticsm and advice of my thesis.
3. Mrs. Dr. Ir. Elisa Kusrini, M.T., CPIM., CSCP. as the thesis supervisor with warm support, inspiration and thoughtful guidance.
4. Mr. Risdiyono, S.T., M.Eng., Ph.D. as thesis examiner with kindly advice and constructive criticsm throughout my thesis.
5. Mr. Muhammad Solahudin, Grad. Dipl. M.M. as head of the regional telecommunications office PT.TELKOM Sleman.
6. Mr. Budi Kuncoro who experienced as a senior manager at PT.TELKOM Jakarta.
7. M. Dicky Afrizal, Bulan Bijak Bestari, Lia Nurkhasanah, and Arum Kartikadevi who helped, supported, understood, and motivated researchers in all conditions.
8. My friends from the Industrial Engineering International Program class batch 2016, for the togetherness and support that cannot be mentioned one by one.
9. My friends from Innovation and Organizational Development (IPO) Laboratory, for the togetherness and support that cannot be mentioned one by one.
10. My friends from Industrial Engineering Students Association (HMTI), for the togetherness and support that cannot be mentioned one by one.

The Authors also thanks all of the concerned parties that cannot be mentioned one by one who has helped me in completing this thesis. Hopefully, the goods which are given by all parties to the Author will be replied to by the kindness of Allah. Finally, the Author realizes that there are still shortcomings as well as weaknesses in this thesis, so the building suggestions and critics are fully expected. The author hopes this research would bring advantages for everyone who reads this.

Wassalamualaikum Wr. Wb.

Yogyakarta, December 2020

Nazila Syarafina Rismhandani

ABSTRACT

PT. Telekomunikasi Indonesia Tbk with Indonesian Digital Home (IndiHome) as one of its products is Internet service companies in Indonesia with the largest number of customers. However, the excellence of IndiHome is only its network ability in reaching almost all regions, yet the quality of the internet and the services provided were judged to be deteriorating and does not meet the customer expectations. A study is needed to be conducted to identify the level of customer satisfaction, service attributes need to be improved and improvement proposal can be given so that customer satisfaction is achieved. Purposive sampling is used to take 100 samples who have or are currently subscribing to IndiHome fiber internet in the Special Region of Yogyakarta by using a questionnaire. The variables used in the questionnaire are based on five service dimensions which are tangible, reliability, responsiveness, assurance and empathy. All surveyed indicators have negative servqual values which means that customer satisfaction has not been achieved. The average servqual value of all indicators is -0.819 and -0.816 for the average servqual value of all variables. The main priority that must be fixed is the stability of Indihome's service. Using contradiction matrix, 3 TRIZ principles are defined as a proposed improvement need to be implemented.

***Keywords*:** Customer Satisfaction, IndiHome, Internet Service Quality, Servqual, TRIZ

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INTRODUCTION

1.1.Background

Indonesian society is now getting used to facing Industrial Revolution 4.0 which is marked by the growing use of the internet. Thus, automation technology meets cyber technology has begun to be applied in various industries, or commonly called the Internet of Things (IoT). Besides, based on a survey of penetration and profile of Indonesian internet users' behavior by *Asosiasi Penyelenggara Jasa Internet Indones*ia and Polling Indonesia (2018), the results of internet user's penetration reached 64.8% of the total population of Indonesia as shown in figure 1.1.

Figure 1.1 internet user's penetration in Indonesia in 2018

To support the Indonesian people in the use of the internet in industry and activities, certainly, an adequate internet network is needed for the entire region, one of which is by using Wi-Fi devices (local area wireless technology). Based on data from research by

Amatullah (2017) and Damsir (2019) internet service companies (fixed broadband) in Indonesia with the largest number of customers are *PT.Telekomunikasi Indonesia, Tbk* (TELKOM) with Indonesian Digital Home (IndiHome) products. According to company research data, the highest number of customers is using IndiHome, which is 3.7 million subscribers (Amatullah, 2017). It is also known that in 2019, the number of IndiHome subscribers increased to 7 million (Jemadu & Saleh, 2020).

Table 1.1 List of Highest Indonesia Fixed Broadband Company's Customer on 2015

Company	Product	Number of Customers
PT Telekomunikasi Indonesia Tbk	Indihome	3.730.000
PT MNC Sky Vision	Indovision	2.300.000
PT Link Net	First Media	1.400.000
PT Supra Primatama Nusantara	Biznet Network	90.000
PT MNC Kabel Mediacom	MNC Play	20.000

(source: Research by Faraz Adilah Amatullah, 2017)

PT. TELKOM is a State-Owned Enterprise (BUMN) which is engaged in telecommunications services for the public and is in the country. In providing services, PT. TELKOM has gone through several developments from providing home telephones so that it becomes an internet service provider using a copper cable which then developed into IndiHome which means providing three direct services with one sophisticated Fiber cable, namely landline telephone, Internet on fiber, or high-speed internet, and cable TV. To support the use of the internet for customers, TELKOM offers the Internet on Fiber which is a high-speed internet service using optical fiber (transmission lines made of glass and fine and small plastics) from TELKOM that has the advantages of being more sophisticated, fast, reliable, and stable.

However, the advantages of fiber optic internet do not meet the expectations of IndiHome service users. As a Fixed Broadband company with most customers does not rule out the possibility that this company still has shortcomings in meeting customer satisfaction. Internet service user satisfaction is the level of one's feelings after comparing the perceived performance with expectations. If the performance provided is in line with

customer expectations, they will make repeat purchases and recommend the others to subscribe to the same place.

There are issues on the online platform that lately have been circulating that the quality of IndiHome internet on fiber is still unsatisfactory and does not meet customer expectations (Amatullah, 2017). On several news portals, social media accounts, and articles, there are facts about many complaints from IndiHome subscribers, especially for their WiFi services.

Moh Amrullah on the website mediakonsumen.com (2019) shared his experiences and complaints in subscribing to IndiHome and when he complained about the problem of customer service. According to him, the company is not responsive in responding to customer complaints, the workforce recruited is less professional, incompetent, and lacks integrity. On the same website (Media Konsumen : Surat Pembaca, 2020), Annisa Sari complained about the coordination, administration, and speed of service which took 2 months to install IndiHome WiFi. Also, another complaint was found regarding the IndiHome subscription bill which increases every month after one to 4 months of subscription without prior notification by the company which is also experienced by many other customers (Tulusi, 2020). Such as the voice of readers on the detiknews news portal (Reynold, 2020) who complained about the change in IndiHome package rates without notification and had objections to the monthly rates being applied.

Reporting from the CNN Indonesia news portal (2020), along with the pandemic period which requires people to work and study from home using the internet network, IndiHome users have complained about the quality of the internet network that is slow or often disconnected and the service from the company is bad through social media platforms. Also, another problem that IndiHome subscribers often encounter is the difficulty of unsubscribing from IndiHome. For example, complaints on Kompas.com (Pertiwi, 2020) and mediakonsumen.com (Munthe, 2020) complained that to unsubscribe from IndiHome, customers need to come in person with a device loaned by the company and after unsubscribing, they still receive a monthly subscription fee. Besides, reported from the kompasiana.com web page, it was found that the IndiHome company offered

customers to increase internet speed at the beginning of the third month after starting to subscribe without any increase in fees. However, six months later the fees went up without a prior appeal and the internet access became slow. Customers complained that taking care of the downgrade of service required a fairly difficult process and each month had to pay a fee to rent a modem every month at a much greater amount than buying the modem directly at a time (Yovinus, 2020).

The majority of customers said that they are forced to choose IndiHome WiFi products due to the company's excellence in reaching almost all regions in Indonesia, but the quality of the internet and the services provided were judged to be deteriorating. This certainly can affect the company's image for potential customers and the company's customer loyalty.

Based on the background of the problems described above, the author intends to conduct a research entitled "Analysis of Customer Satisfaction and Proposed Improvements in The Indonesian Digital Home (Indihome) Fiber Internet Service Industry Using Servqual and Triz Contradiction Matrix Methods" to find solutions to IndiHome WiFi quality problems which is the internet service provider with the most enthusiasts but is known to have a poor customer satisfaction level. This research would be conducted to analyze how customer satisfaction is assessed on the quality of IndiHome's internet on fiber service so that improvements are proposed that can be applied by companies to improve quality so that customers continue to maintain their loyalty and get new customers.

1.2. Problem Formulation

Based on various problems in the background, the problem formulations in this study are

1. What is the level of customer satisfaction based on the quality of service provided by IndiHome fiber internet?
2. What IndiHome fiber internet’s service attributes need to be improved based on customer perception using Servqual?

3. What improvement proposal can be given to the IndiHome fiber internet so that customers are satisfied based on the TRIZ contradiction matrix and 40 inventive principle method?

1.3 Research Objectives

The objectives of this research are to:

1. Identifying the level of customer satisfaction based on the quality of service provided by IndiHome fiber internet
2. Identifying IndiHome fiber internet's service attributes need to be improved based on customer perception using Servqual
3. Identifying improvement proposal can be given to the IndiHome fiber internet so that customers are satisfied based on TRIZ contradiction matrix and 40 inventive principle method

1.4 Problem Limitations

The limitations of the problem specified in this study are

1. This research only discusses IndiHome Fiber Internet service quality
2. respondents are people who have subscribed to or are currently subscribing to IndiHome fiber internet and are domiciled in the Special Region of Yogyakarta.
3. Methods of measuring the level of customer satisfaction using the Servqual and improvement proposal using the TRIZ method.

1.5 Research benefits

The research benefits obtained from this study are as follows:

1. Increase customer satisfaction with the quality of fiber internet services provided by IndiHome
2. Companies can improve and enhance the attributes of IndiHome services according to customer needs
3. Customers get satisfaction so that they become loyal customers in subscribing to IndiHome

CHAPTER II

LITERATURE REVIEW

2.1. Deductive Study

To support and strengthen the theory used in this study, knowledge is used related to this study to explain the basic theory and guidelines that come from the book. The theoretical basis to be discussed is about service, product, quality, service quality, customer satisfaction, and the Servqual and TRIZ methods.

2.1.1 Service

Products are everything that is offered to the market, both palpable and intangible, including packaging, price, company prestige, and company services to meet customer needs. Then, products are classified into two, namely service products that are intangible and tangible goods (Rahman, 2010, p. 9). While according to Juran and Godfrey (1998) product is the output of any process which includes both goods and services.

According to Kotler (2003, p. 372) service is "Any activity or performance that one party can offer to another that is essentially intangible and does not result in the ownership of anything. Its production may or may not be tried to a physical product". Furthermore, service marketing experts define that a service is an activity or series of activities of more or less intangible nature that normally, but not necessarily, take place in the interaction between the customer and service employees and/ or physical resources or good and/ or system of the service provider, which are provided as solutions to customer problems (Gronroos, 1990). Meanwhile, Lovelock and Gummeson (2004) suggested service as a

system. Every service business is a system consisting of two main components, namely service operations, and service delivery. Where the service operation is the processing of inputs and service product elements are created. Meanwhile, service delivery is the assembly, completion, and delivery of these service product elements to customers. Some of these systems are visible or known to customers, while others are not visible or even unknown to the customer.

According to Kotler (2003, p. 446), There are four characteristics of services, namely services are intangible, services are usually produced and consumed simultaneously with customer involvement, services consist of many variations in form, quality, and type, and services cannot be stored and cannot last long. However et al. (2004) disagree with these characteristics because they only apply to certain types of services. They state that services have non-ownership characteristics and include forms of rental or access, where customers benefit from obtaining the right to use certain physical objects, employ human resources and personnel expertise, or gain access to certain facilities and networks.

Based on Lovelock and Gummeson (2004), several broad categories can be identified within the non-ownership framework:

- *Rented goods services* (Judd, 1964)

  Customers get temporary rights to exclusively use certain physical items that they do not want to own or cannot afford at once, such as houses, vehicles, formal clothes, and construction tools.
- *Place and space rentals*

  Customers have the exclusive right to use a certain portion of a large room in a building, vehicle, or another area, such as hotel rooms, seats in public transportation such as buses, trains, ships, or planes, as well as rooms in offices or shops.
- *Labor and expertise rentals*

  Customers employ other people to do work that they decide not to do alone (for example cleaning the house) or are unable to do it themselves due to

lack or absence of the tools, skills, or strength needed, such as surgery, law consultant, and repairing vehicles.

- *Physical facility access and usage*

  Customers rent admissions to certain facilities, such as museums, amusement parks, spas, gyms, fitness centers, or libraries, and can use them during the admission validity period.

- *Network access and usage*

  The customer leases the right to participate in a specific network, such as telecommunications, utilities, banking, insurance, or special information services.

Zeithaml and Bitner (1996, p. 5) provide the following limitations regarding services "Service is all economic activities whose output is not a physical product or construction is generally consumed at that time it is produced, and provides added value in forms (such as convenience, amusement, comfort or health)". Also, services are "deeds, processes, and performances provided, coproduced, or co-created by one entity or person for and/or with another entity or person" (Zeithaml et al., 2018).

Some of these definitions conclude that services are economic activities with intangible physical outputs that provide added value or solutions to problems offered by the interaction between service providers to service users or consumers.

Lupiyoadi (2001, p. 78) stated that five steps can be taken to achieve success in the service sector, namely:

1. Renewing the service offering
2. Localizing the point-of-service system
3. Leveraging the service "contract"
4. Using information power strategically
5. Determining the strategic value of a service business

2.1.2 Quality

Quality is a characteristic of a product/service that depends on its ability to meet customer satisfaction and a condition where there are no defects in the product/service. (Nanda, 2005, p. 1). Then, according to Kotler et al. (1999) quality is freedom from defects. While, based on Ciobotaru et al. (2001), quality is several features with a dynamic evolution induced by the technical progress, which involves the design and development of new products with superior features and performances.

From another point of view quality is the value that a product meets customer needs to provide satisfaction to the customer, or it can also be interpreted as the absence of errors or deficiencies that cause producers to repeat the production process, failure and customer dissatisfaction (Juran & Godfrey, 1998). Juran prefers to define quality by the short phrase “fitness for use” (Nanda, 2005, p. 6).

Product features that meet customer needs	**Freedom from deficiencies**
Higher quality enables companies 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.	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.

Figure 2.1 The Meanings of Quality

(Juran's Quality Handbook : Fifth Edition, 1998)

One of the primary managerial functions to maintain quality as in Juran's Trilogy is quality planning, with the following steps (Nanda, 2005, p. 6):

1. Determine who the target customer is
2. Knowing customer needs

3. Designing products according to customer needs
4. Creating appropriate systems and processes in order to produce appropriate products
5. Deploy the plans to operational levels.

2.1.3 Product

Products are the main output of the company's activities that are offered to targeted markets to fulfill consumer needs. According to Kotler et al. (1999) product is anything that can be offered to a market that might satisfy a customer's need or want which is not limited to physical objects. It includes services, persons, places, organizations, and ideas which capable of satisfying a need. EN ISO 9000 (2000) defined the product as "the result of a process", there are four generic categories of products namely: hardware, processed materials, software, and services. While, according to EN ISO 9000 (2015), a product is the "output of an organization that can be produced without any transaction taking place between the organization and the customer" and its dominant element is generally tangible. Products that sell well in the market depend on the added value obtained by buyers. Therefore, companies need to produce superior products to be competitive, one of the main advantages of a product is to provide product quality that is always good, and under consumer expectations.

As stated by Johnston and Lyth in Brown, Gummeson, Edvardsson, & Gustavsson (Service Quality : Multidisciplinary and Multinational Perspective, 1991, p. 179), Quality is usually considered to only apply to product quality in the manufacturing industry, even though product quality also exists in service industries that also use an item to be used as part of the service system, whether within the system and outside.

The definition of product quality is product performance in performing its functions such as product's overall durability, reliability, precision, ease of operation and repair, and other valued attributes. (Kotler et al., 1999, p. 566), and also includes robustness and ease of use (Trentin et al., 2012). While, based on Garvin (2007), product quality could be a collection of features and Sharp brand

product characteristic which have a contribution to the flexibility of fulfilling specified demand.

From Garvin D. A.'s (1988) perspective, the quality of the product could be defined as a product or service in its ability to satisfy the stated or implied customer's requirements. It is measured by eight dimensions which are:

1. Performance

   Characteristic of operation fundamental from the product's core. This dimension like within the easy-to-use range of products, easy to maintenance, giving benefits, and consume energy efficiently.

2. Features

   A special characteristic or additional feature within the style of complement characteristics. Examples of dimension feature are products have different newest technological individuality with other brands, having an additional function which is not owned by other brands, and have specification more compared to another brand.

3. Reliability

   Related product durability which harsh to damaged and might function better in long term.

4. Conformance to specification

   Device characteristics and specified operating are fulfilled. This dimension is associated with a standard that is per regulation.

5. Durability

   The time the product can be used that closely related to reliability. It is seen from the product's components that do not seem to be easily damaged, although frequently used, and might function better in long term.

6. Serviceability

   Ability to serve which includes speed, competence, comfort, and handling problem.

7. Aesthetics

the attractiveness of products through the five senses. Aspects during this dimension sort of a product that has an interesting design that has an innovative external appearance arranged component elegantly, and there are many product choice models provided.

8. Perceived quality

   the image and reputation of the product and also company responsibility to both the things. This dimension is related to the brand's image which is a picture or impression of the customer to a brand or product.

2.1.4 Service Quality

The development of information and communication technology at this time has led to very fierce competition for companies in obtaining and retaining customers. In service companies, service quality is a necessity so that the company is able to survive and exist. Changes in consumption patterns and customer lifestyles require companies to provide quality services.

Kotler et al. (1999, p. 561) defined services as products that consist of activities, benefits, or satisfaction that are offered for sale. It is essentially intangible and does not result in ownership of anything. Furthermore, EN ISO 9000 (2015) defined service as "output of an organization with at least one activity necessarily performed between the organization and the customer", its elements are generally intangible and service is generally experienced by the customer. It stated that what is involved in services is an activity performed on a customer-supplied tangible nor intangible products, the delivery of an intangible product, and the creation of ambiance for the customer. Every consumer must have expectations in deciding on choosing a product or service. This expectation has a big role as a standard of comparison in evaluating quality and customer satisfaction (Wirawan, 2015).

Service quality is the dominant element of customer evaluations in the service industry which might be very important for determining customer satisfaction. Customers judge the service quality based on their perceptions of the technical

outcome, outcome delivery process, and physical surroundings quality where the service is delivered. According to Kotler (Marketing Management, 11th ed., 2003), service quality must start with consumer needs and end with the consumer's perception. This means that quality is good based on the consumer's point of view or perception. Consumers' perception of service quality is a comprehensive assessment of the superiority of service.

Service quality is intangible and production and consumption run simultaneously. In assessing service quality, consumers are directly involved in participating in the service process, so what is meant by service quality is how consumers respond to the services they consume or feel (Jasfar, 2009, p. 50). Meanwhile, according to Nasution (2010, p. 47), the definition of service quality is centered on meeting the needs and desires of customers and the accuracy of their delivery to match consumer expectations. Furthermore, According to Sangadji and Shopiah (2010, p. 100), Service quality is the level of service excellence expected by consumers which leads to consumer perceptions of the quality of service it receives.

The quality of public services according to Wyckof, quoted by Tjiptono (2004, p. 59), namely as follows: "Service quality is the level of excellence expected and control over that level of excellence to meet customer desires. If the service or service received or perceived (perceived service) is as expected, then the quality of the service or service is perceived as good and satisfying. If the service or services received exceeds customer expectations, then the quality of the service or service is perceived as ideal quality. Conversely, if the services or services received are lower than expected, the quality of the services or services is perceived as poor".

It can be indicated that a service quality that is expected by the community as service recipients expects a level of excellence from each service obtained from previously obtained services. If the services provided exceed the expectations of the customer community, the quality of the services provided will get an ideal

perception from the service recipients. Concluded by Ajeng Kartini A. (2017) Service quality is the level of conformity of service with customer requirements and according to Yakti (2018), service quality is a focal point that is pursued in a product or service to be able to meet customer wants and satisfaction in meeting their needs. Quality services will make customers feel satisfied so that customers will keep coming.

In determining dimensions in service quality assessment, from a study about Servqual which is deprivation from Service Quality, there is a method that has been used as a reference that would explain more in the 2.1.6 about the Servqual approach.

To improve and maintain service quality, there are four strategies (Tjiptono, Strategi Pemasaran : Edisi Kedua, 2004), namely service delivery must be on time, accurate, with attention and friendliness, approach to customers by considering cost factors, time to implement programs, and the influence of customer service, implement a feedback system to understand perceptions customers to the company and other things that support company performance, and implement the results of the feedback.

2.1.5 Customer Satisfaction

According to Kotler, et al. (1999) customer is anyone who is affected by the product or by the process used to produce the product. Oliver in Zeithaml (2018) define satisfaction as the consumer's fulfillment response, a judgment that a product or service feature, or the product or service itself, provides a pleasurable level of consumption-related fulfillment. Furthermore, satisfaction is "the customer's evaluation of a product or service in terms of whether that product or service has met the customer's needs and expectations" (Zeithaml et al., 2018). "The purpose of a service business is to create customer satisfaction. The creation of customer satisfaction can provide several benefits, including a harmonious relationship between the company and customers, providing a good

basis for repurchasing and creating customer loyalty and forming a recommendation that is profitable for the company" (Tjiptono, 2008).

EN ISO 9000 (2015) defined customer satisfaction as "perception of the degree to which the customer's expectations have been fulfilled" until the product or service is delivered, customer satisfaction is not known to the organization or customer in question. Customer satisfaction is the state when buyer expectations have been met the product's performance. If it is not meet the expectations, the buyer would be dissatisfied, otherwise, if performance exceeds expectations, the buyer would be delighted (Kotler et al., 1999). Vega-Vazquez et al. (2013) define customer satisfaction as "the level at which a performance achievement of a product received by a consumer equals the consumer's expectation".

While, based on Limakrisna and Ali's (2016) perception, customer satisfaction is the person's impression of the exhibition of the product or service corresponding to their desire. Customer satisfaction is the individual perception of the performance of goods or services related to customer expectations. customer satisfaction achieved an increasing level of customer loyalty, increased income, and reduced operating costs. As a result, customers are willing to pay more for prime quality products and services (Severi & Ling, 2013). Complaints are a typical marker of low consumer loyalty yet their absence doesn't suggest high consumer loyalty, while when client prerequisites have been concurred with the client and satisfied, this doesn't guarantee high consumer loyalty (EN ISO 9000, 2015).

As for this satisfaction, Foedjiwati and Samuel (2005) suggests that customer satisfaction must be accompanied by monitoring of their needs and desires. Customer satisfaction will be influenced by the product delivery system, product or service performance, company/product/brand image, price value associated with the value received by customers, employee performance, competitor strengths, and weaknesses.

All definition of satisfaction has three common elements (Khoironi et al., 2018):

1. Consumer satisfaction is the response (emotional or cognitive)
2. Responses related to a particular focus (hope, product, consumption experience).
3. The response occurs at a certain time (after consumption, after selection, based on accumulated experience)

According to Zeithaml and Bitner (1996), several factors influence customer expectations of a company, namely:

a) Word of Mouth
   statements (personal or non-personal) stated by people outside the service provider such as experts, friends, family, and mass media publications so that they are quickly accepted by customers
b) Personal Needs
   The basic needs that a person feels for their well-being such as physical, social, and psychological also determine their expectations.
c) Past Experience
   These customer expectations develop from time to time, along with more and more information (non-experimental information) received by customers and the increasing customer experience.
d) External Communication
   Direct or indirect statements by the company regarding its services to customers in the form of media advertisements, personal selling, agreements, or communications with employees of the organization.

Based on this description, satisfaction describes a function of performance and expectations. If the performance is below expectations, the customer is not satisfied and if the performance is following the expectations, the customer is satisfied or if the performance exceeds expectations, the customer is very

satisfied. This is under what Kotler et al. (1999) said, the key to retaining customers is customer satisfaction. Satisfied customers will:

1. Repeat purchases
2. Tell the others about their good experiences with the (recommendations).
3. Less attention to competitors' brands and product advertisements.
4. Buy other products from the same company.

2.1.6 Servqual Method

Servqual can be defined as the difference between the reality and the expectations of customers for the services they receive. Customer expectations are the same as what kind of service the company should provide to customers (Parasuraman et al., 1990) .

Among the various models of service quality measurement, SERVQUAL is the method most widely used (Wisniewski, 2001). Because this method has a good ability to measure the satisfaction of service quality so that it is considered to meet the statistical validity requirements (Rysland & Curry, 2001).

As stated by Parasuraman et al. (SERVQUAL : A Multiple-Item Scale for Measuring Consumer Perceptions of Service Quality, 1988) Servqual may be a concise multiple-item scale with good reliability and validity that companies can use to get a better understand of customers' service expectations and perceptions, so that they could improve the service. It has been designed to be applicable across a broad spectrum of services.

Data gathered through a Servqual survey can be used for a variety of purposes (Zeithaml et al., 2018) :

- To get the average gap score between customers' perceptions and expectations for every service attribute
- To evaluate the worth of service quality in keeping with the 5 Servqual dimensions
- To track customers' expectations and perceptions over time
- To compare a company's Servqual scores against those of competitors.

- To identify and examine customer segments that differ significantly in their assessments of a company's service performance
- To assess internal service quality (quality of service rendered by one department or division of a company to other)

Parasuraman et al. (1990) suggested five dimensions of service quality originating from the ten originally conceptualized dimensions which used as the scale to measure quality called the Servqual model, namely:

a. Tangible

   The availability of physical evidence of services to show their existence to external parties as clear evidence of services provided by service providers which include physical facilities (buildings, warehouses, etc.), labor (as well as the appearance of their workforce), equipment, and means of communication, and anything else that can and should exist in the service process.

b. Reliability

   The ability to perform the promised services reliably and accurately, provide the promised services appropriately, and the ability to be trusted, especially to provide services promptly, in the same way, according to the promised schedule, and without making mistakes.

c. Responsiveness

   Willingness or readiness of service providers to provide services needed and to help consumers quickly and precisely, and with the delivery of clear information.

d. Assurance

   The knowledge, ability, friendliness, politeness, and trustworthiness of company employees to eliminate the indecisive nature of consumers and make them feel free from harm and risk. Derived from several dimensions in the 10 dimensions of service quality, this includes components of communication, credibility, security, competence, and courtesy.

e. Empathy

Attitudes of employees or companies are given to customers with an effort to understand the needs and difficulties of consumers, good communication, personal attention, and easiness for customers to communicate.

Concerning these dimensions of Servqual, a model that describes service quality is also developed which is called the Service Quality Gap Model. This model seeks to explain the main things that can cause differences in service quality. The model is described as follows:

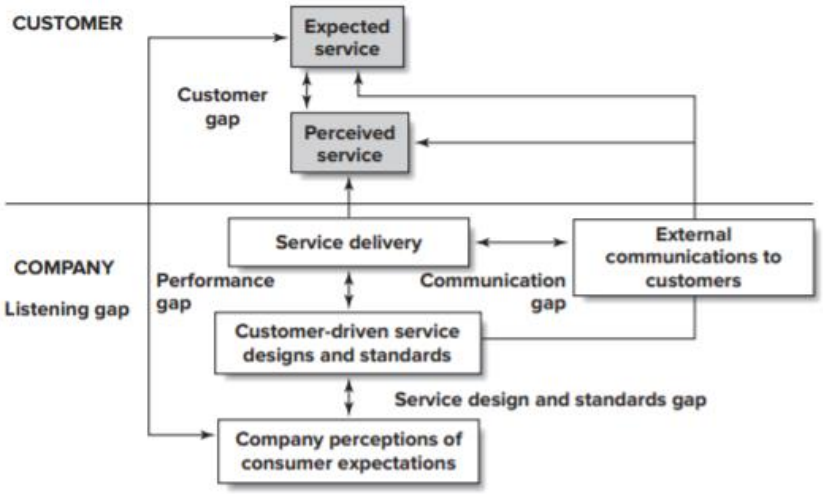


Figure 2.2 Gaps Model of Service Quality

(Services Marketing : Integrating Customer Focus Across the Firm (7th Edition), 2018, p. 45)

To find out the causes of differences in perceptions in providing service quality, Parasuraman et al. (1990) form a service quality model which identifies 5 gaps that fail to deliver service quality as follows:

1. Management Perception Gap

   There are differences between service ratings according to service users and management's perceptions of service user expectations that occur due to a lack of marketing research orientation, inadequate use of research findings, lack of interaction between management and customers, inadequate bottom-up communication, and too much management level.

2. A gap in Quality Specifications

   The gap between management perceptions of service user expectations and service quality specifications. This happens because they do not understand management's commitment to service quality. After all, they do not understand management's commitment to service quality.

3. Service Delivery Gap

   Gaps in service quality specifications and service delivery are caused by role ambiguity, role conflict, the suitability of employees with tasks to be done, suitability of technology used by employees, control systems from superiors, perceived control, and teamwork

4. The Marketing Communication Gap

   The gap between service delivery and external communication is because customer assessments of service quality are influenced by statements made by companies through corporate communications. Gaps occur due to inadequate horizontal communication and a tendency to over-promise.

5. The gap in perceived service quality

   There are differences in perceptions between the services that are perceived and those expected by customers. If both are proven to be the same, the company will get a positive image and impact. Conversely, if what is received is lower than expected, this gap will cause problems for the company.

According to Parasuraman (Soetjipto, 1997) Among the five gaps above, the fifth gap is the most important and the key to eliminating the gap is to eliminate gap 1 to gap 4. They propose several ways to eliminate gap 1 to gap 4 as follows:

5.1.1 Eliminate gap 1 by providing opportunities for customers to convey their dissatisfaction with the company, finding out the wants and expectations of customers of similar companies, finding out the wants and expectations of customers through intermediaries, conducting in-depth research on important customers, ask customer satisfaction after they transact with the company, enhance the interaction between the company

and customers, improve the quality of communication between human resources within the company and reduce corporate bureaucracy.

5.1.2 Eliminate gap 2 by improving the quality of the company's leadership, enhancing human resource commitment to service quality, standardizing certain jobs, especially those that are routine, and setting goals to be achieved effectively (based on customer wishes and expectations).

5.1.3 Eliminate gap 3 by clarifying the division of work, improving the suitability between human resources, technology, and work, measuring performance and providing remuneration according to performance, giving greater authority to HR who are closer to customers, building cooperation between HR, and treat customers as part of the extended family of the company.

5.1.4 Eliminate gap 4 by smoothing the flow of communication between the personnel, marketing, and operational units. Giving greater attention to vital aspects of service quality, keeping messages sent externally from forming customer expectations that exceed the company's capabilities, and encouraging customers to become loyal customers.

To determine a service quality dimension can be said to be of quality and according to expectations or not, the Servqual value is used with 5 Likert scales (Supranto, 2006). Yet, based on Hadi (1991), 5 Likert scale has a double meaning where the respondent is still in doubt or unable to decide or give an answer and creates a tendency to choose neutral answers, thereby reducing the amount of information that can be collected from the respondents. So, there is a modification to 4 Likert scales with the advantage of being able to capture research data more accurately. The Likert scale for the weight of importance/expectation level and weight of performance / Satisfaction Level as follows:

Table 2.1. Weight of Importance / Expectation

Importance Level	**Weight**
least important	1

not important	2
important	3
very important	4

Table 2.2 Weight of Performance / Satisfaction Level

Satisfaction Level	**Weight**
very dissatisfied	1
dissatisfied	2
Satisfied	3
very satisfied	4

While, the Servqual value is calculated by the following formula (Utomo, 2010):

Servqual Score (gap) = PS – ES (2.1)

Where :

ES (Expectation Score) = the value of customer expectations for each service attribute

PS (Perception Score) = the value provided by the customer for each service attribute

Meanwhile, to calculate the expectation score based on the survey results, a formula can be used:

$ES = E_{total}$ Respondent / Total Respondent (2.2)

Where:

$E_{total} = (E_1 \times 1) + (E_2 \times 2) + (E_3 \times 3) + (E_4 \times 4)$ (2.3)

E_1 = Number of respondents answered very not important

E_2 = Number of respondents answered not important

E_3 = Number of respondents answered important

E_4 = Number of respondents answered very important

Total Respondent = Sample number or the total number of respondents participating in the survey

After getting the E_{total}, calculate the average value by dividing the value obtained from the E_{total} formula by the number of respondents, so you will get the Expectation value or the expected value for each service attribute.

To calculate the perception score for each service attribute, the calculation method is the same as the expectation score calculation, with the following formula:

$$PS = P_{total} \text{ Respondent} / \text{Total Respondent} \quad (2.4)$$

Where:

$$P_{total} = (P_1 \times 1) + (P_2 \times 2) + (P_3 \times 3) + (P_4 \times 4) \quad (2.5)$$

P_1 = Number of respondents answered very dissatisfied

P_2 = Number of respondents answered dissatisfied

P_3 = Number of respondents answered Satisfied

P_4 = Number of respondents answered very satisfied

Total Respondent = Sample number or the total number of respondents participating in the survey

According to Akbar (2018), the results of calculations on the Servqual model, if the Servqual score is negative (-) it means that the service quality is less or not good (customers are not satisfied). If the Servqual score is equal to zero (0), it means that the service quality is good (satisfied customers). If the Servqual score is positive (+) it means that the service quality is very good (customers are very satisfied).

2.1.7 TRIZ (Theory of Inventive Problem Solving / *Teoriya Reheniya Izobreatatelskikh Zadact*)

All engineers live with uncertainty which is about where to find the solution of a problem and certainty which is a solution that will be found. In the search for problem-solving, several tools or methods can help an engineer find answers to

the problems at hand. However, to carry out real problem solving by finding and finding appropriate solutions or new concepts, there is a tool that has been used by engineering quality and production experts which they find as a very valuable addition to whatever toolkit they also use. This unique, rigorous, and powerful tool delivers systematic innovation so that it can help engineers to understand and solve the problems faced by accessing the immense treasure of past engineering and scientific knowledge. This tool is known as TRIZ or Theory Reheniya Izobreatatelskikh Zadact (or in English, it is called Theory of Inventive Problem Solving) which is the work of Genrich Altshuller from Russia who succeeded in summarizing a solution that was previously found and then adapted to make it easier for engineers to systematically solve future problems (Gadd, 2011).

TRIZ is a combination of several scientific disciplines, namely science that studies nature (biology, physics, chemistry, etc.), science that studies human habits and life in society (psychology and sociology), and science that studies artificial objects (engineering, design, root cause, and others) (Rantanen & Domb, Simplfied TRIZ: New Problem-Solving Applications for Engineers and Manufacturing Professionals, 2002). Due to the use of TRIZ which supports creativity and innovation in the industry, the use of TRIZ is expanded, it is also used in service industries that have several different characteristics from the manufacturing industry as popularized by Altshuller.

According to Gadd (TRIZ For Engineers: Enabling Inventive Problem Solving, 2011) TRIZ is suitable to be used to solve problems because this comprehensive tool is a simple tool that helps researchers to understand what is desired and is a detailed tool to analyze a system or problem. TRIZ works by helping engineers to improve a system and find new systems/concepts, as well as complete and fill in the gaps in a system. Besides, TRIZ helps engineers to deliver efficiency, cost savings, least harms, overcome psychological inertia, do fast problem solving and clear thinking of problem situations and solution triggers so that we understand the problems faced so that we find all existing

solutions that we have ever known and solutions that had never occurred to us before.

When engineers say their solution idea gives something good but will have a bad impact if the solution is implemented, then we have a problem. In every problem faced by engineers, there must be at least one contradiction which is a simple clash of solutions or it could also be the need for opposite benefits that are achieved with opposite features or functions. There are two types of contradiction, namely technical contradiction when an engineer finds a solution that can improve something but something else gets worse, and physical contradiction when an engineer needs an inversely proportional solution to be applied at the same time or place.

Gadd (2011) said that what we want from our system and what it should be delivering is an Ideality, everything we want (benefits), what we want to put into it (acceptable costs) and everything we don't want (harms) within the terms of the system's constraints. To be able to identify contradiction exists in the system, TRIZ tool called function analysis is used. It maps entire systems to identify the problems with system functions.

Altshuller identified that the simplest (minimal) technical system can be described as having just two components (subject and object) with an action/field between them; when combined they provide a function (Gadd, 2011). Functions provide benefits we cannot see whether we need all the functions, or what is wrong with the functions, see if they are harmful, insufficient, excessive or even missing. Function analysis offers a simplified but detailed picture, a snapshot, of what is happening and is a very powerful aid for our understanding of all the problems, their interrelation, and their priority and helps us capture, log and communicate the essential problems to ourselves and others. It is powerful for any kind of problem including management and business problems.

This Function Map helps us understand the system, highlights any problems, contains a simple guide to identifying the types of problems, and then enables us

to precisely locate the TRIZ solutions to these problems. It is then the task of problem solvers to expand these TRIZ suggested answers (solution triggers) to find useful and detailed solutions to each of their problems. The functional analysis consists of three steps, which are:

1. Component Analysis
2. Interaction Analysis
3. Function Model

The components analysis identifies components of the Engineering system and its supersystem, whereas interaction analysis identifies the interaction between components. Then, the function model identifies and evaluates the functions performed (Adunka, 2012).

To construct a function model, there are several main elements to consider based on Gadd (TRIZ For Engineers: Enabling Inventive Problem Solving, 2011), which are:

Figure 2.3 Function Model Elements

The elements of prime function is what delivered by the system, while the components are subjects and objects, the supplier or receiver of action and environment is a component of a system that cannot be changed or removed.

Subject action Object is a simple delivered function which allows us to describe the different types of problem as follows (Gadd, 2011) :

Figure 2.4 Types of Action in Function Model

When faced with a contradiction we can compromise or solve it. Conventional thinking makes us think that we must choose one and give up the other. Or in

other words, we will feel natural and nothing can be done if something good is obtained, then we will surely accept the consequences by paying more or giving up other functions that will not run optimally. However, TRIZ helps show you how to avoid compromising or optimizing contradictions and will reap both benefits by solving them. In TRIZ thinking 40 Inventive Principles can be applied to resolve contradictions in a simple way to get a smart solution that at first glance may seem impossible.

Altshuller studied 50,000 patents to extract 40 solutions and concepts then defined them as solutions to the contradiction. TRIZ 40 Inventive Principles will assist engineers in solving problems by maximizing the good things and minimizing the bad things. It helps us to uncover the contradictions and then direct us on how to solve them systematically by using which one is relevant from 40 principles. TRIZ solves one problem at a time by reducing it to a simple model. Focus on the solution which gives the main benefits we are seeking, so the other distracting variables will be dealt with in turn.

Zhang et al. (2003) developed 40 inventive principles for service operations management. This development is based on the TRIZ 40 inventive principle that has been developed by Altshuller but was adopted for the service industry so that it is more suitable for the development of tangible products. Service development is distinguished from physical product development because of unique service characteristics, such as customer participation, simultaneity, heterogeneity, intangible, perishable, etc. This suggests that problem-solving in-service operations require a closer relationship between marketing and operations aspects (Zhang et al., 2003). These principles can assist the use of TRIZ in the search for ideas to resolve contradictions in the service industry. TRIZ method is used because it is a method that is considered accurate to formulate a proposed improvement, with the following stages: (i) formulation of contradictions through problem abstraction, (ii) description of general solution ideas, and (iii) interpret general solutions to specific problems faced by companies using the help of 39 parameters Contradiction Table.

Both physical and technical contradictions can be solved with the 40 Inventive Principles but the way to seek solutions is different. To solve technical contradictions used Contradiction Matrix while solving different types of physical contradictions used Separation Principles; Each principle offers a selection of the 40 Principles that will help engineers find solutions to overcome particular physical contradictions.

The contradiction matrix helps solve technical contradictions where engineers improve one thing but exacerbate another by using 40 Principles that are relevant to the problem at hand but do not provide a solution to physical contradictions. When summarizing patents, Altshuller's team created a 39 x 39 contradiction matrix like the figure below:

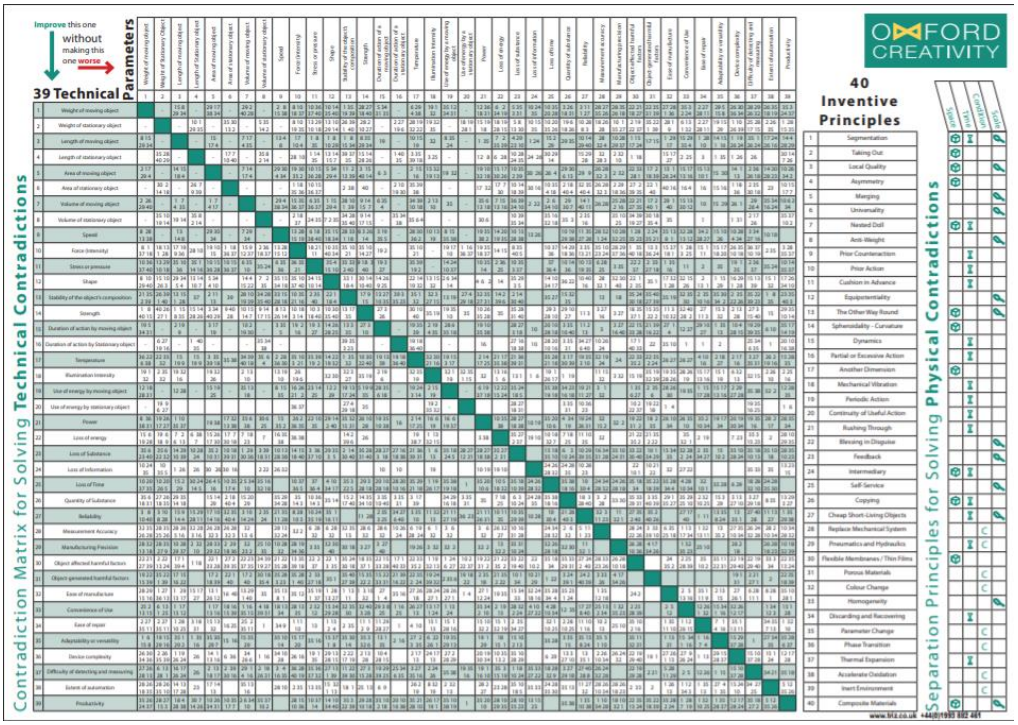


Figure 2.5 TRIZ Contradiction Matrix for Solving Technical Contradictions (TRIZ For Engineers: Enabling Inventive Problem Solving, 2011)

Inventive problems are written in the form of "If-then-but". The procedure for resolving technical contradictions are listed below. (1) Identifying specific parameters. (2) Identify the parameters in the engineering contradiction. (3)

Identifying typical parameters. (4) Identify from Altshuller's list those Typical Parameters that are similar in meaning to the specific parameters or are derivatives of specific parameters (Ahmad, Miswah, Said, & Abdullah, 2017).

In the use of the contradiction matrix, 39 Technical parameters are using what needs to be improved without worsening other parameters with the inventive principle which will provide a solution to improve something without affecting other parameters or making it worse. The 39 parameters of the technique are as follows:

1	Weight of Moving Object	14	Strength	27	Reliability
2	Weight of Stationary Object	15	Duration of Action by Moving Object	28	Measurement Accuracy
3	Length of Moving Object	16	Duration of Action by Stationary Object	29	Manufacturing Precision
4	Length of Stationary Object	17	Temperature	30	Object-Affected Harmful Factors
5	Area of Moving Object	18	Illumination Intensity	31	Object-Generated Harmful Factors
6	Area of Stationary Object	19	Use of Energy by Moving Object	32	Ease of Manufacture
7	Volume of Moving Object	20	Use of Energy by Stationary Object	33	Convenience of Use
8	Volume of Stationary Object	21	Power	34	Ease of Repair
9	Speed	22	Loss of Energy	35	Adaptability or versatility
10	Force	23	Loss of Substance	36	Device Complexity
11	Stress or Pressure	24	Loss of Information	37	Difficulty of Detecting and Measuring
12	Shape	25	Loss of Time	38	Extent of Automation
13	Stability of Object's Composition	26	Quantity of Substance	39	Productivity

Figure 2.6 The 39 Technical Parameters

(TRIZ For Engineers: Enabling Inventive Problem Solving, 2011)

To do problem-solving using the Contradiction Matrix, requires the researcher to think of a solution. Therefore, researchers have to start with thinking of bad solutions. It is a bad solution because something then gets worse. We can find the existing contradictions by thinking about all possible solutions, then analyzing within the solution what is good or bad. We can map what is good about the solutions by asking how does it make the problem better and what is bad about the solutions by asking how does it make the problem worse, onto the

39 Technical Parameters as in the table. Here is the explanation for the TRIZ 39 Parameters:

Table 2.3 The 39 Parameters of Contradiction Matrix TRIZ

(Simplified TRIZ: New Problem Solving Applications for Technical and Business Profressionals, 2018)

No	Parameters	Explanation
	Moving objects	Objects which can easily change position in space, either on their own, or as a result of external forces. Vehicles and objects designed to be portable are the basic members of this class.
	Stationary objects.	Objects which do not change position in space, either on their own, or as a result of external forces. Consider the conditions under which the object is being used.
1	Weight of moving object	The mass of the object, in a gravitational field. The force that the body exerts on its support or suspension.
2	Weight of stationary object	The mass of the object, in a gravitational field. The force that the body exerts on its support or suspension, or on the surface on which it rests.
3	Length of moving object	Any one linear dimension, not necessarily the longest, is considered a length.
4	Length of stationary object	Same
5	Area of moving object	A geometrical characteristic described by the part of a plane enclosed by a line. The part of a surface occupied by the object. OR the square measure of the surface, either internal or external, of an object.
6	Area of stationary object	Same
7	Volume of moving object	The cubic measure of space occupied by the object. Length x width x height for a rectangular object, height x area for a cylinder, etc.
8	Volume of stationary object	Same

9	Speed	The velocity of an object; the rate of a process or action in time.
10	Force (Intensity)	Force measures the interaction between systems. In Newtonian physics, force = mass X acceleration. In TRIZ, force is any interaction that is intended to change an object's condition.
11	Stress or pressure	Force per unit area. Also, tension.
12	Shape	The external contours, appearance of a system.
13	Stability of the object's composition	The wholeness or integrity of the system; the relationship of the system's constituent elements. Wear, chemical decomposition, and disassembly are all decreases in stability. Increasing entropy is decreasing stability.
14	Strength	The extent to which the object is able to resist changing in response to force. Resistance to breaking.
15	Duration of action of moving object	The time that the object can perform the action. Service life. Mean time between failure is a measure of the duration of action. Also, durability.
16	Duration of action by stationary object	Same
17	Temperature	The thermal condition of the object or system. Loosely includes other thermal parameters, such as heat capacity, that affect the rate of change of temperature
18	Illumination intensity	Light flux per unit area, also any other illumination characteristics of the system such as brightness, light quality, etc.
19	Use of energy by moving object	The measure of the object's capacity for doing work. In classical mechanics, Energy is the product of force times distance. This includes the use of energy provided by the super-system (such as electrical energy or heat.) Energy required to do a particular job.
20	Use of energy by stationary object	Same
21	Power	The time rate at which work is performed. The rate of use of energy.

22	Loss of Energy	Use of energy that does not contribute to the job being done. See 19. Reducing the loss of energy sometimes requires different techniques from improving the use of energy, which is why this is a separate category.
23	Loss of substance	Partial or complete, permanent or temporary, loss of some of a system's materials, substances, parts, or subsystems.
24	Loss of Information	Partial or complete, permanent or temporary, loss of data or access to data in or by a system. Frequently includes sensory data such as aroma, texture, etc.
25	Loss of Time	Time is the duration of an activity. Improving the loss of time means reducing the time taken for the activity. "Cycle time reduction" is a common term.
26	Quantity of substance/the matter	The number or amount of a system's materials, substances, parts or subsystems which might be changed fully or partially, permanently or temporarily
27	Reliability	A system's ability to perform its intended functions in predictable ways and conditions.
28	Measurement accuracy	The closeness of the measured value to the actual value of a property of a system. Reducing the error in a measurement increases the accuracy of the measurement.
29	Manufacturing precision	The extent to which the actual characteristics of the system or object match the specified or required characteristics.
30	Object-affected harmful factors	Susceptibility of a system to externally generated (harmful) effects.
31	Object-generated harmful factors	A harmful effect is one that reduces the efficiency or quality of the functioning of the object or system. These harmful effects are generated by the object or system, as part of its operation.
32	Ease of manufacture	The degree of facility, comfort or effortlessness in manufacturing or fabricating the object/system.
33	Ease of operation	Simplicity: The process is NOT easy if it requires a large number of people, large number of steps in the operation, needs special tools, etc. "Hard" processes have low yield and "easy" process have high yield; they are easy to do right.

34	Ease of repair	Quality characteristics such as convenience, comfort, simplicity, and time to repair faults, failures, or defects in a system.
35	Adaptability or versatility	The extent to which a system/object positively responds to external changes. Also, a system that can be used in multiple ways for under a variety of circumstances.
36	Device complexity	The number and diversity of elements and element interrelationships within a system. The user may be an element of the system that increases the complexity. The difficulty of mastering the system is a measure of its complexity.
37	Difficulty of detecting and measuring	Measuring or monitoring systems that are complex, costly, require much time and labor to set up and use, or that have complex relationships between components or components that interfere with each other all demonstrate “difficulty of detecting and measuring.” Increasing cost of measuring to a satisfactory error is also a sign of increased difficulty of measuring.
38	Extent of automation	The extent to which a system or object performs its functions without human interface. The lowest level of automation is the use of a manually operated tool. For intermediate levels, humans program the tool, observe its operation, and interrupt or re-program as needed. For the highest level, the machine senses the operation needed, programs itself, and monitors its own operations.
39	Productivity	The number of functions or operations performed by a system per unit time. The time for a unit function or operation. The output per unit time, or the cost per unit output.

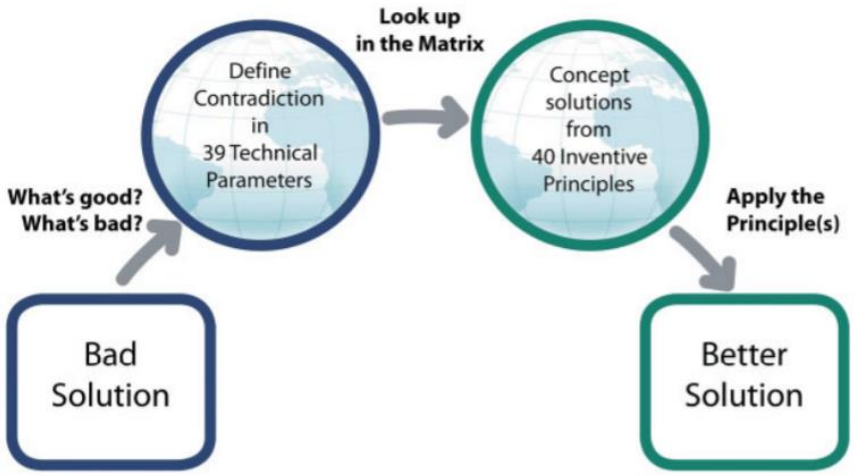


Figure 2.7 Step to Uncover and then Solve Contradictions
(TRIZ For Engineers: Enabling Inventive Problem Solving, 2011)

The problem-solving process using the TRIZ method has three stages, namely as follows (Suryawan, 2014):

1. Identifying the problem by finding out all possible factors that could become a problem
2. Classify the problem by determining the supporting and opposing factors into 39 technical parameters and using the contradiction matrix to find a solution to be the next solution.
3. Finding solutions to problems that must be worked out in solving contradictions using 40 inventive principles.

From fhe contradictions matrix, 3 or 4 of the 40 Inventive Principles of TRIZ would be pointed to be considered. Learn and brainstorm which of these 3-4 can apply to the problem by test the top solution. A good solution will likely come from one of the principles (TRIZ Inventive Problem Solving, 2020).

To solve the contradiction in order to solve the problem is used TRIZ 40 creative principles as below:

1. Segmentation

a. Divide an object into independent parts.

b. Make an object sectional (for easy assembly or disassembly).

c. Increase the degree of an object's segmentation.

2. Extraction (Extracting, Retrieving, Removing)

a. Extract the "disturbing" part or property from an object.

b. Extract only the necessary part or property from an object.

3. Local Quality

a. Transition from homogeneous to heterogeneous structure of an object or outside environment (action).

b. Different parts of an object should carry out different functions.

c. Each part of an object should be placed under conditions that are most favorable for its operation.

4. Asymmetry

a. Replace symmetrical form(s) with asymmetrical form(s).

b. If an object is already asymmetrical, increase its degree of asymmetry.

5. Consolidation

a. Consolidate in space homogeneous objects, or objects destined for contiguous operations.

b. Consolidate in time homogeneous or contiguous operations.

6. Universality

a. An object can perform several different functions; therefore, other elements can be removed.

7. Nesting

a. One object is placed inside another. That object is placed inside a third one. And so on.

b. An object passes through a cavity in another object.

8. Counterweight

a. Compensate for the weight of an object by combining it with another object that provides a lifting force.

b. Compensate for the weight of an object with aerodynamic or hydrodynamic forces influenced by the outside environment.

9. Prior Counteraction

a. Preload counter tension to an object to compensate excessive and undesirable stress.

10. Prior Action

a. Perform required changes to an object completely or partially in advance.

b. Place objects in advance so that they can go into action immediately from the most convenient location.

11. Cushion in Advance

a. Compensate for the relatively low reliability of an object with emergency measures prepared in advance.

12. Equipotentiality

a. Change the condition of the work in such a way that it will not require lifting or lowering an object.

13. Do It in Reverse

a. Instead of the direct action dictated by a problem, implement an opposite action (i.e., cooling instead of heating).

b. Make the movable part of an object, or outside environment, stationary — and stationary part moveable.

c. Turn an object upside-down.

14. Spheroidality - Curvature

a. Replace linear parts with curved parts, flat surfaces with spherical surfaces, and cube shapes with ball shapes.

b. Use rollers, balls, spirals.

c. Replace linear motion with rotational motion; utilize centrifugal force.

15. Dynamicity

a. Characteristics of an object or outside environment, must be altered to provide optimal performance at each stage of an operation.

b. If an object is immobile, make it mobile. Make it interchangeable.

c. Divide an object into elements capable of changing their position relative to each other.

16. Partial or Excessive Action

a. If it is difficult to obtain 100% of a desired effect, achieve more or less of the desired effect.

17. Transition into a New Dimension

a. Transition one-dimensional movement, or placement, of objects into two-dimensional; two-dimensional to three-dimensional, etc.

b. Utilize multi-level composition of objects.

c. Incline an object, or place it on its side.

d. Utilize the opposite side of a given surface.

e. Project optical lines onto neighboring areas, or onto the reverse side, of an object.

18. Mechanical Vibration

a. Utilize oscillation.

b. If oscillation exists, increase its frequency to ultrasonic.

c. Use the frequency of resonance.

d. Replace mechanical vibrations with piezovibrations.

e. Use ultrasonic vibrations in conjunction with an electromagnetic field.

19. Periodic Action

a. Replace a continuous action with a periodic one (impulse).

b. If the action is already periodic, change its frequency.

c. Use pauses between impulses to provide additional action.

20. Continuity of Useful Action

a. Carry out an action without a break. All parts of the object should constantly operate at full capacity.

b. Remove idle and intermediate motion.

c. Replace “back-and-forth” motion with a rotating one.

21. Rushing Through

a. Perform harmful and hazardous operations at a very high speed.

22. Convert Harm into Benefit

a. Utilize harmful factors — especially environmental — to obtain a positive effect.

b. Remove one harmful factor by combining it with another harmful factor.

c. Increase the degree of harmful action to such an extent that it ceases to be harmful.

23. Feedback

a. Introduce feedback.

b. If feedback already exists, change it.

24. Mediator

a. Use an intermediary object to transfer or carry out an action.

b. Temporarily connect the original object to one that is easily removed.

25. Self-service

a. An object must service itself and carry out supplementary and repair operations.

b. Make use of waste material and energy.

26. Copying

a. A simplified and inexpensive copy should be used in place of a fragile original or an object that is inconvenient to operate.

b. If a visible optical copy is used, replace it with an infrared or ultraviolet copy.

c. Replace an object (or system of objects) with their optical image. The image can then be reduced or enlarged.

27. Dispose

a. Replace an expensive object with a cheap one, compromising other properties (i.e., longevity).

28. Replacement of Mechanical System

a. Replace a mechanical system with an optical, acoustical, thermal or olfactory system.

b. Use an electric, magnetic or electromagnetic field to interact with an object.

c. Replace fields that are:

1. Stationary with mobile.

2. Fixed with changing in time.

3. Random with structured.

d. Use fields in conjunction with ferromagnetic

29. Pneumatic or Hydraulic Constructions

a. Replace solid parts of an object with a gas or liquid. These parts can now use air or water for inflation, or use pneumatic or hydrostatic cushions.

30. Flexible Membranes or Thin Films

a. Replace customary constructions with flexible membranes or thin film.

b. Isolate an object from its outside environment with flexible membranes or thin films.

31. Porous Material

a. Make an object porous, or use supplementary porous elements (inserts, covers, etc.).

b. If an object is already porous, fill pores in advance with some substance.

32. Changing the Color

a. Change the color of an object or its environment.

b. Change the degree of translucency of an object or its environment.

c. Use color additives to observe an object, or process which is difficult to see.

d. If such additives are already used, employ luminescent traces or trace atoms.

33. Homogeneity

a. Objects interacting with the main object should be made out of the same material (or material with similar properties) as the main object.

34. Rejecting and Regenerating Parts

a. After completing its function, or becoming useless, an element of an object is rejected (discarded, dissolved, evaporated, etc.) or modified during its work process.

b. Used-up parts of an object should be restored during its work.

35. Transformation of Properties

a. Change the physical state of the system.

b. Change the concentration or density.

c. Change the degree of flexibility.

d. Change the temperature or volume.

36. Phase Transition

a. Using the phenomena of phase change (i.e., a change in volume, the liberation or absorption of heat, etc.).

37. Thermal Expansion

a. Use expansion or contraction of material by changing its temperature.

b. Use various materials with different coefficients of thermal expansion.

38. Accelerated Oxidation

a. Make transition from one level of oxidation to the next higher level:

1. Ambient air to oxygenated.
2. Oxygenated to oxygen.
3. Oxygen to ionized oxygen.
4. Ionized oxygen to ozoned oxygen.
5. Ozoned oxygen to ozone.
6. Ozone to singlet oxygen.

39. Inert Environment

a. Replace a normal environment with an inert one.

b. Introduce a neutral substance or additives into an object.

c. Carry out the process in a vacuum.

40. Composite Materials

a. Replace homogeneous materials with composite ones.

While, solving physical contradictions need careful thought but once we can recognize that we want opposite solutions or benefits, then TRIZ can show the ways to have both by separating the solutions in different ways. Separation can be done in terms of time, place, or condition.

Splitting in time means one solution at a time and the reverse solution at different times. Meanwhile, separating the place means one solution in one place, and the reverse solution in different places. For example, for separation in time, a chalkboard stick is the right length when used, but when not used the stick can be turned short enough to carry it in a bag. As for the separation in place, when

someone wants to drink a cup of hot coffee, the cup used should keep the coffee hot in the cup, but cold to be held outside the cup.

Then, when the problem cannot be resolved in time or place, the principle of separation can also be applied in different conditions or systems. On condition, separation means that the applied solution works for one element, but does not work for another. For example, using a window glass that can be used to see outside clearly, but cannot be seen from the outside. However, when all the separation above has not been able to solve the problem, engineers can use an alternative way by separating the system. Separated by the system can be in the form of scale, inverse, or trying to use a different system (Gadd, 2011).

2.1.8 Sampling Techniques

Research aims are to find answers to questions through the application of scientific procedures. This procedure was developed to increase the probability of being most relevant to the question and to avoid bias. because scientific research is an attempt to reduce the interval with research through data collection and analysis of the information obtained.

One part of the research steps is determining the sample population and research sampling techniques. A researcher can analyze the overall data of the object under study as a collection or a particular community and identify the characteristics of a collection that becomes the object of research only by observing and studying a part of the collection. Then the researcher will get the right method or step to obtain the accuracy of the research and analyze the data on the object. In conducting a study, objects to be studied in research in the form of a complete group of elements, usually in the form of people, objects, transactions for events called populations. Also, samples were taken as the object under study and were considered to represent the entire population (Notoatmodjo, 2010).

In the research method or population, it is used to mention a group of objects that are the center of attention or research and which will be generalized to conclude a larger number of objects based on data from a small group of objects.

A small proportion of objects that are represented in the study are called samples. The sample is part of the population that is expected to represent the population in the study. A large population makes it impossible for researchers to study everything in the population because of limited funds, personnel, and so researchers can use samples taken from that population. What is examined from the sample, the conclusions will be applicable to the population (Sinaga et al., 2019).

In doing sampling, to make the amount corresponds to the actual sample size that will be used as the actual data source, a sampling technique is used by taking into account the characteristics and distribution of the population to obtain a representative sample. Broadly speaking, the sampling technique is divided into two parts, namely probability sampling which provides equal opportunities for each member of the population to be selected as a sample member (Riyanto & Hatmawan, 2020). Meanwhile, non-probability sampling is a sampling method in which each member of the population does not have an opportunity value to be selected as a member of the sample. In non-probability sampling, the selection of unit sampling is based on subjective judgment or judgment and there is no use of probability theory (Utomo, 2010). Each of these techniques has several types of sampling based on the nature of the sample required in the study.

Non-probability sampling is divided into 5 methods, namely quota sampling based on the proportion of certain characteristics to avoid bias, then accidental sampling, namely sampling based on the fact that they happen to occur, the third is purposive sampling, namely sampling based on the special selection that makes certain criteria Who is the informant. the fourth is voluntary sampling, namely sampling based on a willingness to participate in the research. this method is most commonly used in polls. The last is the Snowball sample, which is sampling based on the previous sample tracing (Widodo & Andawaningtyas, 2017, pp. 8-9).

According to Sinaga (2019), research that uses qualitative methods usually uses a data source sampling technique with certain considerations called

purposive sampling. This technique is carried out based on a subjective assessment that the intended respondents have knowledge so they can answer research questions. Samples that are considered capable of answering research questions are those who are experienced or have knowledge related to the research focus. Purposive sample selection is based on certain characteristics that are considered to have a close relationship with previously known population characteristics. This technique determines the sample by selecting a sample among the population following the research objectives that the researcher wants so that the sample represents the criteria/characteristics of the population that have been previously known (Nursalam, 2011).

The sample criteria include inclusion and exclusion criteria, where these criteria determine whether or not the sample can be used. The inclusion criteria are the sample criteria that the researcher wants to be based on the research objectives. While the exclusion criteria are special criteria that cause potential respondents, who meet the inclusion criteria to be excluded from the research group (Untari, 2018).

According to Cohen et al. (2007, p. 101) the larger the sample from the size of the existing population, the better, however, there is a minimum limit that the researcher must take, which is 30 samples. The number of sample members is called the sample size that is expected to represent the population. Roscoe (1975) suggests that the appropriate sample size in any study is between 30-500. In determining the sample size if the information on the chance of occurrence from the population is unknown, the Slovin formula is used (Mufarrikoh, 2020). This formula was introduced by Slovin in 1960, with the mathematical formula as follows:

$$n = \frac{N}{1+N(e)^2} \qquad (2.6)$$

N = population size

E = margin of error

n = required sample size

2.1.9 Validity and Reliability Testing

Previously, several indicators/dimensions in the research variables were discussed. The indicators are then poured into the questionnaire as a research instrument. A good research instrument is an instrument whose measurement results can provide a true picture of the test taker's ability in a particular field that is the target of the measurement so that it does not provide misleading data on something being measured. Therefore, in the preparation of research instruments, especially questionnaires, it is necessary to test their validity and reliability first.

Validity testing refers to the extent to which an instrument performs its function. The instrument is said to be valid if it can be used to measure the thing to be measured. The results of the validity test are not universally valid, an instrument can have a high validity value at a certain time and place, but becomes invalid in a different place or time. Based on Mufarrikoh (2020), in the validity testing process, it is expected that all instrument items are declared valid. If there is an instrument item that is not valid, then the researcher can omit the instrument item, revise the instrument item, or ask the opinion of an expert in the field.

According to Luhut (2009), the higher the validity of a questionnaire as a measuring tool, the faster the measuring tool hits its target. This test can be done by calculating the correlation of each question item with the total value obtained which is called the validity coefficient. The provisions of the validity test lie in the strength of an instrument item on the total score of all instruments on the variable, so the product-moment correlation test is used, also known as the Pearson correlation. With the following formula (Riyanto & Hatmawan, 2020):

$$r_{xy} = \frac{n\sum xy - \sum x \sum y}{\sqrt{\{n\sum x^2 - (\sum y)^2\}\{n\sum y^2 - (\sum y)^2\}}} \qquad (2.7)$$

Where :

r_{xy} = correlation coefficient

n	=	Number of research subjects
$\sum x$	=	Total item score
$\sum y$	=	Total score
$\sum xy$	=	The sum of the multiplication between the item score and the total score
$\sum x^2$	=	Sum of squares of item scores
$\sum y^2$	=	The sum of the squares of the total score

If the resulting correlation is positive, it indicates a parallel relationship, and vice versa, a negative value indicates an inverse relationship between two things. The meaning of the calculation of the correlation coefficient in the validity test is as follows:

- Between 0.8 and 1 = very high validity
- Between 0.6 and 0.8 = high validity
- Between 0.4 and 0.6 = sufficient validity
- Between 0.2 and 0.4 = low validity
- Between 0 and 0.2 = very low validity

To test the validity with the SPSS software application, it can be done by correlating the score of the question items with the total variable score, as well as the bivariate correlation between each score and the total construct score. To make a correlation between the score of the question items with the total score based on the value of r table and r count. The value of the r table can be known by the value of the degree of freedom (df), where df is the number of respondent data minus 2. While the calculated r-value is known from the corrected item-total correlation. The indicator is declared valid if the r-arithmetic is greater than the r-table and is positive. Then to perform bivariate correlation, the validity decision is based on the significant value of each indicator. The indicator is said to be valid if it has a sig value of less than 0.05 (Riyanto & Hatmawan, 2020).

Meanwhile, the reliability of measuring instruments is the consistency of these tools in measuring what is intended to be measured and shows a measure of the

consistency of the respondent's understanding of the instruments on variables. Whenever the measuring instrument is used it will give the same measurement results (Abdullah & Sutanto, 2015). A questionnaire is said to be reliable if a person's answer to a question is consistent or stable over time. If we want to be sure that the scores from the questionnaire scores can reflect a dimension reliably, then the questionnaire we make must show high reliability.

According to Utomo (2010), the reliability test is used to determine the level of confidence in the results of a measurement. Measurements that have high reliability, meaning that measurements can provide consistent measurement results, can provide the same related results if measurements are made at different times. Reliability is one of the main characteristics or characteristics of a good measurement instrument.

Reliability provides an overview of the extent to which a measurement can be trusted, meaning the extent to which the measurement result score is free from measurement error. The level of reliability is empirically indicated by a number called the reliability coefficient. Theoretically, the reliability coefficient ranges from 0-1. The minimum reliability coefficient that must be met by a measuring instrument is 0.7 (Kaplan & Saccuzzo, 2009). The interpretation of reliability always refers to a positive coefficient, so that if the results obtained are negative, there is no meaning.

One of the most commonly used methods of reliability testing to evaluate the sources of variation from a single test tool is Alpha Cronbach. This method is interpreted as a correlation coefficient, then the value ranges from 0 to 1. If the resulting value is negative, then the items tested are not positively correlated and the reliability model is violated. The formula used is as follows (Mufarrikoh, 2020):

$$r_{\alpha} = \frac{k}{(k-1)} \times \left[1 - \left\{\frac{\sum_{j=1}^{k} s_j^2}{s^2}\right\}\right] \qquad (2.8)$$

Where:

r_{α} = Variable reliability coefficient

k = number of subjects in dimensions

s_j^2 = The variance in each dimension

s = The variance of respondents' scores

Based on Mufarrikoh (2020), on the analysis of the variable reliability test, the variable is said to be reliable if the Cronbach's alpha values are greater than 70% or 0.7. As for the reliability test, the indicator is declared reliable if the Cronbach's Alpha (Scale if deleted items) on the indicator is smaller than or equal to the Cronbach's Alpha variable. The meaning of the calculation of the Alpha Cronbach in the reliability test is as follows (Abdullah & Sutanto, 2015):

- Between 0.9 and 1 = very high reliability
- Between 0.7 and 0.89 = high reliability
- Between 0.4 and 0.69 = sufficient reliability
- Between 0.2 and 0.39 = low reliability
- Between 0 and 0.19 = very low reliability

2.2. Inductive Study

Inductive study is knowledge obtained from the results of the literature review on research that has been carried out by previous researchers related to the research being carried out in terms of the method used and the objectives and objects discussed. So, we get knowledge about how research is developing and the shortcomings of previous research.

Several studies on the quality of service and quality of Indihome products in several areas have been carried out. In the IndiHome Triple Play product, it is found that the dimensions of service quality which include physical evidence, reliability, responsiveness, assurance, empathy have a positive and significant effect on customer satisfaction (Armanto, 2018). Besides, according to Saputro et al. (2016), there is a significant correlation between product quality and customer loyalty. The effect of product quality on customer loyalty based on simple regression analysis is 34.4%, while the remaining 65.6% is influenced by other variables. Because the value of

IndiHome product suitability is not comparable to the quality provided, it is suggested that PT Telkom can improve product quality in terms of product usage suitability. Then, Damsir (2019) surveyed that 47% of IndiHome service consumer loyalty in Pekanbaru is influenced by service quality and product quality, and the remaining 0.53 or 53% is influenced by other variables.

A study conducted by Kalfiansyah (2017) with the title "Analysis of the Effect of Product Quality and Service Quality and Loyalty on Customer Satisfaction at IndiHome in Yogyakarta" aims to examine the effect of product and service quality and customer satisfaction on the loyalty of IndiHome internet service users in Condong Catur, Yogyakarta. The method used is purposive sampling method and multiple regression analysis for sampling research and data analysis. The research objects aimed at this research are IndiHome customers who have used IndiHome for more than 3 months and IndiHome customers who live in Yogyakarta City, with the research variables being product quality, service quality, customer satisfaction, and loyalty. The data is taken by distributing questionnaires so that the results of the research show that customer loyalty comes from the satisfaction of customers of IndiHome internet services which cannot be separated from the influence of the quality of the products and services provided.

Based on research data by Kartika (2014), only less than half of respondents who are IndiHome customers in Yogyakarta perceive that they agree on the skills of technical officers in handling engineering disorders. Also, only 27% were satisfied with the attitude of the officers at the payment counter and 60% of the respondents were dissatisfied with the speed of the officers in resolving customer complaints. Apart from these variables, most customers were satisfied with the quality of service provided by IndiHome in 2014. Meanwhile, at IndiHome Witel Sumsel, customer satisfaction with price, emotional factors, and convenience have the lowest score among other customer satisfaction sub-variables. Customers are more likely to complain on online platforms which are public spaces, so it is necessary to improve the service aspect of the company through social media and direct (Amatullah, 2017). According to another study performed at PT Telkom Bengkulu to describe and

analyze how the level of customer satisfaction Indihome found that if there is a disturbance, the technician will come to fix the problem for a long time, based on the accessibility indicator, Indihome customers are not satisfied with its accessibility because the network is often disrupted but not provided a solution by the company (Alimansyah et al., 2017).

A study at IndiHome Sumatra was conducted using Servqual to analyze customer satisfaction. The dimensions used in this study are the dimensions of tangible, reliability, responsiveness, assurance, and empathy. After calculating the value of service quality for each indicator in each dimension, the results show that each indicator is negative. “Judging from the average analysis results, the gap value of −1.539 means that customers have high expectations, but in fact, the performance of the services provided is not as high as the expectations obtained” (Ulkhaq & Br. Barus, 2017).

Yakti (2018) conducted another research using the Servqual method entitled "Analysis of Service Quality on Customer Satisfaction with the Customer Satisfaction Index and Service Quality Method". The study aimed to examine the level of customer satisfaction with service quality at Amayasuites Hotel Yogyakarta with a sample of 72 respondents who were consumers of the hotel. To measure customer satisfaction, the method used in this study is the customer satisfaction index (CSI). Meanwhile, to determine the value of the gap and the priority for improvement, researchers used a service quality tool (Servqual). The dimensions used in the Servqual method are tangible, reliability, responsiveness, assurance, and empathy dimensions. The results obtained from this study are the level of customer satisfaction according to measurements using CSI of 73%, which means that customers are still not satisfied. Meanwhile, according to the Servqual method, a negative (-) gap value is obtained in all dimensions, which means that the customer's perception of the service provided is still less than the expected expectations. Thus, the researchers gave several main priority service factors that need to be improved based on the Cartesian diagram.

There is research entitled "Improving the Quality of Services through the Servqual, AHP and TRIZ methods" which was carried out by examining the conditions at PT. AUTO 2000 Surabaya. Suhartini & Bachtyar (2015) stated that the results of the study, which were assessed using the dimensions of assurance, physical, reliability, responsiveness, and empathy, indicate that customers are still not satisfied with the services provided by the dealer. So, there are 5 services criteria as a priority recommendation for quality improvement, namely service schedule, fast service, warranty on the purchase of spare parts, cleanliness of waiting rooms and toilets, and giving full attention to customer complaints. From the problems in each dimension, a TRIZ analysis was carried out and 5 suggestions for quality improvement were obtained, including eliminating unnecessary procedures, maintaining dealer cleanliness, maintaining coordination between officers, adjusting customer placement according to their classification of needs, and conducting surveys on customer opinions about this dealer.

Sari et al. (2018) studied an Indonesian full-service airline service quality using the integration of Fuzzy Servqual, PCGV Index, and TRIZ. Their findings revealed that 12 service quality criteria needed to be improved because they did not meet customer expectations, so a proposal for improvement using TRIZ was given. Companies need to differentiate service categories for customers, provide easy access to existing information and services by optimizing the performance of skilled workers, and providing adequate facilities. In the case study of airline service, Jeeradist et al. (2016) applied Servqual, Kano, and TRIZ so that the airline can get problem solutions to prepare for possible failures, provide notification and explanation if there are problems, and conduct periodic checks.

The use of Servqual and TRIZ methods has also been applied to other service industries such as hospitals, retail, cafes, and public transportation. Semnani et al. (2014) stated that TRIZ helps the organization make decisions and evaluate service quality with a more open mind. While according to Lee et al. (2019), the Servqual method helps see the relationship between mall shortages in understanding and responding to customers quickly and easily. So that we get a solution to create smart

applications to access information about malls and perform customer evaluations. Nagara et al. (2020) is stated that based on the Servqual in Café XYZ calculation, it can be seen that most of the customers are satisfied, but there is a negative gap value for the completeness of the coffee bean supply. Thus, using TRIZ, it is obtained a recommendation for improvement to control the complete inventory of coffee beans. Besides, a surveyed research that the TRIZ method can be used to improve service quality by combining it with the Servqual, kano, and FTA methods. Wirawan (2015) in the research on DAMRI bus services, 12 priority problems make customers dissatisfied, so it is proposed to improve the design of bus interior facilities as well as making new rules and systems.

Based on the inductive study above, below is a summary of related research on the IndiHome industry and study using TRIZ and Servqual method:

Table 2.4 Summary of Related Study That Has Been Conducted

Author & Year	**Industry**	**Aim**	**Method**
Armanto (2018)	IndiHome Triple Play Denpasar	Knowing the effect of service quality dimensions on IndiHome triple play customer satisfaction	Multiple regression
Saputro, Latianingsih, & Hadikusuma (2016)	IndiHome	Knowing the effect of service quality on customer loyalty in the CS: Go Indonesian Community forum	Simple regression
Damsir (2019)	IndiHome Pekanbaru	Knowing the effect of service quality and product quality on consumer loyalty of IndiHome services in Pekanbaru	Multiple linear regression
Kalfiansyah (2017)	IndiHome Yogyakarta	Analyzing the influence of product quality and service quality and customer satisfaction on customer loyalty IndiHome in Yogyakarta	Multiple regression

Alimansyah, Lipneldi, & Dian (2017).	IndiHome Bengkulu	Analyzing IndiHome customer satisfaction levels and providing recommendations to PT Telkom, Bengkulu	qualitative data analysis with percentage test
Amatullah (2017).	IndiHome Palembang	Analyzing customer satisfaction levels in product use and providing recommendations to IndiHome in the Kenten Sako area, Palembang	Descriptive analysis
Kartika (2014)	PT.Telkom Yogyakarta	Knowing consumer perceptions of service quality and providing recommendations to PT. Telkom Yogyakarta	qualitative data analysis with percentage test
Ulkhaq & Br. Barus (2017).	IndiHome Sumatera	Analyzing customer satisfaction based on the quality of IndiHome product services and providing recommendations to PT. TELKOM Regional 1 Sumatera	SERVQUAL
Yakti (2018)	Hotel	know the level of customer satisfaction with the service quality of the Amayasuites Hotel Yogyakarta	CSI, SERVQUAL
Suhartini & Bachtyar (2015)	Dealer	Analyzing the level of customer satisfaction in product use and providing recommendations to PT. AUTO 2000	SERVQUAL, AHP, TRIZ

Sari, Rinawati, & Midiawati (2018)	Airline	Analyze Indonesian full-service carrier airline's service quality	Fuzzy SERVQUAL, PCGV Index, TRIZ
Jeeradist, Thawesaengskulthai , & Sangsuwan (2016)	Airline	Identify factors influencing service quality in the airline business and enhance passengers' perception of an airline's image through service quality and safety	SQM, SERVQUAL, Kano, TRIZ
Semnani, Far, Shalipoor, & Mohseni (2014)	Hospital	Determine the priority and improvement of service quality provided for patients in the hospital	TRIZ. SERVQUAL
Lee, Zhao, & Lee (2019)	Mall (retail)	Develop innovative retail service system design and evaluation by service quality-driven approach	SERVQUAL, TRIZ
Nagara, Purnamawati, & Suryadi (2020)	Cafe	Analyze of service quality improvement in café	SERVQUAL, TRIZ
Wirawan (2015)	Public Transportation	Proposing quality improvement of DAMRI bus as public transportation	SERVQUAL, kano, FTA, TRIZ

From inductive studies to find out previous research, it is known that several researchers have conducted service research at PT Telkom in general and IndiHome in particular, in several areas including the Yogyakarta area. Also, several researchers have conducted research using the Servqual and TRIZ methods to analyze the quality of the service industry, whether or not they are integrated with other methods. Both of these methods were found to have been used several times in research on the quality of company services both at PT Telkom and other companies. In the results of studies on PT Telkom and IndiHome which have been reviewed by researchers, it is known

that the quality of service provided by the company will affect customer loyalty and satisfaction. Also, from the results of previous research, it can be seen that there are still many customers who are not satisfied with several variables in IndiHome services. The value of IndiHome product suitability is not comparable to the quality provided. From the analysis results of research using Servqual at IndiHome Sumatra, the gap is negative which means that customers have high expectations, but in fact, the performance of the services provided is not as high as the expectations obtained.

Based on these recent studies, the researcher finds that no research analyzes IndiHome internet fiber optic customer satisfaction in the Special Region of Yogyakarta after seeing the fact that in open forums in social media, many users are dissatisfied with the internet services provided by IndiHome. Besides, researchers are trying to find solutions to problems faced by customers by using a problem-solving approach so that the solutions provided are more accurate than without any approach. Therefore, the researcher will analyze customer satisfaction for IndiHome's fiber internet service in the Special Region of Yogyakarta using Servqual which then proposes problem-solving using TRIZ which has never been done before.

CHAPTER III

RESEARCH METHOD

3.1. Research Flow

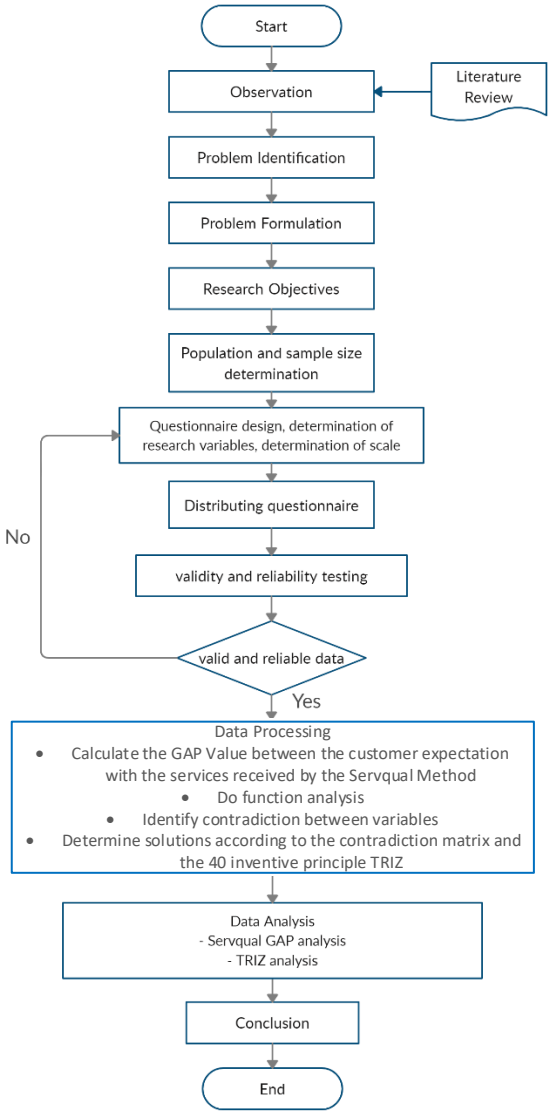


Figure 3.1 Research Flow

To obtain optimal results, this research was conducted with various systematic work steps. The research work step is a series of procedures and steps in conducting structured research that is systematic and directed so that the objectives of the research can be achieved properly. The steps used in this study are seen in the research flowchart in Figure 3.1 with the following explanation.

3.1.1 Observation

At this stage, the researcher observes customer satisfaction with the quality of internet service from the IndiHome internet service provider through customer responses who have used IndiHome WiFi, either directly or through responses uploaded to articles and online news portals and social media platforms.

3.1.2 Literature Review

A literature study is carried out together with the observation process. To conduct research preparation, a reference to the theories and concepts of experts is needed that can strengthen the solution to the problems raised in the research. A literature study is needed in conducting research preparation to obtain theories and concepts about service quality analysis, Servqual and TRIZ contradiction matrix, and inventive principle. In this research, references needed as a reference include library books, articles and scientific writing such as journals related to research.

3.1.3 Problem Identification

Problem identification begins with preliminary research by making observations and is supported by existing literature. Problem identification is carried out to describe the problems that occur in the object of research which then becomes the basis for conducting this research. From the observation, it was found that there were complaints about the quality of service provided by the company to IndiHome WiFi customers. For this reason, it is necessary to research the level of customer satisfaction with the quality of company services, to obtain a performance assessment based on consumer voices as a basis for determining decisions or steps in improving the service quality.

3.1.4 Problem Formulation

After identifying the problems, the problems that can be formulated in this study are how to analyze customer satisfaction, variables that need to be fixed, and proposed improvements for IndiHome internet service providers using the Servqual and TRIZ methods to fit the objectives to be achieved and to clarify the scope of the subject matter faced.

3.1.5 Determination of Research Objectives

Goal setting is needed to answer the existing problems to find out what the research wants to achieve. This objective is then used as a reference in the discussion so that the results are under the stated objectives. Based on the formulation of the problem, this study aims to determine the level of customer satisfaction with IndiHome internet services provided by the company, determine which variables need to be fixed, as well as suggestions that can be given to improve the quality of company services.

3.1.6 Determination of Population and Number of Samples

3.1.6.1 Population

Population is a set of units which are usually people, objects, transactions, or events that we are interested in studying. In this study, the intended population is customers who have or are currently subscribing to IndiHome fiber internet and domiciled in the Special Region of Yogyakarta (DIY).

The Indonesian Internet Service Providers Association (APJII) summarizes the areas with the highest levels of internet usage. The largest number of internet users is still dominated by the Java region with 58.08 percent of the total users in Indonesia (Septania, 2018). This is because the telecommunication network infrastructure is mature so that a number of provinces have internet penetration above 70%, one of which is the province of DIY (bisnis.com, 2019).

Therefore, this research was conducted around the special region of Yogyakarta because based on data from APJII in 2018, the

penetration of internet users was quite large which is 73.8% of the population in the special region of Yogyakarta.

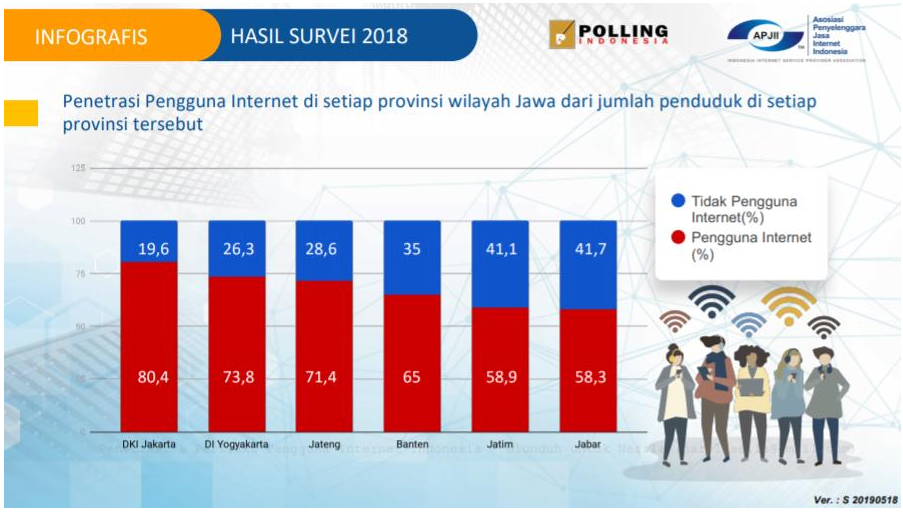


Figure 3.2 penetration of internet users in the province of Java

According to Deputy Deputy General Manager of PT Telkom Tbk Regional IV Yogyakarta, Arif Hidayat in the Krjogja news portal until the end of 2018, the number of Indihome Telkom Yogyakarta subscribers is 121 thousand (Sudjatmiko, 2018).

3.1.6.2 Sample

In this study, a non-probability sampling technique was used, namely a purposive sampling technique which is by selecting a sample among the determined population. This technique is carried out based on a subjective assessment that the intended respondents have knowledge so they can answer research questions. Samples that are considered capable of answering research questions are those who are experienced or have knowledge related to the research focus.

The sample criteria include inclusion and exclusion criteria, where these criteria determine whether or not the sample can be used as follows:

3.1.6.1.1. Inclusion Criteria

1) Samples have been or are currently subscribing to IndiHome's fiber optic.

2) Sample lives in the Special Region of Yogyakarta.

3.1.6.1.2. Exclusion Criteria

1) The sample is not willing to be the subject of this study.
2) The sample does not use IndiHome's fiber optic internet service.
3) the sample is not an IndiHome wifi customer in the Special Region of Yogyakarta

Roscoe (1975) suggests that the appropriate sample size in any study is between 30-500. In determining the sample size if the information on the chance of occurrence from the population is unknown, the Slovin formula is used:

$$n = \frac{N}{N(e)^2 + 1}$$

N = 128,000 IndiHome user

e = 90% or sig. = 1 – 90% = 0.1

$$n = \frac{128000}{128000(0.1)^2+1} = 99.92 \sim 100$$

So, the researcher would take 100 samples who have or are currently subscribing to IndiHome fiber internet and domiciled in the Special Region of Yogyakarta.

3.1.7 Determination of Research Variables

Oliver in Zeithaml (2018) define satisfaction as the consumer's fulfillment response, a judgment that a product or service feature, or the product or service itself, provides a pleasurable level of consumption-related fulfillment. Therefore, to measure customer satisfaction IndiHome fiber internet service, the required variable is the quality of IndiHome internet services provided by the company.

In determining service quality variables for making questionnaires, the researcher refers to the opinion of Parasuraman et al. (1990). Where the variables used in the questionnaire are based on five service dimensions. The five dimensions are as follows:

1. Tangible, to measure physical appearance, equipment that supports services, employee appearance, and means of communication.
2. Reliability, to measure IndiHome's ability to provide timely and reliable services according to the standards claimed.
3. Responsiveness, to measure the ability to give service to customers and make refinement responsively.
4. Assurance, to measure the knowledge, ability, politeness, and trustworthiness of employees, free from danger, risk, and doubt over the damage.
5. Empathy, to measure employees' understanding of customer needs and the attention given by employees.

3.1.8 Making A Questionnaire

To find out the respondent's response to the existing problems, it is necessary to design an appropriate measuring instrument. In this study, the questionnaire is used as a data collection tool. A questionnaire is several written questions that are used to obtain information from the respondent about the things he/she knows (Gulo, 2000).

In this research, what is meant by the questionnaire method is several written questions that are used to obtain information about customer satisfaction with IndiHome internet services. This research questionnaire is in the form of a questionnaire on the level of respondent satisfaction which is compiled from predetermined research variables. The stages of making the questionnaire are as follows:

1. The level of importance (expectation). The questionnaire in this section is used to measure the level of consumer expectations of service attributes at IndiHome internet service providers
2. The level of satisfaction (perception). The questionnaire in this section is used to measure the level of satisfaction felt by consumers with the services they feel.

The questionnaire list of questions includes two indicators, namely questions on the level of importance and satisfaction indicators. The questions used in this study are closed questions, where the category used by the Likert scale is an analysis of the level of expectations and perceptions as in tables 2.1 and 2.2. Giving a Likert scale using intervals of 1-4 to make it easier for respondents to fill out the questionnaire. The questionnaire attributes are determined based on references and literature regarding what things are complained about and make customers dissatisfied during their subscription as well as other things that affect customer satisfaction on IndiHome internet services. The following is a questionnaire that will be used for data collection:

Table 3.1 Research Questionnaire

	Question attribute	Customer Expectation				Customer Perception			
		1	2	3	4	1	2	3	4
	Tangible								
T1	IndiHome equipment that supports internet services is functioning properly								
T2	Customers easily communicate with service providers								
	Reliability								
R1	IndiHome services offered are under what customers receive								
R2	Customers have no difficulty subscribing to the service								
R3	Services are provided on time as promised to customers								
R4	The fees that need to be paid are under the initial agreement								
R5	Service providers perform transparency to customers when there are changes								

	Question attribute	Customer Expectation				Customer Perception			
R6	IndiHome service is stable								
	Responsiveness								
S1	Employees are always ready to help whenever needed								
S2	Employees serve complaints responsively								
S3	Customer problems are resolved completely								
	Assurance								
A1	Employees have good knowledge and skills at work								
A2	Customers get information that is clear and easy to understand								
A3	Employees serve friendly and polite								
A4	Trustworthy employees								
A5	Customers have no problems with IndiHome services								
A6	Service providers provide compensation if there are problems								
	Empathy								
E1	Employees give attention to customers								
E2	Service providers are open to criticism and suggestions from customers								
E3	Service providers provide services according to customer needs								

3.1.9 Distributing Questionnaire

The questionnaires that have been compiled are then distributed to respondents who meet the inclusion criteria. Respondents were asked to serve

in the form of numbers about IndiHome internet services in the level of expectation and perceived level of perception for each attribute.

The purpose of distributing this questionnaire is to determine the level of customer satisfaction with the service quality provided by the company and the perceived service quality expectations.

3.1.10 Validity and Reliability Testing

3.1.10.1 Validity Testing

When researching by collecting data using a questionnaire, the questionnaire created must be able to measure what it wants to measure. The higher the validity of a variable (attribute), the more the test is about the target, and the more it shows what it should show.

In this study, the validity test will be carried out using SPSS software. It can be done by correlating the score of the question items with the total variable score, as well as the bivariate correlation between each score and the total construct score. To make a correlation between the score of the question items with the total score based on the value of r table and r count. The indicator is declared valid if the r- arithmetic is greater than the r-table and is positive. The R-table used is based on df = N (number of samples) - 2 and α (alpha). Then to perform bivariate correlation, the indicator is said to be valid if it has a sig value less than 0.05.

If there is an instrument item that is not valid, then the researcher can omit the instrument item, revise the instrument item, or ask the opinion of an expert in the field.

3.1.10.2 Reliability Testing

The reliability test was conducted to know that even if the variables in the questionnaire were asked of the respondents, the results did not deviate too far from the average respondent's answer to that variable.

In this study, the reliability test will be carried out using SPSS software. On the analysis of the variable reliability test, the variable is said to be reliable if the Cronbach's alpha values greater than 70% or 0.7. As for the reliability test, the indicator is declared reliable if the Cronbach's Alpha (Scale if deleted items) on the indicator is smaller than or equal to the Cronbach's Alpha variable. If the questionnaire is not reliable, then the questionnaire needs to be revised.

3.1.11 Data Processing

Based on the data that has been collected from respondents, the authors perform data processing to determine the level of customer satisfaction for IndiHome internet services. The qualitative data collection is applied through the SERVQUAL approach with service attributes that are guided by the dimensions of service quality developed by Parasuraman, namely tangible, reliability, responsiveness, assurance and empathy.

To be able to identify the system contradiction, the function analysis tools is used by draw the function model. After obtaining the value of the gap between customer expectations and perceptions, then further identified the Problem contradictions and determined general solution ideas are then interpreted into specific problems as the right solution by using a contradiction matrix and 40 inventive principles.

3.1.12 Data Analysis

Based on the results of data processing carried out, then we can further analyze the results of data processing. The analysis will lead to the research objectives and will answer questions on the formulation of the problem. Analysis of the results of the data in this study is about how the level of customer satisfaction of IndiHome internet services and proposing the right solution to overcome the contradiction of existing problems to improve company performance so that customer satisfaction is met.

3.1.13 Conclusions and Suggestions

The final stage of the research is to make conclusions from the research results based on the objectives to be achieved. In this study it will be known the level of customer satisfaction based on the quality of service provided by IndiHome fiber internet, IndiHome fiber internet's service attributes need to be improved based on customer perception using Servqual and improvement proposals can be given to the IndiHome fiber internet so that customers are satisfied based on the contradiction matrix and the TRIZ inventive principle method.

CHAPTER IV

DATA COLLECTING AND PROCESSING

This chapter describes the results of the IndiHome service quality analysis based on the servqual and TRIZ methods. The discussion of the results of this study begins with a quantitative analysis which includes testing the validity and reliability using the help of the SPSS statistical computer program. Research data collection was carried out by distributing questionnaires to research respondents, namely customers who have subscribed or are currently subscribing to IndiHome WiFi. In this study, 110 questionnaires were distributed through the online form, while 103 were returned with 100 questionnaires that were processed because there were respondents who did not fit the inclusion criteria. Details of the questionnaire acquisition in this study can be seen in the data summary attachment. After the data collected has been tested valid and reliable, then the gap value in the data is analyzed so that an appropriate suggestion can be obtained.

4.1 Data Profile of Respondents

The respondents used in this study were 100 users of IndiHome's fiber optic WiFi internet who live in a special area of Yogyakarta. The respondents' productivity is described based on demographic data which includes gender, age, occupation, subscription status, reasons for subscribing, subscription period, and experience of complaining.

4.1.1 Gender

Gender is grouped into two parts, namely (1) female and (2) male.

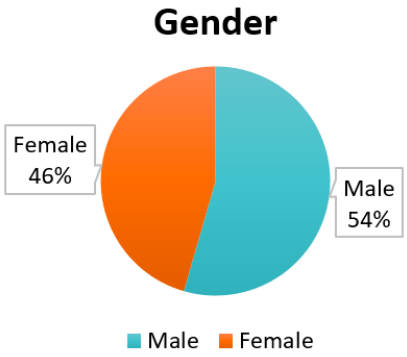


Figure 4.1 Distribution of respondents based on gender

In Figure 4.1 it can be seen that of the 100 total respondents, 54% of the respondents were male and the remaining 46% were female.

4.1.2 Age

In general, the age levels are grouped into four sections, namely (1) 17-20 years, (2) 21-30 years, (3) 30-40, and (4) more than 40 years.

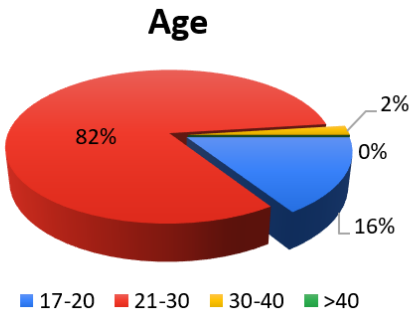


Figure 4.2 Distribution of respondents by age

From Figure 4.2 it can be seen that 16% of the respondents are 17-20 years old, while those aged 21-30 years dominate as much as 82%, 2% of the respondents are 30-40 years old, and no respondent is over 40 years old.

4.1.3 Profession

In general, the types of work are grouped into six sections, namely (1) student, (2) entrepreneur, (3) self-employed, (4) civil servant, (5) private employee, and (6) others.

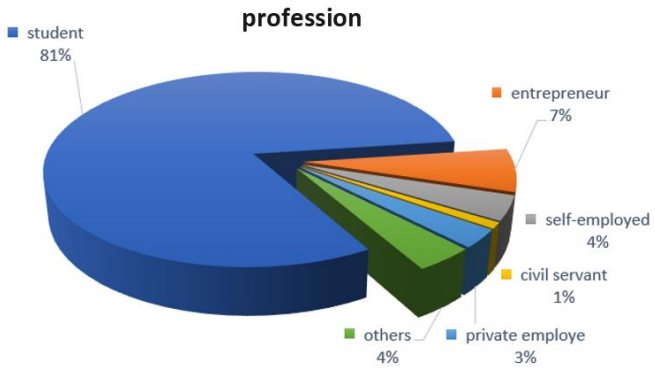


Figure 4.3 Distribution of respondents by occupation

Based on figure 4.3, it can be seen that 81% of the respondents are students, 7% are entrepreneurs, 4% of the respondents are self-employed, 1% civil servants, 3% of private employees, and the rest are respondents with various professions.

4.1.4 Subscription status

IndiHome Fiber optic subscription status is divided into 5 categories, namely (1) Since the beginning until now the respondent has subscribed to IndiHome WiFi, (2) currently subscribing to IndiHome WiFi after switching from another provider, (3) having subscribed to IndiHome WiFi but now no longer subscribing to WiFi, (4) have subscribed to IndiHome Wifi but have switched to another provider, and (5) have never subscribed to IndiHome WiFi.

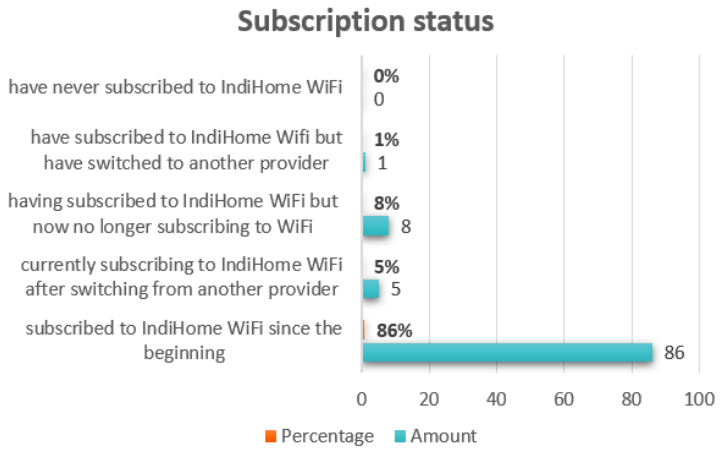


Figure 4.4 Distribution of respondents based on subscription status

Figure 4.4. shows that the majority of respondents, namely 86% have subscribed to IndiHome WiFi since the beginning of using WiFi, 5% used

IndiHome after switching from another provider, 1% had switched to another provider, while 8% had no longer subscribed to WiFi, and there are no respondents who have not been subscribed to IndiHome WiFi.

4.1.5 Reasons to subscribe to IndiHome WiFi

In general, there are 6 reasons why respondents subscribe to WiFi through the IndiHome provider, namely (1) the respondent only knows the IndiHome provider, (2) the respondent subscribes to a fixed-line and cable TV at the same time, (3) The network has reached the respondent's residence, (4) the subscription fee relatively cheap, (5) IndiHome is known to be good, and (6) others. At this point in question, respondents can choose more than one reason why they choose to subscribe to WiFi from the IndiHome service provider.

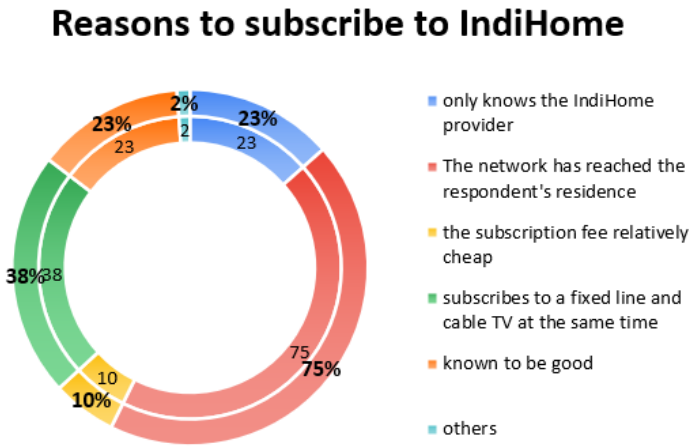


Figure 4.5 Distribution of respondents based on reasons for subscribing to IndiHome

Based on figure 4.5, it can be seen that the majority of respondents, namely 75% chose IndiHome because the internet network has reached their place of residence, then 38 respondents reasoned that they simultaneously subscribe to landlines and cable TV, then respondents chose because they only know IndiHome providers and because IndiHome is well known 23 people, while 10% of respondents feel the IndiHome price is cheap, and 2% have other reasons.

4.1.6 Subscription period

In general, the period for respondents to subscribe to IndiHome WiFi is divided into 5 categories, namely (1) less than 2 months, (2) between 2 to 5 months, (3) between 5 to 12 months, (4) between 1 and 2 years and (5) more than 2 years.

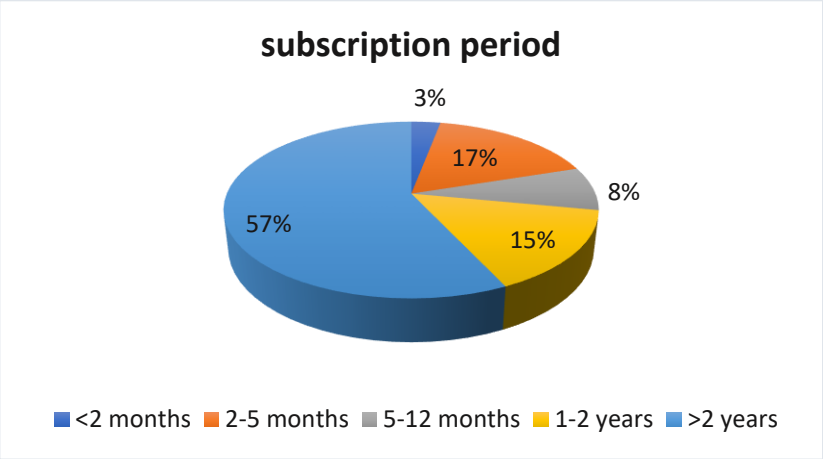


Figure 4.6 Distribution of respondents based on length of subscription

From figure 4.6 it can be seen that more than half of the respondents have subscribed to WiFi IndiHome for more than 2 years, than respondents who have subscribed for 2 to 5 months are 17%, 15% of respondents have subscribed for 1-2 years, 8% have subscribed for 5 up to 12 months, and the remaining 3% of respondents have just subscribed for less than 2 months.

4.1.7 Experience in filing complaints

There are two divisions in the customer experience of filing a complaint of IndiHome fiber optic, namely (1) the respondent ever complained, and (2) the respondent has never filed a complaint.

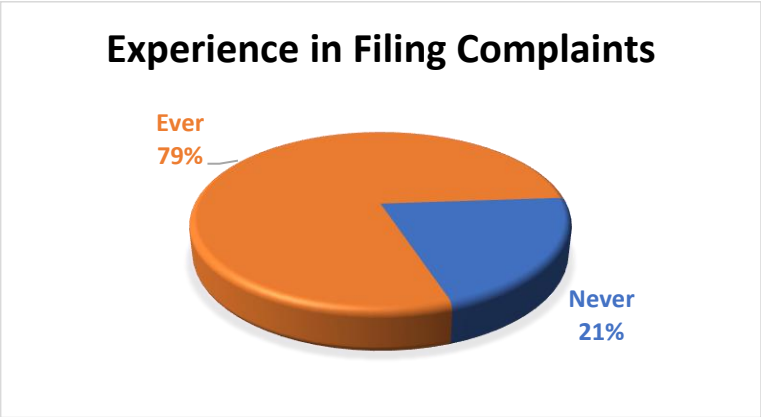


Figure 4.7 The distribution of respondents based on experience filed complaints

From figure 4.7 regarding the distribution of respondents in submitting complaints, it can be seen that the majority of respondents have complained to IndiHome providers about the quality of IndiHome WiFi because there are things that make them dissatisfied, namely 79% of 100 respondents, and only 21% of respondents who have never complained to IndiHome.

4.2 Validity Testing

Validity shows the extent to which measuring instruments are used to measure what is being measured. It can be done by correlating the score of the question items with the total variable score, as well as the bivariate correlation between each score and the total construct score.

In this study, the validity test was carried out using SPSS 23 software to 100 respondents with 19 indicators from 5 variables. The indicator is declared valid if the r-arithmetic is greater than the r-table with df = 100-2 = 98 and $\alpha = 0.05$. Then to perform bivariate correlation, the indicator is said to be valid if it has a sig value less than 0.05.

4.2.1.Expectation Validity Testing

The results of the validity test for 20 indicators of the 5 variables of customer expectations on the quality of IndiHome WiFi service are as follows:

Table 4.1 Expectation Validity Testing

Indicator	r_{table}	$r_{arithmetic}$	Sig.	criteria	category
Tangible					
T1	0,1966	0.623	0	valid	High validity
T2	0,1966	0.785	0	valid	High validity

Indicator	r_{table}	$r_{arithmetic}$	Sig.	criteria	category
Reliability					
R1	0,1966	0.747	0	valid	High validity
R2	0,1966	0.823	0	valid	Very high validity
R3	0,1966	0.854	0	valid	Very high validity
R4	0,1966	0.749	0	valid	High validity
R5	0,1966	0.798	0	valid	High validity
R6	0,1966	0.718	0	valid	High validity
Responsiveness					
S1	0,1966	0.826	0	valid	Very high validity
S2	0,1966	0.928	0	valid	Very high validity
S3	0,1966	0.784	0	valid	High validity
Assurance					
A1	0,1966	0.765	0	valid	High validity
A2	0,1966	0.752	0	valid	High validity
A3	0,1966	0.832	0	valid	Very high validity
A4	0,1966	0.805	0	valid	Very high validity
A5	0,1966	0.668	0	valid	High validity
A6	0,1966	0.734	0	valid	High validity
Empathy					
E1	0,1966	0.846	0	valid	Very high validity
E2	0,1966	0.788	0	valid	High validity
E3	0,1966	0.835	0	valid	Very high validity

Based on table 4.1, it can be seen that all indicators used in the questionnaire are valid, because the $r_{arithmetic}$ value> r_{table} (0.1966) and the sig value < 0.05.

4.2.2.Perception Validity Testing

The results of the validity test for 20 indicators of the 5 variables of customer perception on the quality of IndiHome WiFi service are as follows:

Table 4.2 Perception Validity Testing

Indicator	r_{table}	$r_{arithmetic}$	Sig.	criteria	category
Tangible					
T1	0,1966	0.618	0	valid	High validity
T2	0,1966	0.747	0	valid	High validity
Reliability					
R1	0,1966	0.759	0	valid	High validity
R2	0,1966	0.75	0	valid	High validity
R3	0,1966	0.605	0	valid	High validity
R4	0,1966	0.601	0	valid	High validity
R5	0,1966	0.639	0	valid	High validity
R6	0,1966	0.752	0	valid	High validity
Responsiveness					
S1	0,1966	0.767	0	valid	High validity
S2	0,1966	0.791	0	valid	High validity
S3	0,1966	0.746	0	valid	High validity
Assurance					
A1	0,1966	0.637	0	valid	High validity
A2	0,1966	0.696	0	valid	High validity
A3	0,1966	0.474	0	valid	Sufficient validity
A4	0,1966	0.622	0	valid	High validity
A5	0,1966	0.713	0	valid	High validity
A6	0,1966	0.685	0	valid	High validity
Empathy					
E1	0,1966	0.708	0	valid	High validity
E2	0,1966	0.686	0	valid	High validity
E3	0,1966	0.759	0	valid	High validity

Based on table 4.1, it can be seen that all indicators used in the questionnaire are valid, because of the $r_{arithmetic}$ value > r_{table} (0.1966) and the sig value < 0.05.

4.3 Reliability Testing

The reliability test was conducted to know that even if the variables in the questionnaire were asked of the respondents, the results did not deviate too far from the average respondent's answer to that variable.

The reliability test was carried out using SPSS 23 software. The variable is said to be reliable if the Cronbach's alpha values > 70% or 0.7. As for the reliability test, the indicator is declared reliable if the Cronbach's Alpha (Scale if deleted items) on the indicator ≤ Cronbach's Alpha variable.

Table 4.3 Reliability Test Result

	Cronbach's Alpha	r_{table}	criteria	Category
expectation	0.967	0.196	reliable	Very High Reliability
reality	0.942	0.196	reliable	Very High Reliability

Based on Table 4.3, the reliability test was carried out on the expectation and reality variables in the questionnaire which was declared valid. It can be seen that the results of Cronbach's Alpha calculations on both variables> rtable, so they are declared reliable.

Then the reliability test is also carried out to test each indicator on the variable, namely as follows:

a. Expectation

Table 4.4 Expectation Reliability Test

indicator	Cronbach's Alpha	Cronbach's Alpha if Item Deleted	criteria
Tangible			
T1	0.967	0.967	reliable
T2	0.967	0.965	reliable
Reliability			
R1	0.967	0.965	reliable
R2	0.967	0.964	reliable
R3	0.967	0.964	reliable
R4	0.967	0.966	reliable
R5	0.967	0.965	reliable

indicator	Cronbach's Alpha	Cronbach's Alpha if Item Deleted	criteria
R6	0.967	0.966	reliable
Responsiveness			
S1	0.967	0.964	reliable
S2	0.967	0.963	reliable
S3	0.967	0.965	reliable
Assurance			
A1	0.967	0.965	reliable
A2	0.967	0.965	reliable
A3	0.967	0.965	reliable
A4	0.967	0.965	reliable
A5	0.967	0.967	reliable
A6	0.967	0.966	reliable
Empathy			
E1	0.967	0.964	reliable
E2	0.967	0.965	reliable
E3	0.967	0.964	reliable

From table 4.4 it can be seen that all expectation indicators are declared reliable because of the value of Cronbach's alpha (if item deleted) $\leq$ cronbach's alpha variable. All indicators are included in the very high-reliability category because the value is between 0.9 to 1.

b. Reality

Table 4.5 Perception Reliability Test

indicator	Cronbach's Alpha	Cronbach's Alpha if Item Deleted	criteria
Tangible			
T1	0.942	0.94	reliable
T2	0.942	0.938	reliable
Reliability			

indicator	Cronbach's Alpha	Cronbach's Alpha if Item Deleted	criteria
R1	0.942	0.937	reliable
R2	0.942	0.938	reliable
R3	0.942	0.941	reliable
R4	0.942	0.94	reliable
R5	0.942	0.94	reliable
R6	0.942	0.938	reliable
Responsiveness			
S1	0.942	0.937	reliable
S2	0.942	0.937	reliable
S3	0.942	0.938	reliable
Assurance			
A1	0.942	0.94	reliable
A2	0.942	0.939	reliable
A3	0.942	0.942	reliable
A4	0.942	0.94	reliable
A5	0.942	0.938	reliable
A6	0.942	0.939	reliable
Empathy			
E1	0.942	0.938	reliable
E2	0.942	0.939	reliable
E3	0.942	0.937	reliable

From table 4.5 it can be seen that all perception indicators are declared reliable too because of the value of Cronbach's alpha (if item deleted) < Cronbach's alpha variable. All indicators are included in the very high-reliability category because the value is between 0.9 to 1.

4.4 Service Quality Data Processing

In processing data using the servqual method obtained from the results of filling out the questionnaire, data processing is carried out by measuring the value of customer expectations and perceptions of service performance at IndiHome and measuring the Gap Score Servqual as the value of service quality.

[1] Calculation of the Value of Respondents' Expectations on the Quality of IndiHome WiFi Fiber Optic Service

First, to calculate the expectation score based on the survey results, the formula as below:

$$E_{total} = (E_1 \times 1) + (E_2 \times 2) + (E_3 \times 3) + (E_4 \times 4) \quad (4.1)$$

Where:

E_1 = Number of respondents answered very not important

E_2 = Number of respondents answered not important

E_3 = Number of respondents answered important

E_4 = Number of respondents answered very important

$$ES = E_{total} \text{ Respondent / Total Respondent} \quad (4.2)$$

The calculation of expectation score based on the servqual questionnaire result as below:

Table 4.6 Calculation of Expectation Score

Indicator	very important (E1)	Important (E2)	not important (E3)	very not important (E4)	E_{total}	Expectation Score
T1	69	30	1	0	368	3.68
T2	76	21	3	0	373	3.73
R1	72	27	1	0	371	3.71
R2	64	35	1	0	363	3.63
R3	65	32	3	0	362	3.62
R4	61	37	1	1	358	3.58
R5	66	30	3	1	361	3.61
R6	81	16	3	0	378	3.78

S1	72	26	1	1	369	3.69
S2	68	30	2	0	366	3.66
S3	72	27	1	0	371	3.71
A1	66	34	0	0	366	3.66
A2	72	27	1	0	371	3.71
A3	67	33	0	0	367	3.67
A4	64	34	1	1	361	3.61
A5	75	22	2	1	371	3.71
A6	72	25	3	0	369	3.69
E1	61	35	4	0	357	3.57
E2	65	34	1	0	364	3.64
E3	64	35	1	0	363	3.63

Table 4.7 Expectation Score for Every Service Indicator

Variable	Indicator		Expectation Score
Tangible	T1	IndiHome equipment that supports internet services is functioning properly	3.68
	T2	Customers easily communicate with service providers	3.73
Reliability	R1	IndiHome services offered are under what customers receive	3.71
	R2	Customers have no difficulty subscribing to the service	3.63
	R3	Services are provided on time as promised to customers	3.62
	R4	The fees that need to be paid are under the initial agreement	3.58
	R5	Service providers perform transparency to customers when there are changes	3.61

Variable	Indicator		Expectation Score
	R6	IndiHome service is stable	3.78
Responsiveness	S1	Employees are always ready to help whenever needed	3.69
	S2	Employees serve complaints responsively	3.66
	S3	Customer problems are resolved completely	3.71
Assurance	A1	Employees have good knowledge and skills at work	3.66
	A2	Customers get information that is clear and easy to understand	3.71
	A3	Employees serve friendly and polite	3.67
	A4	Trustworthy employees	3.61
	A5	Customers have no problems with IndiHome services	3.71
	A6	Service providers provide compensation if there are problems	3.69
Empathy	E1	Employees give attention to customers	3.57
	E2	Service providers are open to criticism and suggestions from customers	3.64
	E3	Service providers provide services according to customer needs	3.63

In table 4.6 above, you can see the results of the calculation of the expected value of each respondent on each indicator or attribute of IndiHome WiFi service. Then calculate the expected value of each service quality variable by finding the average value of each variable. From the calculation results, it is obtained the expected value of all dimensions in table 4.8 as follows:

Table 4.8 Score of Respondents' Expectation on All Variables

Variable	Expectation Score
Tangible	3.705
Reliability	3.655
Responsiveness	3.687
Assurance	3.675
Empathy	3.613

[2] Calculation of the Value of Respondents' Perceptions on the Quality of IndiHome WiFi Fiber Optic Service

After getting the E_{total}, calculate the average value by dividing the value obtained from the E_{total}l formula by the number of respondents.

To calculate the perception score for each service attribute, the calculation method is the same as the expectation score calculation, with the following formula:

$$P_{total} = (P_1 \times 1) + (P_2 \times 2) + (P_3 \times 3) + (P_4 \times 4) \quad (4.3)$$

P_1 = Number of respondents answered very dissatisfied

P_2 = Number of respondents answered dissatisfied

P_3 = Number of respondents answered Satisfied

P_4 = Number of respondents answered very satisfied

$$PS = P_{total} \text{ Respondent / Total Respondent} \quad (4.4)$$

The calculation of expectation score based on the servqual questionnaire result as below:

Table 4.9 Calculation of Perception Score

Indicator	**very satisfied (P1)**	**Satisfied (P2)**	**Dissatisfied (P3)**	**very dissatisfied (P4)**	**P_{total}**	**Perception Score**
T1	12	61	23	4	281	2.81
T2	25	47	18	10	287	2.87
R1	16	49	26	9	272	2.72

R2	24	41	25	10	279	2.79
R3	31	43	20	6	299	2.99
R4	30	51	12	7	304	3.04
R5	20	49	22	9	280	2.8
R6	2	28	44	26	206	2.06
S1	21	44	27	8	278	2.78
S2	22	42	29	7	279	2.79
S3	29	42	19	10	290	2.9
A1	33	58	7	2	322	3.22
A2	30	54	15	1	313	3.13
A3	42	53	5	0	337	3.37
A4	32	59	5	4	319	3.19
A5	6	33	42	19	226	2.26
A6	11	38	31	20	240	2.4
E1	18	59	19	4	291	2.91
E2	27	50	14	9	295	2.95
E3	20	59	15	6	293	2.93

Table 4.10 Perception Score for Every Service Indicator

Variable	Indicator		Perception Score
Tangible	T1	IndiHome equipment that supports internet services is functioning properly	2.81
	T2	Customers easily communicate with service providers	2.87
Reliability	R1	IndiHome services offered are under what customers receive	2.72
	R2	Customers have no difficulty subscribing to the service	2.79
	R3	Services are provided on time as promised to customers	2.99
	R4	The fees that need to be paid are under the initial agreement	3.04

Variable	Indicator		Perception Score
	R5	Service providers perform transparency to customers when there are changes	2.8
	R6	IndiHome service is stable	2.06
Responsiveness	S1	Employees are always ready to help whenever needed	2.78
	S2	Employees serve complaints responsively	2.79
	S3	Customer problems are resolved completely	2.9
Assurance	A1	Employees have good knowledge and skills at work	3.22
	A2	Customers get information that is clear and easy to understand	3.13
	A3	Employees serve friendly and polite	3.37
	A4	Trustworthy employees	3.19
	A5	Customers have no problems with IndiHome services	2.26
	A6	Service providers provide compensation if there are problems	2.4
Empathy	E1	Employees give attention to customers	2.91
	E2	Service providers are open to criticism and suggestions from customers	2.95
	E3	Service providers provide services according to customer needs	2.93

In table 4.9 above, you can see the results of the calculation of the value of each respondent's perception of each indicator or attribute of the IndiHome WiFi service. Then the calculation of the perceived value of each service quality variable by looking for the average value of each variable. From the calculation results, the expected values of all dimensions are shown in Table 4.11 as follows:

Table 4.11 Score of Respondents' Perception of All Variables

Variable	Perception Score
Tangible	2.84
Reliability	2.733
Responsiveness	2.823
Assurance	2.928
Empathy	2.93

[3] Calculation of Service Quality (Servqual) Score

In this calculation, it will be seen the quality of service provided by IndiHome on its WiFi Fiber Optic service to customers. It is necessary to determine the priority for improvements that will be made by management at IndiHome. This assessment is obtained from the calculation of the gap in the expectation value and the perceived value for each dimension as follows:

Servqual Score (gap) = PS – ES (4.5)

Where :

ES (Expectation Score) = the value of customer expectations for each service attribute

PS (Perception Score) = the value provided by the customer for each service attribute

Table 4.12 Servqual Score for Every Service Indicator

Variable	Indicator		Expectation Score (x)	Perception Score (y)	Servqual Score (y-x)
Tangible	T1	IndiHome equipment that supports internet services is functioning properly	3.68	2.81	-0.87
	T2	Customers easily communicate with service providers	3.73	2.87	-0.86
Reliability	R1	IndiHome services offered are under what customers receive	3.71	2.72	-0.99

Variable	Indicator		Expectation Score (x)	Perception Score (y)	Servqual Score (y-x)
	R2	Customers have no difficulty subscribing to the service	3.63	2.79	-0.84
	R3	Services are provided on time as promised to customers	3.62	2.99	-0.63
	R4	The fees that need to be paid are under the initial agreement	3.58	3.04	-0.54
	R5	Service providers perform transparency to customers when there are changes	3.61	2.8	-0.81
	R6	IndiHome service is stable	3.78	2.06	-1.72
Responsiveness	S1	Employees are always ready to help whenever needed	3.69	2.78	-0.91
	S2	Employees serve complaints responsively	3.66	2.79	-0.87
	S3	Customer problems are resolved completely	3.71	2.9	-0.81
Assurance	A1	Employees have good knowledge and skills at work	3.66	3.22	-0.44
	A2	Customers get information that is clear and easy to understand	3.71	3.13	-0.58
	A3	Employees serve friendly and polite	3.67	3.37	-0.3
	A4	Trustworthy employees	3.61	3.19	-0.42
	A5	Customers have no problems with IndiHome services	3.71	2.26	-1.45
	A6	Service providers provide compensation if there are problems	3.69	2.4	-1.29

Variable	Indicator		Expectation Score (x)	Perception Score (y)	Servqual Score (y-x)
Empathy	E1	Employees give attention to customers	3.57	2.91	-0.66
	E2	Service providers are open to criticism and suggestions from customers	3.64	2.95	-0.69
	E3	Service providers provide services according to customer needs	3.63	2.93	-0.7
		average	**3.6645**	**2.8455**	**-0.819**

In table 4.10 it can be seen that the results of the calculation of the Servqual Score for all indicators, which result from the difference between the value in the perception column and the value in the expectation column are all negative value gaps which can be seen in the Servqual Score column. The average of indicator's servqual score is -0.819.

After finding that all servqual scores for each indicator are negative, then the indicators are sorted according to the largest to the smallest gap value. This is done to determine the priority order for improvements using the TRIZ method. The indicator with the lowest servqual value is -1.72, the stability of IndiHome service and the highest is -0.3,the friendliness and politeness of employees. With details in table 4.13 as follows:

Table 4.13 Ranking Indicator Based on Gap Value

Indicator		servqual score
R6	IndiHome service is stable	-1.72
A5	Customers have no problems with IndiHome services	-1.45
A6	Service providers provide compensation if there are problems	-1.29
R1	IndiHome services offered are under what customers receive	-0.99
S1	Employees are always ready to help whenever needed	-0.91
T1	IndiHome equipment that supports internet services is functioning properly	-0.87

Indicator		servqual score
S2	Employees serve complaints responsively	-0.87
T2	Customers easily communicate with service providers	-0.86
R2	Customers have no difficulty subscribing to the service	-0.84
R5	Service providers perform transparency to customers when there are change	-0.81
S3	Customer problems are resolved completely	-0.81
E3	Service providers provide services according to customer needs	-0.7
E2	Service providers are open to criticism and suggestions from customers	-0.69
E1	Employees give attention to customers	-0.66
R3	Services are provided on time as promised to customers	-0.63
A2	Customers get information that is clear and easy to understand	-0.58
R4	The fees that need to be paid are under the initial agreement	-0.54
A1	Employees have good knowledge and skills at work	-0.44
A4	Trustworthy employees	-0.42
A3	Employees serve friendly and polite	-0.3

In addition to the servqual value data for each indicator, the servqual score is calculated for each variable by looking for the average value of perceptions and expectations for each variable. So that the results are obtained as in table 4.14 below:

Table 4.14 Servqual Value For Each Dimension

Variable	Perception Score (y)	Expectation Score (x)	Servqual Score (y-x)
Tangible	2.84	zssxsa3.705	-0.865
Reliability	2.733	3.655	-0.922
Responsiveness	2.823	3.687	-0.863
Assurance	2.928	3.675	-0.747
Empathy	2.93	3.613	-0.683
average	**2.851**	**3.667**	**-0.816**

4.5 Designing Proposed Quality Improvement Using TRIZ

4.5.1 **Function Analysis**

To be able to identify contradiction exists in the system, a TRIZ tool called function analysis is used. To be able to construct a function model using these tools, information from experts is used. In this research, Mr. Muhammad Solahudin who is the head of the PT TELKOM Sleman who understands all existing systems in PT. TELKOM including the IndiHome system explains information about how the IndiHome WiFi system works in carrying out its functions to customers. The explanation is then applied to the function analysis through several stages as follows:

1. IndiHome WiFi Component Analysis
    a. Product: WiFi IndiHome
    b. System Component
        - Internet Service Provider (ISP) IndiHome
        - Router
        - Internet Network
        - MyIndiHome platform
        - social media platform
        - Ticket
        - Backbone
        - Customer
        - Cable
        - Bandwidth
    c. Supersystem Component
        - Subscription fee
        - Complaint
        - Questions
2. Interaction Between Components
    1) Customer requests a WiFi installation via the platform
    2) ISP checks availability on the backbone
    3) ISP prepares the backbone

4) ISP confirms to customers
5) The customer pays a subscription fee
6) Fees accepted by the ISP
7) Backbone support cable
8) The ISP installs fiber optic cables at the residence of the customer
9) The internet network is transported by fiber optic cable
10) ISP leases out routers
11) The internet network is transported to the router
12) The router translates the network into an IndiHome WiFi signal
13) The router used by customers
14) Customers let, not take care of the router
15) WiFi is used by customers
16) The condition of the fiber optic cable affects the IndiHome WiFi network
17) The use of WiFi is limited by bandwidth
18) Customers exceed bandwidth capacity
19) ISP provides MyIndiHome Platform services
20) Each user's WiFi status is recorded on the MyIndiHome platform
21) Customers ask questions
22) Customers submit complaints
23) Questions accepted by the IndiHome social media platform
24) complaints received by the IndiHome social media platform
25) Social media platform managers forward customer complaints to the ISP
26) Social media platform managers answer customer questions
27) The ISP produces customer complaint tickets
28) The ISP resolves customer complaints
29) Customers access the MyIndiHome platform
30) The platform produces customer complaint tickets
31) The platform helps provide information directly to customers
32) Complaint tickets are processed by the ISP
33) The ISP resolves customer complaints

3. Function Model

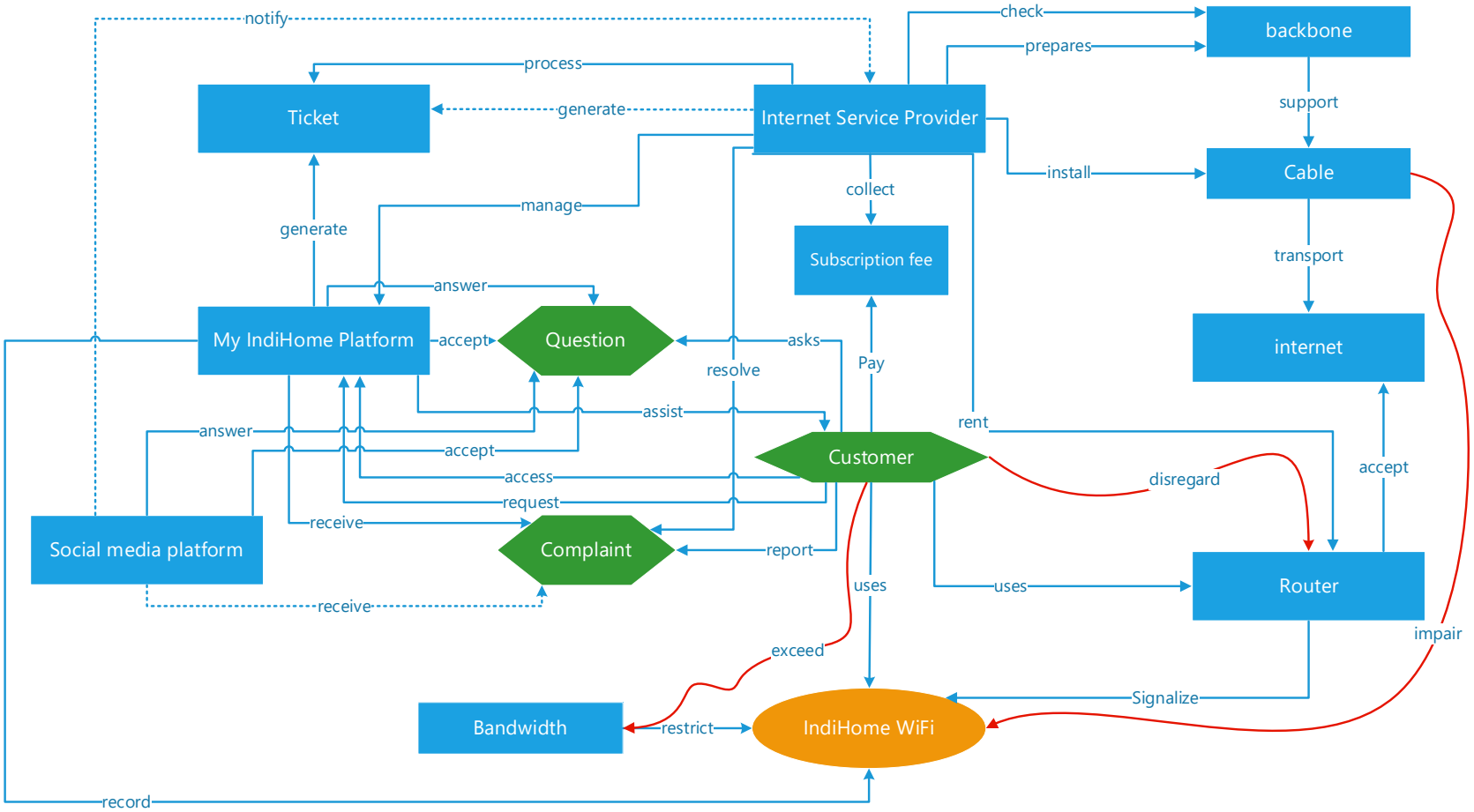


Figure 4.8 IndiHome WiFi's Function Model

Based on the functional analysis, it is found in figure 4.8 that there are several different functions. To make the wifi works properly there are ISP, backbone, fiber optic cable, internet network, router, fee and bandwidth that work normally and effectively. To assist the customer in accessing all needs regarding the WiFi, MyIndiHome platform is working effectively. Customers can also access social media platforms to access information and report complaints, yet this platform works ineffectively because the ticket could be generated only if the social media's staff forward information or complaints to ISP first. The last is there are several harmful functions as the contradiction on the system. The router used by the customer to access WiFi is disregarded so that it may be broken or decrease its quality in carrying out its function, the cable used to transport the network from ISP may degrade in its quality or having some problem regarding its length or cable reel so that it will impair the quality of WiFi function, and the last is customer often exceed the use of bandwidth internet limit whereas the bandwidth limitation is based on the customer's needs and ability to subscribe to WiFi, with excessive bandwidth usage the network tends to be unstable and slow.

4.5.2 Problem Modeling and Initial Solution Analysis

After knowing the existing problem based on a negative servqual score and do the problem mapping using the function model, then a general solution is designed which is then translated into technical parameters that are improving features to be better. Initial solutions for solving problems faced by IndiHome internet service customers were obtained from brainstorming between researchers and several experts. These experts are experienced people working in the Telkom company in charge of IndiHome internet services. They are Mr. Budi Kuncoro who has experience as a Senior Manager in the Networking field of PT TELKOM Jakarta and Mr. Muhammad Solahudin who is the head of the PT TELKOM Sleman office who has an understanding of IndiHome networks and information systems.

In this study researcher only consider the variable within the score above -0.90, the most critical problem based on the variable's servqual gap rank and confirmed as the urgency based on Mr.Solahuddin as the expert's perspective. Those variables are:

Table 4.15 The Most Important Variable

Indicator		servqual score
R6	IndiHome service is stable	-1.72
A5	Customers have no problems with IndiHome services	-1.45
A6	Service providers provide compensation if there are problems	-1.29
R1	IndiHome services offered are under what customers receive	-0.99
S1	Employees are always ready to help whenever needed	-0.91

The initial solution is entered in the Technical Requirements table, then adjusted to the Altshuller Contradiction Matrix table (TRIZ contradiction matrix) based on the explanation of 39 parameters as shown in table 2.3. In the Contradiction Matrix in the form of a table with 39 x 39 elements divided into 2, the 39 upright elements are improving features, while 39 horizontal elements are worsening features. For the first stage of problem-solving using the TRIZ method, what is looking for is an improving feature. Improving feature means the initial solution to improve service quality or what do we want to make better. Those 39 parameters and 40 inventive principles were explained in chapter 2.

Based on the problems with the quality of IndiHome internet services which cause unsatisfied customers, the initial solution is given according to the expert from the company by improving the following parameters:

1. For the internet network to be stable (R6), applying bandwidth limitation is needed as a divider of data transfer speed, when matched with Engineering parameters, this increases the stability of the network as an object component (# 13) as the integrity of the system.
2. So that customers do not encounter problems with service (A5), companies can educate customers about maintaining the equipment used such as routers as a tool to direct data packets from the ISP to the customer's network with the appropriate route and cables by not placing them carelessly or piling up with other items so that equipment that supports their service does not cause problems and functions properly.

Also, the company could be equipped the router with a guide to using either the equipment or the service. periodic maintenance and inspection/testing are carried out on the performance of equipment and infrastructure both on the provider and customer sides. Other than that recommend anticipatory steps to customers to provide Uninterruptible Power Supply (UPS) to save power in case of power failure. Thus, the performance of internet services will be better. The improved technical parameter is the object generated harmful factor (# 31) which is one that reduces the efficiency or quality of the functioning of the system generated by the object, as part of its operation.

3. As a guarantee for the customer (A6), the company needs to educate the customer about compensation in proportion to the disturbance caused by the equipment provider stated in the contract that has been agreed by using an interactive platform. This helps customers to trust the company because of a guarantee, thereby improving the reliability parameter (# 27) which is the system's ability to perform its intended functions in predictable ways and conditions.
4. Customers will receive services under what the company offers (R1) if:
   a. During the installation of the service, an acceptance test is carried out by checking the conformity of the internet speed that has been installed. So, customers will know that in the future the company will provide the same internet speed as at the beginning of the installation and make customers believe in the company.
   b. the company truly uses fiber optic cable according to what is offered to transport the internet network from the ISP to the customer’s residence.

   Those two would increase the reliability parameter (# 27) which is the system's ability to perform its intended functions in predictable ways and conditions.
5. By educate and emphasize customers use the direct complaint line with the application platform provided by the company, employees will be more ready to help whenever needed (S1). Because many customers do not know about the use of the MyIndiHome application platform, so the process of resolving customer needs is ineffective because it takes another long route. Although the application has been systemized so that it assists the company by immediately record

complain and generates tickets for immediate completion by required employees directly.

Also, the company could complete the backbone in each area with a sign if there is still a place for new installation or not. Other than that company could ensure every officer who finishes installing new services or repairing cables, update information on the platform regarding the availability of new internet installation places Thus, customers did not wait for long and increase the loss of time parameter (# 25) which means reducing the time taken for the activity.

The complete results can be seen in the following table:

Table 4.16 Initial Solution

No	Indicator	Customer Expectation	General Solution	What do We Want to Make Better	Improving Parameters
1	R6	IndiHome service is stable	apply bandwidth limitation	stable internet	stability of the object (#13)
2	A5	Customers have no problems with IndiHome services	educate customers about maintaining the equipment used	Service not encountered problems and functions properly	object generated harmful factor (#31)
3	A6	Service providers provide compensation if there are problems	inform compensation stated in the contract that has been agreed by using interactive platform	customers trust companies	reliability (#27)
4	R1	IndiHome services offered are	perform an internet speed	customers trust companies	reliability (#27)

No	Indicator	Customer Expectation	General Solution	What do We Want to Make Better	Improving Parameters
		under what customers receive	acceptance test and truly using fiber optic cable		
5	S1	Employees are always ready to help whenever needed	Educate and emphasize users complain directly using the company platform	customers did not wait for long	loss of time (#25)

Based on table 4.16, of the 5 priority attributes, it is adjusted to the improving feature table and 4 elements are under the technical requirements. The number of attributes is not the same as the number of elements, because several attributes have the same elements. For example, for the attributes “give compensation” and “perform acceptance test by checking the suitability of internet speed”, both correspond to the element number 27 “reliability” of the table improving feature in the contradiction matrix. "Reliability" here means the reliability provided by the internet service of IndiHome as expected by customers.

4.5.3 Impact of Solutions and Contradiction Analysis

The second stage is the worsening feature. This means the impact of the initial solution when it is done. After the first stage in the Contradiction Matrix, which is to determine the improving feature elements, then from the technical requirements, we look for worsening features by considering the improving features of each attribute in the technical requirements. Based on the initial solution to IndiHome internet service quality problems which caused dissatisfied customers, the worsening parameter as the following:

1. - If the company applying bandwidth limitation
   - Then the internet network would be stable

- But customers potentially ignore their limits and use the internet more than they should, perceived internet network would be decreased than it should be

2. - If company educate customers about maintaining the equipment used
   - Then service not encountered problems and functions properly, customers would have no problems with IndiHome services
3. - If company inform compensation stated in the contract that has been agreed by using interactive platform
   - Then would gain customers trust because customers understand very well that the company gives compensation as a guarantee.
4. - If customer perform an internet speed acceptance test and the company truly use fiber optic cable
   - Then customers believe that what IndiHome services offered are under what is receive
   - But the installation of cables by the company in an area over time will create many connections so that the cable is too long and makes a lot of cable coils so the quality of its function will decrease

5.- If the company educate and emphasize users complain directly using the company platform
   - Then customers did not wait for long

The complete results can be seen in the following table:

Table 4.17 Impact of Solution

No	Indicator	Customer Expectation	General Solution	What Get Worse as A Result	worsening parameters
1	R6	IndiHome service is stable	apply bandwidth limitation	perceived internet network would be decreased than it should be	Object affected harmful factor (#30)
2	A5	Customers have no	educate customers about	-	-

No	Indicator	Customer Expectation	General Solution	What Get Worse as A Result	worsening parameters
		problems with IndiHome services	maintaining the equipment used		
3	A6	Service providers provide compensation if there are problems	inform compensation stated in the contract that has been agreed by using an interactive platform	-	-
4	R1	IndiHome services offered are under what customers receive	perform an internet speed acceptance test and truly using fiber optic cable	Decreasing cable's function quality	object generated harmful factor (#31)
5	S1	Employees are always ready to help whenever needed	Educate and emphasize users complain directly using the company platform	-	-

It can be seen from Table 4.17, the impact of the initial improvement solution in the worsening feature column has 2 elements which are object generated harmful factor and object generated harmful factor worsening parameters.

4.5.4 Contradictions Based on the TRIZ 40 Inventive Principles

The next step is to find inventive principles based on the results of the meeting on improving features and worsening features in the contradiction matrix. The meeting of each element will produce several inventive principles that aim to find the basis of proposals for solutions to improve service quality. Complete results can be seen in the following table:

Table 4.18 Contradiction Analysis

Indicator	Problem	general solution	Improving Parameters	worsening parameters	Inventive Principle
R6	IndiHome service is stable	apply bandwidth limitation	stability of the object (#13)	Object affected harmful factor (#30)	35,24,30,18
A5	Customers have no problems with IndiHome services	educate customers about maintaining the equipment used	object generated harmful factor (#31)	-	-
A6	Service providers provide compensation if there are problems	inform compensation stated in the contract that has been agreed by using an interactive platform	reliability (#27)	-	-
R1	IndiHome services offered are under what customers receive	perform an internet speed acceptance test and truly using fiber optic cable	reliability (#27)	object generated harmful factor (#31)	35,2,40,6
S1	Employees are always ready to help whenever needed	Educate and emphasize users complain directly using the company platform	loss of time (#25)	-	-

It can be seen from table 4.18, It can be seen that not all indicators contradict the initial solution given by the expert from PT Telkom. A solution can provide results by increasing one parameter but it results in the worse of other parameters, so the inventive principle recommendation is given.

These numbers contain global analyzes as listed in chapter 2 which can be used as a solution to improving the quality of IndiHome WiFi services. For example, for number 35 as the most repeated principle:

Principles 35. Parameter Changes:

A. Change an object's physical state

B. Change the concentration or consistency

C. Change the degree of flexibility

D. Change the temperature

Principles 35 can be a solution to the priority of improving the service quality. Of the 4 sub-principles, it can be logically adapted to any of the attributes.

4.5.5 Proposed Improvements Based on the Application of the TRIZ 40 Inventive Principles

Of the 5 attributes that are the main priority, improving service quality requires solutions that are not just trial and error. But must consider the impact when the solution is implemented. From the contradictions matrix, 3 or 4 of the 40 Inventive Principles of TRIZ would be pointed to be considered. Learn and brainstorm which of these 3-4 can apply to the problem by test the top solution. A good solution will likely come from one of the principles (TRIZ Inventive Problem Solving, 2020)

Consideration of the solution of 1 attribute can be found using a row of Principles used. The initial solutions for IndiHome internet service were combined with solutions from the inventive principles. This solution based on inventive principles is also the result of brainstorming with the experts previously mentioned in sub-chapter 4.5.1. There are several solutions from the inventive principles that support the initial solution, but there are also those that add solutions to achieve the goal of improving the service quality. The complete results are as follows:

Table 4.19 Proposed Improvement for Each Problem

Indicator	Problem	Inventive Principle	TRIZ Proposed Improvement
R6	IndiHome service is stable	35,24	• Using an automatically programmed platform for giving information on the recent limit of internet services and how the customer should use it. • Adding bandwidth limitations so that users can use more freely according to their capacity

Indicator	Problem	Inventive Principle	TRIZ Proposed Improvement
R1	IndiHome services offered are under what customers receive	35,6	• Limiting the length of the cable and cable reels used • Using only one cable to be attached to a backbone for all network users in a certain area

The explanation for table 4.19 is explained as below:

1. **An object can perform several different functions; therefore, other elements can be removed (universality)**

   Inventive principle number 6 is used, namely "universality" to ensure that IndiHome services offered are under what customers receive by Using only one cable to be attached to a backbone for all network users in a certain area so that cable connections are not piling up or too many connections are long. Then the network is distributed without using cables, namely with one backbone that transmits a signal for one area and is captured using a WiFi extender with the same internet quality for each user.

2. **Mediator (Use an intermediary object to transfer or carry out an action)**

   Furthermore, inventive principle number 24 is used, namely “intermediary” by using the existed platform for providing detailed information on services such as the recent limit of internet services and how the customer should use it. So that customer would know their bandwidth limitation and their use. If they exceed the limit, they would realize that the internet may not be stable as before.

3. **Transformation of Properties (Change concentration)**

   By transforming the properties according to principle number 35, “change concentration” point, the company can solve customer problems in terms of stability of internet and make sure what offered are under what customer perceived. An implementation following these principles is to adding bandwidth limitations so that users can use more freely according to their capacity and having stable internet without any worry of their excessive use of the internet, thus the

WiFi service would be stable. For the other indicator, that may cause harm by using the cable with too long connection and several cable coil, this principle applied by giving standard for the length of the cable and cable reels used in every WiFi installation.

Table 4.20 Proposed Improvement Based on Each Inventive Principles

TRIZ Principles	**Explanation**	**Service resolutions for the internet service industry**
6: universality	An object can perform several different functions; therefore, other elements can be removed	• Using only one cable to be attached to a backbone for all network users in a certain area and is captured using a WiFi extender with the same internet quality for each user.
24 : Mediator	Use an intermediary object to transfer or carry out an action	• Using an automatically programmed platform for giving information on the recent limit of internet services and how the customer should use it
35: Transformation of Properties	Change concentration	• Adding bandwidth limitations so that users can use more freely according to their capacity • Limiting the length of the cable and cable reels used

CHAPTER V

DISCUSSION

After calculating and processing the data from the survey results through distributing questionnaires in the previous chapter, in this chapter the researcher needs to analyze the data for the five variables or Servqual dimensions and the solutions that can be offered through the TRIZ approach.

5.1. Questionnaire Result Data Analysis

5.1.1 Validity Testing

The validity test was carried out using the help of SPSS software with the Pearson product-moment technique. The first step taken is to find the value of the r_{table}, using 100 respondents and a significance level of 5%, then the r table results are 0.1966. The next step is to find the $r_{arithmethic}$ value, where the results can be seen in the Corrected item-total Correlation. The data is said to be valid if $r_{arithmethic} \geq r_{table}$. Based on tables 4.1 and 4.2, the SPSS output results show that all the attributes of the statement are valid in the first iteration. This shows that all question indicators have been able to perform their measuring function or provide measurement results that are appropriate for their purpose.

5.1.2 Reliability Testing

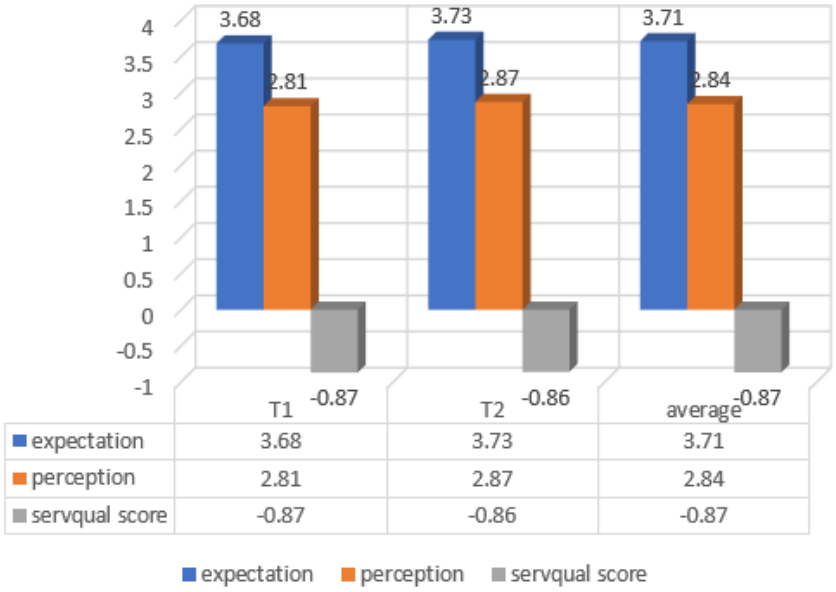
As with validity testing, this reliability test uses SPSS software with the Cronbach's Alpha method. A data is said to be reliable when it has a Cronbach Alpha value > 0.7 and indicators are declared reliable because of the value of Cronbach's alpha (if item deleted) $\leq$ Cronbach's alpha variable. Data will be more consistent and have high reliability when its value approaches 1. Based on the results of data processing in table 4.3, the value of Cronbach's Alpha at the level of importance is 0.967 and

the satisfaction level is 0.942. In addition, in tables 4.4 and 4.5 all indicators have a smaller Cronbach's Alpha (if item deleted) value is the same as the value in the variable. Where the data can be said to have very good reliability. This shows that if the questionnaire is distributed several times to different respondents, the results will not deviate too far from the average respondent's answer or it can be said that the respondent's answer will be stable or consistent.

5.2 Analysis of the Value of Perceptions, Expectations, and Servqual Calculation Results

Based on the calculation of the perception, expectation, and Servqual values that have been done previously, the researcher will discuss the perception, expectation, and Servqual values of each questionnaire indicator based on its dimensions as follows.

5.2.1 Tangible



	T1	T2	average
expectation	3.68	3.73	3.71
perception	2.81	2.87	2.84
servqual score	-0.87	-0.86	-0.87

Figure 5.1 Servqual Calculation Results for Tangible Dimensions

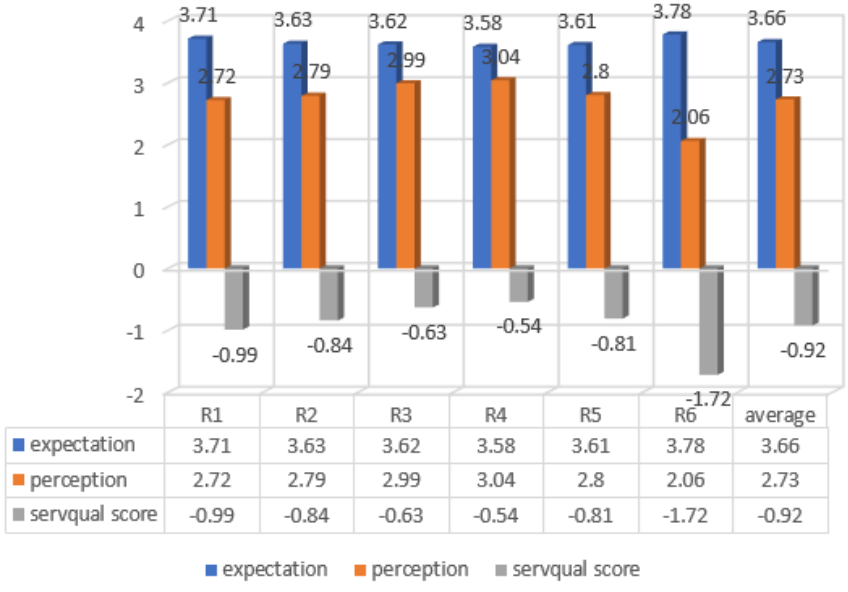
According to the results in Figure 5.1, it can be seen that the respondent's perception for each indicator on the tangible variable is smaller than the respondent's expectation. Thus, a negative gap or servqual score is obtained, which means that the service quality especially tangible variable provided by IndiHome's fiber-optic WiFi has not met the respondents' expectations.

The tangible dimension is a dimension that describes the physical appearance of a service. In this dimension, customer expectations of IndiHome equipment and the ease of communicating with service providers are very high which can be seen from the average expectation score is 3.71. But in reality, customer expectations are not what they are.

According to respondents' perceptions, IndiHome equipment that supports internet services is not functioning properly and finds it difficult to communicate with the service providers. This makes customers give perception values for T1 and T2 indicators of only 2.81 and 2.87, so that the average perceived value in the tangible dimension is below number 3 that is 2.84. The results of these calculations indicate that the quality of service provided by WiFi IndiHome, especially in the tangible dimensions, is unsatisfactory for customers.

The gap value obtained for the indicator in the Tangible dimension is all negative, to be exact, the gap is -0.87 and -0.86 for indicator T1 and T2. Therefore, the researcher got servqual score for the tangible dimension is -0.87. because of this negative value, the company needs to make improvements in the tangible dimension to increase customer satisfaction.

5.2.2 Reliability



	R1	R2	R3	R4	R5	R6	average
expectation	3.71	3.63	3.62	3.58	3.61	3.78	3.66
perception	2.72	2.79	2.99	3.04	2.8	2.06	2.73
servqual score	-0.99	-0.84	-0.63	-0.54	-0.81	-1.72	-0.92

Figure 5.2 Servqual Calculation Results for Reliability Dimensions

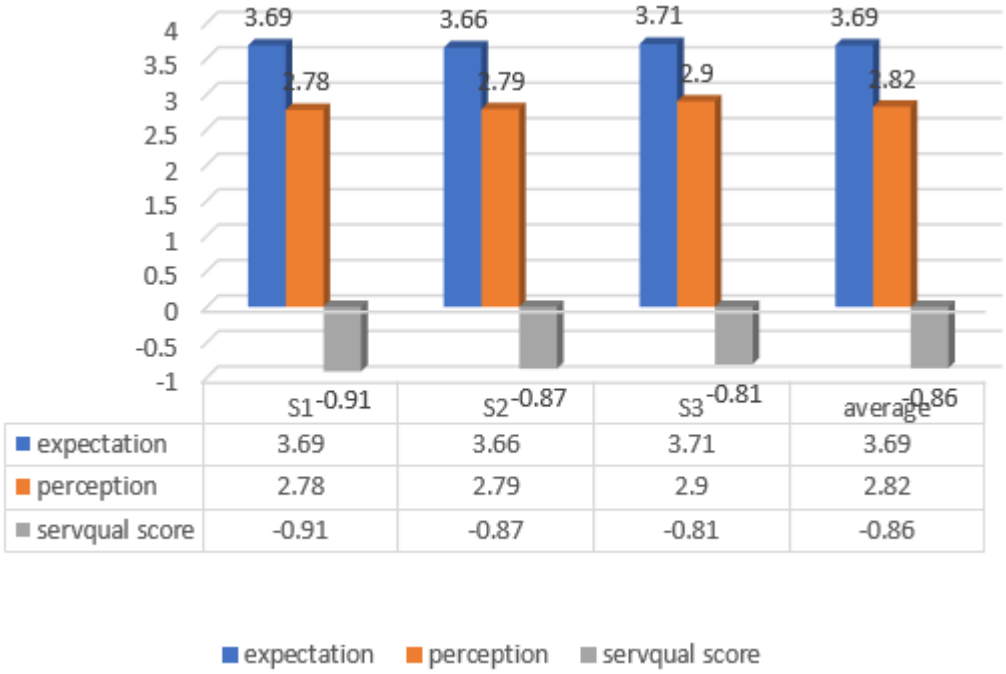
Based on the results in Figure 5.2, it can be seen that the respondent's perception for each indicator on the reliability variable is smaller than the respondent's expectation. Thus, a negative gap or servqual score is obtained, which means that the service quality especially the reliability variable provided by IndiHome's fiber-optic WiFi has not met the respondents' expectations.

A service provider is considered reliable when the company can provide services as promised promptly, accurately, and satisfactorily. In this dimension, customer expectations of conformity with the realization of IndiHome's offers and promises, ease of subscription, transparency, and service stability are very high which can be seen from the average expectation score of 3.66. But in reality, customer expectations are not what they perceived.

According to respondents' perceptions, IndiHome does not provide services as promised and offered, does not provide clarity on the use of fees that customers have paid, and customers feel the least satisfied with IndiHome's WiFi service which is considered unstable. This makes customers give perception values for R1 of 2.72, R2 of 2.79, R3 of 2.99, R4 of 3.04, R5 of 2.8, and R6 of 2.06 so that the average perception score in the tangible dimension is 2.73 which is below 3. The results of these calculations indicate that the quality of service provided by WiFi IndiHome, especially in the reliability dimensions, is unsatisfactory for customers.

The gap value obtained for the reliability dimension is negative, to be exact, it is -0.92. All of the indicators in this dimension are negatives, -0.99 on R1, -0.84 on R2, -0.63 on R3, -0.54 on R4, -0.81 on R5, and -1.72 on R6. Because of this negative value, the company needs to make improvements of reliability dimensions to increase customer satisfaction.

5.2.3 Responsiveness



	S1	S2	S3	average
expectation	3.69	3.66	3.71	3.69
perception	2.78	2.79	2.9	2.82
servqual score	-0.91	-0.87	-0.81	-0.86

Figure 5.3 Servqual Calculation Results for Responsiveness Dimensions

Based on the results in Figure 5.3, it can be seen that the respondent's perception for each indicator on the responsiveness variable is smaller than the respondent's expectation. Thus, a negative gap or servqual score is obtained, which means that the service quality especially the responsiveness variable provided by IndiHome's fiber-optic WiFi has not met the respondents' expectations.

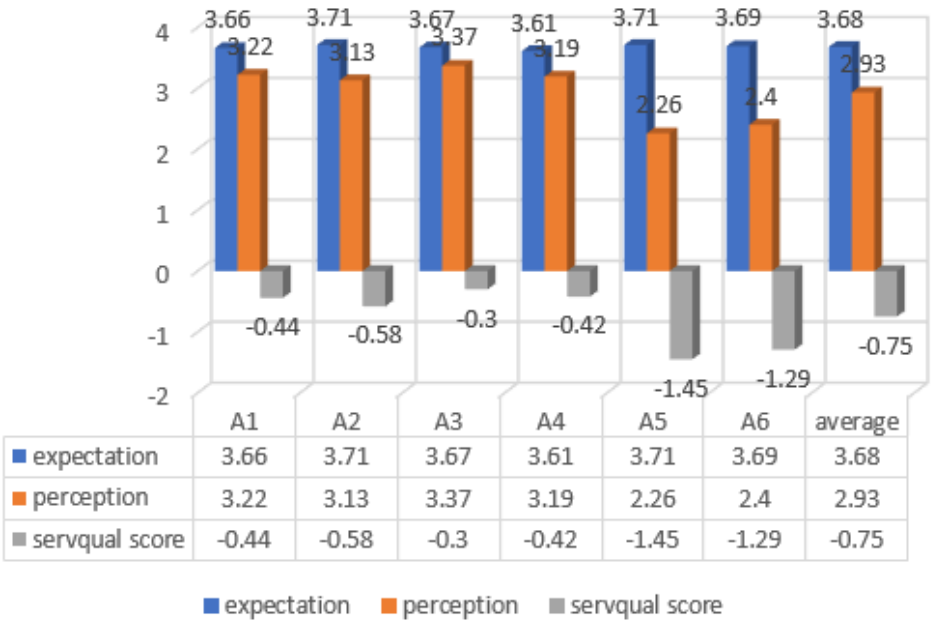
The responsiveness dimension is the level of responsiveness that a company can provide as well as the desire and willingness of employees to help customers appropriately. In this dimension, customer expectations of IndiHome employees who can be relied on in solving problems faced by customers are very high which can be seen from the average expectation score of 3.69. But in reality, customer expectations are not what they are.

According to respondents' perceptions, IndiHome's employees are not ready enough to help solve customer problems responsively and thoroughly. This makes customers give perception values for S1, S2, and S3 indicators of only 2.78, 2.79, and 2.9 so that the average perception score in the tangible dimension is below

number 3 that is 2.82. The results of these calculations indicate that the quality of service provided by WiFi IndiHome, especially in the responsiveness dimensions, was found unsatisfactory for customers.

The gap value obtained for the indicator in the responsiveness dimension is all negative, to be exact, the gap is -0.91, -0.87, and -0.81 for indicator S1, S2, and S3. Therefore, the researcher got servqual score for the responsiveness dimension is -0.86. because of this negative value, the company needs to make improvements in the responsiveness dimension to increase customer satisfaction.

5.2.4 Assurance



	A1	A2	A3	A4	A5	A6	average
expectation	3.66	3.71	3.67	3.61	3.71	3.69	3.68
perception	3.22	3.13	3.37	3.19	2.26	2.4	2.93
servqual score	-0.44	-0.58	-0.3	-0.42	-1.45	-1.29	-0.75

Figure 5.4 Servqual Calculation Results for Assurance Dimensions

Based on the results in Figure 5.4, it can be seen that the respondent's perception for each indicator on the assurance variable is smaller than the respondent's expectation. Thus, a negative gap or servqual score is obtained, which means that the service quality especially the assurance variable provided by IndiHome's fiber-optic WiFi has not met the respondents' expectations.

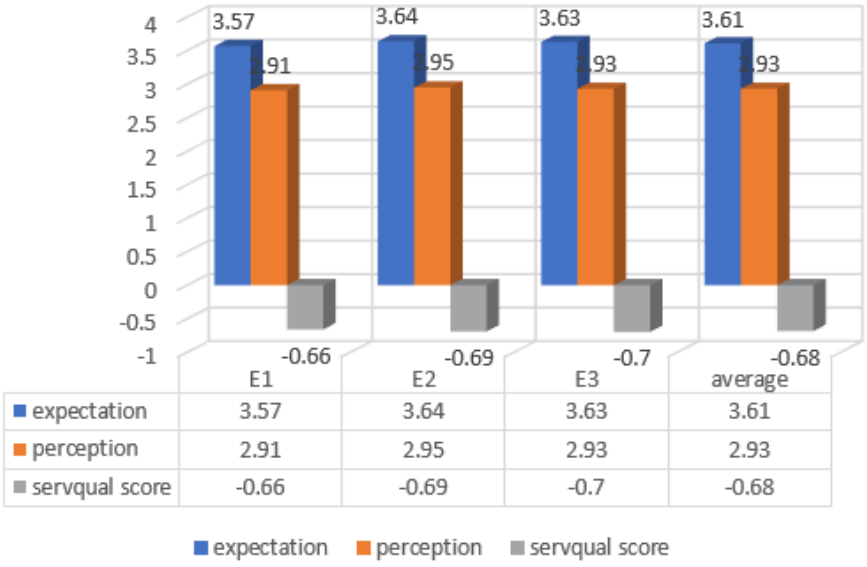
The assurance dimension is a guarantee of knowledge, attitude, courtesy and the ability of employees to foster a customer's trust in the company. In this dimension, customer expectations of guaranteed employee professionalism and

guaranteed service from IndiHome are very high which can be seen from the average expectation score of 3.68. But in reality, customer expectations are not what they perceived.

According to respondents' perceptions, There are many problems with IndiHome's WiFi service and the company does not provide compensation, besides that employees are still not satisfactory in terms of knowledge, skills at work and in providing information to customers. This makes customers give perception values for A1 of 3.22, A2 of 3.13, A3 of 3.37, A4 of 3.19, A5 of 2.26, and A6 of 2.4 so that the average perception score in the assurance dimension is 2.93 which is below 3. The results of these calculations indicate that the quality of service provided by WiFi IndiHome, especially in the assurance dimensions, is unsatisfactory for customers.

The gap value obtained for the assurance dimension is negative, to be exact, it is -0.75. All of the indicators in this dimension are negatives, -0.44 on A1, -0.58 on A2, -0.3 on A3, -0.42 on A4, -1.45 on A5, and -1.29 on A6. Because of this negative value, the company needs to make improvements in assurance dimensions to increase customer satisfaction.

5.2.5 Empathy



	E1	E2	E3	average
expectation	3.57	3.64	3.63	3.61
perception	2.91	2.95	2.93	2.93
servqual score	-0.66	-0.69	-0.7	-0.68

Figure 5.5 Servqual Calculation Results for Empathy Dimensions

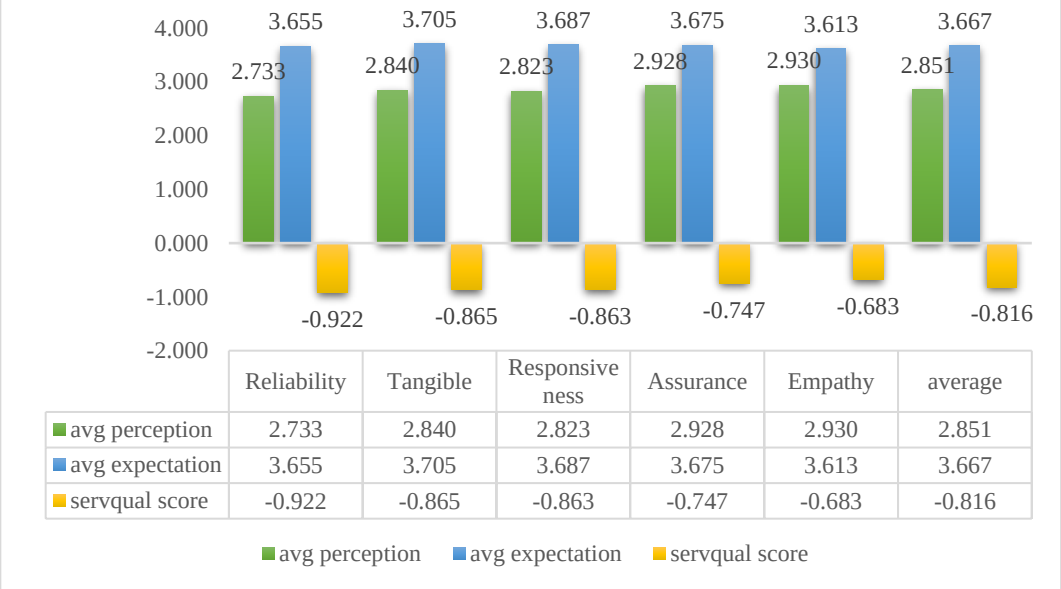
The last dimension is empathy, based on the results in Figure 5.5, it can be seen that the respondent's perception for each indicator on the empathy variable is smaller than the respondent's expectation. Thus, a negative gap or servqual score is obtained, which means that the service quality especially the empathy variable provided by IndiHome's fiber-optic WiFi has not met the respondents' expectations.

The empathy dimension is a dimension that is defined as the ease of establishing relationships, good communication, and the ability to provide personal attention and needs to customers. In this dimension, customer expectations of IndiHome's attention to customer needs and openness to criticism and suggestions are high enough which can be seen from the average expectation score of 3.61. But in reality, customer expectations are not what they feel.

According to respondents' perceptions, IndiHome did not give enough attention to customers and provide what they need, also did not open enough for suggestions and criticism. This makes customers give perception values for E1, E2 and E3 indicators of only 2.91, 2.95 and 2.93. So that the average perception score in the empathy dimension is below number 3 that is 2.93. The results of these calculations indicate that the quality of service provided by WiFi IndiHome, especially in the empathy dimensions, is unsatisfactory for customers.

The gap value obtained for the indicator in the empathy dimension is all negative, to be exact, the gap is -0.44, -0.42 and -0.3 for indicators E1, E2 and E3 respectively. Therefore, the researcher got servqual score for the empathy dimension is -0.68. because of this negative value, the company needs to make improvements in the empathy dimension to increase customer satisfaction.

5.3.Comparative Analysis of Service Quality for Each Variable



	Reliability	Tangible	Responsiveness	Assurance	Empathy	average
avg perception	2.733	2.840	2.823	2.928	2.930	2.851
avg expectation	3.655	3.705	3.687	3.675	3.613	3.667
servqual score	-0.922	-0.865	-0.863	-0.747	-0.683	-0.816

Figure 5.6 Comparison of Expectation, Perception, and Servqual Values of Each Variable

From Figure 5.6 above, it can be seen that all dimensions have a perceived value that is lower than customer expectations. If analyzed separately from the expectations, perceptions, and servqual values of each dimension, it can be seen that the highest expectation score is in the tangible dimension with a value of 3.705. Customers place high expectations on the physical evidence of IndiHome WiFI services. Meanwhile, the dimension with the lowest expectation is empathy with a value of 3.613. This means that, compared to other dimensions, customer expectations of the company's empathy are not that big. The overall average expectation is 3,667, which means that customers have high expectations for IndiHome WiFi services.

For perception value, the highest score is in the empathy dimension with a value of 2.93. that is, compared to other dimensions, IndiHome's best performance is its empathy with customers. While the dimension with the lowest perceived value is the reliability dimension, which is 2,733, which means that the most unsatisfactory service for customers is the company's reliability. The average customer perception score as a whole is 2,851, meaning that the customer is not satisfied with the service received while subscribing to IndiHome fiber-optic WiFi.

Meanwhile, based on the Servqual score, the reliability dimension has the largest gap, which is -0.922. The other dimensions are tangible, responsiveness, assurance and empathy, respectively, with the gap or servqual score of -0.865, -0.863, -0.747, -0.683, respectively. Besides, the overall average servqual score obtained is -0.816. The gap value between customer expectations and perceptions for IndiHome WiFi services is still quite large and has a negative value, therefore improvements are needed to improve service quality.

5.4.TRIZ Contradiction Matrix Analysis

In preparing solutions to problems that have been found in the servqual analysis based on the negative gap or servqual score, the researcher uses the TRIZ contradiction matrix analysis. The analysis is carried out by finding a general initial solution, analyzing the good impact as an improving feature and the bad impact as a worsening feature, then obtaining recommendations for inventive principles that can be used based on existing contradictions, and formulating appropriate solutions based on the appropriate principles for each problem.

From the analysis, it is found 5 elements improving feature, while the impact of the initial improvement solution in the worsening feature column has 2 elements. So that we get 7 inventive principles based on the contradiction matrix which contains global solutions. The principle used is the principle that can be used as a solution to improve the quality of IndiHome WiFi services. The initial solutions for IndiHome WiFi were combined with solutions from the inventive principles.

There are several solutions from the inventive principles that support the initial solution, but there are also those that add solutions to achieve the goal of improving service quality. In the end, 3 principles are defined as suggestions for solutions that have been adapted to the existing problem.

Inventive principles used as a result of this TRIZ contradiction matrix analysis are universality, intermediary and parameter change. These principles are then translated into suggested solutions that companies can apply to improve the quality of IndiHome WiFi services. The proposed solution are using only one cable to be attached to a backbone for all network users in certain area and is captured using a WiFi extender with

the same internet quality for each user, using an automatically programmed platform for giving information on recent limit of internet services and how customer should use it, adding bandwidth limitations so that users can use more freely according to their capacity and limiting the length of the cable and cable reels used.

In carrying out the implementation of the proposed improvement with TRIZ for IndiHome internet service quality, there are several measurement parameters based on expert knowledge from PT TELKOM to assess whether an indicator has improved and is running well, namely:

1. Services offered are under what customers receive

   To find out whether what IndiHome offers at the start is in accordance with what customers receive, then the internet speed parameter or what is known as bandwidth is used to measure the amount of data that can be transferred in units of time using Mbps (Megabits per second). At the beginning of the installation, customers must pay attention to how many Mbps of internet speed they want and do a speed test using services available on the internet. On the speed test platform, you can find out what the download and upload speeds are on the internet network used. Below are the internet speeds offered by IndiHome:

   - 10 Mbps
   - 20 Mbps
   - 30 Mbps
   - 40 Mbps
   - 50 Mbps
   - 100 Mbps
   - 200 Mbps
   - 300 Mbps

2. Internet speed stability

   For the internet speed to be stable and in accordance with what is needed, customers must pay attention to the use of Wi-Fi according to its designation. The following are conditions that customers must comply with in order for the network to remain stable based on the page https://www.indihome.co.id/internet :

Table 4.21 Wi-Fi Usage Recommendations

Internet Speed	**the recommended number of devices**
10 Mbps	1-3 devices
20 Mbps	3-5 devices
30 Mbps	5-7 devices
40 Mbps	7-10 devices
50 Mbps	10-12 devices
100 Mbps	12-18 devices
200 Mbps	18-25 devices
300 Mbps	25-30 devices

In addition, from the company side, you can carry out routine checks on network quality in each area by using the EMBASSY application (Easy Measurement for Bandwidth, Attenuation, Attainable Rate & SNR Speedy) and IBOOSTER (a web-based application that can currently be used to determine High network quality. Customer Speed Internet) owned by PT TELKOM. with the standard Signal to Noise Ratio (SNR):

Table 4.22 Reference standard for Signal to Noise Ratio (SNR) parameter value in Embassy Software

Parameter	Standard	Internet Quality
Signal to Noise Ratio	$\geq$ 25 dB	Good
	$\leq$ 13 dB	Poor

(Fitri, Srihendayana, & Dasril, 2014)

3. Company responsiveness

   In handling customer problems, PT. TELKOM has implemented a Service Level Guarantee, namely, the problem is resolved within one day or known as One-Day Service. It is planned to be upgraded to Half-Day Service. With this guarantee, customers can judge whether the company is responsive to solving problems or not.

4. Completeness of the problem

   To ensure the completeness of a problem, the company uses a 3-on-3 assurance parameter, which is to ensure that there is no re-interruption, under specification and that the service is no more than a service level guarantee.

It is expected that the solutions proposed in this study will be truly successful in helping IndiHome to increase customer satisfaction. Like several companies, even multi-national companies have successfully implemented solutions to various problems using the TRIZ method such as Samsung, Hitachi, Siemens and 3M (Domb, 2000).

Issues	Customers' inconvenience	Percentage
Find a place	Parking is not available	34.4%
	Cannot find specific brand shop	10.6%
Find/buy products	Counter staffs over-aggressive introduces	13.3%
	Required heavy lifting after shopping	13.1%
	Cannot find proper brand goods	11.4%
Make shopping decision	Do not like to shop without discounts	21.3%
	Friends' comments are required	13.2%
Watch movies	Long queuing while buying tickets	10.6%
Meal experience	Finding seats after meal-ordering at food court	43.3%
	Knowing available space in advance	27.6%
	Worrying about placeholder items missing	22.4%

Figure 5.7 Another Study Survey of Customers' Inconvenience
(Lee, Zhao, & Lee, 2019)

Also, a study at U Mall that designed a shopping guidance service system included the entire new service system evaluation process using the TRIZ method. the consumer survey was conducted to identify the factors that influenced service quality in the retail business and to evaluate the consumer perceptions.

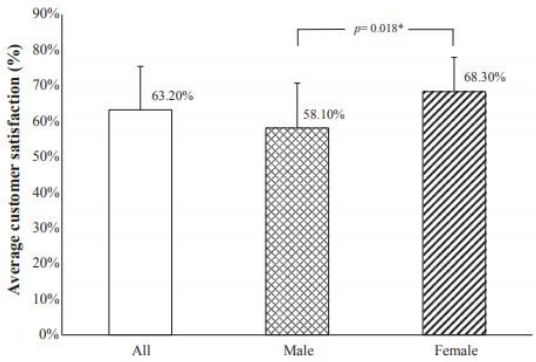


Figure 5.8 Another Study Survey of Customers' Satisfaction
(Lee, Zhao, & Lee, 2019)

This research proves that in the end, in the evaluating customer experience stage after testing the proposed solution based on TRIZ for 2 years it was found that customer satisfaction had increased, more than half of the respondents were satisfied with the solutions given. The service quality points are improved in the new service blueprint and thus the new service model is significantly enhanced and accepted. (Lee, Zhao, & Lee, 2019).

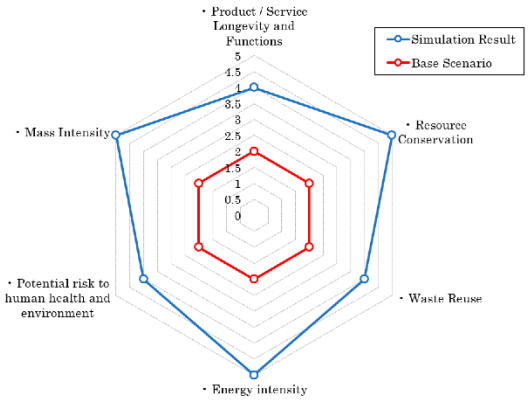


Figure 5.9 Study of TRIZ Simulation Result

(Boavida, 2020).

A Combined Use of TRIZ Methodology and Eco-Compass tool research also conducted and simulated to develop innovative solutions systematically. The results show that it was possible to attain innovation according to a level of established sustainable environmental parameters, meanwhile solving the inventive problem identified by maintaining the system functions (Boavida, 2020).

CHAPTER VI

CONCLUSION AND SUGGESTION

After doing research, processing and analyzing the data, it can be concluded as follows:

1. Customer satisfaction based on the quality of service provided by IndiHome fiber internet has not been achieved because based on calculations using the servqual method, all surveyed indicators have negative gap values. The average of servqual value of all indicators is -0.819 and -0.816 for the average servqual value of all variables. This means that there is still a gap between customer expectations and perceptions regarding the quality of IndiHome WiFi services. Customer expectations have not been met by the company in delivering IndiHome WiFi services, so customers are not satisfied with the perceived quality.
2. All of the IndiHome fiber internet's service attributes need to be improved based on customer perception using Servqual method. The order of variables that need to be improved based on the gap servqual value are reliability, tangibles, responsiveness, assurance and empathy with servqual scores of -0.922, -0.865, -0.863, -0.747, and -0.683, respectively. Meanwhile, based on the gap indicator value, the main priority that must be fixed is the stability of Indihome's service, problems faced by customers in using services, providing compensation, conformity of service offerings to what customers receive, employee responsiveness, and 15 other indicators.
3. There are 3 principles are defined as suggestions for solutions that have been adapted to the existing problem. Improvement proposal can be given to the IndiHome fiber internet so that customers are satisfied based on TRIZ contradiction matrix and 40 inventive principles method which are universality, intermediary and parameter change principles. The proposed solution are using only one cable to be attached to a backbone for all

network users in a certain area and is captured using a WiFi extender with the same internet quality for each user, using an automatically programmed platform for giving information on the recent limit of internet services and how the customer should use it, adding bandwidth limitations so that users can use more freely according to their capacity and limiting the length of the cable and cable reels used

Then the suggestions that researchers can give are as follows:

1. To improve the quality of IndiHome WiFi services, the proposed approach can be applied to real-life problems to increase customer satisfaction and loyalty.
2. Companies are advised to continue to conduct periodic evaluations of company performance and service quality based on customer perceptions.
3. The suggestion that can be given to further researchers is to be able to take advantage of the results of this study for further research using other methods and other variables.
4. Further research is expected to compare the value gap in the quality of IndiHome internet services based on the expectations and perceptions of respondents before and after the implementation of the TRIZ solution on each service quality indicator on IndiHome fiber optic internet.

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APPENDIX A.
R TABLE

DF = n-2	0.1	0.05	0.02	0.01	0.001
	r 0,005	r 0,05	r 0,025	r 0,01	r 0,001
1	0.9877	0.9969	0.9995	0.9999	1.0000
2	0.9000	0.9500	0.9800	0.9900	0.9990
3	0.8054	0.8783	0.9343	0.9587	0.9911
4	0.7293	0.8114	0.8822	0.9172	0.9741
5	0.6694	0.7545	0.8329	0.8745	0.9509
6	0.6215	0.7067	0.7887	0.8343	0.9249
7	0.5822	0.6664	0.7498	0.7977	0.8983
8	0.5494	0.6319	0.7155	0.7646	0.8721
9	0.5214	0.6021	0.6851	0.7348	0.8470
10	0.4973	0.5760	0.6581	0.7079	0.8233
11	0.4762	0.5529	0.6339	0.6835	0.8010
12	0.4575	0.5324	0.6120	0.6614	0.7800
13	0.4409	0.5140	0.5923	0.6411	0.7604
14	0.4259	0.4973	0.5742	0.6226	0.7419
15	0.4124	0.4821	0.5577	0.6055	0.7247
16	0.4000	0.4683	0.5425	0.5897	0.7084
17	0.3887	0.4555	0.5285	0.5751	0.6932
18	0.3783	0.4438	0.5155	0.5614	0.6788
19	0.3687	0.4329	0.5034	0.5487	0.6652
20	0.3598	0.4227	0.4921	0.5368	0.6524
21	0.3515	0.4132	0.4815	0.5256	0.6402
22	0.3438	0.4044	0.4716	0.5151	0.6287
23	0.3365	0.3961	0.4622	0.5052	0.6178
24	0.3297	0.3882	0.4534	0.4958	0.6074
25	0.3233	0.3809	0.4451	0.4869	0.5974
26	0.3172	0.3739	0.4372	0.4785	0.5880
27	0.3115	0.3673	0.4297	0.4705	0.5790
28	0.3061	0.3610	0.4226	0.4629	0.5703
29	0.3009	0.3550	0.4158	0.4556	0.5620
30	0.2960	0.3494	0.4093	0.4487	0.5541
31	0.2913	0.3440	0.4032	0.4421	0.5465
32	0.2869	0.3388	0.3972	0.4357	0.5392
33	0.2826	0.3338	0.3916	0.4296	0.5322
34	0.2785	0.3291	0.3862	0.4238	0.5254
35	0.2746	0.3246	0.3810	0.4182	0.5189
36	0.2709	0.3202	0.3760	0.4128	0.5126
37	0.2673	0.3160	0.3712	0.4076	0.5066
38	0.2638	0.3120	0.3665	0.4026	0.5007
39	0.2605	0.3081	0.3621	0.3978	0.4950
40	0.2573	0.3044	0.3578	0.3932	0.4896

DF = n-2	0.1	0.05	0.02	0.01	0.001
	r 0,005	r 0,05	r 0,025	r 0,01	r 0,001
41	0.2542	0.3008	0.3536	0.3887	0.4843
42	0.2512	0.2973	0.3496	0.3843	0.4791
43	0.2483	0.2940	0.3457	0.3801	0.4742
44	0.2455	0.2907	0.3420	0.3761	0.4694
45	0.2429	0.2876	0.3384	0.3721	0.4647
46	0.2403	0.2845	0.3348	0.3683	0.4601
47	0.2377	0.2816	0.3314	0.3646	0.4557
48	0.2353	0.2787	0.3281	0.3610	0.4514
49	0.2329	0.2759	0.3249	0.3575	0.4473
50	0.2306	0.2732	0.3218	0.3542	0.4432
51	0.2284	0.2706	0.3188	0.3509	0.4393
52	0.2262	0.2681	0.3158	0.3477	0.4354
53	0.2241	0.2656	0.3129	0.3445	0.4317
54	0.2221	0.2632	0.3102	0.3415	0.4280
55	0.2201	0.2609	0.3074	0.3385	0.4244
56	0.2181	0.2586	0.3048	0.3357	0.4210
57	0.2162	0.2564	0.3022	0.3328	0.4176
58	0.2144	0.2542	0.2997	0.3301	0.4143
59	0.2126	0.2521	0.2972	0.3274	0.4110
60	0.2108	0.2500	0.2948	0.3248	0.4079
61	0.2091	0.2480	0.2925	0.3223	0.4048
62	0.2075	0.2461	0.2902	0.3198	0.4018
63	0.2058	0.2441	0.2880	0.3173	0.3988
64	0.2042	0.2423	0.2858	0.3150	0.3959
65	0.2027	0.2404	0.2837	0.3126	0.3931
66	0.2012	0.2387	0.2816	0.3104	0.3903
67	0.1997	0.2369	0.2796	0.3081	0.3876
68	0.1982	0.2352	0.2776	0.3060	0.3850
69	0.1968	0.2335	0.2756	0.3038	0.3823
70	0.1954	0.2319	0.2737	0.3017	0.3798
71	0.1940	0.2303	0.2718	0.2997	0.3773
72	0.1927	0.2287	0.2700	0.2977	0.3748
73	0.1914	0.2272	0.2682	0.2957	0.3724
74	0.1901	0.2257	0.2664	0.2938	0.3701
75	0.1888	0.2242	0.2647	0.2919	0.3678
76	0.1876	0.2227	0.2630	0.2900	0.3655
77	0.1864	0.2213	0.2613	0.2882	0.3633
78	0.1852	0.2199	0.2597	0.2864	0.3611
79	0.1841	0.2185	0.2581	0.2847	0.3589
80	0.1829	0.2172	0.2565	0.2830	0.3568

DF = n-2	0.1	0.05	0.02	0.01	0.001
	r 0,005	r 0,05	r 0,025	r 0,01	r 0,001
81	0.1818	0.2159	0.2550	0.2813	0.3547
82	0.1807	0.2146	0.2535	0.2796	0.3527
83	0.1796	0.2133	0.2520	0.2780	0.3507
84	0.1786	0.2120	0.2505	0.2764	0.3487
85	0.1775	0.2108	0.2491	0.2748	0.3468
86	0.1765	0.2096	0.2477	0.2732	0.3449
87	0.1755	0.2084	0.2463	0.2717	0.3430
88	0.1745	0.2072	0.2449	0.2702	0.3412
89	0.1735	0.2061	0.2435	0.2687	0.3393
90	0.1726	0.2050	0.2422	0.2673	0.3375
91	0.1716	0.2039	0.2409	0.2659	0.3358
92	0.1707	0.2028	0.2396	0.2645	0.3341
93	0.1698	0.2017	0.2384	0.2631	0.3323
94	0.1689	0.2006	0.2371	0.2617	0.3307
95	0.1680	0.1996	0.2359	0.2604	0.3290
96	0.1671	0.1986	0.2347	0.2591	0.3274
97	0.1663	0.1975	0.2335	0.2578	0.3258
98	0.1654	0.1966	0.2324	0.2565	0.3242
99	0.1646	0.1956	0.2312	0.2552	0.3226
100	0.1638	0.1946	0.2301	0.2540	0.3211

APPENDIX B
SERVQUAL QUESTIONNAIRE

Kuesioner Analisis Kepuasan Pelanggan Terhadap Kualitas Industri Penyedia Layanan Fiber Internet Indonesian Digital Home (IndiHome)

Perkenalkan saya Nazila Syarafina Rismhandani mahasiswi Program S1 Teknik Industri Universitas Islam Indonesia. Dalam rangka menyelesaikan Tugas Akhir (Skripsi), saya bermaksud untuk melakukan penelitian mengenai "Analisis Kepuasan Konsumen dan Usulan Peningkatan di Industri Jasa Internet Fiber Indonesian Digital Home (IndiHome) dengan Metode Servqual dan Triz Contradiction Matrix". Tujuan dari penelitian ini ialah menganalisis kepuasan pelanggan terhadap kualitas industri jasa menggunakan Servqual beserta usulan yang tepat untuk meningkatkan kualitas yang diberikan berdasarkan TRIZ Contradiction Matrix dan 40 Inventive Principles.

Untuk dapat melanjutkan penelitian, saya memohon kesediaan Bapak/Ibu/Saudara/i untuk menjadi responden di kuesioner penelitian ini. Semua informasi yang diberikan akan dijaga kerahasiannya. Informasi ini hanya akan digunakan untuk kepentingan penelitian dan tidak akan diberikan pada pihak ketiga diluar kepentingan penelitian.

Saya ucapkan terima kasih kepada responden yang telah meluangkan waktu untuk mengisi kuesioner ini dengan baik, jujur dan sesuai pada penilaian masing-masing.

Jika terdapat pertanyaan, kritik, dan saran terkait kuesioner, Anda dapat menghubungi saya melalui email : 16522201@students.uii.ac.id

Screening Question

Pilihlah jawaban yang sesuai

Apakah anda pernah / sedang berlangganan WiFi IndiHome? *

- ◯ Ya, saya sekarang berlangganan WiFi IndiHome sejak awal menggunakan WiFi
- ◯ Ya, saya sekarang berlangganan WiFi IndiHome setelah beralih dari WiFi lain
- ◯ Ya, dulu saya pernah berlangganan WiFi IndiHome, tetapi sekarang sudah tidak berlangganan WiFi lagi
- ◯ Ya, dulu saya pernah berlangganan WiFi IndiHome, tetapi sudah beralih ke WiFi lain
- ◯ Saya tidak pernah berlangganan WiFi IndiHome

Apakah alasan anda memilih menggunakan provider IndiHome? (boleh pililh lebih dari 1) *

- [ ] Hanya mengetahui provider IndiHome
- [ ] Jaringannya sudah menjangkau tempat tinggal saya
- [ ] Sekaligus berlangganan telepon rumah dan TV kabel
- [ ] Biayanya murah
- [ ] Terkenal bagus
- [ ] Other:

sudah berapa lama anda berlangganan WiFi IndiHome? *

- ◯ < 2 bulan
- ◯ 2 - 5 bulan
- ◯ 5 - 12 bulan
- ◯ 1 - 2 tahun
- ◯ > 2 tahun

Apakah anda pernah melakukan complain atas kualitas WiFi IndiHome? *

- ◯ Ya
- ◯ Tidak

Identitas Responden

Pilihlah jawaban yang sesuai

Nama *

Your answer

Jenis Kelamin *

- ◯ Pria
- ◯ Wanita

Usia *

- ◯ 17-20
- ◯ 21-30
- ◯ 30-40
- ◯ > 40

Pekerjaan *

- ◯ Pelajar/Mahasiswa
- ◯ Pegawai Negeri
- ◯ Wiraswasta
- ◯ Wirausaha
- ◯ Other:

Kuesioner

Pada setiap atribut pertanyaan terdapat 2 indikator yaitu mengenai ekspektasi (kepentingan) pelanggan yang ingin didapatkan dan mengenai persepsi (kepuasan) pelanggan atas realita yang didapatkan mengenai kualitas layanan internet IndiHome, dengan skala sebagai berikut:

- skala ekspektasi
1 : sangat tidak penting
2 : tidak penting
3 : penting
4: sangat penting

- skala persepsi
1 : sangat tidak puas
2 : tidak puas
3 : puas
4 : sangat puas

contoh : "saya berharap WiFi IndiHome jaringannya stabil karena menurut saya hal ini sangat penting (4), tetapi kenyataannya saya tidak puas (2) dengan jaringannya"

Tangible

1. Peralatan IndiHome yang mendukung layanan jasa internet berfungsi dengan baik

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

2. Pelanggan dengan mudah berkomunikasi dengan penyedia layanan

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

Reliability

3. Layanan IndiHome yang ditawarkan sesuai dengan yang diterima pelanggan

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

4. Pelanggan tidak menemui kesulitan dalam berlangganan layanan

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

5. Layanan diberikan tepat waktu sesuai yang dijanjikan kepada pelanggan

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

6. Biaya yang perlu dibayarkan sesuai dengan kesepakatan awal

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

7. Penyedia layanan melakukan transparansi kepada pelanggan apabila terdapat perubahan

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

8. Layanan IndiHome stabil

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

Responsiveness

9. Karyawan selalu siap membantu setiap kali dibutuhkan

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

10. Karyawan melayani keluhan dengan tanggap

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

11. Masalah pelanggan diselesaikan sampai tuntas

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

Assurance

12. Karyawan memiliki pengetahuan dan keterampilan yang baik dalam bekerja

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

13. Pelanggan mendapatkan informasi yang jelas dan mudah dimengerti

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

14. Karyawan melayani dengan ramah dan sopan

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

15. Karyawan dapat dipercaya

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

16. Pelanggan tidak menemui masalah pada layanan IndiHome

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

17. Penyedia layanan memberikan ganti rugi apabila terdapat masalah

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

Empathy

18. Karyawan memberikan perhatian terhadap pelanggan

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

19. Penyedia layanan terbuka untuk kritik dan saran dari pelanggan

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

20. Penyedia layanan memberikan layanan sesuai dengan kebutuhan pelanggan

ekspektasi / harapan

Mark only one oval.

1 2 3 4

sangat tidak penting ⬭⬭⬭⬭ sangat penting

persepsi atas realita

Mark only one oval.

1 2 3 4

sangat tidak puas ⬭⬭⬭⬭ sangat puas

APPENDIX C

QUESTIONNAIRE RESULTS LIKERT SCALE VALUE OF RESPONDENTS' EXPECTATIONS

	Indicator																			
	tangible		reliability						responsiveness			assurance						empathy		
Respondent	1	2	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	1	2	3
1	4	4	4	4	4	3	4	4	4	4	4	4	4	3	3	4	4	3	3	4
2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
3	4	3	3	3	3	3	2	4	3	3	3	3	4	3	3	4	4	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	3	3	3	4
6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
7	4	3	3	3	3	2	3	3	4	3	4	3	4	3	3	3	3	3	4	3
8	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
9	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
10	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
11	4	4	4	4	4	4	4	4	4	4	4	4	3	4	3	4	4	4	4	4
12	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
13	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	3
14	4	4	4	3	3	3	3	4	4	4	4	3	4	3	3	4	4	3	3	3
15	3	2	3	3	2	3	2	2	1	2	4	3	3	3	3	2	2	2	2	2
16	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
17	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
18	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
19	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
20	4	4	4	4	4	4	4	4	3	4	4	3	4	4	4	1	3	4	3	4
21	4	4	4	3	3	4	4	4	4	4	4	3	4	4	4	4	4	3	4	3
22	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
23	4	3	3	3	2	3	2	4	4	3	4	4	2	4	2	3	4	3	3	3
24	3	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
25	4	4	4	3	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4

	Indicator																			
	tangible		reliability						responsiveness			assurance						empathy		
Respondent	1	2	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	1	2	3
26	4	4	4	4	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4
27	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
28	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
29	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
30	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
31	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
32	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
33	3	3	3	2	3	3	3	2	2	3	3	3	3	3	3	2	2	3	3	3
34	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
35	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4
36	3	3	4	4	4	3	4	4	4	3	3	3	4	4	4	4	4	4	4	4
37	3	3	4	3	3	3	3	4	3	3	4	3	3	3	3	4	3	3	3	3
38	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3
39	4	4	4	4	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4
40	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
41	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	3
42	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	3	3	4
43	3	3	3	3	2	1	1	2	3	2	2	3	3	3	3	3	3	2	3	3
44	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4
45	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	4	4	4	4
46	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
47	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
48	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3
49	3	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4
50	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
51	4	4	4	4	4	4	4	4	3	4	3	3	3	4	3	4	4	3	4	4

	Indicator																			
	tangible		reliability						responsiveness			assurance						empathy		
Respondent	1	2	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	1	2	3
52	3	4	4	3	4	4	3	4	3	3	3	3	3	3	3	3	3	3	3	3
53	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
54	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
55	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	3	3	3
56	2	4	4	3	3	4	4	4	3	3	3	3	3	3	3	4	4	2	3	4
57	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
58	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3
59	4	4	3	3	4	3	4	3	4	4	4	3	4	4	4	4	4	4	4	4
60	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	4	4	3	3	3
61	4	4	3	3	3	3	3	3	4	3	3	4	3	4	3	3	4	3	3	3
62	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
63	4	4	4	4	4	3	3	4	4	4	4	4	3	4	4	4	3	3	3	3
64	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
65	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
66	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
67	4	4	4	3	4	3	3	4	4	4	4	4	4	3	3	4	4	4	4	4
68	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
69	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
70	4	4	2	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
71	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3
72	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
73	4	4	4	4	4	3	4	4	4	3	3	3	4	3	3	3	3	4	4	3
74	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
75	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
76	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
77	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

	Indicator																			
	tangible		reliability						responsiveness			assurance						empathy		
Respondent	1	2	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	1	2	3
78	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
79	3	3	3	3	3	3	4	3	3	3	3	3	4	4	4	4	4	4	4	4
80	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
81	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	3	4	4	4
82	4	2	3	4	3	3	3	4	3	3	3	3	4	3	3	4	3	3	3	3
83	3	4	4	3	4	4	4	4	4	4	4	4	3	4	4	3	4	3	3	3
84	3	4	3	4	4	4	3	3	4	4	4	4	4	4	4	3	4	3	3	3
85	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
86	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
87	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
88	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
89	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
90	3	4	4	3	3	3	4	4	3	3	3	4	4	3	3	4	3	3	4	3
91	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
92	4	4	3	3	3	4	3	4	3	3	4	4	3	3	3	4	3	3	3	3
93	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
94	3	2	3	3	3	3	3	3	4	3	3	4	4	3	3	4	3	2	4	3
95	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
96	4	4	4	3	4	4	4	4	3	4	4	4	3	3	3	4	3	4	3	4
97	3	4	4	4	3	4	4	3	4	3	3	3	4	3	3	4	4	3	3	3
98	3	3	3	3	3	3	3	4	3	3	3	3	3	3	3	3	3	3	3	3
99	4	4	4	4	4	3	3	4	4	4	4	4	4	4	4	4	4	3	4	4
100	3	4	4	3	3	3	3	4	3	3	3	3	3	3	3	3	4	3	4	4

APPENDIX D

QUESTIONNAIRE RESULTS LIKERT SCALE VALUE OF RESPONDENTS' PERSPECTIVES

	Indicator																			
	tangible		reliability						responsiveness			assurance						empathy		
Respondent	1	2	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	1	2	3
1	3	1	2	1	2	3	3	2	1	2	1	3	3	2	3	1	2	3	3	3
2	2	2	1	2	2	3	2	1	2	2	2	3	3	3	2	1	2	2	3	2
3	3	2	3	3	2	3	2	2	2	3	3	4	4	3	3	2	1	3	3	3
4	3	2	2	2	2	2	2	1	2	1	1	2	2	2	2	1	2	2	3	2
5	3	4	3	4	4	3	2	3	4	4	4	4	4	4	3	2	2	4	3	3
6	3	1	1	1	3	3	2	1	2	1	1	1	2	3	1	1	1	2	1	1
7	3	3	3	3	3	2	3	2	3	3	4	3	4	3	3	3	3	3	3	3
8	3	3	3	4	3	4	4	3	3	3	2	3	4	4	3	3	3	3	4	3
9	2	2	2	2	1	3	3	1	1	1	1	3	2	3	3	2	2	2	3	2
10	3	4	4	4	3	4	4	3	3	4	3	4	3	3	3	3	3	4	4	3
11	3	2	3	2	3	4	3	2	3	3	2	2	3	3	3	2	3	3	2	2
12	3	3	4	4	4	3	3	2	3	3	3	3	3	3	4	3	3	3	3	3
13	3	3	3	3	3	3	4	4	4	4	4	4	3	4	4	3	4	4	4	4
14	3	4	3	3	3	3	3	2	3	3	4	3	3	3	3	2	3	3	3	3
15	3	2	3	3	2	3	2	2	1	2	4	3	3	3	3	2	2	2	2	2
16	3	3	2	2	2	2	3	2	3	3	2	3	3	4	3	3	2	3	4	3
17	3	2	2	3	2	4	2	1	2	2	3	2	3	4	4	2	2	3	3	3
18	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
19	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
20	3	2	2	2	3	3	2	1	2	2	2	3	3	3	3	1	2	3	1	3
21	3	3	3	3	3	4	3	2	3	3	2	3	3	4	3	2	2	2	4	3
22	3	3	4	4	4	3	3	3	4	3	4	4	3	4	4	3	4	3	3	4
23	2	4	3	4	1	3	3	3	4	4	3	3	4	3	4	3	4	3	3	3
24	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
25	4	4	4	3	4	4	3	3	4	4	4	4	4	4	4	2	2	4	4	4

	Indicator																			
	tangible		reliability						responsiveness			assurance						empathy		
Respondent	1	2	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	1	2	3
26	3	4	4	2	3	2	3	2	3	4	4	3	4	4	4	2	3	3	4	3
27	4	3	3	3	3	3	3	3	3	3	3	3	3	3	3	4	4	3	3	4
28	3	3	3	4	3	4	3	3	3	2	3	3	3	2	3	3	3	3	3	3
29	2	3	3	3	4	3	3	2	3	3	3	4	3	3	4	3	2	4	3	3
30	3	4	2	4	3	4	3	2	3	2	3	3	4	4	3	2	2	3	3	3
31	3	3	3	2	2	3	2	2	3	3	3	4	3	4	4	2	3	3	4	3
32	4	4	4	4	4	3	4	3	4	4	4	4	4	4	4	4	3	4	4	4
33	3	3	3	2	3	3	3	2	2	3	3	3	3	3	3	2	2	3	3	3
34	2	3	1	3	3	3	2	1	2	2	3	3	2	3	3	1	3	3	3	3
35	3	3	3	3	4	3	3	2	4	4	4	3	4	4	2	2	3	2	4	3
36	2	3	1	3	4	1	1	1	4	3	2	3	3	3	3	1	2	2	3	3
37	2	3	3	3	3	3	3	2	3	3	3	3	3	3	3	2	3	3	3	3
38	2	2	2	2	3	4	4	1	2	2	4	3	3	3	3	1	2	3	2	3
39	1	4	1	4	4	2	1	1	1	2	1	1	4	4	1	1	1	2	2	1
40	4	3	4	4	4	4	4	3	2	2	3	3	3	3	2	3	4	3	3	3
41	3	3	3	4	3	4	3	3	3	2	3	3	4	4	3	2	3	3	3	3
42	3	4	3	4	4	3	4	3	2	3	3	4	4	3	3	3	3	2	2	4
43	4	3	3	3	3	1	2	2	2	2	2	3	3	3	3	3	2	3	3	2
44	3	1	3	2	3	3	4	1	1	1	2	3	4	3	3	2	1	1	1	3
45	2	3	1	1	3	1	1	1	3	3	3	3	2	4	3	2	1	3	1	2
46	3	3	4	3	4	4	3	2	3	4	4	4	4	3	4	2	3	3	3	3
47	2	3	3	2	3	3	2	2	3	3	3	3	3	3	3	2	1	3	2	2
48	3	3	3	3	3	2	3	1	3	3	3	2	2	3	3	2	2	2	2	3
49	3	3	4	3	3	3	3	2	4	3	4	4	4	4	4	3	3	4	3	3
50	3	4	3	4	4	4	3	3	3	3	4	4	4	4	3	3	1	3	2	3
51	3	3	2	2	4	4	4	2	3	3	3	3	3	3	3	2	2	3	3	3

	Indicator																			
	tangible		reliability						responsiveness			assurance						empathy		
Respondent	1	2	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	1	2	3
52	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	2	3	3	3
53	4	3	3	4	4	4	3	3	3	3	3	4	4	3	4	4	3	3	3	3
54	3	2	2	1	1	1	2	1	2	1	2	3	2	4	3	1	1	1	1	2
55	3	3	2	2	3	2	2	2	3	3	3	3	3	3	3	2	1	3	3	3
56	3	4	3	3	3	4	3	2	3	2	3	3	2	3	3	2	2	2	2	2
57	3	2	3	2	2	4	3	2	2	3	3	4	4	3	3	2	3	3	2	3
58	3	4	3	4	3	2	1	3	3	4	4	3	3	4	3	2	3	3	3	3
59	2	4	2	2	4	4	3	1	4	4	4	4	3	4	4	3	1	4	4	4
60	3	3	3	3	4	3	3	3	3	3	3	3	3	3	4	3	1	4	4	3
61	3	3	2	3	3	3	3	2	3	3	3	3	3	3	3	3	2	2	3	3
62	3	4	3	3	2	3	2	2	3	3	2	3	3	4	3	3	3	3	3	2
63	3	2	2	3	3	3	3	2	2	2	2	3	3	3	2	2	3	3	3	3
64	2	4	4	4	4	4	4	2	3	3	4	4	3	4	4	2	4	4	4	4
65	4	4	4	3	3	4	4	3	4	4	4	4	4	4	4	3	3	4	4	4
66	3	2	3	2	3	4	3	2	2	2	3	4	3	3	3	2	3	3	3	3
67	1	1	1	1	1	1	2	1	2	2	2	3	2	3	3	1	1	1	1	1
68	1	1	2	2	4	2	1	1	1	1	1	2	3	2	1	1	1	2	2	4
69	2	3	3	2	3	3	4	1	3	2	3	3	3	3	3	2	3	3	3	3
70	3	1	2	1	2	3	1	2	3	3	3	4	1	3	3	1	1	3	2	3
71	3	3	2	2	2	3	2	3	3	2	2	3	3	3	3	3	2	2	2	3
72	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	3	2	3	3	4
73	3	4	3	3	3	3	3	3	4	4	2	4	4	4	4	4	4	3	4	3
74	2	3	3	3	2	3	3	2	2	2	3	3	3	4	3	3	2	2	3	3
75	3	2	3	3	4	4	3	1	3	3	2	2	2	3	3	2	3	3	4	2
76	3	2	2	2	2	4	3	2	2	2	4	3	3	4	4	2	2	3	3	3
77	3	4	4	4	4	4	4	3	4	4	4	4	4	4	4	2	4	4	4	4

	Indicator																			
	tangible		reliability						responsiveness			assurance						empathy		
Respondent	1	2	1	2	3	4	5	6	1	2	3	1	2	3	4	5	6	1	2	3
78	4	3	2	4	4	4	4	2	4	3	2	3	4	3	4	4	4	4	4	4
79	3	3	3	3	3	3	3	2	2	3	3	3	3	4	4	3	2	3	3	3
80	1	1	1	1	1	1	1	1	1	1	1	3	2	4	4	1	1	3	1	1
81	3	4	3	3	4	3	4	2	4	4	4	4	4	4	4	2	3	4	4	4
82	2	3	3	1	2	2	2	1	2	2	1	4	2	3	3	1	1	1	4	2
83	2	2	2	2	3	3	3	2	2	2	2	3	2	4	3	2	2	2	2	2
84	3	4	3	4	4	4	3	3	4	4	4	4	4	4	4	3	3	3	4	3
85	4	4	4	4	4	3	2	2	3	3	3	4	4	4	4	3	3	3	4	3
86	2	2	2	3	3	3	3	1	3	3	3	4	3	4	4	2	3	4	4	4
87	3	4	3	3	3	4	4	2	3	4	4	4	4	4	3	2	2	3	3	3
88	4	3	4	4	4	4	4	3	4	4	4	4	4	4	4	3	4	4	4	4
89	3	3	3	3	4	3	2	3	4	4	4	3	3	3	3	3	3	3	3	4
90	2	1	2	1	2	3	4	1	2	2	2	3	3	3	4	1	1	3	4	3
91	3	3	3	3	3	3	2	3	2	3	3	3	3	3	3	2	1	3	3	3
92	2	3	2	3	3	3	3	2	3	3	3	3	3	3	3	2	2	3	3	3
93	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
94	3	3	3	2	4	3	3	2	3	2	4	4	3	4	3	3	3	3	3	3
95	3	3	2	3	4	3	2	2	4	4	3	4	3	4	4	2	3	4	3	4
96	2	2	2	2	1	2	1	1	1	2	1	3	2	3	3	1	1	2	3	2
97	2	1	2	1	2	1	1	1	2	2	1	2	2	2	1	2	2	2	1	1
98	3	3	3	3	2	3	3	2	3	2	3	3	3	3	3	2	3	3	3	3
99	3	3	3	3	2	2	3	2	2	3	4	3	3	4	3	1	3	3	4	4
100	2	1	1	2	3	3	3	1	2	2	3	3	3	3	3	1	1	3	1	1

APPENDIX E

VALIDITY TEST RESULTS USING SOFTWARE IBM SPSS STATISTICS 23

a. Expectation

		T1	T2	R1	R2	R3	R4	R5	R6	S1	S2
T1	Pearson Correlation	1	.460**	.376**	.537**	.484**	.345**	.361**	.425**	.533**	.603**
	Sig. (2-tailed)		0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
T2	Pearson Correlation	.460**	1	.712**	.588**	.716**	.647**	.642**	.576**	.641**	.760**
	Sig. (2-tailed)	0		0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
R1	Pearson Correlation	.376**	.712**	1	.639**	.734**	.585**	.622**	.639**	.544**	.660**
	Sig. (2-tailed)	0	0		0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
R2	Pearson Correlation	.537**	.588**	.639**	1	.729**	.610**	.650**	.572**	.679**	.712**
	Sig. (2-tailed)	0	0	0		0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
R3	Pearson Correlation	.484**	.716**	.734**	.729**	1	.713**	.743**	.598**	.652**	.826**
	Sig. (2-tailed)	0	0	0	0		0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
R4	Pearson Correlation	.345**	.647**	.585**	.610**	.713**	1	.723**	.576**	.453**	.708**
	Sig. (2-tailed)	0	0	0	0	0		0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
R5	Pearson Correlation	.361**	.642**	.622**	.650**	.743**	.723**	1	.570**	.583**	.739**
	Sig. (2-tailed)	0	0	0	0	0	0		0	0	0
	N	100	100	100	100	100	100	100	100	100	100
R6	Pearson Correlation	.425**	.576**	.639**	.572**	.598**	.576**	.570**	1	.582**	.668**
	Sig. (2-tailed)	0	0	0	0	0	0	0		0	0
	N	100	100	100	100	100	100	100	100	100	100
S1	Pearson Correlation	.533**	.641**	.544**	.679**	.652**	.453**	.583**	.582**	1	.770**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0		0
	N	100	100	100	100	100	100	100	100	100	100
S2	Pearson Correlation	.603**	.760**	.660**	.712**	.826**	.708**	.739**	.668**	.770**	1
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	
	N	100	100	100	100	100	100	100	100	100	100
S3	Pearson Correlation	.592**	.588**	.557**	.597**	.618**	.622**	.552**	.552**	.621**	.824**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100

A1	Pearson Correlation	.482**	.575**	.495**	.605**	.586**	.546**	.485**	.505**	.680**	.716**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
A2	Pearson Correlation	.463**	.463**	.513**	.680**	.618**	.437**	.622**	.421**	.660**	.660**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
A3	Pearson Correlation	.499**	.591**	.511**	.710**	.644**	.603**	.609**	.475**	.697**	.777**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
A4	Pearson Correlation	.419**	.576**	.548**	.690**	.691**	.581**	.646**	.458**	.619**	.750**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
A5	Pearson Correlation	.361**	.434**	.479**	.513**	.465**	.407**	.504**	.549**	.634**	.568**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
A6	Pearson Correlation	.356**	.589**	.483**	.552**	.500**	.503**	.508**	.523**	.719**	.649**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
E1	Pearson Correlation	.548**	.602**	.536**	.666**	.731**	.615**	.710**	.566**	.636**	.763**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
E2	Pearson Correlation	.430**	.523**	.528**	.583**	.600**	.452**	.633**	.502**	.694**	.651**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
E3	Pearson Correlation	.455**	.667**	.639**	.684**	.729**	.575**	.683**	.572**	.606**	.751**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
total	Pearson Correlation	.623**	.785**	.747**	.823**	.854**	.749**	.798**	.718**	.826**	.928**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100

		S3	A1	A2	A3	A4	A5	A6	E1	E2	E3	total
T1	Pearson Correlation	.592**	.482**	.463**	.499**	.419**	.361**	.356**	.548**	.430**	.455**	.623**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100

T2	Pearson Correlation	.588**	.575**	.463**	.591**	.576**	.434**	.589**	.602**	.523**	.667**	.785**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
R1	Pearson Correlation	.557**	.495**	.513**	.511**	.548**	.479**	.483**	.536**	.528**	.639**	.747**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
R2	Pearson Correlation	.597**	.605**	.680**	.710**	.690**	.513**	.552**	.666**	.583**	.684**	.823**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
R3	Pearson Correlation	.618**	.586**	.618**	.644**	.691**	.465**	.500**	.731**	.600**	.729**	.854**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
R4	Pearson Correlation	.622**	.546**	.437**	.603**	.581**	.407**	.503**	.615**	.452**	.575**	.749**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
R5	Pearson Correlation	.552**	.485**	.622**	.609**	.646**	.504**	.508**	.710**	.633**	.683**	.798**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
R6	Pearson Correlation	.552**	.505**	.421**	.475**	.458**	.549**	.523**	.566**	.502**	.572**	.718**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
S1	Pearson Correlation	.621**	.680**	.660**	.697**	.619**	.634**	.719**	.636**	.694**	.606**	.826**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
S2	Pearson Correlation	.824**	.716**	.660**	.777**	.750**	.568**	.649**	.763**	.651**	.751**	.928**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
S3	Pearson Correlation	1	.717**	.557**	.690**	.660**	.441**	.483**	.647**	.486**	.555**	.784**
	Sig. (2-tailed)		0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
A1	Pearson Correlation	.717**	1	.495**	.664**	.589**	.540**	.543**	.606**	.580**	.605**	.765**
	Sig. (2-tailed)	0		0	0	0	0	0	0	0	0	0

	N	100	100	100	100	100	100	100	100	100	100	100
A2	Pearson Correlation	.557**	.495**	1	.556**	.735**	.555**	.523**	.647**	.696**	.597**	.752**
	Sig. (2-tailed)	0	0		0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
A3	Pearson Correlation	.690**	.664**	.556**	1	.797**	.440**	.641**	.702**	.643**	.667**	.832**
	Sig. (2-tailed)	0	0	0		0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
A4	Pearson Correlation	.660**	.589**	.735**	.797**	1	.407**	.471**	.691**	.637**	.655**	.805**
	Sig. (2-tailed)	0	0	0	0		0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
A5	Pearson Correlation	.441**	.540**	.555**	.440**	.407**	1	.622**	.461**	.598**	.549**	.668**
	Sig. (2-tailed)	0	0	0	0	0		0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
A6	Pearson Correlation	.483**	.543**	.523**	.641**	.471**	.622**	1	.559**	.605**	.628**	.734**
	Sig. (2-tailed)	0	0	0	0	0	0		0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
E1	Pearson Correlation	.647**	.606**	.647**	.702**	.691**	.461**	.559**	1	.754**	.735**	.846**
	Sig. (2-tailed)	0	0	0	0	0	0	0		0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
E2	Pearson Correlation	.486**	.580**	.696**	.643**	.637**	.598**	.605**	.754**	1	.742**	.788**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0		0	0
	N	100	100	100	100	100	100	100	100	100	100	100
E3	Pearson Correlation	.555**	.605**	.597**	.667**	.655**	.549**	.628**	.735**	.742**	1	.835**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0		0
	N	100	100	100	100	100	100	100	100	100	100	100
total	Pearson Correlation	.784**	.765**	.752**	.832**	.805**	.668**	.734**	.846**	.788**	.835**	1
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	
	N	100	100	100	100	100	100	100	100	100	100	100

b. Reality

		T1	T2	R1	R2	R3	R4	R5	R6	S1	S2
T1	Pearson Correlation	1	.363**	.584**	.427**	.332**	.413**	.392**	.576**	.416**	.387**

	Sig. (2-tailed)		0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
T2	Pearson Correlation	.363**	1	.548**	.691**	.472**	.286**	.315**	.562**	.641**	.671**
	Sig. (2-tailed)	0		0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
R1	Pearson Correlation	.584**	.548**	1	.560**	.382**	.430**	.519**	.634**	.452**	.541**
	Sig. (2-tailed)	0	0		0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
R2	Pearson Correlation	.427**	.691**	.560**	1	.550**	.453**	.377**	.627**	.481**	.498**
	Sig. (2-tailed)	0	0	0		0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
R3	Pearson Correlation	.332**	.472**	.382**	.550**	1	.387**	.333**	.339**	.517**	.479**
	Sig. (2-tailed)	0	0	0	0		0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
R4	Pearson Correlation	.413**	.286**	.430**	.453**	.387**	1	.637**	.423**	.316**	.303**
	Sig. (2-tailed)	0	0	0	0	0		0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
R5	Pearson Correlation	.392**	.315**	.519**	.377**	.333**	.637**	1	.403**	.343**	.320**
	Sig. (2-tailed)	0	0	0	0	0	0		0	0	0
	N	100	100	100	100	100	100	100	100	100	100
R6	Pearson Correlation	.576**	.562**	.634**	.627**	.339**	.423**	.403**	1	.548**	.594**
	Sig. (2-tailed)	0	0	0	0	0	0	0		0	0
	N	100	100	100	100	100	100	100	100	100	100
S1	Pearson Correlation	.416**	.641**	.452**	.481**	.517**	.316**	.343**	.548**	1	.793**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0		0
	N	100	100	100	100	100	100	100	100	100	100
S2	Pearson Correlation	.387**	.671**	.541**	.498**	.479**	.303**	.320**	.594**	.793**	1
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	
	N	100	100	100	100	100	100	100	100	100	100
S3	Pearson Correlation	.391**	.555**	.566**	.477**	.444**	.416**	.436**	.513**	.591**	.657**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100

A1	Pearson Correlation	.314**	.403**	.494**	.275**	.250*	.330**	.361**	.459**	.471**	.540**
	Sig. (2-tailed)	0	0	0	0.01	0.01	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
A2	Pearson Correlation	.411**	.527**	.497**	.612**	.455**	.426**	.466**	.504**	.417**	.517**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
A3	Pearson Correlation	0.18	.477**	.235*	.297**	0.19	0.16	0.17	.238*	.403**	.417**
	Sig. (2-tailed)	0.08	0	0.02	0	0.06	0.12	0.09	0.02	0	0
	N	100	100	100	100	100	100	100	100	100	100
A4	Pearson Correlation	.302**	.355**	.430**	.278**	0.15	.311**	.394**	.342**	.495**	.511**
	Sig. (2-tailed)	0	0	0	0.01	0.13	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
A5	Pearson Correlation	.558**	.538**	.564**	.581**	.378**	.345**	.450**	.696**	.551**	.493**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
A6	Pearson Correlation	.432**	.433**	.556**	.579**	.304**	.379**	.489**	.544**	.520**	.454**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
E1	Pearson Correlation	.348**	.412**	.405**	.423**	.446**	.437**	.389**	.468**	.575**	.611**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
E2	Pearson Correlation	.366**	.523**	.499**	.459**	.303**	.372**	.438**	.411**	.512**	.568**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
E3	Pearson Correlation	.450**	.451**	.516**	.491**	.482**	.427**	.511**	.523**	.550**	.568**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100
total	Pearson Correlation	.618**	.747**	.759**	.750**	.605**	.601**	.639**	.752**	.767**	.791**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100

	S3	A1	A2	A3	A4	A5	A6	E1	E2	E3	total

T1	Pearson Correlation	.391**	.314**	.411**	0.18	.302**	.558**	.432**	.348**	.366**	.450**	.618**
	Sig. (2-tailed)	0	0	0	0.08	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
T2	Pearson Correlation	.555**	.403**	.527**	.477**	.355**	.538**	.433**	.412**	.523**	.451**	.747**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
R1	Pearson Correlation	.566**	.494**	.497**	.235*	.430**	.564**	.556**	.405**	.499**	.516**	.759**
	Sig. (2-tailed)	0	0	0	0.02	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
R2	Pearson Correlation	.477**	.275**	.612**	.297**	.278**	.581**	.579**	.423**	.459**	.491**	.750**
	Sig. (2-tailed)	0	0.01	0	0	0.01	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
R3	Pearson Correlation	.444**	.250*	.455**	0.19	0.15	.378**	.304**	.446**	.303**	.482**	.605**
	Sig. (2-tailed)	0	0.01	0	0.06	0.13	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
R4	Pearson Correlation	.416**	.330**	.426**	0.16	.311**	.345**	.379**	.437**	.372**	.427**	.601**
	Sig. (2-tailed)	0	0	0	0.12	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
R5	Pearson Correlation	.436**	.361**	.466**	0.17	.394**	.450**	.489**	.389**	.438**	.511**	.639**
	Sig. (2-tailed)	0	0	0	0.09	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
R6	Pearson Correlation	.513**	.459**	.504**	.238*	.342**	.696**	.544**	.468**	.411**	.523**	.752**
	Sig. (2-tailed)	0	0	0	0.02	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
S1	Pearson Correlation	.591**	.471**	.417**	.403**	.495**	.551**	.520**	.575**	.512**	.550**	.767**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100

S2	Pearson Correlation	.657**	.540**	.517**	.417**	.511**	.493**	.454**	.611**	.568**	.568**	.791**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
S3	Pearson Correlation	1	.558**	.472**	.440**	.502**	.381**	.405**	.551**	.349**	.593**	.746**
	Sig. (2-tailed)		0	0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
A1	Pearson Correlation	.558**	1	.401**	.392**	.646**	.371**	.315**	.484**	.419**	.548**	.637**
	Sig. (2-tailed)	0		0	0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
A2	Pearson Correlation	.472**	.401**	1	.357**	.321**	.465**	.389**	.406**	.392**	.492**	.696**
	Sig. (2-tailed)	0	0		0	0	0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
A3	Pearson Correlation	.440**	.392**	.357**	1	.468**	.216*	0.19	.320**	.333**	.263**	.474**
	Sig. (2-tailed)	0	0	0		0	0.03	0.06	0	0	0.01	0
	N	100	100	100	100	100	100	100	100	100	100	100
A4	Pearson Correlation	.502**	.646**	.321**	.468**	1	.411**	.328**	.565**	.470**	.490**	.622**
	Sig. (2-tailed)	0	0	0	0		0	0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
A5	Pearson Correlation	.381**	.371**	.465**	.216*	.411**	1	.539**	.422**	.402**	.453**	.713**
	Sig. (2-tailed)	0	0	0	0.03	0		0	0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
A6	Pearson Correlation	.405**	.315**	.389**	0.19	.328**	.539**	1	.457**	.505**	.519**	.685**
	Sig. (2-tailed)	0	0	0	0.06	0	0		0	0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100
E1	Pearson Correlation	.551**	.484**	.406**	.320**	.565**	.422**	.457**	1	.530**	.568**	.708**
	Sig. (2-tailed)	0	0	0	0	0	0	0		0	0	0
	N	100	100	100	100	100	100	100	100	100	100	100

E2	Pearson Correlation	.349**	.419**	.392**	.333**	.470**	.402**	.505**	.530**	1	.592**	.686**
	Sig. (2-tailed)	0	0	0	0	0	0	0	0		0	0
	N	100	100	100	100	100	100	100	100	100	100	100
E3	Pearson Correlation	.593**	.548**	.492**	.263**	.490**	.453**	.519**	.568**	.592**	1	.759**
	Sig. (2-tailed)	0	0	0	0.01	0	0	0	0	0		0
	N	100	100	100	100	100	100	100	100	100	100	100
total	Pearson Correlation	.746**	.637**	.696**	.474**	.622**	.713**	.685**	.708**	.686**	.759**	1
	Sig. (2-tailed)	0	0	0	0	0	0	0	0	0	0	
	N	100	100	100	100	100	100	100	100	100	100	100

APPENDIX F

RELIABILITY TEST RESULTS USING SOFTWARE IBM SPSS STATISTICS 23

a. Expectation

Case Processing Summary

		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.967	20

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
T1	69.6100	61.715	.576	.967
T2	69.5600	60.107	.762	.965
R1	69.5800	60.771	.724	.965
R2	69.6600	59.823	.807	.964
R3	69.6700	59.072	.836	.964
R4	69.7100	59.723	.717	.966
R5	69.6800	58.826	.781	.965
R6	69.5100	60.939	.691	.966

S1	69.6000	59.333	.805	.964
S2	69.6300	58.842	.918	.963
S3	69.5800	60.509	.761	.965
A1	69.6300	60.700	.736	.965
A2	69.5800	60.711	.732	.965
A3	69.6200	60.278	.802	.965
A4	69.6800	59.270	.779	.965
A5	69.5800	60.610	.632	.967
A6	69.6000	60.404	.698	.966
E1	69.7200	58.850	.820	.964
E2	69.6500	60.189	.762	.965
E3	69.6600	59.762	.815	.964

b. Reality

Case Processing Summary

		N	%
Cases	Valid	100	100.0
	Excluded[a]	0	.0
	Total	100	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.942	20

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
T1	54.1000	116.939	.583	.940
T2	54.0400	111.736	.709	.938
R1	54.1900	112.499	.724	.937
R2	54.1200	111.501	.706	.938
R3	53.9200	115.105	.551	.941
R4	53.8700	115.508	.550	.940
R5	54.1100	114.503	.589	.940
R6	54.8500	113.341	.725	.938
S1	54.1300	111.791	.738	.937
S2	54.1200	111.420	.762	.937
S3	54.0100	111.283	.707	.938
A1	53.6900	117.085	.603	.940
A2	53.7800	115.951	.653	.939
A3	53.5400	120.352	.429	.942
A4	53.7200	116.789	.580	.940
A5	54.6500	113.402	.676	.938
A6	54.5100	112.596	.641	.939
E1	54.0000	115.131	.673	.938
E2	53.9600	113.332	.642	.939
E3	53.9800	113.616	.728	.937