



**PROCEEDING BOOK OF**  
The 2<sup>nd</sup> APTIK International Conference on Poverty and  
Environment (2AIC)  
“A Sustainable Recovery for People and the Environment”

**Virtual Conference (ONLINE)**

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**Universitas Katolik De La Salle Manado**

## REMARKS BY HEAD OF APTIK

Honorable speakers,

Dear participants

On behalf of APTIK chairperson, allow me to warmly welcome you all to The Second International Conference of Association of Indonesian Catholic Higher Education (APTIK). The theme of the conference: “*A Sustainable Recovery for People and the Environment*” shows a deep concern of APTIK on sustainable development. I believe that we – members of the big family of higher education – have to fully participate in developing a better life for all. However, we also need to protect our world from environmental destruction at the same time. In line with ‘*Laudato Si*’ main messages, APTIK members commit to work and act together in building ecological conscience and culture of environment protection among all students and lecturers.

This conference gathers a significant amount of academics from APTIK members and also from other Higher Education Institutions in Indonesia and some other parts of the world. Through inputs of keynote and invited speakers, presentation of selected papers and discussions among participants, we can certainly expect that this academics’ gathering is able to formulate excellent ideas for sustainable recovery for people and environment.

We are delighted and honored to have among us six distinguished speakers who will share their excellent thoughts and experiences to the participants of this conference. On behalf of APTIK family, I thank the two keynote speakers and the four invited speakers for their valuable time and thoughts to share with us.

I wish you a successful and fruitful conference. God bless you all.

Fr. Yulius Yasinto, SVD  
**APTIK Vice Chairperson**

## REMARKS BY RECTOR OF UNIVERSITAS KATOLIK DE LA SALLE MANADO

The 2nd APTIK International Conference 2021 has chosen the theme *A Sustainable Recovery for People and the Environment*. This theme presupposes that the condition of the earth and human life are urgent and important to be restored in a sustainable manner. On one hand, this conference is situated based on the perspective of the UN Sustainable Development Goals. On the other hand, however, this conference affirms the commitment of APTIK and its university members to realize the concept of integral ecology.

The concept of integral ecology is conveyed by Pope Francis in his encyclical *Laudato Si'* (2015). The earth as our home is sick and endangered, and we are called to preserve and recover its condition. Ecology can never be separated from humanitarian issues. The destruction of nature and the environment simultaneously signifies the occurrence of injustice, poverty, and suffering. Thus, ecological crisis is synonymous with the decline of the quality of human life and the imbalance of general welfare.

It is expected that this conference brings diverse research outcomes, but together they become scientific and academic contributions to sustainable recovery to actualize integral ecology.

I extend my gratitude to APTIK Administrators who entrusted the organization of this conference to Universitas Katolik De La Salle Manado. I sincerely thank the keynote speakers, the invited speakers, and all the researchers who present their research in this forum. I appreciate the presence and participation of the lecturers and students. Last but not least, I also would like to thank the organizing committee of this conference.

Prof. Dr. Johanis Ohoitumur

**Rector of Universitas Katolik De La Salle Manado**

## REMARKS BY CHAIRMAN OF THE ORGANIZING COMMITTEE

Peace and good health to all of us.

We convey our praise and gratitude to our Lord Jesus Christ who allows us to hold the Second APTIK International Conference on Poverty and Environment. This activity should actually have been carried out in 2020, along with the 20th anniversary of the De La Salle Catholic University, but due to the COVID-19 pandemic and with the approval of the APTIK leadership, we have postponed it until today.

The theme that we raise is in line with the present pandemic condition which has been devastating to all the living creatures on earth. The Second APTIK International Conference of 2021 is expected to address this hot issue for a better life in the future.

We invited two keynote speakers, namely the Head of APTIK and the Rector of Universitas Katolik De La Salle Manado to elaborate further on this theme.

We also have four invited speakers to discuss this topic according to their practice and experience in dealing with this issue in their respective countries which are US (James Krejci), Philippines (Bro. Armin Luistro), Taiwan (Prof. Martin Kao) and Indonesia especially in the East (Pater Dr. Philipus Tule, SVD).

The participants, both lectures and practitioners will examine the main theme and sub-theme more deeply based on their respective fields of expertise while also presenting some ideas for solutions that can be applied to the community life, government agencies and other sectors to eliminate the pandemic we are currently experiencing so that we can enjoy a more normal life as usual.

We would like to thank the APTIK leaders for providing the opportunity for Universitas Katolik De La Salle Foundation to be the organizer of this activity. Thank you to the Foundation and its apparatus. Thanks to the Rector of Universitas Katolik De La Salle Manado. Thanks to the keynote speakers and invited speakers, the participants who were willing to present their findings.

Thank you to the government of North Sulawesi Province, to the Governor and Deputy Governor. Thanks to Manado Mayor Andre Angow and Deputy Mayor dr. Richard Sualang and the Municipality apparatus. Thanks to the Village Head of Kairagi and Kombos as well as the local security personnel and the community around the campus.

Dr. Jozef R. Raco  
**Chairman of 2AIC**

## REMARKS BY CHAIRMAN OF THE PTU DE LA SALLE MANADO FOUNDATION

We give thanks to God for His arrangement, so that this second APTIK international conference can take place. The theme of this conference is a *Sustainable Recovery for People and the Environment*. This theme is very challenging for all of us, especially academics. Because all nations and countries in the world are currently struggling to get out from the chaos caused by the COVID-19 pandemic. Pope Francis in his New Year's welcome, February 8, 2021, before the ambassadors for the Holy See of the Vatican, said: *this world is seriously ill, not because of the Covid 19 Virus, but also in its natural environment, its economic and political processes, and even more so in its human relationships.*"

For this reason, this conference has become an open area to accommodate ideas and thoughts from academics, according to their respective expertise. We don't expect that the conference will make a contribution that can turn things around for the better, but even if it's small, it will still provide significant value.

I thank the APTIK Management, who has entrusted the organization of this conference to the Catholic University of De La Salle Manado.

Finally, I would like to thank the keynote speakers and invited speakers, all presenters, all writers, reviewers, who have shared their valuable experiences and all those who have contributed their best efforts and assistance in organizing this event.

Fr. Benansio Salombre  
**Chairman of the PTU De La Salle Manado Foundation**

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## CONFERENCE DETAIL INFORMATION

Date	:	November 19-20, 2021
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Rector of Catholic University of De La Salle Manado

## INVITED SPEAKERS



**Dr. James Krejci**  
Lewis University, Illinois, USA  
(Chair - Associate Professor - Business Administration)



**Prof. Martin Kao, Ph.D.**  
Providence University, Taiwan  
(Associate Professor - Tourism Dept.)



**Br. Armin Luistro**  
Visitor of Lasallian East Asia District  
De La Salle Manila-Philippines



**Pater Dr. Philipus Tule**  
Rector of Catholic University of  
Widya Mandira Kupang

# 2<sup>nd</sup> AIC 2021

## PROCEEDING BOOK OF

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(2AIC)

“A Sustainable Recovery for People and the Environment”

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## SCOPE OF THE CONFERENCE

The 2<sup>nd</sup> APTIK International Conference on Poverty and Environment (2AIC) 2021 aims to bring together leading academic scientists, researchers, research scholars, observers, and practitioners to exchange and share their knowledge, theoretical analysis, concepts and designs, opinions, and policies in relation to poverty alleviation, preservation of nature and Covid-19 pandemic and recovery strategies. Full scopes of the conference are as follows:

- Environment
- Green and Renewable Energy
- Social, Economics and Humanities
- Disaster Prevention and Mitigation
- Poverty
- Health and Education
- ICT
- COVID-19 Pandemic and Recovery Strategies

# The Impact of Cleanliness, Health, Safety, and Environmental Sustainability Facilities on Tourist Satisfaction at Bukit Kasih

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**Abstract**— The tourism industry in Indonesia has experienced a rapid decline in the number of tourists as a negative impact of the COVID-19 pandemic. As a response, the Ministry of Tourism and Creative Economy introduced Cleanliness, Health, Safety, and Environmental Sustainability (CHSE) protocol that must be implemented by every tourist destination in Indonesia. The purpose of this protocol is to prevent further transmission of COVID-19 by ensuring that all facilities at tourism destinations are correctly prepared in accordance with CHSE protocol guidelines. Proper implementation of this protocol may result in higher tourists' confidence and satisfaction when visiting these destinations. This research aims to analyze the causal relationship between CHSE-based facilities (independent variable) and tourist satisfaction (dependent variable) at Bukit Kasih by applying a correlation analysis and a simple linear regression technique. Data used in this research is gathered from 40 respondents who have experienced the implementation of the CHSE protocol at Bukit Kasih. The results showed that the availability of CHSE-based facilities had a strong positive impact on tourist satisfaction as the coefficient correlation value was 0.796. Another finding was that the regression equation was  $y = 5.930 + 0.319x$ . Based on the t-test, it was found that  $t_{count} > t_{table}$  with the significance of 0.000, which means the hypothesis that states the availability of CHSE-based facilities at Bukit Kasih has an impact on tourist satisfaction is accepted.

**Keywords**— CHSE, COVID-19 Pandemic, Tourism

## I. INTRODUCTION

The coronavirus disease (COVID-19) pandemic has had a major impact on many economic sectors, including tourism. The rapid spread of COVID-19 led to the implementation of social restrictions by many governments all over the world. The effect of this restriction can be evidenced by the fall in the number of tourist visits since March 2020. North Sulawesi Province in Indonesia, has also experienced a significant decline in visitors' number in 2020, as domestic visitors were only less than a quarter of the previous year, while the number of foreign visitors declined by more than 84% [1].

In August 2020, the Ministry of Tourism and Creative Economy of the Republic of Indonesia responded by introducing a protocol called Cleanliness, Health, Safety, and Environmental Sustainability (CHSE) to prevent and control the outbreak of COVID-19 pandemic in tourism destinations. This protocol acts as guidelines for the whole tourism industry to anticipate the shifting in tourism

patterns, where tourists are more concerned than ever when it comes to health matters when visiting destinations. By implementing this protocol properly, it is expected that tourists will be more confident and this may translate into an increase in the number of tourist visits domestically and internationally.

Bukit Kasih (Hill of Love), which opened for business in November 2002, is a major religious tourism destination in Minahasa. This destination serves as a spiritual center for all six official religions recognized in Indonesia, namely Islam, Protestantism, Roman Catholicism, Buddhism, Hinduism, and Confucianism. Visitors of different faiths can worship God side-by-side in peaceful harmony at houses of worship that are built on the second peak of the hill. At the center of Bukit Kasih, the owner erected a 22-meter tall monument as a symbol of unity and solidarity of all religions in Indonesia.

During the COVID-19 pandemic, the number of domestic and foreign tourists at Bukit Kasih has declined dramatically. Due to social restrictions, this destination was temporarily closed in March 2020 before its reopening in November of the same year. The management of Bukit Kasih realizes that in order to obtain more visitors, it must be able to prove that it can implement CHSE protocol in accordance with the guidelines from the Ministry of Tourism and Creative Economy. This can be done by providing proper facilities, such as running water for visitors to wash their hands, clean and sanitized toilets, a sufficient number of trash cans, thermoguns to measure visitors' temperature, evacuation points, security posts, and clean surroundings. The availability of these facilities may lead to better satisfaction that may result in new and returning visitors to this destination.

This research is conducted to analyze the impact of the availability of CHSE-based facilities on tourist satisfaction at Bukit Kasih. Correlation and simple linear regression techniques are utilized to analyze data gathered from 40 respondents. By finding out whether this relationship exists, the management of Bukit Kasih is expected to be able to determine further strategies to develop this tourism destination to satisfy the visitors.

## II. LITERATURE REVIEW

### A. Tourism

Tourism can be defined as temporary activities conducted by an individual or groups outside of their

permanent residency with the purpose of seeking pleasure [2]. In order to maximize the experience of tourists, a tourism destination must be able to provide all the components expected by the visitors [3]. These components are called the 4A's of tourism that consist of:

1. *Attraction* is the main potential of a tourism destination that should be developed to encourage tourists to visit. Attraction can either be natural, man-made, or a combination of both.
2. *Amenities* consist of all facilities and services provided within a tourism destination. This includes accommodations, restaurants and bars, shopping facilities, etc.
3. *Accessibility* is the ease of access to the tourism destination, for example, good road condition, availability of public transportation, etc.
4. *Ancillary* is all services that can provide tourists with better experience, such as travel insurance, ease of information, and car rental.

#### B. The Effects of COVID-19 Pandemic on Tourism

According to the Indonesian Tourism Act., some of the benefits of tourism activities are better economic growth, less unemployment, and better welfare for the stakeholders of the tourism industry [4]. However, due to the rapidly declining number of tourists who visit tourism destinations caused by the outbreak of COVID-19, the tourism industry is no longer beneficial for many. This declining number is caused by two factors. The first factor is travel and social restrictions that are regulated by local and national governments have limited people's mobility, thus, tourists can no longer visit tourism destinations. The second one comes from within tourists themselves, in which they are worried about being infected by the coronavirus. This leads to much lower demand for tourism. The United Nations World Tourism Organization (UNWTO) reported that at the end of 2020, the number of international visitors went down by 74% [5]. The same organization also predicted that it would take between two to four years for international tourism to recover and return to the level of 2019.

Table 1: Number of international visitors to Indonesia

Year	Number of visitors
2017	14,039,799
2018	15,810,305
2019	16,106,954
2020	4,052,923
until June 2021	802,378

The tourism sector in Indonesia has also been hit hard by the COVID-19 pandemic. Two main indicators of the impact of tourism on the national economy are the number of international visitors and the amount of foreign exchange income [6]. Table 1 shows that the number of foreign tourists who visit Indonesia has declined significantly since the outbreak of COVID-19 in early 2020 [7]. Since the first case of Covid-19 was found in March 2020, the numbers of international visits have been between 115.765 and 164.079 [8]. Similarly, the Ministry of Tourism and Creative Economy reported that the foreign exchange income has

been down by nearly 80% from US\$16.90 billion in 2019 to US\$3.54 billion in 2020 [9].

#### C. CHSE Protocol

The government has an important role in developing strategies in the tourism industry [10]. In response to the COVID-19 pandemic's negative effects on the tourism industry, the Ministry of Tourism and Creative Economy of the Republic of Indonesia launched the Cleanliness, Health, Safety, and Environmental Sustainability (CHSE) protocol. CHSE protocol is an extension of the broader health protocol announced by the Ministry of Health with the scope of preventing and controlling the transmission of COVID-19 in public facilities [11]. All tourism-related businesses are advised to implement the CHSE protocol to ensure that all services and facilities are safe for tourists. These businesses include tourism destinations, tourism transportation agencies, hotels and homestays, restaurants, and Meeting, Incentive, Convention, and Exhibition (MICE) industries.

For tourism destinations management, in particular, there is a specific set of general guidelines that should be followed [12], which are:

1. Paying attention to current local and national information regarding COVID-19.
2. Providing and communicating a Standard Operating Procedure (SOP) to other tourism stakeholders.
3. Training the SOP to its employees and surrounding community prior to reopening.
4. Installing written warnings with regards to physical contacts, regular handwashing, and other COVID-19 prevention rules.
5. Providing cleaning and health utensils, such as handwashing facilities, hand sanitizer, thermoguns, and trash cans.
6. Ensuring that facemasks are worn by all visitors and employees.
7. Providing safety and security tools, such as medical boxes, fire extinguishers, and evacuation maps.
8. Checking the body temperature of visitors and employees.
9. Ensuring that thermoguns function properly.
10. Providing written reports about visitors' and employees' body temperature.
11. Refunding entrance fees to visitors who are not allowed to enter the destination.
12. Limiting the capacity of the destination to prevent overcrowding.
13. Implementing time-limit and flow management.
14. Providing reservation service by phone, social media or other online, and non-cash payment.
15. Providing e-form to visitors to gather information regarding personal information.
16. Organizing tourism package with limited participants.
17. Organizing indoor and outdoor activities with a strict health protocol in place.
18. Organizing art shows with a strict health protocol.
19. Ensuring that strict health protocols, such as clean and proper air ventilation, are implemented on tourism transportation vehicles and services.

20. Building and training a special team responsible for emergency situations.
21. Coordinating with local health facilities to serve visitors and employees in need of medical assistance.
22. Coordinating with local government institutions regarding the handling of emergency situations.
23. Coordinating with local COVID-19 agencies and health service providers if cases of COVID-19 are found in the destination.
24. Providing health insurance for visitors
25. Ensuring the usage of earth-friendly materials.
26. Ensuring the efficient use of water, gas, and electricity.
27. Ensuring the implementation of proper waste management.
28. Ensuring the provision of a beautiful and comfortable environment at the destination.
29. Controlling and evaluating the implementation of CHSE SOP regularly.

CHSE certificate will be granted to those who are able to properly implement all criteria and indicators of the protocol. To be granted this certificate, a tourism destination must get through several stages, which are self-assessment, self-declaration, field assessment by a team of auditors, and certification. This certificate will serve a guarantee to visitors and communities that the facilities and services provided by a particular destination have been set to a high standard in accordance with the government regulations in terms of cleanliness, health, safety, and environmental sustainability.

#### D. Tourist Satisfaction

Tourist satisfaction is one of the essential determinants of success for tourism destinations. The satisfaction of tourists is obtained by comparing their expectations prior to travel and their experience after traveling [13]. A tourism destination should be able to understand the needs and expectations of visitors when providing the facilities, product, and services, because failure to deliver tourist expectations may lead to poor satisfaction [14] [15].

Customers, including tourists, satisfaction is determined by several factors [16], which are:

1. *Quality of product.* Customers will be satisfied if the product they purchased is of high quality.
2. *Quality of service.* In tourism, quality service is a major factor that determines whether tourists will return to a destination or not.
3. *Emotion.* Self-esteem can be the reason why tourists choose a destination over another, therefore, the image of a tourism destination must be kept intact.
4. *Price.* Many tourists are price-sensitive, hence, proper price determination may be a deciding factor.
5. *Cost.* Unexpected extra costs will lead to dissatisfaction. It is important for businesses to be transparent about the total cost that must be paid by customers in advance.

If tourists perceive that the determining factors in a destination meet or even exceed their expectations, then they may return and recommend the destinations to others, while dissatisfaction will lead them to do the opposite [17].

### III. RESEARCH METHOD

#### A. Data Collection

The population in this research was all tourists who have visited Bukit Kasih during the implementation of the CHSE protocol. The exact number of population is unknown due to the lack of data provided by the management of Bukit Kasih. When the number of population is unknown, the number of samples in a study that uses a regression model can be determined by multiplying the number of variables by 10 [18]. Based on that, the sample size in this research was determined to be 40 respondents (20 x 2 variables).

Moreover, the sampling technique used was random sampling, in which questionnaires were distributed to people who have visited Bukit Kasih, who were randomly met either at the destination or somewhere else. Data were collected in April 2021. Each respondent was asked to fill out a questionnaire, where the items were in the form of a five-point Likert scale. The responses were ordered as follows: “Strongly disagree” (1 point), “Disagree” (2 points), “Neutral” (3 points), “Agree” (4 points), and “Strongly agree” (5 points).

#### B. Variables

The independent variable in this research is the availability of CHSE-based facilities, while the dependent variable is tourist satisfaction. Each variable consists of some indicators and each indicator comprises several items as shown in Table 2. Please note that these items only include facilities that are visible to respondents.

Table 2: Research variables, indicators, and items

Variables	Indicators	Items
Availability of CHSE-based facilities (x)	Cleanliness	Handwashing facilities
		Hand-sanitizer
		Clean toilets
		Trash cans
	Health	Thermogun
		Good ventilation
	Safety	Evacuation points
		Security posts
Environmental Sustainability	Clean surroundings	
Tourist satisfaction (y)	Satisfaction towards cleanliness	Cleanliness-based facilities are satisfactory
	Satisfaction towards health	Health-based facilities are satisfactory
	Satisfaction towards safety	Safety-based facilities are satisfactory
	Satisfaction towards environmental sustainability	Environmental sustainability-based facilities are satisfactory

#### C. Methods of Data Analysis

In order to find out the strength and direction of the relationship between the independent variable (x) and dependent variable (y), a correlation analysis was conducted to find the Pearson Product-Moment coefficient correlation value (r). The obtained value was then interpreted based on ranges of r value as shown in Table 3 [19].

Table 3: Interpretation of correlation coefficient

<i>r</i> value	Interpretation
0.00-0.09	No/negligible correlation
0.10-0.39	Weak correlation
0.40-0.69	Moderate correlation
0.70-0.89	Strong correlation
0.90-1.00	Very strong correlation

Furthermore, a simple linear regression technique was adopted to estimate the degree of impact caused by the independent variable towards the dependent variable [20]. The mathematical model of simple regression analysis is

$$y = \alpha + \beta x \quad (1)$$

where  $\alpha$  is the  $y$ -intercept (constant) and  $\beta$  is the slope (regression coefficient).

#### D. Hypotheses

To be able to determine the relationship between the variables, hypotheses are needed to be proven by comparing the  $t_{table}$  and  $t_{count}$  as well as  $p$ -values found in regression analysis. The hypotheses in this research were as follows:

$H_0$ : The availability of CHSE-based facilities ( $x$ ) at Bukit Kasih has no impact on tourist satisfaction ( $y$ )

$H_1$ : The availability of CHSE-based facilities ( $x$ ) at Bukit Kasih has an impact on tourist satisfaction ( $y$ ).

## IV. RESULT AND DISCUSSION

### A. Characteristics of Respondents

The characteristics of the 40 respondents are shown in Table 4. The majority of them are female, representing 57.5% of the total respondents. With regards to age, the age group of between 31 and 40 years old represented 42.5% of respondents, followed by age groups 21-30 and 41-50 years old who have a similar percentage of 22.5%. It is also shown that almost two-thirds of respondents are high school graduates.

Table 4: Respondents characteristics

Category	Characteristics	<i>f</i>	%
Sex	Male	17	42.5%
	Female	23	57.5%
<b>Total</b>		<b>40</b>	<b>100%</b>
Age	≤ 20	5	12.5%
	21 – 30	9	22.5%
	31 – 40	17	42.5%
	41 – 50	9	22.5%
	≥ 51	0	0%
<b>Total</b>		<b>40</b>	<b>100%</b>
Last level of education	Elementary	0	0%
	Junior High School	2	5%
	High School	26	65%
	Diploma	7	17.5%
	Bachelor	5	12.5%
	Post-graduate	0	0%
<b>Total</b>		<b>40</b>	<b>100%</b>

### B. Correlation Coefficients

Table 5 shows that the value of the correlation coefficient ( $r$ ) is 0.796, which implies that there was a strong positive relationship between the availability of

CHSE-based facilities ( $x$ ) and tourist satisfaction at Bukit Kasih. Furthermore, the determination coefficient, represented by *adjusted r*<sup>2</sup> in Table 4, has a value of 0.624. This means that 62.4% of the impact on tourist satisfaction at this destination was caused by the availability of CHSE-based facilities, while the remaining 27.6% was influenced by other factors that were not observed in this research.

Table 5: Model summary

<i>r</i>	<i>r</i> <sup>2</sup>	Adjusted <i>r</i> <sup>2</sup>	Std. Error of the Estimate
.796	.634	.624	.821

### C. Regression

Table 6 shows the constant or slope ( $\alpha$ ) with a value of 5.930 and regression coefficient ( $\beta$ ) value of 0.319. By using these values the simple linear regression equation can be established as

$$y = 5.930 + 0.319x \quad (2)$$

This equation implies that 5.930 is the constant value of tourist satisfaction when there are no CHSE-based facilities available. Moreover, a one-unit change in the availability of these facilities will increase tourist satisfaction by 0.319 unit.

Table 6: Predictors

Model	Unstandardized Coefficient		Standardized Coefficient	<i>t</i>	Sig.
	<i>B</i>	Std. Error	Beta		
(Constant)	5.930	1.433		4.139	.000
Availability of CHSE-based facilities	.319	.039	.796	8.110	.000

Dependent variable: Tourist satisfaction

### D. Hypothesis Testing

In Table 6, the  $t_{count}$  is 8.110. Using a confidence level of 95% ( $\alpha = 0.05$ ) with 40 respondents and two variables, it can be determined that  $t_{table}$  is 2.024. As  $t_{count} > t_{table}$ , then  $H_0$  is rejected and  $H_1$  is accepted. It can also be seen in the same table that the  $p$ -value (shown by Sig.) is 0.000. A  $p$ -value that is less than 0.05 means that the independent variable has a significant impact on the independent variable.

### E. Discussion

The correlation analysis shows that the correlation coefficient ( $r$ ) has a value of 0.796 which means that  $H_1$  is accepted and  $H_0$  is rejected. Furthermore, as  $t_{count}$  is larger than  $t_{table}$  and the  $p$ -value is 0.000, the same conclusion can also be made, in which the availability of CHSE-based facilities ( $x$ ) had a positive and significant impact on tourists' satisfaction ( $y$ ) at Bukit Kasih. This is in line with a study regarding the influence of CHSE on tourists' satisfaction and decision to visit conducted at several hotels in Depok [21].

Provision of the CHSE-based facilities would increase the expenditures of tourism destinations. However, a study for [22] shows that a proper implementation of tourism public health service quality results in not only tourists' satisfaction, but also in better trust and loyalty that may lead visitors to revisit and recommend the destination. As more satisfied tourists come to visit tourism destinations, it would also have a positive impact on the development of the tourism industry as a whole [23].

Moreover, the government should establish a strict control procedure on the implementation of the CHSE protocols. A study from [24] shows that some tourism destinations are still not ready to properly implement these protocols as well as many visitors still choose to disobey them.

## V. CONCLUSIONS

The CHSE protocol, launched by the Ministry of Tourism and Creative Economy of the Republic of Indonesia, aims to provide tourists with the guarantee that a tourism destination is able to provide cleanliness, health, safety, and environmental sustainability. This research shows that in Bukit Kasih, the availability of CHSE-based facilities had a strong positive impact on tourists' satisfaction. During and after the COVID-19 pandemic, the ability to meet and even exceed tourists' expectations in terms of health protocols can be a major determinant for success, therefore, it is important for tourism destinations to pay more attention to this matter.

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# The Influence of Promotions on Instagram towards Tourists' Decision to Visit Puncak Kai'santi Tomohon

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**Abstract**— Due to the rapid spread of Covid-19, the tourism sector has been severely impacted. The number of domestic and foreign tourists has declined significantly all over the world. To anticipate further decline, one solution is by intensifying tourism promotion through social media. The number of Instagram users in Indonesia has increased by nearly 50% since the Covid-19 pandemic started in early 2020, which shows that this media may act as an effective and attractive promotional tool for tourist destinations. Puncak Kai'santi, a tourist destination located in Tomohon, North Sulawesi, has utilized its Instagram accounts to promote its attractions and facilities. This research aims to find out the influence of Puncak Kai'santi's promotions on Instagram towards tourists' decision to visit. The researchers distributed questionnaires to 30 respondents by using purposive sampling method, which then processed by SPSS 25. The results showed that promotion on Instagram had a very strong positive influence on tourists' decision to visit this destination, as shown by the coefficient correlation (R) value of 0.865. Furthermore, the coefficient of determination (R<sup>2</sup>) is 0.749, which implies that 74.9% of tourists' decision to visit Puncak Kai'santi was influenced by its promotional activities on Instagram, while the remaining 25.1% was caused by other factors.

**Keywords**— Covid-19 Pandemic, Tourism, Social Media

## I. INTRODUCTION

Indonesia is well-known all over the world for its abundance of natural beauty and cultural diversity. These natural and cultural charms have been attracting many international tourists to visit Indonesia. With more tourists visiting and spending their money, the tourism sector becomes the second-largest source of foreign exchange after oil and gas. The tourism industry in Indonesia had improved between 1995 and 2019, however, the rapid spread of the Coronavirus Disease (COVID-19) pandemic in early 2020 has disrupted the tourism industry chain.

Due to the pandemic, the government of Indonesia implement social restrictions, in which people are instructed to limit their mobility and spend more time at home to prevent the transmission of the coronavirus. North Sulawesi, one of the provinces in Indonesia, also experiences the impact of this restriction. This is evidenced by the declining number of domestic and international tourists in North Sulawesi as shown in Table 1. In 2020, the number of international tourists that visited North Sulawesi was down to 23,031 visitors, approximately 15% of that in

2019, while the number of domestic visitors was only one-fifth of the previous year [1].

Table 1: Number of tourists to North Sulawesi

Year	Number of international tourists	Number of domestic tourists
2015	32,097	1,070,681
2016	41,103	1,484,402
2017	87,976	1,698,534
2018	127,879	1,958,899
2019	153,656	2,200,000
2020	23,031	447,020

One solution to the declining number of tourists is by intensifying tourism promotion activities in order to introduce new tourism destinations as well as to remind visitors about the existing ones. The internet is one of the increasingly popular promotional tools that is utilized in the tourism industry. Along with the development of the internet and increasingly sophisticated technology, the media for communication has also experienced a rapid development, such as the emergence of social media.

Instagram is an example of social media that is widely used around the globe. The number of Instagram users in Indonesia has increased drastically since the start of the COVID-19 pandemic. In early 2020, there were approximately 62 million Instagram users, which increased to 83.7 users by December of the same year. The latest data, from July 2021, shows that there were currently 91.8 million people who were registered as active Instagram users in Indonesia [2]. The increasing number of social media users is considered as an impact of the pandemic, in which many people have to stay at and do their works from home.

As more and more people use Instagram regularly, the tourism industry can take advantage by using this social media as a promotional tool to introduce tourism destinations. Attractive contents, photographs, videos, as well as positive reviews and comments found in Instagram may influence visitors' decision to visit a tourism destination.

Puncak Kai'santi, a tourism destination that is located in Tomohon, North Sulawesi, is popular due to its breathtaking mountain view as its most popular attraction. This destination has utilized its Instagram accounts extensively as a promotional tool by posting photographs, videos, and other contents regularly. However, no studies have been

done in this destination to ascertain the impact of promotion on Instagram decision of tourists to visit. This research aims to analyze the influence of using Instagram as a promotional medium on tourists' decision to visit Puncak Kai'santi, especially during the COVID-19 pandemic.

## II. LITERATURE REVIEW

### A. Tourism Promotion

Promotion is a key factor that determines the success of a tourism destination. Tourism promotion is defined as planned activities that are done systematically and regularly with the aim to influence people to visit a destination [3]. To convey the promotion materials to a larger audience, tourism marketers use mass media as a promotional tool [4]. Mass media consists of:

1. Printed media: newspapers, magazines, brochures, etc.
2. Electronic media: televisions, radios, etc.
3. Online media: online news, e-commerce, social media, etc.

Social media, such as Instagram, Facebook, and TikTok, have been gaining popularity among marketers in the tourism industry. Through social media, users can share texts, photographs, videos, and audios interactively with others. These kinds of media are web-based and allow users to share information instantly despite geographical locations.

The utilization of social media makes it easier for users to communicate with one another. Moreover, other functions and benefits of social media are [5]:

1. As an alternative or a replacement for one-way media, such as newspapers, televisions, and radios.
2. As a medium that can turn audience who relays messages into messenger.
3. Its ability to reach more market segments and target markets for seller.
4. Much easier for customers to search for specific items that they need to purchase.

In order to use social media effectively in promotion activities, the concept of 4Cs is an important determinant [6]. This concept consists of:

1. Context  
This relates to how a story or a message is framed to make it more attractive.
2. Communication  
The second C focuses on how to deliver and grow a message, and also to listen and respond to the audience.
3. Collaboration  
Collaboration is about how to build a cooperation between the sender and the audience to effectively and efficiently convey the message.
4. Connection  
The last component of the 4Cs emphasizes on how to forge and maintain a long term relationship between the sender and the audience.

### B. Instagram as a Promotional Tool

Instagram is one of the social media that has a large number of users so it can reach many people and can spread information more widely and more quickly. This is why Instagram is considered as an effective promotional tool in the business sector, including in the tourism industry. The benefits of using Instagram as a promotional tool [7] are as follow:

1. Instagram helps to provide marketers with information needed to determine market segmentations, such as age, location, and interests.
2. Instagram helps marketers in filtering information so that the correct target market can be determined.
3. Users can get feedback about their products in the form of criticism and suggestions via Instagram at any time and anywhere.

Instagram has similar features to other popular social media [8]. Some of these features are:

1. Profile  
A user can create their own profile along with a photograph, so they can easily be recognized by others.
2. Followers  
An account user can follow another person and/or businesses that they are interested in.
3. Hashtag (#)  
A user can use this symbol to make it easier for people looking for a specific information
4. Automatic Notification  
This notification notifies the account user that someone is following, liking a photo, or commenting on a photograph on the account.
5. Connect to Social Networks  
Instagram account users can provide information or photos easily, thus creating a relationship between one account user and another.
6. Location Tags  
Account users can include the location on the uploaded photograph so that the location can be known by other users.

As of July 2021, the users of Instagram in Indonesia were dominated by users within the age group of 18 to 34 years old. 36% of Instagram users came from the 18-24 years old age group, while the age group of 24-34 represented 32.7% of the total users. In terms of gender, there was a slight difference between the percentage of male and female, in which there were 53.2% female users and 46.8 male ones [9].

### C. Decision to Travel

Visitors' decision to visit a tourism destination is closely related with tourists' behavior. Tourist behavior is an important factor in tourism marketing activities that should be acknowledged by the tourism businesses because these businesses do not know what is in the mind of tourists before, during, and after visiting the destinations [10]. When making their decisions, tourists go through several stages [11], which are:

1. Recognizing needs  
 In this stage, tourists realize that they have needs, particularly needs to travel to seek pleasure.
2. Searching for information  
 Motivated by the need to travel, tourists will start looking for more information regarding tourism products and/or services. The information can be obtained from:
  - a. Personal experience.
  - b. Family, friends, and colleagues.
  - c. Advertisements from sellers or intermediaries.
  - d. Mass media.
3. Evaluating alternatives  
 During this stage, tourists evaluate the tourism destinations based on the several factors, such as price, product quality, and service quality.
4. Purchasing  
 After evaluating several alternatives, tourists decide to purchase the products/services that they believe will offer the best benefits for them.
5. Evaluating decisions after purchasing  
 The last stage relates to tourists comparing their expectations and what they receive in reality to determine their satisfaction or dissatisfaction. If tourists are satisfied, they may decide to revisit or recommend the tourism destination, otherwise they will switch to other destinations.

### III. RESEARCH METHOD

The research was conducted at Puncak Kai'santi, which is located in Woloan Dua Village, West Tomohon District, Tomohon City, North Sulawesi Province. The population in this research was all the followers of Puncak Kai'santi Instagram accounts, namely @kaisantigarden and @kaisanti.tomohon, with a total of 2,616 followers as of June 1<sup>st</sup>, 2021. The sampling technique used was the purposive sampling method with 30 respondents, which deemed sufficient for a survey [12]. These respondents were asked to fill out a questionnaire using a five-point Likert scale as shown in Table 2. Data gathered were then processed using SPSS 25.

Table 2: Measurement scale

Scale	Score
Strongly disagree	1
Disagree	2
Neutral	3
Agree	4
Strongly Agree	5

This research applied a quantitative method, namely a simple linear regression analysis. This method is a statistical technique that is used to predict the impact of an independent variable (X) on a dependent variable (Y) [13]. The formula for simple linear regression analysis is

$$Y = a + bx \quad (1)$$

where:

Y = Tourists' decision to visit

X = Promotion on Instagram

a = Constant

b = Regression coefficient.

For this research, these two variables and their indicators are shown in Table 3. The independent variable comprised 16 questions related to the 4Cs concept, whereas the dependent variable consisted of six questions related to tourists' decision making stages. These variables were then analyzed to determine whether the constructed hypotheses could be proven to determine the relationship between promotion on Instagram and tourists' decision to visit Puncak Kai'santi. The hypotheses are:

Ho: There is no relationships between promotion on Instagram and tourists' decision to visit Puncak Kai'santi

Ha: There is a relationship between promotion on Instagram and tourists' decision to visit Puncak Kai'santi.

Table 3: Variables and Indicators

Variables	Indicators
Promotion on Instagram (X)	Context
	Communication
	Collaboration
	Connection
Tourists' decision to visit (Y)	Recognizing needs
	Searching for information
	Evaluating alternatives
	Purchasing
	Evaluating decisions after purchasing

### IV. RESULT AND DISCUSSION

#### A. Characteristics of Respondents

Table 4 shows that the majority of respondents were male, who represented 56.67% of total respondents. In terms of age, two-third of the respondents were from the age group 21-25 years old.

Table 4: Respondents characteristics

Category	Characteristics	f	%
Sex	Male	17	56.67%
	Female	13	43.33%
<b>Total</b>		<b>30</b>	<b>100%</b>
Age	16-20	7	23.33%
	21-25	20	66.67%
	26-30	2	6.67%
	>30	1	3.33%
<b>Total</b>		<b>30</b>	<b>100%</b>

#### B. Validity and Reliability Tests

A validity test aims to determine whether a questionnaire can measure what it supposes to measure accurately by comparing the values of  $r_{count}$  and  $r_{table}$  [14]. Table 5 shows that with a significance level of 0.05, all items in the questionnaires were valid as  $r_{count} > r_{table}$  for each item.

To measure the data consistency, a reliability test must be conducted. For a data to be consistent, the value of Cronbach’s Alpha must be higher than 0.7 [15]. Table 6 shows that both independent and dependent variable could measure the data reliably.

Table 5: Validity test

Item	r <sub>count</sub>	r <sub>table</sub>	Result
1	0.607	0.361	Valid
2	0.796	0.361	Valid
3	0.572	0.361	Valid
4	0.437	0.361	Valid
5	0.852	0.361	Valid
6	0.818	0.361	Valid
7	0.887	0.361	Valid
8	0.731	0.361	Valid
9	0.791	0.361	Valid
10	0.716	0.361	Valid
11	0.812	0.361	Valid
12	0.743	0.361	Valid
13	0.627	0.361	Valid
14	0.866	0.361	Valid
15	0.693	0.361	Valid
16	0.722	0.361	Valid
17	0.763	0.361	Valid
18	0.742	0.361	Valid
19	0.834	0.361	Valid
20	0.782	0.361	Valid
21	0.724	0.361	Valid
22	0.757	0.361	Valid

Table 6: Reliability test

Variable	Cronbach’s Alpha	Number of Items	Result
X	0.947	16	Reliable
Y	0.866	6	Reliable

### C. Classical Assumptions Test

A compulsory test that is required for a research that uses Ordinary Least Square (OLS), such as simple regression analysis, is called the Classical Assumptions Test. The first part of this test is the normality test that aims to find out whether the data is normally distributed. In this research, the Kolmogorov-Smirnov test was conducted by comparing the level of significance (0.05) with the significance value of the data analysis. As the result of Kolmogorov-Smirnov test showed that significance value of 2.000 which is larger than 0.05, then it can be concluded that the data was distributed normally.

The next step was to conduct a linearity test to determine the existence of a linear relationship between the independent and the dependent variables. In the test, it was found that the significance value of the Deviation of Linearity (0.134) was larger than the level of significance (0.05). This implies that the variables used in this research were linear.

The last part of the classical assumptions test is the heteroscedasticity test that determines whether the residuals of a regression are normally distributed. One way to determine this is by looking at the scatterplot shown in Fig. 1. In this figure, the plots are distributed above and below 0 without forming a clear pattern. This means that heteroscedasticity problem did not occur in this data analysis.

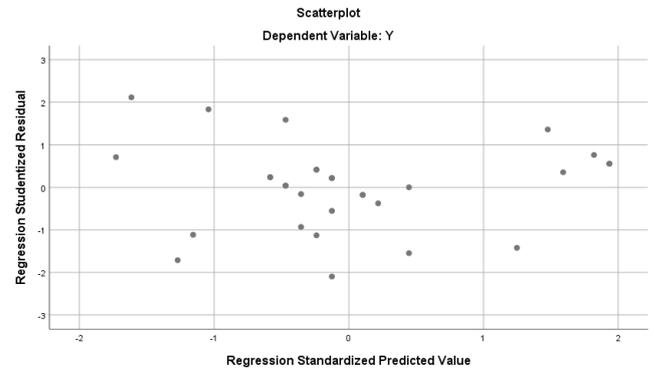


Fig.1. Scatterplot of heteroscedasticity test

### D. Simple Linear Regression Analysis

From the output in Table 7, the simple regression linear equation was found to be

$$Y = 3.831 + 0.256x \quad (2)$$

This equation implies that if the Promotion on Instagram variable (X) is constant or stays at 0, then the Tourists’ decision to visit variable will be affected at the value of 3.381. Meanwhile, if the value the variable X increases by one unit, then the value of variable Y will increase by 0.256 unit or 25.6%

Table 7: Coefficients

Model	Unstandardized Coefficient		Standardized Coefficient	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.831	1.786		2.145	.041
Promotion on Instagram	.256	.028	.865	9.139	.000

Dependent variable: Tourists’ decision to visit

### E. T-test

A t-test aims determine the individual relationship between the independent variable (X) and the dependent variable (Y). In this test, if the value of t<sub>count</sub> is larger than t<sub>table</sub>, then the relationship between variables exists, and vice versa. As the significance level was 0.05 and the number of respondents participating in this research was 30, then the t<sub>table</sub> had a value of 1.701. This value is smaller than the value of t<sub>count</sub> (2.145) in Table 7, therefore there was a proven relationship between Promotion on Instagram as the independent variable (X) and Tourists’ decision to visit as the dependent variable (Y).

Furthermore, Table 7 also shows that the significance value of the independent variable is 0.000. Because this value is less than the level of significance (0.05), then Ho is rejected and Ha is accepted.

#### F. Determination Coefficient Test

Based on the data processed on SPSS as shown in Table 8, the coefficient correlation (R) between Promotion on Instagram (X) and Tourists’ decision to visit (Y) was 0.865, which means there was a strong positive correlation between the two variables. The value of R<sup>2</sup> was 0.749 that implies variable X had a very strong positive impact on variable Y with a percentage of 74.9%, while the remaining 25.1% was caused by other variables or factors that were not included in this regression analysis.

Table 8: Model summary

R	R <sup>2</sup>	Adjusted R <sup>2</sup>	Std. Error of the Estimate
.865	.749	.740	1.319

#### V. CONCLUSIONS

Social media, such as Instagram, can be a useful promotional tool to introduce tourism destinations to visitors. However, tourism promotion activities must be done efficiently and effectively, for example by implementing the concept of 4Cs. For the case of Puncak Kai’santi, this research proves that promotion on Instagram has a positive and significant impact on tourists’ decision to visit. However, it should be noted the number of sample is limited due to the COVID-19 pandemic. A larger sample size that focuses more on younger respondents, as the digital natives, may give a better understanding about the impact of promotion of social media on young tourists’ decision to visit.

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# A System Dynamics Simulation Approach for Describing How Carbon Emissions Produced from a Production System

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**Abstract**— This paper discusses how a production system will produce carbon emissions when the system carries out its activities. This mainly due to the use of energy obtained from fossil fuels. The use of electricity will also produce emissions if it comes from burning coal, natural gas or other fossil fuels. For a particular production system prototype, a model in the form of a mathematical formula taken from natural phenomena occurring in the system, under the influence of the environmental conditions of the system, can be constructed. However, mathematical models involving multiple differential equations cannot be described or understood easily. For this reason, the formulation can be expressed in the language of system dynamics. The language is actually a generalization of a system of differential equations expressed in the formulation of stock and flow diagrams. The diagram represents the differential rate quantities of the transfer processes involved, and the integration of their accumulative quantities. Several special software related to system dynamics language are now widely known, one of which is Vensim PLE (by Ventana Systems, Inc.) which can be used for academic purposes. With this software, the emission process in the production system can be easily displayed and completed. A prototype of what-if analysis can be carried out in the learning classroom to understand the behavior of the modeled system and to derive the best activity control decision setting of the system. For simplicity, the scope of the research is limited to a hypothetical factory which is a single process and then followed by a single distribution stage.

**Keywords**— Carbon Emission, Single Stage Production System/ Model, Prototype, System Dynamics

## I. INTRODUCTION

Industry in general consists of supply chain units. Certain products are created through a long series of processes from raw materials to finished products. In a supply chain there is at least one factory that acts as the heart of the system. The factory determines the rhythm of the flow of goods from raw materials to the community. The factory pulls materials from the upstream side, processes them, and then pushes downstream. On the upstream side there are supply companies, and on the downstream side there are distribution companies. The scope can be local, national, or global. The useful products that are created play an important role in growing an economy that is useful for the welfare of the community.

Unfortunately there are side effects from the industry, one of which is carbon emissions. Industry is the main source of carbon emissions because the unity of the supply chain requires the existence of several factors, especially the

three most important, namely: electricity, transportation and factories. According to [1], these three factors are the main sources of carbon emissions, followed by agriculture, commercial, and residency. As long as the energy used is sourced from fossil fuels, the emission process will continue to occur ([2]).

The content of carbon dioxide in the atmosphere is increasing, causing global warming and climate change on earth. For one unit of product produced by industry, it can be traced the amount of carbon emissions that have been raised from the beginning, to become a product to consumers. The amount of carbon per unit of product is called the carbon footprint of that product. Carbon footprint is a marker of the amount of carbon emissions that accumulate directly or indirectly, and are attached to a product ([3]). Furthermore, [3] categorizes the origin of the carbon footprint into the following types: indirect carbon footprint (which is brought from suppliers) and direct (from production activities in factories). Both types are accumulated and integrated in the carbon footprint of a product. A high value on the carbon footprint indicates that a lot of emissions have been produced to create the product. So the carbon tax must be high too, which eventually forces the price of the product to be high.

Carbon footprint analysis includes identification of emission sources, composition and quantity of Green House Gases arising from them. Normally, the analysis uses the life-cycle assessment method ([4]). With this method, the accumulated carbon footprint of a product can be traced back to all stages of the activity it has undergone, such as processing, transportation, and storage, and others (See Fig. 1).

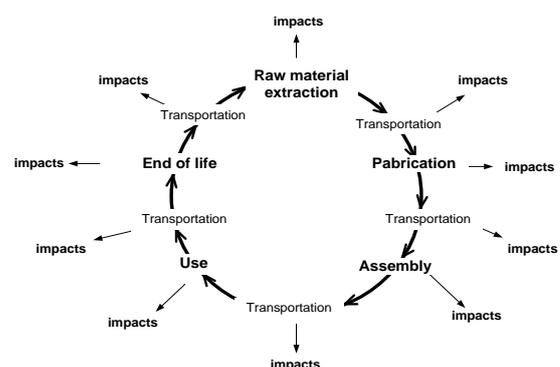


Fig 1. Life-Cycle Assesment (adapted from [5])

In [5], the number of emissions that occurs along the closed-loop supply chain is calculated using the concept of mass transfer phenomena. Carbon emissions in each stage of the supply chain are modeled as the process of mass transfer of gas from the emission source to the environment, among others by taking into account differences in concentration, the influence of wind, and dry or wet precipitation. The total emissions released by the supply chain come from suppliers, factories, warehouses, and non-stationary sources. As an illustration, a simple four-echelon automotive supply chain located in China consisting of suppliers, manufacturers, warehouses, and logistics service providers provides the emission distribution as shown in Table 1.

Table 1. Distribution of emission quantities in each echelon in a sample supply chain (analyzed from [6])

Supply chain echelon	Supplier	Logistic	Plant	Warehouse	Total
Relative emission (calculated)	25.2%	21.9%	39.6%	13.4%	100%

To limit carbon emissions, each organization is required to comply with the maximum allowable emission limits. Two of the four emission limiting mechanisms ([6]) are cap and trade and tax policy. In the cap and trade system (or carbon trading, [7] calls it quantity based), there is cost consequences if the quota (cap) is violated. However, the rest of the quota can also be sold, meaning that in the cap and trade system, emission quotas can be traded ([8],[9],[10]). Meanwhile, in the tax system, companies producing carbon emissions bear the tax per unit ton of emissions issued ([10]).

## II. PROBLEM

A product exists to meet the needs of society. The product is created by a supply chain system, which starts from the process of extracting materials from nature by, for example, a mining company (echelon-1). The extracted material is then sent by a certain transportation vehicle, to a processing company (echelon-2) to become a material with certain specifications, which are needed as raw materials by the factory (echelon-3, focal echelon). In factories, raw materials are processed, along with other raw materials, to become a product.

Controlling the quantity of carbon emissions should start from the operational planning stage in the entire supply chain. It is important to find the right operational settings to ensure the carbon footprint per unit of product is below the value set by the regulator. The supply chain operational controller can do this if there is a "forward" calculation tool, starting from the creation of raw materials, transportation and others, until the product is created and distributed. Calculations in the life-cycle assessment are technically "backward". So a calculation model that is forward (in the direction of the product metamorphosis) can provide a prediction of the carbon footprint of each product unit if the operational conditions are set on certain decisions.

In this paper, an example of a simple modeling with a very simplified scope is presented. The system is limited to the factory (which is reviewed globally, so it is a single process) followed by a single distribution stage. Provision

processes along the upstream, and along the subsequent downstream, are not covered so that the discussion is not too broad. The emission quantity is simply calculated based on the emission factor. Emission factors must be identified in each emission activity that takes place, based on empirical or observational data. The basic definition of emission factor is the quantity of emission that arises per unit of process activity ([1]).

The model is then expressed in the form of a VENSIM PLE diagram (academic version). Some important instructions are obtained from the user manual, and small modules called "molecules", which are provided in the software ([11]). The modeling is directed at the activities of production, storage and delivery, as well as the emissions that arise in a single production system (because the factory is viewed as a single process unit) with one distribution center (DC). Two objectives to be achieved with the model are (1) to describe simply how emissions occur, and (2) to estimate the quantity of emissions per unit product for a particular operational decision setting.

## III. SYSTEM DESCRIPTION

The system to be discussed is a factory with one process stage, followed by one distribution channel. The upstream and downstream sides are excluded from the discussion, without intending to eliminate them (see [12] for comparison).

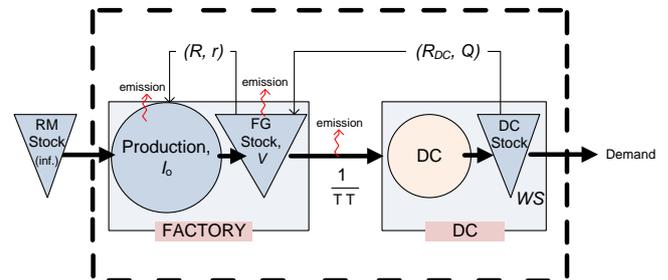


Fig 1. System Under Study

The behavior of the system is assumed to follow the following conditions:

1. The stock of raw materials is sufficient so that there is never a shortage (the effect on the system can be ignored).
2. The amount of carbon footprint per unit of raw material when it leaves the raw material warehouse is certain ( $C_0$  kg carbon per unit of raw material), which is not calculated in this paper.
3. The factory controls the finished product stock (FG) with the  $(R, r)$  mechanism.
4. There is only one distribution center (DC), where the inter-arrival time of demand from the DC is represented by its inventory cycle time.
5. Emissions arise from production activities, FG storage, and delivery to DC.
6. Emission factors are identified as much as possible from secondary data (general data), which is processed by taking into account the suitability of the unit for each emission activity that is considered.

#### IV. RESEARCH METHOD

The research was conducted by means of simple modeling and simulation. Fig 1 gives the framework of the research. While [12] solved the model using numerical discrete Markovian approach, in this paper the model was conducted using continuous system dynamics approach.

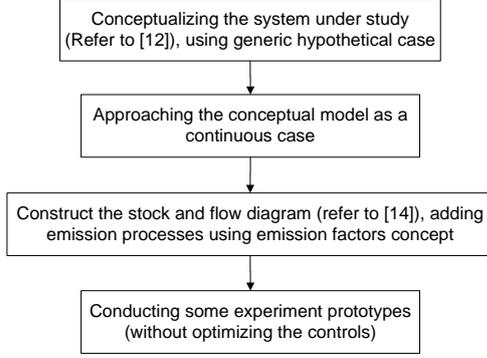


Fig 1. The research framework

##### A. Raw material preparation

To limit the scope of the problem, raw materials are considered to be always available when needed. It is considered that only one type of raw material is processed to become one unit of product. This raw material certainly already contains a carbon footprint of a certain value caused by the processes of processing, storage, transportation, etc., which are experienced before arriving at the raw material warehouse at the factory. As already mentioned, the carbon footprint, for example, is  $C_0$  kg carbon per unit of raw material.

##### B. Production

Production run on a stop and went on the basis using a mechanism (R,r) which was approached as a process for continuous materials ([13]). Production activities in factories were viewed in terms of aggregates so that these activities were a one-stage process, where the production leadtime was assumed to be exponentially distributed.

Suppose the electricity demand for production, on average, was 100 kwh/unit/day, then the value of the production emission factor,  $\epsilon_p$ , for example was estimated as follows ([13]):

$$\begin{aligned} \epsilon_p &= 0.875 \frac{\text{kg carbon}}{\text{kwh}} \\ &= \left( 0.875 \frac{\text{kg carbon}}{\text{kwh}} \right) \left( \frac{50 \text{ kwh}}{1 \text{ unit}} \right) \\ &= 43.75 \frac{\text{kg carbon}}{\text{unit}} \end{aligned} \quad (1)$$

The production emission,  $E_p$ , was calculated based on the production emission factor and the production rate,  $I$ , according to the following manner:

$$E_p = \epsilon_p \left( \frac{\text{kg carbon}}{\text{unit}} \right) \cdot I \left( \frac{\text{unit}}{\text{day}} \right) \cdot T_p(\text{day}) \quad (2)$$

##### C. Finished product warehouse

Products were sent to the finished product warehouse in the same quantity as the lots of production each time they arrive at the warehouse. The mechanism (R, r) assumed the lotsize was one unit. However, it could then be multiplied by another number, if desired, the lot size of the production was more than one. The finished product warehouse accommodated the production before it was finally sent to distribution, with the lotsize of shipments being equal to the lotsize of the demand.

If, for example, the average electricity requirement to store one unit of product for one day was 1 kwh, then the value of the storage emission factor,  $\epsilon_h$ , was estimated as follows ([13]):

$$\begin{aligned} \epsilon_h &= 0.875 \frac{\text{kg carbon}}{\text{kwh}} \\ &= \left( 0.875 \frac{\text{kg carbon}}{\text{kwh}} \right) \left( \frac{1 \text{ kwh}}{\text{unit.day}} \right) \\ &= 0.875 \frac{\text{kg carbon}}{\text{unit.day}} \end{aligned} \quad (3)$$

Storage emissions,  $E_h$ , were calculated by multiplying the storage emission factor, inventory level,  $V$ , in warehouse, and storage time,  $T_h$ , according to the following equation:

$$E_h = \epsilon_h \left( \frac{\text{kg carbon}}{\text{unit.day}} \right) \cdot V(\text{unit}) \cdot T_h(\text{day}) \quad (4)$$

##### D. Shipment

There was only one distribution channel. The amount sent follows the specified lotsize. This meant that the quantity of each demand was equal to the lotsize. The time between arrivals of demand was determined by the amount of inventory cycle time in the distribution center warehouse.

Shipping emissions were calculated based on the shipping emission factor and the number of shipments and delivery times according to the following:

$$E_s = \epsilon_s \left( \frac{\text{kg carbon}}{\text{shipment}} \right) \cdot F \left( \frac{\text{shipment}}{\text{day}} \right) \cdot T_s(\text{day}) \quad (5)$$

To estimate the value of  $\epsilon_s$  for example it was estimated as follows ([13]):

$$\begin{aligned} \epsilon_s &= \left( 74,100 \frac{\text{kg carbon}}{\text{TJ}} \right) \left( \frac{1 \text{ L}}{7 \text{ km}} \right) \left( \frac{36 \times 10^{-6} \text{ TJ}}{\text{L}} \right) \\ &= 0.381 \frac{\text{kg carbon}}{\text{km}} \\ &= \left( 0.381 \frac{\text{kg carbon}}{\text{km}} \right) \left( \frac{60 \text{ km}}{\text{hour}} \right) \left( \frac{16 \text{ hour}}{\text{day}} \right) \\ &= 365.8 \frac{\text{kg CO}_2}{\text{day.shipment}} \end{aligned} \quad (6)$$

##### E. The continuous model

With a continuous approach, the change in stock in the finished product warehouse, FG Stock, was expressed as the volume of liquid  $V$  that got input  $I$ , and gave output  $D$  as shown in Fig. 2 ([13], [14],[15]).

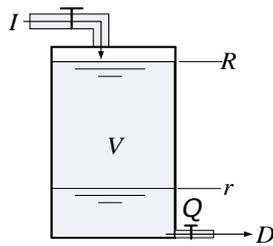


Fig 2. The system is described as a continuous process

The system of equations related to the process in Fig. 1 was expressed as follows:

$$\frac{dV}{dt} = I - D \quad (7)$$

Where mechanism  $(R, r)$  means:

$$I = \begin{cases} I_0 & \text{if } V \leq r \text{ to } V = R \\ 0 & \text{if } V > R \text{ to } V < r \end{cases} \quad (8)$$

The production cycle time was exponentially distributed with an average of  $1/I_0$ , and the demand interarrival time was exponentially distributed with the mean  $WS$ , where:

$$D = \begin{cases} Q & \text{if demand comes} \\ 0 & \text{if demand not comes} \end{cases} \quad (9)$$

The continuous system in Fig. 1 was written in a system dynamics model using Vensim PLE software (Fig. 3). The complete quantification of variables is provided upon request.

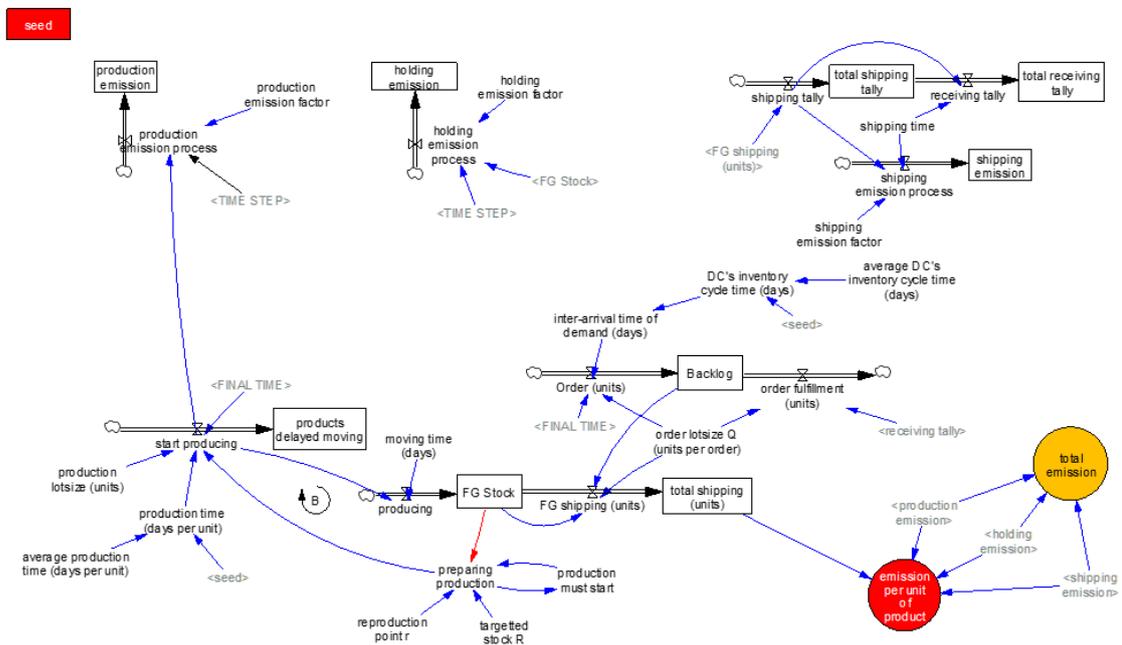


Fig 3. System dynamics model in Vensim PLE for the system in question (the equations used can be seen in the attachment)

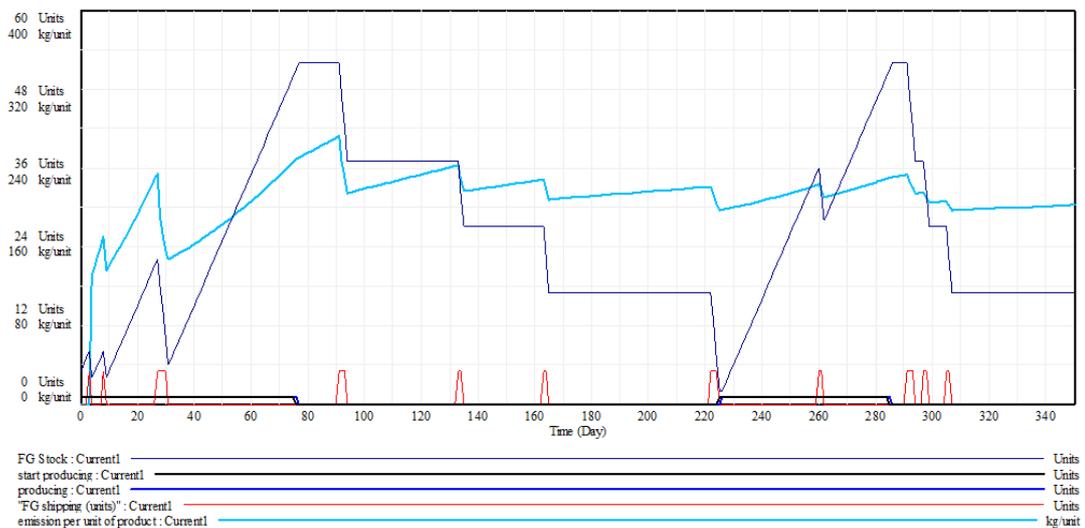


Fig 4. Profile of the inventory level in the FG warehouse, and the amount of emission per unit of product (up to 200 kg/unit) in the case example

F. Numerical example

As a simple example, we discuss a hypothetical case with the following conditions. The factory produced with the mechanism  $(R, r)$ , where  $R = 50$  and  $r = 10$ . Production time was exponentially distributed with an average of  $1/24$  days. The inter-arrival time was exponentially distributed with an average of  $300/24$  days. Demand was always  $Q = 5$  units. Delivery time was  $30/24$  days. Assuming the production, storage, and shipping emission factors had the magnitude as written on the previous pages, the run is shown in Fig 4. The amount of inventory in the FG warehouse is dynamic, which changes when there is production and/or delivery. In this simple example, the delivery is done at the same time the request arrives. Emissions per unit of product, where the average per product is 202.16 kg of carbon, since leaving the raw material warehouse.

V. RESULT AND DISCUSSION

This paper provides a simple example of emissions arising when the system performs production, storage, and product delivery activities. The amount of emissions produced depend on several operational decisions in the system, namely reproduction point  $r$ , targeting stock  $R$ ,

production lotsize, and delivery lotsize  $Q$ . A sensitivity analysis in the example case is carried out by looking at the effect of changes in these variables on the emission quantity for each product unit. The change range, for example, is as follows:  $r$  between 5 and 50,  $R$  between 10 and 200, shipping lotsize between 5 and 20, and production lotsize between 1 and 10 units.

Fig 5 shows the effect of changes in  $r$  and  $R$  simultaneously on the emission quantity. Fig 6 shows the same thing if the shipping lotsize variable is added, and in Fig 7 if lotsize production is also added. Production increases inventory, so emissions are high because of production emissions and inventory emissions. It can be seen that the larger the value of  $r$ ,  $R$ , and production lotsize, especially when in their combination, the larger the emissions will arise. It is also seen that the high emissions have occurred earlier (Fig 7).

Sometimes at that time there is also a delivery activity. Delivery activities cause inventory in the FG warehouse decreases, storage emissions decrease, and shipping emissions arise. From the pattern that occurs, it can be seen which activities provide the most emissions. An optimum setting of those controls can be found, however, it is beyond the scope of this paper.

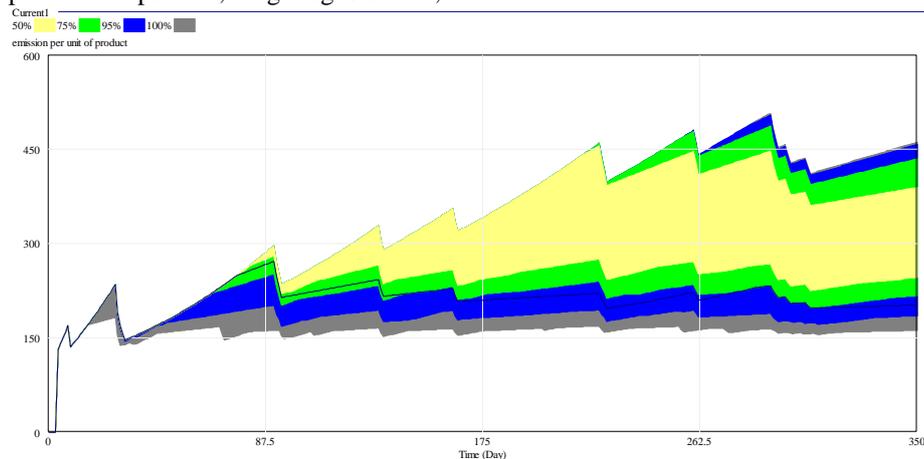


Fig 5. An overview of the emission range that arises (can reach 450 kg/unit) if a variation of the  $r$  and  $R$  decisions is made

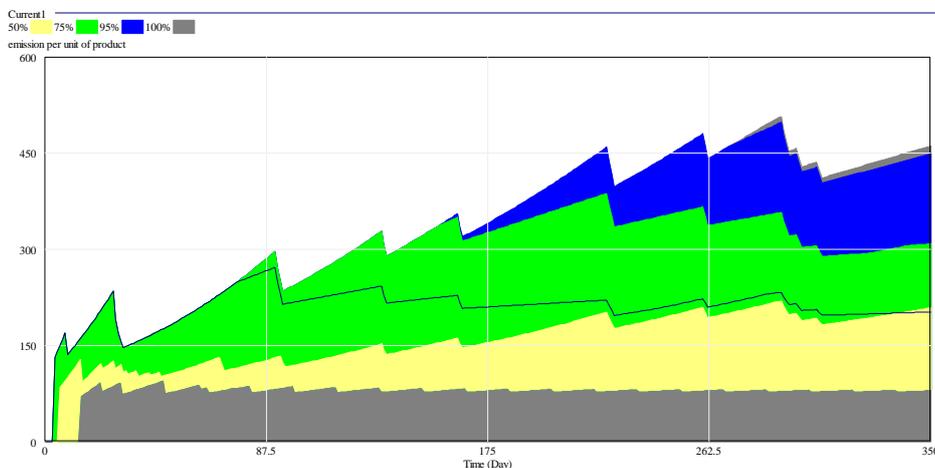


Fig 6. An overview of the emission ranges that arise (can reach 470 kg/unit) if a variation of the  $r$ ,  $R$  and order lotsize decisions is made

## VI. CONCLUSIONS

Industry is needed to increase welfare. However, there are side effects, namely carbon emissions that cause global warming and climate change if fossil fuels are used as the source. A simple model based on system dynamics can be used to reveal the emission when the system is operating. A system of differential equations will be obtained if the dynamics of the system is modeled with a continuous approach. The solution will be quite complicated because there are some limitations in the system of equations.

However, with the concept of system dynamics using Vensim PLE software, for example, the system of

differential equations can be solved relatively easily. The model obtained may be used as a means for simulating and predicting the quantity of emissions that will arise if a certain decision scenario is chosen. However, it is still a simple prototypes. Some next improvements should be conducted. It is recommended for future research to examine in more detail how the system can be set, not in combination, such that the emission is under control. Also, an example of a real supply chain system, which is generally multi-echelon, needs to be examined to give a more specific picture of the concept that has been built.

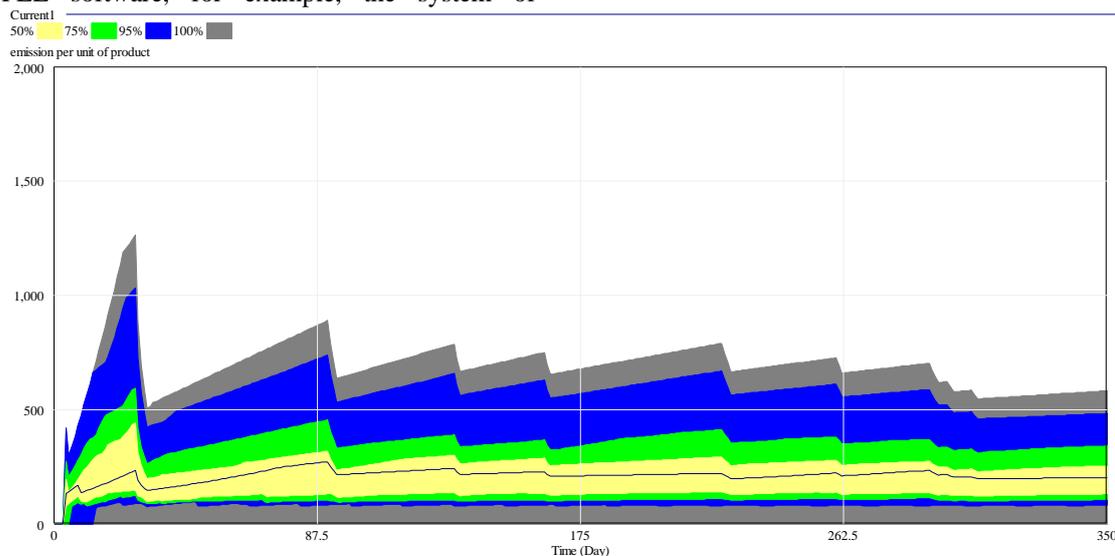


Fig 7. An overview of the emission range that arises (can reach 750 kg/unit) if variations are made to  $r$ ,  $R$ , order lotsize, and production lotsize

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# Exploring the Effects of Social-Economic Status on The Perceived Knowledge on Urban Environment amongst Primary Students Living in Slum Area of Urban Semarang

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**Abstract**— Environmental education especially at early ages for sustainable development is needed to bring dynamic urban life in the future. Semarang as a developing city has developed rapidly in recent years. Infrastructure development and the upgrading of public facilities is a priority for better urban quality. Even slum area has been targeted for development. In the case of Gunung Brintik, a part of the vertical slum area located in the city center has developed in to a tourist destination with a creative makeover in collaboration with residents working well to improve the image of the area. But physical change is not enough to bring quality upgrades. Many aspects have to be considered as a quality upgrading tool. With preserved primary infrastructure, education facility as the backbone of educational development of Gunung Brintik, as children in terms of embracing children lives there. Focusing on formal education, Servatius Elementary School plays a leading role in educating children live in Gunung Brintik area which are specifically poor, lack of environmental awareness, and lack of knowledge of urban basic infrastructure function, living in a poor condition area and with the special family background. To will explore the social-economic impact of environment and urban knowledge among children in the studied area, an interview was conducted to the teachers in Servatius Elementary School based on the grade. Answers were analyzed and compared with the case study to get the base line of the alternative applicable strategy of urban environmental education at the elementary level. The results showed a possible method to apply as the way to educate children in the studied area about urban environment awareness. These results suggest that physical activity is a potential method to gain urban environment awareness for the children in the studied area. On this case, the concept of physical activity should be applied into the education model for elementary level to attract students to learn and understand more about urban environment.

**Keywords**— Poverty, Urban Poor, Urban Environment

## I. INTRODUCTION

Human and the natural environment are an inseparable unity, both interact with each other and in a good living environment will be a harmonious and balanced interaction between components in the environment.

The condition of urban area we live today will change the day and after. The regeneration of citizen and the informatic technology era will change the urban rhythm, and also the urban structure. Kids as the part of citizen also

has the role to make urban area a better place and also the opposite. Physical environments change in urban area caused many problems especially environmental problems which can be an obstacle for urban sustainability goal.

The Ministry of Health shows that only 20% of Indonesians care about the surrounding environment and its impact on their health. This data is certainly a common concern especially in people living below the poverty line who are unable to find an ideal environment for their families. This problem mostly happened to and experienced by the families of students who attend private elementary schools in the city of Semarang located in the middle of the city. The students at this school have special family background characteristics, namely coming from a very low socio-economic status background. Regarding the physical environment, most of them live in unhealthy home environments, inhabited by many people with poor sanitation.

In case of primary students living in slum area in the city center, the urban and environmental problems of Gunung Brintik becomes more crucial. Living side by side with the hype of urban life and technology makes them looks abandoned. Departing from low living conditions and living habits that do not pay attention to the surrounding environment both from the urban and environmental aspects due to the formation of squalid living habits and ignorance of all basic rules and standards in acting in urban areas beyond their consciousness, where such a pattern of life can be a threat to the sustainability and sustainability of the city and the environment in the future, considering they are also part of the next generation that will hold full power and control of the sustainability of the city and the environment.

Therefore, it is very important to educate, foster awareness and instill basic knowledge of urban and environmental planning in children from marginal communities to be able to anticipate the formation of a destructive community in the future

## II. LITERATURE REVIEW

Sustainable Development is a central issue in society. It becomes a new foundation for life and education. Education for Sustainable Development or ESD transforms the concept of education from getting knowledge, attitude, and

skill to applying knowledge, attitude, and skill to sustain life and society for the future [2]. The concept of ESD is based on the agenda of the United Nations for Environment and development [3].

Education on the environment is a long-term solution in solving current environmental problems. The ultimate goal of sustainable development is to improve human quality while reducing the habits and impact of human behavior on the environment. All residents of the city must be actively involved in maintaining and preserving the environment, including children. Education in the family environment is an informal education that is first accepted by children. Therefore, education in the family environment is the foundation for the formation of attitudes and traits of children. The nature and character of the child is mostly absorbed from their parents and other family members [5]. The informal education is needed to support formal education and to get children prepared to accept external supplements in education from school. This is related to the social readiness to successes of the Sustainable Development Goals in 2030. The education background of the parent being a big role in terms of intensity of the informal education. Education by parents in children's learning activities will be theoretically motivate the learning of children and affect student learning achievement, then the socio-economic status factor of parents is suspected to also support student learning achievement and level of understanding. Because if the socio-economic status of parents is high or moderate, it will be able to meet the various learning facilities needed by their children. With learning facilities that can be fulfilled, children can do proper learning activities that will ultimately have a positive impact on the learning achievements achieved [5].

Mainly, education affects environmental health conditions. The level of education is concerned with a person's intellectual level, so it is possible to positively correlate with knowledge, to the environmental problems of society [4].

Children from low socio-economic status mainly suffer from bad condition of life including increased traffic volume on the urban area, pollution, poor housing and residential also makes them vulnerable to [1]. In the condition of low socio-economic status, the role of education is needed more than the highest status or it will make inequalities in society [6].

In Germany, ESD becomes a foundation for the concept of *Gestaltungskompetenz*. *Gestaltungskompetenz* is a concept of key competencies for social relations and natural resources economy and management [2]. *Gestaltungskompetenz* has three key competencies. Those are interactive use of tools and media, co-operate in groups marked by diversity, and act independently. Interactive use of tools and media is a key competency about how to integrate a new perspective and knowledge, anticipate the action and thought, identify and assess risks and uncertainties, and interdisciplinarity. Co-operate in groups marked by diversity is a competency where people can act and plan in cooperation, participate in decision-making processes, and motivate others to act in a sustainable way. Lastly, act independently is a key competency for reflecting

own principles and justice with others, how to act and plan independently, showing and feeling empathy and solidarity.

In Japan, there is “*Kankyōkyōiku shidōshiryō*”, a guide for teachers about environmental education. This guide has been revised three times because of the agenda of the United Nation about the environment. The purpose of this guide is to create a society where people can solve a problem in the environment and society. The competencies in “*Kankyōkyōiku shidōshiryō*” about ESD are the ability to sense the environment, ability to solve environmental issues, ability to process data, ability to utilize information, ability to think critically, manner to form an agreement, manner to determine justly, and manner to participate in environmental protection and conservation [3].

*Gestaltungskompetenz* and “*Kankyōkyōiku shidōshiryō*” applied the competencies not only in formal education but also in informal education. Those two concepts form the students to interact with life and environmental issues step by step. The purpose of the two concepts is the student as the future for society can challenge the environmental and society issue in everyday life.

### III. RESEARCH METHOD

The research method carried out in this research is a qualitative research method that is descriptive and the analysis referred to data and utilized existing theories as supporting material.

In this study, the case study methods was used to study the background, circumstances, and interactions that occurred between cities and neighborhoods against study targets. Case studies are conducted on children of elementary education groups of SD PL Servatius Gunung Brintik on grade 1 and grade 3.

In-depth interview with the teachers of grade 1 and 3 also discussion and interaction with the students become the main primary data of this research.

### IV. RESULT AND DISCUSSION

After the entire series of data collection activities in exploring effects of socio-economic status on perceived of knowledge of environment in primary students was carried out, then the first stage in the primary data collection process was to conduct an interview with the 1st and 3rd grade guardian teachers about the basic condition of SD PL Servatius Gunung Brintik Semarang students as the object of study which is done for get the basic condition of students.

From the results of the interview, important information was obtained related to the background and characteristics of students of SD PL Servatius Gunung Brintik Semarang. From the aspect of concentration level and interest in learning, the results of students' learning concentration skills are only effective 15 minutes out of a total of 90 minutes. This is due to the student's less interest in the objects, as well as the distractions and conditions of the surrounding environment that affect the individual students. The conditions got worse as the pandemic started. This situation showed that study from home is not for everyone. Regarding to the concentration level of students, it shows that studying without total guidance is impossible for them.

From the aspect of economic conditions and the level of education of student guardian, obtained that student at SD PL Servatius Gunung Brintik Semarang are students with lower economic background with low awareness and low parental responsibility in carrying out the role as guardians of students. According to the results of interviews with 1st and 3rd grade teachers who fully understand the condition of each student, it was obtained the fact that the job of the student's parents was not permanent with a fixed income as well. The majority are casual workers, rickshaw drivers, as well as commercial sex workers. So that the family economy was also charged to students as children. In addition to studying in school, students still have the responsibility to earn money to support the household. Even some of their parents stated school and education would only make them poorer.

The condition of the resident's area also shows that they did not try to make their environment clean. Living in a bad sanitation and housing quality became a normal living condition for them, which makes them having low awareness for environment sustainability.



From the chart above, the condition of children awareness in terms of managing sewage and garbage in the residential environment is not in a good condition. The trash can availability was not enough to get children to understand how to manage and throw their garbage including plastic used from their daily activity. This condition mainly caused the area quality worst.

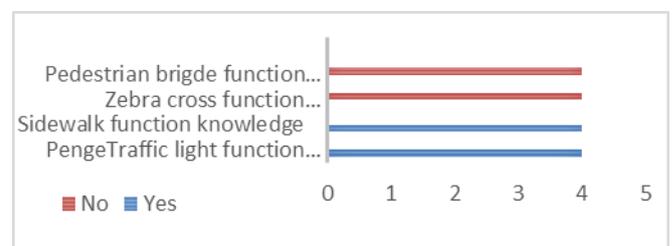
Clean water access is none of their concern. Every household have access to the clean water, and this condition makes children in the studied area can use water whenever they like.



From the chart above, the condition of clean water access is mainly good. They have an easy access for clean water for their daily activity. They even know when they have to wash their hands. But they do not know where the water comes from. The only thing they know is clean water comes from the tap water in their house. Basic hydrology system is far from their understanding. And this condition can be a serious trouble for long term condition of the environment. Children need to be educated for gaining water efficiency awareness by teaching them about basic hydrology system.

In terms of urban and environmental awareness of the object study, the condition of social and economy make a big role in students understanding of do's and don'ts in urban environment. Basic knowledge of basic urban facilities is none of their concern. Living in the middle of the city did not make them understand about the city because of the precedence on their daily life.

Despite of the conditions, students' willingness to study is possible to build with some attractive rewards. They also prefer studying with physically active than sit and listen. As authors talked to the students and discussed about urban and environment matters, students have a big interest of playing and having physical activity in urban space without knowing and understanding about basic manners and urban infrastructure function. This can be a big problem for students' safety and the environment sustainability.



From the chart above, the condition of children awareness and knowledge about basic infrastructure in the urban area is mainly lacking of basic knowledge for the function of infrastructure. They do not know how to cross the street, and this condition can be a potential factor of traffic accident. This condition caused by their environment never teach them how to do in the hectic urban area especially to cross the street, because what they know is just walk when the cars stop without knowing where to walk and how to behave as a pedestrian.

## V. CONCLUSIONS

Urban and environment sustainability is a part of developing a better city. Our responsibility to make the city environmentally save for the next generation. In terms to achieve urban and environment sustainability, any generation should take a part and play a big role. Including children, the next generation who will take control of city we live now should have awareness and knowledge about environmental matters and urban safety. As the agent of change, children should have an enough knowledge and awareness about urban and environment despite of the socio-economic background.

From the condition of Gunung Brintik children, the informal education from family environment is lacking of quality and abilities. That was caused by the low quality and awareness of the parents to gain motivation and understanding for the children to study and exploring the surrounding environment in a positive way.

Learning from the case of Japan and Germany, the education of urban and environmental sustainability should be given in formal education and in informal education. Those two concepts form the students to interact with life and environmental issues. As the characteristic of Gunung Brintik children is more into physical activity, the education

system can be applied. Direct interaction with the nature and urban environment space issues can be a way to help them learn and gain awareness. Teacher and guardian role are also important, as elementary level students still need a guidance to absorb and understand information, simple simulation game can also be a choice as the learning method which can be used in school or played at home with family so parents or guardian can learn together to achieve a sustainable urban and environment.

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# Islamic Spirituality and Socio-Economic Development of Society in The Province of West Java-Indonesia in The Context of Covid-19 Pandemic

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**Abstract**— The strong belief of Muslims that the real leader of Muslims community is Allah Himself has always been the basis of the government system of an Islamic state or Islam-majority state. Religious legitimacy for the leader authority and the socio-economic policy is a must. Islam is a religion embraced by the majority of Indonesian people. Even though Indonesia is not an Islamic state, Islamic spirituality could never be separated from the socio-economic life of the Indonesian society. In this paper, the researchers have concentrated the inquiry on the relationship between Islamic spirituality and socio-economic development of society in The Province of West Java, where in 2019-2020 more than 95% of the population was Muslim. The purpose of this paper was to investigate: 1) the Islamic spirituality that thought and lived by the Indonesian people in the Province of West Java; 2) its relevance to ideal socio-economic development; 3) its stance on the ongoing socio-economic development during Covid-19 pandemic. The method used was a quantitative method using a google form e-questionnaire for data collection. The research subjects were kyai, ustadz-ustadzah, da'i and those who are considered as the key holders of the truth of Islamic teachings. The number of research subjects were 100 people from various regions in the Province of West Java. The main result of the inquiry: Islamic spirituality has advanced development in West Java Province as it is open to universality and plurality.

**Keywords**— *Hadith/sunnah, Islamic Spirituality, Muslim Belief, Religious Socio-Economic Development, The Koran*

## I. INTRODUCTION

The main idea of this paper is the influence of Islamic spirituality on socio-economic development. Hence, the discussion will be divided into three stages. The first, the authors will comprehensively describe from Islamic perspective what spirituality is, what the foundation of the Islamic spirituality is, and how Islamic spirituality affects human personality and behavior. Afterwards, the authors will explain further how human personality and behavior can determine the unique form of social bonds and relations and the typical economic policies in the Islamic society. The second, based on the theory of Islamic spirituality and its influence on how society should be organized, the authors seek to do research on how Muslims society in the Province of West Java-Indonesia implement the spirituality of Islam in socio-economic development in the context of covid-19 pandemic. This research aimed to provide insight to the

readers that religion and spirituality can never be separated from the life of Indonesian people in general and Muslim in particular. By knowing this reality, they, especially those who live in West Java Province, whether they embrace Islam or other religions, can determine what kind of socio-economic development is appropriate and what kind of supportive involvement can suitable for it. The third, the authors, based on the data and analysis of it, provide conclusions and recommendations. The approach used by the authors in this research was a deductive approach, an approach that begins with an ideal description and then how it can be realized in the concrete life. The authors have accumulated information by distributing questionnaires through electronic media to those who have the authority to preach publicly. They, through their sermons, always convey Islamic teachings on spiritual, personal, social, political and other matters to the Muslim community. They, through their statements in their sermons, can also influence the thinking and behavior of the Muslim community. The information obtained will be analyzed by means of quantitative methods.

There is an assumption that every Islam-majority state is always underdeveloped. The authors sought to verify the truth of this assumption in a case study of development in West Java, whether it is true that successful development in The Province of West Java is heavily influenced by Islamic spirituality. Some of the main literature used as a source of scientific reference for this paper are: a) Ragab, in his article “Islam and The Development,” resists the assumption that Islamic spirituality in itself is the cause of ignorance and poverty; b) Abdul-Rahman, in his work “Islamic Spirituality and Mental Well-Being,” elucidates the effect of Islamic spirituality on the human emotional and mental condition; c) Nasr, in his article “The Quran as the Foundation of Islamic Spirituality” and Brohi, in his article “The Spiritual Significance of the Quran” describe the central role of the Quran in Islamic spirituality; d) Hasan and his friends in their work “Islam” in “Voices from Religions on Sustainable Development” explore the influences of Islamic spirituality on sustainable development; e) The Indonesia Masterplan of Sharia Economy 2019-2024; f) West Java Development Policy in 2018-2023.

## II. LITERATURE REVIEW

Humans in general have three main aspects within themselves. They are spiritual, mental, and physical. Among these three aspects, the most essential and influential aspect which is often overlooked by western psychologists is the spiritual aspect [1].

### A. Islamic Spirituality and Human Personality

Term “spirituality” is frequently used in the Christian world. In the context of Islamic teaching, words used to translate “spirituality” are: a) “rūhāniyyah” from basic word “rūh” (Arabic) means spirit, b) “ma’na’iyyat” from basic word “ma’na” (Persian) means spirit, the power of spirit, the reality beyond the material reality, inner journey, encounter with God [2]. Spirituality is the core of human personality because the strong spirituality will be able to strengthen human personality and vice versa flimsy spirituality will enfeeble it. Spirituality is closely related to human faith which includes the trust in God, the closeness to God and the submission to God. Human beings who have an attachment to God will never undergo stress, depression, or other mental disorders because they have no attachment to the material world and they are convinced that God who has created the universe and the lives in it has arranged them in accordance with His will. God, the source of love and justice, will always fulfil the needs of all creatures that He has created. “*And there is no creature on earth but that upon Allah is its provision, and He knows its place of dwelling and place of storage. All is in a clear register.*” (Surah Hud verse 6). Therefore, believers are able to cope with every problem in everyday life calmly and sincerely [3]. Submission to God and His will is a fundamental concept in Islam. Islam itself is the Arabic term which means to surrender to God and to implement His words [4].

There are three sources of uneasiness and worries for human beings in their worldly lives. They are: a) the welfare of life: how they can fulfill their daily needs so that they can live prosperously? could they achieve happiness by having all material things in the world? is worldly wealth the main condition for humans to feel happy? b) the true meaning of life: why they were created by God to live and to work hard in this world if they have to die at last and leave everything they have accumulated and everything they have achieved behind? c) the final purpose of life: is death the end of their existence? Is there any other life beyond earthly life that they have to live? Does the way they live in this world determine how they live in the hereafter? There are so many complicated questions emerge in the human mind that science and technology cannot provide the content answers. In the Islamic perspective, God will take care of the lives of those who believe in Him forever, here in the world and in the hereafter. That’s why there is no reason for believers to worry about their lives. God’s purpose in creating humans based on the Islamic teaching is to appoint humans as His servants and vicegerent to preserve the earth, to care for everything that lives in it and to make use of all available resources for the common good. “And (remember) when your Lord said to the angels: ‘Verily, I am going to place on the earth a vicegerent (Caliph)’” (Surah the Cow verse 30).

That’s the true meaning of every human life. Happiness from the Islamic point of view always includes both happiness in this world and happiness in the hereafter. There is no use for humans to work hard to accumulate worldly wealth because it cannot save them in the hereafter unless they use it to help others, especially those who are poor and suffering. “The Day when there will not benefit [anyone] wealth or children. But only one who comes to Allah with a sound heart.” (Surah the Poets verse 88-89). The maturity of spirituality will generate the maturity of personality. The maturity of the human personality will be manifested in how humans behave, how humans relate to each other and how humans treat nature.

### B. Islamic Spirituality and Human Integrity

Humans have four kinds of relationships that must be carried out in balance. It means that one relationship cannot ignore the other one. The first is human relationship with God (*habluminallah*). “*And I did not create the jinn and mankind except to worship Me.*” (Surat the Winnowing Winds verse 56). This kind of relationship (spiritual) is established by offering prayer (*salah*) five times a day (*fajr* before sunrise, *duhr* in early afternoon, *asr* in late afternoon, *maghrib* after sunset, *isha* at night), offering *dhikr*, reciting the Koran, and delving *hadith*. The second is human relationship with him/herself (*habluminannafsih*). “*O you who have believed, fear Allah. And let every soul look to what it has put forth for tomorrow - and fear Allah. Indeed, Allah is Acquainted with what you do.*” (Surat the Exile verse 18). This kind of relationship (mental) is woven by carrying out self-introspection / self-reflection (*muhasabah*) and training self-awareness. The third is human relationship with each other (*habluminannas*). “*O mankind, indeed We have created you from male and female and made you peoples and tribes that you may know one another. Indeed, the most noble of you in the sight of Allah is the most righteous of you. Indeed, Allah is Knowing and Acquainted.*” (Surah the Rooms verse 13). This kind of relationship (social) is intertwined by interacting with each other in a family, community, or society. The fourth is human relationship with nature (*habluminal’alam*). “*Corruption has appeared throughout the land and sea by [reason of] what the hands of people have earned so He may let them taste part of [the consequence of] what they have done that perhaps they will return [to righteousness].*” (Surah the Romans verse 41). This kind of relationship (environmental) is established by maintaining, preserving, protecting the living environment and using it for the common good without destroying the balance of the ecosystem in it. The spiritual relationship is considered as the solid foundation for the other ones because if humans have a harmonious and profound relationship with God then their relationship with themselves, others and nature will become harmonious and profound as well.

Development in Islamic thought has an integral nature which always keeps every aspect in human life balance, a) a balance in the achievement of worldly and heavenly prosperity, b) a balance in spiritual, mental and behavioral growth in the human personality, c) a balance in the human

relationship with God, with him/herself, with others, and with nature [5]. The principle of balance in Islamic development has been firmly regulated in the five pillars of Islam. The first pillar is *shahadah* (faith), believe in Allah and believe that Muhammad is His prophet and messenger who receives and proclaims the word of God. The second pillar is *salah* (prayer). Reciting the Koran, implementing the word of God in everyday life and praying five times a day have to be done for the sake of the growth of spiritual aspect of human life. The third pillar is *sawm* (fasting) in the month of Ramadan. The fourth pillar is *zakah* (almsgiving). Fasting and almsgiving have to be done to cultivate not only the spiritual aspect but also the economic, personal, social and environmental aspect. In addition to self-control, fasting also aims to control consumption which is correlated with the production, distribution and exploitation of natural and human resources. Almsgivings that are conducted wholeheartedly to the poor and neglected also foster and evolve many aspects other than the spiritual aspect because they train the faithful not to be attached to the private property and to be involved in the development of community or society. The fifth pillar is *hajj* (being on pilgrimage to Mecca). The main destination of the pilgrimage to Mecca is to encounter more intimately with God and with other Muslim communities around the world.

### C. Islamic Spirituality and Socio-economic Development

Socio-economic development from an Islamic perspective is an integral development, namely development that includes all aspects of human life that have been described previously. The balance in development can be achieved only if the ongoing development is based on the Islamic spirituality. Human dignity is always placed at the center point of the entire development process as though an anchor for a boat. Every development process must be imbued with human dignity and directed towards the respect for human dignity. Hence, socio-economic growth cannot be defined merely as the growth of consumption, production, income, wealth and property that results in the enhancement of social status. Islam never forbids people to seek as much wealth as possible, but Islam cannot justify the existence of social and economic inequality and injustice [6]. Islamic economic system will never be separated from Islamic spiritual values. In a very simple definition, an economic system is a system for distributing scarce resources effectively and efficiently in such a way that it can meet the needs of all generations, both present and future generations, without curtailing human freedom and creativity [7]. Islamic spirituality opposes all systems that hinder the realization of justice in the world [8].

Indonesia as Muslim-majority country has the potential to implement *shariah* socio-economic system. The Islamic principles which are based on The Koran and Hadith are called *shariah*. Religious almsgiving such as *zakah* (obligatory) and *waqf* (voluntary) can be used as a significant option to overcome the problem of poverty and unfair income distribution in Indonesia [9]. For Muslims, refusing to pay *zakah* is the same as rejecting the truth of

Islamic teachings conveyed by God through the His prophet Muhammad. The principle of *zakah* utilization in development is very different from the principle of taxation. *Zakah* is exclusively used to help poor people to improve the quality of their lives. Hoarding of wealth usually done by capitalist is something that Muslims should not do, so that through *zakah* Muslims can return their excess wealth to the people in need [10]. In “Indonesia Islamic Economic Masterplan 2019-2024”, Indonesian Ministry of National Development Planning inform that Islamic economic in common includes financial, philanthropy and the real sector that have applied for *halal* certification. In simple terms, the economy of Islam can be defined as the economy of *halal* based on Islamic law (*shariah*) [11]. The influence of Islamic spirituality can be observed in the formulation of vision and mission of West Java Province Government. The vision is “The realization of the champion of West Java physically and mentally with innovation and collaboration.” In the first mission formulation, the role of mosque and the worship place as the center of civilization is really crucial. The target of this mission is the Islamic boarding school-the champion, the mosque-the champion, the ulema-the champion [12].

### III. RESEARCH METHOD

The tool of research used by the authors in obtaining data was e-questionnaire, a kind of questionnaire compiled using the google-form application and distributed via social media to respondents. The number of respondents who sent responses was 100 people. All respondents were people, male or female, who had a very strong Islamic background of education and knowledge. They have been living in the Province of West Java. Moreover, all of them are people who have the task of preaching to convey publicly Islamic teachings so that their knowledge and opinions will greatly and massively influence the opinion of Islamic community. The types of questions were grouped into three major sections, namely questions about Islamic spirituality, questions about the meaning of the Covid-19 pandemic and the relationship between Islamic spirituality and the socio-economic system. In each question, the authors have prepared 4-5 answer options and 1 blank line (“other” option) that could be filled freely by respondent.

The method and tool of research chosen by authors were very convenient to the research objective to compare the ideal and the real, the universal and the local. The context of Covid-19 pandemic is the real context to gauge the implementation of respondent Islamic spirituality as in this context many people fall into poverty or experience socio-economic hardships.

### IV. RESULT AND DISCUSSION

Based on the data in table 1, the authors can describe the characteristics of respondents. Most respondents were male. It is intensely usual in the culture of patriarchy that domination of religious truth is in the hand of male. Almost all respondents opine that they are Muslim since they were born. In terms of age, they are mature people and in terms of Islamic formal education, most of respondents have received a good education from the undergraduate level to

the doctoral level and they have been working in the field of Islamic education. They teach the truth of Islamic teaching to the Islamic congregation as well in their preaching in the Province of West Java.

Table 1: Characteristics of respondents

No.	Themes	Responses	%
1	Sex	Male	88%
		Female	12%
2	Muslim since	Birth	96%
3	Formal education	Doctoral	35%
		Master	31%
4	Field of work	Undergraduate	22%
		Education	84%
5	Age	>50	29%
		46-50	27%
		41-45	25%
		36-40	6%
6	Appellation	Ustadz/ustadzah	53%
		Kyai	15%
		Da'i	2%
7	Frequency of preaching	Once to twice a week	55%
		Three times to ten times a week	33%
8	Location of preaching	The province of West Java	81%
		The province of West Java and other provinces in Java	4%

Table 2: Islamic spirituality

No.	Themes	Responses	%
1	Deepening Islamic knowledge	Formal education	88%
2	The main elements of Islamic spirituality	Love for God	53%
		Submission to God	33%
3	Evolving Islamic spirituality	Reciting, studying the Koran & hadith	91%
4	Islamic virtues	Self-control	89%
5	Islamic spirituality & the humanity	Islamic spirituality awakens humanity	88%
6	Islamic spirituality & the plurality	Plurality enriches Islamic spirituality	47%
		Plurality does not conflict with Islamic spirituality	41%

Based on the data in table 2, the authors can describe that formal education is still the main means of passing on Islamic knowledge to the next generation. Religion-based formal education, from the lowest level to the highest level, will always be in demand by the community and religious education teachers have a very significant role. Personal relationship with God (love and submission) is the essence of Islamic spirituality. The way to love invisible God is to read and obey His words which had been revealed to all mankind through the Prophet Muhammad SAW and written in the Koran and Hadith [13], [14]. Divinity cannot be separated from humanity. The closer a person is to God, the Creator of all mankind, the closer he is to mankind. Islamic spirituality fosters the spirit of humanity. Islamic spirituality helps shape the human personality into a human being who has firm self-control. Since Islam is believed to be the last

religion that completes the previous religions, so not many respondents think that other religions can enrich Islamic spirituality.

Table 3: Islamic spirituality and socio-economic system

No.	Themes	Responses	%
1	Human prosperity	Blessing from God	69%
2	Causes of poverty	Sloth	65%
3	Human well-beings	The balance of spiritual, social, and economic aspect	99%
4	The foundation of socio-economic system	The foundation of	100
		The Koran, hadith	%
5	Earning a living	In accordance with spiritual values	99%
6	Utilization of wealth	Includes social responsibility	100%
7	The purpose of Islamic socio-economic system	Social justice for all mankind	98%
8	Earthly welfare-heavenly welfare	Earthly welfare has nothing to do with heavenly one	78%

Based on the data in table 3, the authors can describe that most respondents opined that human prosperity is a gift from above. Even so, human effort is still needed to reach it, even though it will be in vain without His will. However, earthly welfare has nothing to do with heavenly one. Since God's will can only be known in the Qur'an and Hadith, then the Koran and Hadith must be the foundation of the socio-economic system. Spiritual aspect is included in human socio-economic well-beings. Socio-economic system cannot be freed from spiritual values. Every religious person has a social responsibility in the use of wealth for the welfare of others, especially those in need. Finally, the purpose of Islamic socio-economic system is social justice for all mankind. The openness to universality and plurality is at the core of Islamic spirituality in advancing development [15] [16].

Table 4: Opinion on Covid-19 pandemic

No.	Themes	Responses	%
1	The meaning of Covid-19 pandemic	Test of human faith from God	72%
2	Health protocols	God sets the rules	64%
3	Islamic spirituality theme in mind	Repentance and forgiveness	69%

Based on the data in table 4, the authors can describe that most respondents never considered an event as it really was. As religious people, they always interpret it from a religious point of view. They strive to find behind every event what God is thinking, what God is expecting, and what God is doing. Divine reality always exists behind human reality and controls it. Covid-19 pandemic is regarded as a test of human faith from God. The human response expected by God is their repentance from sins. Health protocols are considered as the rules set by God Himself through the medical team.

In the era of the Covid-19 pandemic, many people lost their jobs and income due to the policy of limitation or

restriction of society activities set by the government to prevent transmission of the virus. Poverty and the inability to meet the necessities of life pose a threat to people's lives in the household [17]. This problem is one of the many problems that have come up due to the COVID-19 pandemic. However, most respondents seemed to find it easier to relate the disaster to the sins people have committed so that the religious theme that always comes to mind is the theme of repentance and forgiveness of sins. Human sins always lead to disaster. Only a quarter of the total respondents were inspired by the theme of service and good deeds. If the Covid-19 pandemic is a trial from God then God alone is able to cease it and only human repentance can touch God's heart to put an end to it. This problem becomes more complicated when in fact many good people are affected by disasters and many bad people are spared from disasters. The justice of God in this case is at stake.

#### V. CONCLUSIONS

In itself, Islamic spirituality is by no means a retardation to socio-economic development. Surrender to God which is the essence of Islamic spirituality does not negate human freedom at all. On the contrary, this such an attitude gives true freedom to mankind. God Himself wants justice to be manifested throughout the earth. Complying with the word of God will eschew the human from injustice. Muslims in Indonesia and especially in West Java Province have always longed for and fought for the official and legal implementation of shariah in all aspects of life. They will support the ongoing development in Indonesia as long as it does not conflict with Islamic law.

However, this should be addressed carefully and wisely by Muslims because if they fall into the extreme position that the application of sharia in development makes Muslims close themselves to universality and plurality and focus on both building themselves and discriminating against those who are different from them then they are contrary to their own spirituality. What happens then is only enmity, chaos, or hatred. Therefore, social justice for all mankind in the teachings of Islam will never be realized.

As a matter of fact, if development in Indonesia is consistently carried out on the basis of Pancasila and the 1945 Constitution, it will never contradict Islamic law because the realization of social justice for all Indonesia people is the goal of both of them. The values of Pancasila are the values that are also internalized in every religion. Finally, for the next research, the authors recommend a theme that needs to be explored, namely “Islamic Finance System and Development in West Java Province.”

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# The Culture and Gender's perspective among SME's Female Entrepreneurs: A Comparative Studies in Malaysia, Japan, and Indonesia

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**Abstract—** Female SME's expertise has a relatively significant role in the economic sector of the Asian Region. The opportunity, the comfortable living environment, and the openness of the global economy have made them economically secure by running small business enterprises yet has to be opposite to the gender's perspective. The purpose of this study was to investigate the factors that influence female immigrants to run their businesses and their experiences in responding to the phenomenon of gender differences in their social relations. This study emphasises observations and interviews using the theoretical approach of Feminism Post-Structural Discourse Analysis with field observations and interviews of respondents. The researcher has found that long-standing migrants in Japan are even considered *Seikatsusha*, particular Japan philosophy in living society. Likewise, female's SME expertise from Japan in Indonesia have even mingled like most people. Different phenomena happened among Japanese migrants in Malaysia and Indonesian female migrants in Japan.

**Keywords—** *Entrepreneur, Female Migrant, SME, Gender*

## I. INTRODUCTION

In many aspects of life in society, men dominate in many affairs outside the household, especially in business. Some data and facts show that men dominate business groups. This phenomenon also occurs in the business affairs of entrepreneurs. World Bank data shows that only one woman becomes a business owner out of 3 male businessmen globally. In the Asian Region, during the 2014-2018 business year, only 20-30% of women controlled the Small Business Entrepreneur (SME) market share, while the rest were men who accounted for 70-80% of the total market share of small and medium enterprises.

This phenomenon occurs in variations in 3 (three categories) countries with low, middle, and high incomes. The World Bank noted that only 10-20% female SME business owners, while countries with middle to high incomes can reach 30% of female business owners, while male entrepreneurs own the rest.

In general, several factors influence the lack of women becoming entrepreneurs compared to men. Research in psychology reveals that men have better management skills because of better emotional influence than women. Men's thinking abilities are also considered more realistic and rational than women. Therefore, men's management skills are considered not to be superior to women, even though

women are proven to have tolerant, flexible, and no less creative and energetic characters than men. Unfortunately, the character of women tends to be emotional excess. So that the positive workability of women will affect the management ability of women leaders when dealing with other people, be it employees, co-workers, and other stakeholders in their business.

## II. LITERATURE REVIEW

Likewise, the results of a study by a researcher in management, Rosebeth Moss Kanter, on 14 female company leaders in the UK. Stakeholders depict these female company leaders in 5 stereotyped traps described in their colleagues and employees' eyes. The five stereotyped traps are *pets*, *seductress*, *mother*, *Iron Maiden*, *Queen Bee*. The character adapts to the way each female company leader treats or communicates with colleagues daily: (1) **Pets**. This stereotype describes a female leader who runs a business using interaction and communication patterns in a humorous and fun style. Her co-workers have given her this nickname because she is sweet, funny, and such a comfortable leader even though she remains firm to her subordinates. Unfortunately, a figure like this is considered less skilled as a leader, (2) **Seductress** This stereotype describes a leader who only relies on personal charm rather than workability. Anyone who knew her thought that she uses sexual attraction as part of their work interaction and communication patterns to have many conveniences in working. However, people think that they are a threat to their female co-workers because their charm attracts many male colleagues and bosses to succeed, (3) **Mother**. This stereotype describes nurturing, loving, protecting's figure who always tries to be close to almost all stakeholders. This figure is respected and respected because he is considered a professional, critical, and supportive figure. (4) **Iron Maiden**. People give this nickname to the most authoritative female leaders because they are aggressive, masculine, and work with an iron fist. Some think that this group is workaholic women who do not seem to need a man at work. On the other hand, they are seen as stubborn, scary, difficult to approach, often like to pressure subordinates and co-workers. (5) **Queen Bee**. This stereotype describes a person who threatens the existence of female colleagues or superiors. Baxter (2012) describes this figure as a female leader who only focuses on her performance, a single fighter, dominant, and aggressive. The results of their hard

work make them competent women who can compete with anyone but are reluctant to be rivalled and do not want to be defeated. These characters are a combination of both masculine and feminine characters.

This article revealed how the empirical experiences of women, small and medium-sized businesses ran. This research revealed the perspectives, perceptions, and communication patterns carried out in running their daily businesses. The research objects were female migrants who have SME businesses in the destination countries. These seven informants were in 3 (three) countries, namely Indonesia (INA), Malaysia (MY), and Japan (JPN). The seven respondents were:

1. Hanae (HN), migrant from Japan in Indonesia
2. Sayuri (SY), migrant from Japan in Indonesia
3. Midori (M), migrant from Japan in Indonesia
4. Takayoshi (T), Japanese migrant in Malaysia
5. Kim (K), a fellow of female migrants from Japan in Malaysia
6. Eva (E), a migrant from Indonesia in Japan
7. Nurjanah (N), a migrant from Indonesia in Japan

The informant selection strategy as sampling in the study was purposive sampling technique, in which researchers determined and searched for informants based on criteria that were following the research topic. As stated by Oliver C. Robinson, the strategy of taking purposive sampling that represents the project topic or topic being studied requires certain categories of informants who are different but can answer the essential questions. Therefore, the researchers chose informants who have criteria as migrants who originate and are domiciled in Malaysia, Japan, and Indonesia. In addition, due to the pandemic period, it is not easy for researchers to choose informants who are willing to meet or share their experiences with others.

The informants described internal and external factors influencing their decisions and comfort in running micro and medium enterprises in the destination country. There are internal factors (self-character, the culture of the country of origin, family support, and personal motivation) and external factors (government regulations of the destination country, cultural constraints, gender perspective, and social environment support). The two factors, namely internal and external factors, are the most influential variables in the decisions and resilience of these migrants running SME businesses in the destination country.

The more comprehensive economic openness, globalisation, opportunity for all people from various nations to seek a better life abroad are the main reasons for migrants to survive in the destination country. Nurul Aeni noted that the increase in remittances from women migrant groups always experienced a significant increase from year to year. By remittances, the poverty rate is reduced, and even able to improve the standard of living of people from immigrant countries and regions so those migrant families can get out of poverty. During the 2013-2017 financial year, the number of female Indonesian migrant workers is dominant, accounting for 70% of Indonesian workers abroad. As many as 95.9% of Indonesian female migrants explained the reasons for becoming migrants to get a better

income. The rest were on the grounds of the unavailability of job opportunities and the desire to get new experiences.

The phenomenon of globalisation also opens up opportunities for the high number of migrants coming and going from one country to another. The revolution in information technology, communication, and transportation increases the high dynamics of the movement of people from one country to another to migrate. Besides increasing remittances, the dynamics of human migration migrating between nations also affect cultural patterns, skills and knowledge transfer, economy, and technology between countries.

### III. RESEARCH METHOD

The authors used in-depth interviews with the seven informants mentioned above. The researcher used in-depth interviews to find out more about the experiences of each informant so that they could answer the research questions.

In the tradition of qualitative research methods, in-depth interviews allow researchers to dialogue with informants and focus on informants as samples. Through interviews, researchers can focus on the informants' perceptions and feelings towards the objects and issues studied because they will get the depth of the informants' thoughts, ideas, and real problems. This article used in-depth interviews that have a flexible nature allow researchers to develop questions according to the process of interpreting the answers submitted by informants. The in-depth interview step begins with the life experiences of the informants, followed by digging up information about the background, reasons, motivations, perceptions, and communication patterns of each informant. The researcher then used it as material for analysis and then synchronised it with the study of the theory used.

In the interview stage, the researcher used discourse analysis to find out the words and language used by the informants when explaining the phenomenon of communication patterns that were built together with stakeholders. The analysis technique in this study used the relationship between the concrete experience of the informant and synchronises it with theory, namely Feminism Post-structuralism Discourse Analysis (FPDA). FPDA developed by linguistic researcher Judith Baxter will identify names, classifications, self-identity, speech, and self-image of communication patterns between women and the parties associated with them in everyday spoken language. Through discourse analysis, the researcher could see the power relations that arise through the choice of words and language by female informants with related parties. The researched could also see how the social environment supports migrant workers who have SME businesses in neighbouring countries through discourse analysis. Through interviews that focus on language and words, researcher could deconstruct the true meaning of patterns of interaction and communication between informants and the parties associated with them. FPDA analysis identified the language characteristics and words that representation in qualifications, including:

1. **Name and nickname.** That is the choice of words to designate the subject in the interaction. It can be a

name or other designation that refers to the identity of the subject

2. **Classification** is part of the labelling of the subject as part of the labelling in work relations, social relations, both personally and in groups. It refers to the activities of the subject of the actor. For example, words used with facts of age, occupation, or other particular identities.
3. **Self-identity** is related to the assessment used by others who pay attention to the behaviour of the subject.
4. **Speech**. In the form of words or ways of communicating conveyed to the subject directly, be it colleagues or other people who interact with the subject.
5. **Image**. In the form of images, metaphors, or other symbols, they refer to the depiction of the subject conveyed by the other party.

In this descriptive qualitative study, the researcher adopted the Fairclough model of critical discourse analysis to identify language and word choice. The method of critical discourse analysis of the Fairclough model used the integration of three levels of analysis, namely:

1. Textual analysis (micro-level) is a descriptive analysis that focuses on the dimensions of the text.
2. Analysis of discourse practice (Meso level) which focuses on the interpretation of the distribution, production, and consumption of discourse
3. Socio-cultural analysis (macro-level) whose analysis is more explanatory in the socio-cultural context of the emergence of a discourse

#### IV. RESULT AND DISCUSSION

Fairclough's critical discourse analysis uses 3 (three) dimensions of analysis, textual analysis (Macro level), discourse analysis (Meso level), and socio-cultural analysis (Micro level). The language and phrases were used to identify the subject as described in the FPDA theory. The FPDA theory developed by Judith Baxter puts forward the emergence of gender power relations that are integrated into the language and social power, especially in individual subjective experiences. The dismantling of the discourse on gender power relations appears in many ways, ranging from conversational practices, texts, and social practices through everyday language. In this article, the researcher did not analyse the text through text. The identification analysis technique records the words and language through the conversation's process.

Meanwhile, the meso level identified the concrete experiences of the informants from relationships and interactions with other people or groups that are directly related to the research subjects. Like the definition of discourse analysis, words and language will be constructed or disassembled in the context of social experience . The researcher then continued the interpretative process to understand the true meaning of the facts expressed by research subjects. At the macro level, the same technique also occurred.

#### A. Micro Level

Of the seven informants in this study, some things became the findings in this study at the micro-level, namely the motivation of each informant to choose to become migrants to their respective destination countries. Each informant had a different motivation to come as migrants so that it would also affect their chances of establishing themselves as micro-enterprises in the destination country.

Table 1. Motivation of Arrivals as Migrant to Destination Country

Name	Origin	Dest	Arrival Motivation
HN	JPN	INA	She loved Indonesia since young (since college) and felt comfortable living in Indonesia and getting to know Indonesia more while studying at the Indonesian Art Institute, Yogyakarta and decided to live in Yogyakarta in 2003 because she later married a man from Indonesia and opened a floor ceramics production in Yogyakarta
SY	JPN	INA	She loves Indonesia because she has visited several other countries in Europe and Asia but feels most comfortable living in Indonesia and decided to live in Bali in 1992 and married an Indonesian, so he decided to stay in Indonesia by doing furniture and art business in Bali.
M	JPN	INA	Firstly, she is looking for a job, and from the beginning got an offer to work in Jakarta from a friend from Japan and had come and went Indonesia-Japan until finally decided to stay in Indonesia since 2016 and opened a snack shop.
T	JPN	MY	A woman from Japan chooses to live in Penang, Malaysia, because she follows her husband, who works in a Japanese company that opens a branch office in Malaysia, so like it or not, she has to follow her husband to live in Malaysia and together with a community of fellow Japanese women in Penang to do handmade works to be offered and sold to fellow Japanese or other Malaysians
K	JPN	MY	Choose to live in Malaysia because he follows his husband, who works in a Japanese company in Malaysia. The main task and goal are to take care of the family, especially the child who has to stay close to his husband, so she must follow his husband who works in Malaysia.
E	INA	JPN	he liked challenges and wanted a career abroad that was financially promising, met and married a man who worked as a migrant worker in Japan and followed his husband to move to Japan in 2017 and became a nurse as well as an entrepreneur by selling Indonesian products in Japan
N	INA	JPN	Following her husband's higher education at a university in Japan, she has expertise in the Japanese language and has known Japan since college and has worked as a Japanese translator in a Japanese company. She moved to Japan along with her husband's education in 1995 but then decided to open a halal bakery in 2010

According to the interviews with each informant, this article shows that the motivation and background of the female migrants who finally decided to stay and open an SME business in the destination country was intertwined from the influence of their previous life experience and knowledge about the destination country. After they got to know the destination country, these migrant women were

more confident in deciding to stay in the destination country as migrants because they met and married a partner who comes from or works in the destination country. The decision also settled down by the husband's decision.

"I came here and listened to the *Gamelan* of the Solo Palace and *Mangkunegaran*<sup>1</sup>, and I fell in love. Furthermore, I might be interested in the culture here too. His way of life is relaxed, yes friendly. After that, I felt like coming here again. Continue to come next year too. Then I want to live in Indonesia even more." (Hanae, 2020)

"Previously, I was a nurse in Medan, but then my husband was accepted to work in Japan, so six months later, I followed and worked at the hospital. But now also make a business selling goods from Indonesia to Japanese people online" (E, 2021)

The findings are slightly different for informants from Japan in Malaysia. The decision to follow their husbands motivated female migrants in Malaysia. However, they admitted that they did not know the information or had no picture of life in the country where their husbands work in Malaysia.

"At first we Japanese did not have any idea what Malaysia would be like, but because my husband was assigned to work in Malaysia, inevitably this Japanese woman decided to move to Malaysia even though at first the purpose of joining was only to take care of children," (T, 2020)

In other words, on average, they made decisions as migrants because of the influence of their current situation and conditions. When the partner (male) decided to stay in the destination country, these female migrants followed that choice and felt more confident in deciding for their life steps because they followed the partner (male). Against the background of this decision, having an SME business with an economic motive was also not the goal for them to become migrants in Malaysia.

An informant conveyed the same motivation from Indonesia in Japan. The reason for following their husbands and being a family carer was because their husbands work in Japan, making them choose to become migrants in Japan. Once there was an opportunity to become an SME entrepreneur, they did not hesitate to start an SME business. Primarily because of the financial benefits they got, as well as support from outside parties.

### B. Meso Level

Concerning the meso-level discourse analysis, the researcher describes the research findings regarding the support from the closest people and families that made these migrant women decided to settle down and opened a business in the migrant destination country. This analysis interprets the results of the interviews of informants that revealed how the role, support, and encouragement of families in their decision to leave their origin country.

From the findings of in-depth interviews from the respondents, the research concluded that the family support for these female migrants is also inseparable from the husband's role. The husband's role can be used as a guarantee for the family to allow women to migrate to other countries. This guarantee of a husband's presence even

seems to be a requirement for women to migrate, even though these immigrant women usually travel abroad or long distances on their own. It can say that the independence of these migrant women is not convincing enough for the family to allow these women to migrate to other countries.

Table 2. Family Support

Name	Origin	Dest	Family Support
HN	JPN	INA	Feeling comfortable living in Jogja, she has time to return to Japan before finally feeling like going back to Jogja. His mother was unfortunate to hear about HN's decision to move to Indonesia because he wanted HN to stay in Japan by becoming a Gamelan teacher. However, because they decided to marry an Indonesian, their parents let go because it would guarantee her life and future. In the early period of business matters as an SME entrepreneur, she relates to her husband to build relationships with others. Over time and adapted to her husband's character, HN chose to take care of the office more.
SY	JPN	INA	She started to travel to several countries (including Europe and several other countries in Asia) at a young age, so she did not think about how his family would respond as long as he was comfortable with it himself. Her husband's support is not much because the furniture and antique business are related to Japanese people, while her husband is Indonesian. Therefore, she is mostly running the business affairs and relations alone.
M	JPN	INA	She came to Indonesia because a sponsor guaranteed a job, so he left Japan for Indonesia with the belief to find a better life. The family also let go because M has an older sister who can take care of her mother, so she feels comfortable leaving her family for a better life and job than in Japan
T	JPN	MY	She has the principle that married Japanese women have the primary responsibility for the family. When the husband has a work assignment to another country, the woman is obliged to care for the family. Opening business opportunities in any field is not an obligation because the main task of living in Malaysia is for the family. After the business in Malaysia is over, everyone will return to Japan
K	MY	MY	Having 2 Japanese female friends open a Japanese ceramics class to fill activities is not their primary business because their main job is to take care of their family. They open and serve customers who want to take ceramic workshop classes with their husbands' permission and after they finished the household affairs. In terms of ceramic gallery business activities, both partner with local people who have totality and more flexible time than the 2 Japanese women they work with.
E	INA	JPN	Once married, there is no longer any reason for E to refuse migration to Japan. Husband has a guarantee of working in Japan so that economically, security guarantees and the comfort of living in Japan do not need to doubt. Deciding to work and have a micro business in Japan is also with the permission of the husband because the business policy in Japan is not

easy, so it requires the help of a husband who has access and convenience in administrative matters with the Japanese government

At first, she did not think about opening a business. She decided to migrate to Japan after marrying an Indonesian husband studying at a university in Japan. After 18 years of living in Japan and his three children growing up, N had the opportunity to take a baking class. Armed with the experience of youth from a family that owns a cake business, N is finally allowed to own a cake business with the help and supervision of his husband as a person who is more familiar with the Japanese environment and government regulations.

N INA JPN

Likewise, for the decision to open a business in the country of migration destination, it is entirely the authority of the husband of the migrant woman whether to allow the migrant woman to have an SME business or not. Especially for migrants in Malaysia and Japan. The influence of local government regulations is pretty strict and does not make it easy for migrants to open businesses in those two countries.

"This Japanese woman who joins her husband in Malaysia tends not to have the intention to do business economically. If they want to open any business, they must partner with local people, so some who want to increase their economic income are relatively using the network of fellow Japanese here. They will manufacture goods and sell them only to Japanese people, so it has nothing to do with local government regulations." (K, 2020)

The reason for the economic stability only occurs to Indonesian migrants. The primary purpose of their arrival as migrants in Malaysia was to accompany their husbands who work in Japanese companies in Malaysia. Local government regulations and short work contracts have prevented these Japanese migrant women from working in Malaysia as something that should be maintained and pursued. For the Japanese migrant in Malaysia, the husband's salary guarantee, which is more than sufficient to finance the needs of family life in the destination country, made these immigrant women did not make the SME business they run a necessity.

However, different findings appeared in Japanese female migrants in Indonesia who were not so dependent on their business from their husbands. The influence of the philosophy and culture of Japanese people who are accustomed to a culture of hard work and doing things fast-paced, while according to two informants, the character and culture of Indonesian men are relatively more relaxed. Therefore, in business matters, when they already know how to run business management, then all business matters can be done by themselves.

"Firstly, I depending on my husband, but because my husband is relaxed and more into the arts. Slowly I handle my office matters while my husband only does what I want and encourages him to do or pass it on to people." (HN, 2020)

"My husband originally came to Japan for studies so I could not bother him with my baking business. Only when I conveyed my intention to open a cake shop did he support my intention, also because he knows that I have baking skill since

my mother had a cake business in Bandung, so she allowed it" (N, 2021)

### C. Macro Level

On a broader level, namely, how the social environment supports migrant women who have SME businesses in the destination country, the researchers found relatively diverse facts from each female migrant in different countries. The research revealed that the character of each migrant and the country origin's culture also influenced the attitude and character of each female migrant in running a business. The responses of the seven informants to the social support question point were different from one another.

Table 3. Social Support

Name	Origin	Dest	Social Support
HN	JPN	INA	Since the beginning of his stay in Jogja, he did not intend to be close to other people, just like what he usually did when he was young in Japan, which tended to be apathetic and individualistic. The informants also know that there are rules for socialising with neighbours or the environment, but it is only for business purposes, not other social life. From the beginning, they relied on their husbands to build relationships with their husbands, but over time they could adapt and have their way of socialising without depending on their husband
SY	JPN	INA	The informant feels dominant because he is the boss, so he has very high self-confidence and thinks anyone should submit to him. Japan's robust culture makes it adopt more professional communication patterns, emphasise firmness in attitude, and be more open in expressing opinions and thoughts.
M	JPN	INA	She assumes that she came to Indonesia to work and be a boss. She did not depend on relationships with other people in many ways, including in terms of work. She can do everything herself and feeling a very striking cultural difference because she feels that the sexist culture in Indonesia shapes the character of the female employees to be more spoiled, unlike her.
T	JPN	MY	The Japanese community in Malaysia is so strong that it does not rely much on outsiders outside the community. This also influences the initial intention of Japanese migrant women coming to Malaysia to take care of their families. At the same time, their husbands have work contracts with companies in Malaysia, so that many community members cannot speak languages other than Japanese. As a result, relations with outsiders outside the Japanese community were very limited, almost non-existent
K	MY	MY	Usually, they are very secretive and do not want to interact with outsiders much. They want to focus more on their family and only want to connect with people who have a pressing interest in them. Even for business matters, because they partner with local people, there is a tendency for business affairs to be handed over to their local partners, and they only receive reports. In other words, the role of local partners is essential for the sustainability of their business here
E	INA	JPN	Her husband had been to Japan 3 (arrival) months earlier, so there were only a few psychological problems. In addition, before coming to Japan, he had provided Japanese

language skills so that the situation became more comfortable because he was familiar with Japanese neighbours who often exchanged food or even left their children when the informant had a sudden need. Likewise, for SME business matters, informants can offer products to their Japanese neighbours or friends personally and only among their closest circle. However, due to strict business policies, the informant did not refer to his business as a business because that definition would clash with the many rules and regulations of the Japanese government, which are very strict for someone who does have a business goal.

As a Japanese literature scholar, the informant already has excellent Japanese language skills. A husband who has taken higher education in Japan is also related, so the language barrier is no hindrance. When she starts an SME business, it is precisely because she has lived in Japan for ten years and had the opportunity to take a course in making halal cakes. The opportunity developed with assistance from the local Health Office, which was carried out at the local *yakusho*, precisely in the regional library for four years. Any technical obstacles are also helped by the Health Service so that from the beginning of preparation to the informant's cake business can run even though he is an immigrant.

N INA JPN

Informants with Japanese cultural backgrounds who have cultural backgrounds from the country of origin also influenced how the informants responded to social phenomena they faced in the migration destination country. In addition, government regulations of the destination country and support from the social environment also influenced how these migrants showed attitudes in relating and communicating. HN felt that social relations were unnecessary because she has never met such a tradition and practised it while living in Japan.

"When it comes to relations (with residents in Indonesia), I rely on my husband. Yes, especially in early times. Now because I have settled in my own house, so I try (by myself). Try to come along. So there was a wedding that I contributed to. I saw a child was born. When it comes to a social gathering, I do not. There is a name for that *chonaikai*, like *arisan* (in Japan). However, there is no (sort of) social gathering to collect money. However, the *chonaikai* is a collection of residents who talk about the same problem, roads, or garbage. Maybe it is because I am a foreigner, but I am also a bit lazy in Japan (to participate in such activities)" (HN, 2020)

From the interviews with informants from Japan who were in Indonesia, gender discrimination did not apply in the principles of professionalism, hard work, firmness in daily routines. Dependence on a partner was only at the beginning of the migration phase. However, a few years later, these Japanese migrant women in Indonesia adapted and were comfortable with their communication and relationship styles. In addition, the openness of Indonesians to their existence as business actors allowed them to adopt a Japanese-style work culture that applied in communication relations and daily work.

"My position is clear. Those employees might do not want me, but I am the person who gave them a salary. They might try to be polite, so at first, it was very protected but when I go home

and face neighbours who have nothing to do with me, sometimes there is (laziness) because, in the beginning, what happened often and (neighbours) talk badly about me." (SY, 2020)

The ability to adapt quickly also applied to Indonesian migrants in Japan. Their readiness before arriving as migrants made the adaptation process faster. Besides improving their language skills, they could quickly get to know Japanese culture as a destination country because they accompanied their husbands who have lived longer in Japan. In addition, the character of the Indonesian people is flexible, more open, and easy to adapt. In addition to that, the support and assistance from the surrounding environment gave a lot of direction and advice. In running the SME business, the excellent support from the surrounding environment made running an SME business run smoothly.

The phenomenon was different with female migrants from Japan in Malaysia. In addition to regulations that make it difficult for them to do business in Malaysia, according to them, elements of Malaysian culture were not easy to accept because of differences in language and traditions. Therefore, many Japanese migrants assumed that implementing an SME business was not easy. Besides, the initial purpose of arriving as migrants was not to work but only to accompany their husbands serving in Malaysia, making their life in Malaysia as comfortable as possible by interacting only among Japanese people in a limited community.

"In this Penang Japanese Association. The language of instruction we use is also only Japanese because many Japanese here cannot speak English, particularly Melayu, so we only use Japanese. Activities here vary according to needs. When we have a business selling handicrafts, we usually offer it only to the community. Alternatively, if community friends are interested in offering it to outsiders, we prepare and market it. However, it is also related to the network role of fellow people in this Japanese community. In essence, we support each other and make the existence of Japanese people in Malaysia comfortable in other countries." (T, 2020)

#### Discussion

From the results of this study, Researchers found several findings in the study related to how culture and gender perspective affect migrant women who have SME businesses in 3 countries, namely Malaysia, Indonesia, and Japan.

1. Female migrant informants from Japan in Indonesia were motivated to become migrants because they liked Indonesia. Have experienced visiting various countries but felt that Indonesia was the most comfortable and open country. Having an Indonesian husband made the reason for staying and doing business for SMEs to be more vital and more comfortable. It was because they had a partner who would support them, even though Indonesian husbands do not have the enthusiasm and work ethic expected. The similarity of culture and the lax supervision of foreigners who have businesses in Indonesia made them feel comfortable and continued to run their business in Indonesia
2. Female migrant informants from Japan in Malaysia were motivated to come to Malaysia because they

followed their husbands on duty from a Japanese company in Malaysia. The main goal was to take care of the family so that they did not have a solid motivation to run an SME business which was only a side-line while taking care of children and taking care of the family. Economic stability made them not have a great desire to run an SME business but as a means of socialising with other people, especially fellow Japanese who live in the same country. Malaysian culture that is not open enough to foreigners and regulations for foreigners to try is quite tricky, making their arrival as migrants in Malaysia only temporary and then returning home to their country, Japan.

3. Female migrant informants from Indonesia in Japan were initially motivated to come as migrants to Japan because they followed their husbands who worked or studied in Japan. However, they wanted to work and open small and medium businesses to get better economic stability. The open character of Japanese culture, excellent support for foreigners, and strict regulations but with assistance made Indonesian migrants in Japan continued to run their SME business comfortably. In other words, they felt the effects of Japanese culture, which is very open to foreigners, like the Japanese philosophy of *seikatsusha*, a philosophy for Japanese people who consider others like brothers/sisters and make them comfortable when living or being around.
4. The presence of men as companions made it easier for informants to access anything when they were migrants. Starting from the ease of getting permission from the family to migrate to other countries, the ease of getting access to any information from the destination country, the ease of communication patterns with other people because of the husband's figure, and the ease of self-development because of the guaranteed support, security, and comfort from the family.
5. An investigation into discourse analysis through word and language descriptions conveyed by the informants showed that at the language text level, the gender perspective that describes the critical role of men in women was still very confidential. It showed among the identification of names, labelling, self-identity, and images that were still very dominant with the presence of men. Even though they had SME businesses independently, their dependence on men was still considerable. However, this does not only apply to themselves who feel more comfortable when they have a partner, but also perceptions of their family and social environment, which were relatively more aware of the existence of female migrant groups when she was married.

## V. CONCLUSIONS

Research on women and gender will be more interesting when it relates to the empirical experience of migrant women in different countries from their origin. From the experiences and stories of the eight informants from Indonesia, Malaysia, and Japan.

It can be concluded that the power of culture and family influence the decisions of migrant women SME entrepreneurs in their home countries. The decision to stay permanently as a migrant is not a personal decision but rather the influence of family factors, and to running their business into entrepreneurship is her personal decision. Besides, solid decision to migrate because they have a husband who is always with them, and their business decisions are also influenced by the blessing of their husbands, even though the decision is solely to get a better life.

In other words, the factors that influenced these migrant women to migrate and settle in the destination country were due to family, partner, and economic factors. However, the most dominant influence was the effect of gender differences which made all of these decisions easier if they had a husband who always accompanied them.

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# The Role of Head CT, Mechanism of Trauma, Severe of Trauma in Improving Survival Rates for Head Trauma Patients

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**Abstract**— The survival rate of head trauma patients may be influenced by the results of Computed Tomography (CT) scans and other examination such as mechanism of trauma and severe of trauma. The objective of this study was to analyze the relationship between CT outcome characteristics, mechanism of trauma, severe of head trauma and survival rates patients. This type of research is a descriptive correlation study. The sample for this study consisted of data from the medical records of patients with moderate and serious head injuries from January 2017 to December 2018. Overall, 180 medical reports were reviewed for this study. The predominant sex in this study was males up to 129 patients (71.7%) with an average age of 43.63 years. Respondents were dominantly able to survive 92 people (51.1%). The most dominant trauma mechanism is Traffic Accident with a total of 155 people (86.1%). CT Scan results showed that the majority of 69 people (38.4%) had interaxial bleeding ICH. The CT results and severe of trauma variables have a significant regression coefficient, while the mechanism of trauma is not significant. The coefficient of determination of 23,1% independent variables namely CT result, mechanism of trauma, severe of trauma was able to explain the dependent variable survival rate, while the rest was explained by other factors not included in the model. More research is needed to determine the 76,9% of other factors that need to be investigated to see the factors that affect the survival rate of head trauma patients.

**Keywords**— CT Result, Mechanism of Trauma, Severe of Trauma, Head Trauma, Survival Rate

## I. INTRODUCTION

Head trauma is closely linked to survival rates because it is associated with physio pathological processes. The survival rate of head-traumatized patients depends on epidemiological, clinical and biochemical factors. Survival rates for patients with head injuries are grouped into immediate deaths, early deaths and late deaths. Reference [1] shows that 90.3% of patients survived and 9.7% did not suffer trauma in the hospital. The prevalence of head trauma cases in the world shows the rate of 67 to 317 per 100,000 with a mortality rate of 4% to 7% of moderate head trauma patients and 50% of severe head trauma patients [2]. The national prevalence of traumatic brain injury is 8.2% of the average percentage of traumatic brain injury in each province, which is 4.5% to 12.8%. Head trauma cases are calculated by each province and there are 15 provinces that

have a trauma prevalence higher than the national figure, one of which is an East Java Province, which ranks seventh with a prevalence of 9.3% [3].

Based on the results of the pre-study, emergency room cases are divided into trauma and non-traumatic cases. Head injury is one type of case that is often found in the emergency department of the RSUD Dr Soedono Madiun. Visitor statistics in 2017 showed that the total number of patient visits to the ER was 24,354 patients with 924 patients belonging to the intermediate care category, consisting of 53.46% head trauma cases and 46.54% non-head trauma.

Clinical assessment of head trauma patients used an examination of the mechanism of trauma, length of prehospital time, Glasgow Coma Scale (GCS), systolic blood pressure, age and supported by diagnostic tests such as CT Scan. The findings of the clinical assessment and computed tomography are used to assess the severity of head injuries [4]. The CT results for a head injury are divided between interaxial and extra axial. Interaxial CT results are divided into intracranial hemorrhage (ICH) and intraventricular hemorrhage (IVH), while CT results are broken down. Extra axial scans are subdivided into Epidural Hemorrhage (EDH), Subdural Hemorrhage (SDH) and Subarachnoid Hemorrhage (SAH). The CT scans continue to be ordered as one of the diagnostic examinations of head trauma, while the CT scan results can sometimes miss other problems that can be found from physical examination, for example, fractures, epidural and subdural hemorrhage, and subarachnoid hemorrhage [5]. Helsinki CT scoring system was found to be the most accurate score among the others in predicting the outcome of the patient based on morphological findings in CT scan [6]. Results from CT scans show only 6% to 8% of head injury patients, and less than 1% of head injury patients require neurological intervention. The mortality from head injury was 11.1% of the 171 patients who had CT or 13.9% of the 137 patients who had abnormal CT findings. This is slightly better than the 15.1% and 19.8% mortality from head injury previously reported from this locality [7].

Assessing severity through clinical evaluation and supportive studies such as CT scans can provide a quantitative picture and an overview of survival rates. The

identification of the severity of head trauma and the use of CT scans is still a challenge to continue to develop, because trauma is a time sensitive condition in determining the needs of patients with limited resources [8].

## II. LITERATURE REVIEW

### A. Head Trauma and CT Result

Head trauma causes damage to the skull and brain with varying severity from mild to severe. Brain damage caused by trauma generally has a direct or indirect impact [1]. In principle, brain damage consists of two time mechanisms, namely primary head trauma and secondary head trauma [9]. Primary head trauma is the result of initial damage to the brain after a traumatic event, and has an impact on physical damage to parenchyma such as tissues, blood vessels, axons and brain neurons. This damage results in cerebral edema or laceration of brain tissue and surrounding areas. Brain conditions that cause brain damage can occur due to mechanical forces or collisions [8]. Secondary head trauma evolves over hours and days after the initial trauma. Secondary head trauma causes a complex pathological process and is a continuation and complication of primary brain trauma. The complex process in secondary head trauma results from brain pathological processes that include changes in brain biochemistry and metabolism after trauma.

Changes in biochemical substances can affect the development of the severity of brain injury. The biochemical substance of the brain consists of the excitatory amino acids glutamate, aspartate, cytokines and other free radicals. The pathophysiological process of secondary head trauma also causes neuronal cell death. Neuronal cell death occurs during the process of secondary brain damage mechanism consisting of lactic acidosis, excitatory amino acids, nitric oxide, cytokines, bradykinins, acrophages. There was also a secondary brain result consisting of hypoxemia, hypotension, hyperthermia, hypocapnia, hypercapnia, hyperglycemia, hypoglycemia, increased intracranial pressure, infection, vasospasm and seizures. This has a negative impact on the brain and causes complications both intracranial, extracranial and systemic thereby increasing the severity [10].

The process of damage due to skull fracture can occur at the top or bottom, open or closed. Cases of fracture of the base of the skull have signs through the raccoon eye sign (periorbital ecchymosis), battle sign (retro auricular ecchymosis), rhinorrhea and otorrhea (blood and/or cerebrospinal fluid discharge) and weakness of the VII or facial nerves. Intracranial lesions are also a morphological damage to head trauma that have a significant pathological impact on the survival rate of head trauma patients. In localized lesions, epidural bleeding occurs. An epidural hemorrhage causes blood to collect in the space between the skull and the dura mater. This condition is caused by a rupture of the meningeal artery which is a type of artery between the dura mater and the skull bone. Bleeding from the meningeal arteries can cause a rapid increase in intracranial pressure. This condition will last for a while, but when the body is not able to compensate better, it is easy to lose consciousness progressively. Patients are increasingly

restless, confused and fall into a coma which is often accompanied by unilateral neurological abnormalities. Cases of severe head trauma in 30% often have subdural hemorrhage. Subdural bleeding more often comes from a ruptured vein. Acute subdural hemorrhage is also one of the local lesion damage. Clinical symptoms develop after 24 hours to 48 hours. Subacute subdural hemorrhage is also associated with contusions and moderate head trauma. Clinical manifestations are similar to acute subdural hemorrhage and occur between 48 hours to 2 weeks after injury, so it is expected that the patient is quickly brought to the hospital for a craniotomy. The survival rate of patients with acute and subacute subdural hemorrhage is very low which is associated with the resulting brain damage.

Another type of local diffuse trauma is Intracerebral Hemorrhage (ICH) which is a type of bleeding that occurs in the brain substance. This condition often occurs in the frontal and temporal lobes. ICH is often caused by blunt trauma with great force or from penetrating trauma. This bleeding occurs over a few hours or days and causes neurological changes. Continuation and brain damage due to acceleration and deceleration is called diffuse brain trauma which causes mild but not disruptive commotions but does not impair consciousness and temporary neurological dysfunction. Disorientation and confusion are mild forms of commotion disorder, but are not accompanied by retrograde amnesia. Patients with commotion conditions can recover without neurological defects, but still experience neurological deficits, namely difficulty remembering, nausea, dizziness, and depression.

The unique characteristic of the pathophysiology of head trauma is that the process differs from that of other areas of the body. The uniqueness of the pathophysiological process of the brain is due to the anatomical position of the brain in the skull. The skull is a closed and rigid compartment. Bleeding and swelling within the skull can increase the volume of brain contents thereby increasing intracranial pressure. Increased intracranial pressure in the brain becomes dangerous when the pressure is higher, because it can push the brain causing displacement of the brain that is to become lower, lateral or against the rigid structure of the skull. This process has the effect of restricting blood flow to the brain and reducing oxygen supply. Cells in the brain become anoxic and cannot metabolize properly, causing ischemia, infarction, and irreversible brain damage, and eventually brain death.

### B. Survival Rate

Survival has the origin of the word survive which has the meaning of the ability to defend oneself in certain circumstances. Survival rate is described in the trimodal distribution of trauma based on the time interval from trauma to death. This concept divides the time of the incident into three things, namely immediate death, early death and late death, where each group has inclusion criteria. The time of death into three, namely immediate death, early death and late death with different criteria for each time of death [10].

Table 1 : Presence of survival rate on head trauma classification according to time, scene and etiology

<b>Death</b>	<b>Time</b>	<b>Scene</b>	<b>Etiology</b>
<i>Immediate</i>	Minute	The scene or moments after arriving at the Emergency Room	<i>Brain Injury</i> and hemorrhage
<i>Early</i>	Hours (1-24 hour)	Hospital	Major and subdural hemorrhage
<i>Late</i>	Day – Week (> 24 hour)	Hospital	Organ failure, seps, hemorrhage

Survival rate is influenced by several factors, namely 1) Mechanism of trauma, each age group has different characteristics. In the older age group, the mechanism of trauma that occurs more often is falls, while in the younger age group it is motor vehicle accidents. The mechanism of trauma determines which part of the head is traumatized. The mechanism of trauma and survival rate has a reverse ratio, namely the more severe the trauma mechanism, the lower the survival rate. 2) Length of time prehospital The amount of time spent in prehospital varies from patient to patient because it depends on various factors. Head trauma patients who have a delay in patient transfer to the ED may experience a decreased survival rate, increased mortality and the risk of dying within two hours. The death of head trauma patients occurred in the first minute and at the scene of the incident by 66%. Another complication caused by spending too long in the prehospital is the brain's biochemical processes that will give sequelae when healing is greater. 3) GCS, a tool for assessing neurological status as well as a predictor of the severity of head trauma. The GCS classification describes reduced survival rates and increased mortality in head trauma patients. Head trauma patients with a GCS score of 3-5 have a mortality risk of 77%, a GCS score of 6-8 has a mortality rate of 26%. 4) Systolic blood pressure, shows the pump function of the heart that circulates blood in each organ. Systolic blood pressure is associated with brain tissue perfusion. Inadequate systolic blood pressure in supplying blood and oxygen to the brain causes ischemic effects of the brain that cause a lot of brain tissue to malfunction. A systolic blood pressure of less than 90 mmHg in head trauma patients reduces survival rates and increases the risk of high mortality. A decrease in systolic blood pressure of 10 mmHg increased mortality by 18.8%. 5) Age, one of the independent factors for head trauma survival rate. Age affects the physiological function of brain tissue and other organs. Older age has a risk of systemic complications when head trauma occurs, thereby reducing survival rates. At the age of 65 years, the incidence of head trauma increases and the survival rate of head trauma also decreases compared to younger ages. Surgical intervention was associated with the greatest improvement in outcomes for moderate head injuries, followed by mild and severe injuries [13].

### III. RESEARCH METHOD

This research is a Descriptive Correlational Study. The research was conducted in RSUD Dr Soedono Madiun, Indonesia uses the medical records of moderate and severe head trauma patients between January 2017 and December

2018. The sample technique for this study was purposive sampling. The inclusion criteria for this study were medical records of patients with moderate head trauma and severe head trauma, aged more than 18 years. The exclusion criteria for this study were medical records of head trauma patients with open skull fractures, multiple traumas, and alcohol intoxication.

Data were collected using observation sheets which included gender, education, employment status, age, severe of trauma (moderate and severe), CT Scan results (interaxial: ICH, IVH and extra axial: EDH, SDH, SAH), mechanism of trauma (traffic accident and falls) and survival rate category. This research has received ethical approval from the Health Ethics Commission of the Faculty of Medicine, Universitas Brawijaya number 93/EC/KEPK-S2/03/2019.

### IV. RESULT AND DISCUSSION

There were 494 medical records of head trauma patients in the period 1 January 2017 to 31 December 2018 and 180 medical records were obtained as research samples. The dominant sex in this study was male as many as 129 patients (71.7%) with the dominant education of head trauma patients being SMA as many as 79 patients (43.9%) and there were 136 patients (75, 6%) are working. The majority of respondents in this study experienced severe head trauma with a total of 98 people (54.4%). Respondents in this study were dominantly able to survive 92 people (51.1%). The most dominant trauma mechanism is Traffic Accident with a total of 155 people (86.1%). CT Scan results showed that the majority of 69 people (38.4%) had interaxial bleeding ICH (tabel 2). This analytical study was used biner logistic regression. The model show = 0,040 – 0,275 (CT Result) + 1,665 (Severe of trauma) + 0,232 (Mechanism of trauma). That results showed a 95% confidence level, the available data explain that the CT results and severe of trauma variables have a significant regression coefficient to the model, while the mechanism of trauma is not significant to the model (tabel 3). The coefficient of determination of 23.1% independent variables namely CT result, mechanism of trauma, severe of trauma was able to explain the dependent variable survival rate, while the rest was explained by other factors not included in the model. The percentage of accuracy in the survival group is 73.9%, where if calculated according to the prediction there are 92 respondents while the results of the observation are 65 respondents who did not survive. Then, to survive, according to the prediction calculation, there are 88 while the results of the observation are 59 and the percentage for accuracy is 64.1%. The overall accuracy percentage is 68.9%.

Based on the results of the study, the average age of the sample in this study was 43.63 years with the lowest age being 18 years and the highest being 65 years. The results of this study are supported by the findings of the Basic Health Research which shows that the age range of 35-44 years is often traumatized [3]. The cases of head trauma often occur in the 18-40 years old group. Head trauma is the most common cause of death in adults younger than 45 years and the leading cause of long-term disability [12]. The results of

this study indicate that patients who often experience head trauma are in the productive age range. The incidence of traffic accidents that cause head trauma increases in the productive age. In productive age, men often have the highest proportion, as in this study, male sex dominates the occurrence of head trauma [13]. One of the factors that causes the high incidence of head trauma due to traffic accidents in the productive age is the number of the productive age population that dominates and the high mobility in this age group. Productive age has a tendency to show driving skills, but it is not accompanied by good driving knowledge, ethics and skills.

Table 2 : Presence of diagnosis, mechanism of trauma, CT scan results to survival rate patient with head trauma

Data		Survival Rate Category								Total	
		Immediate		Early*		Late**		Survive***			
		N	%	N	%	N	%	N	%	N	%
Severe of head trauma	Moderate	0	0	0	0	23	20,1	59	71,9	82	45,6
	Severe	0	0	19	19,4	46	46,9	33	33,7	98	54,4
Mechanism of trauma	Traffic accident	0	0	18	11,6	57	36,8	80	51,6	155	86,1
	Fall	0	0	1	4	12	48	12	48	25	13,9
CT Scan result	Interaxial										
	ICH	0	0	9	5	33	18,4	27	15	69	38,4
	IVH	0	0	1	0,5	6	3,2	2	1,1	9	5
	Extra axial	0	0	2	1,1	11	6,2	2	1,1	15	8,3
	EDH	0	0	7	3,9	26	14,5	10	5,5	43	23,9
	SDH	0	0	4	2,2	27	15	13	7,3	44	24,4
	SAH										

\* Early: the ability to survive within 1-24 hours after head trauma  
 \*\* Late: ability to survive within 1-5 days after head trauma  
 \*\*\* Survive: ability to survive > 5 days after head trauma

Table 3 : The CT results, mechanism of trauma and severe of trauma to survival rate

Variabel	p-value	Sig.
CT result	0,008	
Mechanism of trauma	0,578	0,05
Severe of trauma	0,000	

Mechanisms of trauma cause different impacts on head trauma because of the different effects caused. Mechanism of trauma in the emergency department of RSUD dr. Soedono Madiun was caused by a Traffic Accident and fell. Traffic accidents dominate as the cause of head trauma in Madiun. National data shows that 65.6% of traffic accidents are caused by collisions. Traffic accidents that are the cause of head trauma in Madiun are mostly caused by two-wheeled vehicle accidents. National data shows the number of two-wheeled vehicles in Indonesia reaches 113 million. The number of two-wheeled vehicles in Madiun reaches 94% of all vehicles, making it the main cause of traffic accidents. The main causes of head trauma are traffic accidents, violence, drowning, burning, poisoning and falls [14][16]. The mechanism of trauma that causes head trauma in Madiun other than traffic accidents is falling from a height. This type of fall is caused by falling from trees, cliffs, roofs of houses and stairs. The average fall height of head trauma patients admitted to the emergency department of RSUD dr. Soedono Madiun is 2 – 5 meters. That falls contributed to 21% of head trauma cases, most of which 12% occurred due to falls from a height of > 3 meters, and 9% fell from a height of < 3 meters.

Based on the results of the study, it was found that there was a relationship between CT Scan results and the survival rate of head trauma patients. CT Scan is one of the supporting examinations needed by head trauma patients to assess the type of bleeding that occurs. An anatomical study of brain damage, and found that direct head trauma is the main mechanism of trauma to sub cortical lesions and high energy results in 20% of subcortical trauma in patients and 30% with corpus callosum lesions will produce good outcomes bad, so it can reduce the survival rate [15].

Head trauma patients who are prone to having a risk of complications also require investigations such as CT Scan and radiology in other areas of the body. In the condition of head trauma patients who are considered low risk for head trauma complications, it is necessary to observe an emergency doctor and nurse for one hour. Assessment of head trauma in patients who are at low risk and who return to the ED within 48 hours of discharge with persistent complaints related to head trauma, consider a CT scan and discussion with the expert team.

Along with the development of knowledge and technology, several studies have different opinions on CT Scan examination in head trauma patients which can reduce survival rate. Several studies say that the long waiting time for head trauma patients to get a CT scan and surgery is also a factor that can affect the survival rate. The CT scans continue to be ordered as one of the diagnostic examinations of head trauma, while CT scan results can sometimes miss other problems that can be found from physical examination, for example, fractures, epidural and subdural hemorrhage, and subarachnoid hemorrhage [5]. CT scan results show only 6%-8% of patients with head trauma, and less than 1% of patients with head trauma are found to require neurologic intervention. CT Scan examination can increase the length of time handling cases of head trauma. The American College of Emergency Physicians recommends avoiding head CT scans in low-risk mild head trauma patients based on a validated decision rule in order to reduce radiation exposure to the patient, and to reduce the time spent providing care. A long definitive surgical procedure can also affect the decrease in survival rate, because the time required for treatment of head trauma is directly proportional to the resulting outcome.

This study showed that the most dominant CT scan results in all survival rate groups was interaxial with ICH. ICH is a type of bleeding that occurs in the brain substance. This condition often occurs in the frontal and temporal lobes. ICH is often caused by blunt trauma with great force or from penetrating trauma. This bleeding occurs over a few hours or days and causes neurological changes. Continuation and brain damage due to acceleration and deceleration is called diffuse brain trauma which causes mild but not disruptive commotions but does not impair consciousness and temporary neurological dysfunction. There is an age-related trend towards CT scan results in head trauma. CT scan results showed an increase in intracranial hematoma with intracerebral hematoma in the elderly group [9]. These results cause the survival rate in elderly patients to decrease. There is an increased mortality correlation between intracerebral or extracerebral hematomas of more than 15 cc. Subarachnoid hemorrhage

and brain compression also increase with age. The survival rate of head trauma patients should continue to be improved and maintained as well as one of the nurse's duties. The role of nurses in the emergency room when dealing with head trauma patients is to maintain brain function and prevent secondary injuries to the brain that can occur due to intracranial hemorrhage, brain edema and hypoxia [17].

#### V. CONCLUSIONS

In general, that the CT results and severe of trauma variables have a significant regression coefficient to the model, while the mechanism of trauma is not significant. The coefficient of determination of 23,1% independent variables namely CT result, mechanism of trauma, severe of trauma was able to explain the dependent variable survival rate, while the rest was explained by other factors not included in the model. The limitation of this study is that the measurement data of the independent variables in this study were only taken when the head trauma patient came to the ED and no observations or repeated measurements were made, so that the researcher did not know the progress of the patient's condition on a regular basis. Regular observation is important for nurses as an action to maintain brain function and prevent secondary trauma which results in a decrease in the survival rate of head trauma patients. Nurses should carry out the role of triage and re-triage, maintain airway, breathing, circulation, observation of vital signs, and neurological status, physical examination and history taking, fluid resuscitation and drugs according to doctor's instructions, arranging laboratory testing or CT scans and report the results to the doctor, provide emotional support to the patient and family, and when the patient is discharged from the emergency room, the nurse prepares health education related to the treatment and recovery program and follow-up control schedule. More research is needed to determine the 76,9% of other factors that need to be investigated to see the factors that affect the survival rate of head trauma patients.

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# Building Rocket Stove to Support the Sustainable Palm Sugar Industry

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**Abstract**— Palm sugar is considered a healthier alternative to refined white sugar because it still contains nutritional value. Indonesia is one of the largest palm sugar producing countries in the world. Most palm sugar producers obtain palm sugar from palm farmers in the form of sugar. Meanwhile, the process of making sugar is mostly carried out by farmers in their fields or in the forest. During sugar processing, most of the farmers still use traditional wood burning stoves which give an unhygienic environment image because of the smoke and low size of the stove so that dust can easily enter the cooking. Therefore, this study aimed to build a rocket stove for palm farmers to use when cooking sap into sugar. The research method used in this study was a product development research, especially appropriate technology products. The design of the rocket stove in this study was based on the needs of sugar palm farmers in North Sulawesi, and its efficiency was evaluated from the palm sugar cooking experiment carried out using this stove. The results showed that the cooking time of 30 litres of sap into palm sugar was 2 hours with the use of 14 kg of firewood. In addition, the process of cooking sugar looked more hygienic and produced less smoke pollution. This research contributes in particular to the application of appropriate technology. Furthermore, the application of this appropriate technology supports the sustainability of the palm sugar industry in general.

**Keywords**— Palm Sugar, Arenga Pinnata Sugar, Food Safety, Rocket Stove

## I. INTRODUCTION

Sugar palm (*Arenga pinnata* Merr) is one of the most common palm plants in Indonesia [1]. Almost all parts of the palm plant can be utilized with palm sap considered as the main product. By local people, palm sap can be used as raw material for making palm sugar so that they can earn additional income from selling palm sugar [2]. Tomohon City as a center for palm plantations in North Sulawesi has enormous potential to be developed, especially palm sugar products to support the national food security program. For the palm sugar industry, the sustainability of its business is determined by the application of food safety which is currently a must, especially if the product wants to reach international market. Therefore, the application of food safety principles by all segments involved in the processing of palm sugar, including processing by palm farmers is necessary to ensure the quality and safety of palm sugar products in order to succeed in gaining market, especially in developed countries that require product quality and safety.

In Tomohon, North Sulawesi, the tapping of palm sap is usually done twice a day, namely tapping in the afternoon then the results of tapping the palm sap are taken in the morning, and tapping in the morning and the results are collected in the afternoon. The palm sap undergoes a very fast fermentation process. If the palm sap has been fermented, then the sap can no longer be processed into palm sugar. Therefore, before the sap fermentation process occurs, it must be cooked as soon as possible [2]. The process of cooking sap or palm sugar processing by palm farmers is generally carried out in farms far from settlements or in forests where they tap sap from palm trees. The remote location makes palm farmers unable to use gas fuel to process sap into palm sugar. As a consequence, sugar processing carried out by palm farmers uses wood or traditional biomass as the main energy source. Palm farmers only collect wood that is available around their gardens or forests without buying, so the use of traditional biomass fuels for palm sugar processing among palm farmers remain high. On the other hand, the use of wood fuel affects human health. Regarding the use of wood fuel for households, it is reported that around 165,000 people die each year due to air pollution from the traditional use of biomass [3]. Therefore, there is a need for technology and techniques for sustainable production using traditional biomass fuels. This can happen if the use of traditional biomass fuels, which is one of the renewable resources, is more efficient and cleaner, in accordance with the national green sustainable growth program [3].



Figure 1. Processing of palm sugar using a traditional wood-fired stove

Currently, most palm farmers use traditional wood-fired stoves to process palm sugar. From the observations on sugar palm farmers in North Sulawesi, it can be seen that the

stove used causes smoke pollution and the possibility of soil dust entering the cooking pan because the top of the open pan is very close to the ground as shown in Figure 1 [4]. Therefore, this study aims to design a rocket stove that is used for processing palm sugar. The rocket stove was chosen because it uses energy more efficiently, and its design can be adapted to local conditions so that palm sugar processing becomes more hygienic and reduces smoke pollution that occurs during the cooking process.

## II. LITERATURE REVIEW

Aren (*Arenga pinnata* Merr) is a palm plant that grows in tropical forests and is commonly found in South and Southeast Asia [1] including Indonesia. Almost all parts of the palm tree can be used, namely leaves, fruit, sap, stems, and fibers. However, of all the parts used, palm sap is considered the main product of the palm tree and is usually used as a sweetener by local people as a source of income by selling their palm sugar [2].

Although currently palm farmers generally tap palm juice from sugar palm trees that grow in their farms or forests, the Indonesian government in 2007 made the planting of palm trees for industrial purposes. Palm sugar can be used as an alternative sugar to meet some of the domestic sugar needs. In addition, palm sugar also has the potential to be exported, especially to developed countries where consumers prefer natural sweeteners such as palm sugar. Palm sugar products are considered as products that have more 'authentic' ingredients and have a reputation for healthier and safer sugar compared to other processed ingredients [5]. Palm sugar usually does not undergo any refining process, as a result it can bring potential nutritional benefits as reported from several studies including polyphenols [6], [7], mineral nutrients such as phosphorus, potassium, calcium, iron magnesium [8], [9], antioxidants [10], and has a low glycemic index value that is potentially good for diet foods [5], [9]. At the industrial level, the current global economic and market situation requires the industry to improve its competitive capabilities, one of which is by improving product quality. For the food industry, there are two factors that must be considered, namely the needs to ensure product safety and to protect the health of consumers [11]. This is also one of the main challenges and obstacles faced by the food industry which is required to produce quality food products that are safe for consumption and do not contain any additives that endanger human life and health.

The following is the process of processing palm sugar. The process of making palm sugar starts from tapping the sap, cooking the sap, molding, and hardening the palm sugar. Sap tapping is usually done twice a day, in the morning and afternoon. The late afternoon sap is filtered using a traditional sieve made from palm fibers, then the sap is poured into a pan, cooked until it boils, and stored until the next morning. The sap from the morning tap is mixed with the semi-finished sap from yesterday afternoon before being cooked together. During the heating process, the sap produces foam and often overflows from the pan. So that the sap that is being cooked does not spill, the farmer stirs and adds 1 tbsp of coconut oil to the cooked sap. Farmers

usually stir the sap until it thickens, before extinguishing the fire. To find out whether the cooking of sap can be stopped, farmers use cold water and samples of cooked sap. If the droplets of the sap sample harden, the cooking process can be stopped. Cooking usually takes about 4-5 hours, depending on the amount of sap cooked. Next, the sugar is molded by pouring the concentrated sap into the cleaned coconut shell [2],[4].

Several studies to develop biomass-fueled stoves have been reported such as the design of energy-efficient and environmentally friendly biomass stoves for traditional wood-fired stoves. The design of a low-pollution wood fuel stove using cement-concrete walls reported by B.Yinuanto et al. [12] has a size of 40x50x50 cm for the length, width, and height respectively, with a combustion chamber diameter of 18 cm. In the furnace wall there is an air space that functions as an insulator. The furnace test was carried out by heating water to 98°C using two pots measuring 29 cm and 37 cm, and using firewood with two levels of wood dryness, namely 16% and 24%. The test results show that heating water using a 29 cm pan and firewood with a wood dryness level of 16% produced the best efficiency of 20%. While the use of a 37 cm pan and firewood with a wood dryness level of 24% to heat water resulted in the lowest efficiency of 16%. Figure 2 is the design of the wood-fired stove from the study.

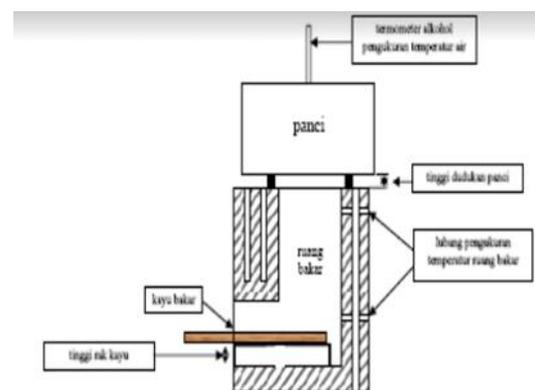


Figure 2. Design of The Stove by B.Yinuanto [12]

Another stove design is the research conducted by A. Ridwan [13] who designed, built and tested traditional and modified stoves. In the modified furnace there is a primary airflow with 13 holes, and a secondary 21 holes with a diameter of 10 mm. The diameter of the kiln is 35 cm, the height of the wood fuel holder with the pan is 20 cm and the ground is 35 cm. With the same treatment in both furnaces, the results obtained are that the thermal efficiency in the traditional furnace is 4.2% with a boiling water temperature of 86.3°C, and for the modified furnace the thermal efficiency is 14.7% with a boiling water temperature of 99°C. In addition, there is less smoke pollution in modified furnaces compared to traditional combustion stoves. The furnace design of this study is as shown in Figure 3.

The reported energy-efficient stove design uses the concept of a rocket stove. The rocket stove is one of the innovations of firewood stoves by reducing the use of firewood. The shape of the rocket stove is suspected to have an effect on the height of the fire because the wind blown by

the blower focuses in one direction so that the burning fuel produces an optimal fire. The principle of the rocket stove is the stove has an air opening for the entry of oxygen, which is located under the firewood burning place so that it can meet the oxygen needed during the combustion process. A fire that gets enough oxygen produces constant heat which is then flowed through the combustion chamber to the top end so that this furnace produces a more efficient combustion because all the wood burns completely and smoke during combustion is minimized [4].

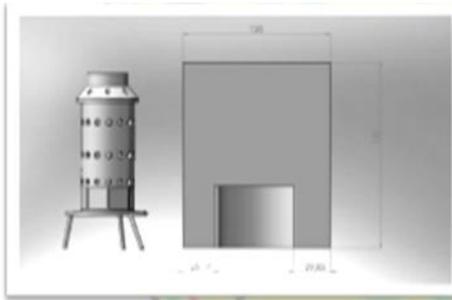


Figure 3. Design of The Stove by A. Ridwan [13]

However, both stoves do not have a chimney, besides those are designed for household use. This can be seen from the furnace testing using pans with sizes of 29cm and 37cm [12], and 20 cm [13]. These two stoves cannot be used for cooking sap into palm sugar, because of the large volume of sap that requires a large pan, as well as a chimney because it uses more firewood than cooking for household needs. Therefore, this study aims to design a rocket stove that is used to cook palm sap into palm sugar by considering the size of the pan used and the presence of a chimney to reduce smoke pollution generated during the cooking process.

### III. RESEARCH METHOD

This research follows the concept of product development research, especially product for appropriate technology by building a rocket stove. The preliminary study was conducted on groups of sugar palm farmers and the sugar palm industry in North Sulawesi. This research involved the design, building, and testing of the rocket stove. The design of the rocket stove included the design of its components: the pan stand, the air intake chamber, the firewood and combustion chamber, and the chimney.

**Building the rocket stove.** The materials used for building the rocket stove were bricks, cement, iron as frames, and iron pipe for the chimney. All these materials were obtained around the location where the rocket stove was built, namely in North Minahasa, North Sulawesi province of Indonesia.

**Rocket stove testing.** The material used to test the rocket stove was sap obtained from palm farmers in Minahasa, North Sulawesi. The rocket stove test was done by cooking the sap until it became palm sugar. During the cooking process, observations and measurements were made on the initial volume of sap, cooking time, cooking temperature, final result of cooking (palm sugar), as well as measuring the amount of firewood used.

The scatter diagram was used to show the relationship between the cooking time and temperature of the sap into palm sugar.

## IV. RESULT AND DISCUSSION

The design of the rocket stove included a more detailed rocket stove design of the components in the rocket stove, namely the pan stand and the furnace body, air intake chamber, combustion chamber, and chimney.

### 1. Design of the Pan Stand and Furnace

The size of the rocket stove and pan stand depended on the size of the pan used, so the design of the rocket stove began with selecting the size of the pan that would be used for processing palm sugar. In this study, a pan with a diameter of 65 cm was used which could cook about 30 litres of palm sap. In order for the pan to be in contact with the combustion chamber so that the sap could be heated properly, and also the pan did not shake during the process of stirring the sap into palm sugar, the diameter of the pan stand was set to 60 cm.

### 2. Design of Air Intake Chamber

The air intake chamber served to supply air into the combustion chamber to produce a strong fire and burn all the existing wood. From the results of the experiment with several sizes, the optimal size of the air intake chamber was selected, which was 10 cm high and 44 cm wide. This size also kept the heat from coming out of the cooking furnace so that workers could work comfortably during the sap sugar cooking process

### 3. Design of Combustion Chamber

At the top of the air intake chamber, there were a place to put firewood and a combustion chamber with a size of 20x44 cm. This size was determined because of the amount of firewood required and was also adjusted to the size of the stove. The air intake chamber and the combustion chamber were separated by the presence of iron frames that were able to handle the load of the firewood used and further strengthened the rocket stove.

### 4. Design of Chimney

The chimney was constructed to reduce smoke pollution in the palm sugar cooking area. The mouth of the chimney was placed at the top of the combustion chamber so that the smoke produced could be pushed by air from the air intake chamber to the chimney. The selection of the chimney pipe with a length of 130 cm and a diameter of 5 cm was adjusted to the conditions of the experimental site, especially the height of the roof, so that the smoke produced could be flowed through the chimney and discharged out of the cooking area.

The design of all components of the rocket stove is given in Figure 4.

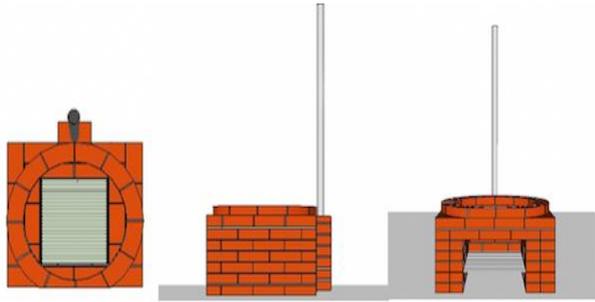


Figure 4. The design of rocket stove : top view (left), side view (middle), front view (right)

### 5. Rocket Stove Testing

The results of this rocket stove design have been tested several times using both water and palm sap. The following was the temperature and cooking time obtained from testing the rocket stove using 30 litres of palm sap which was processed into palm sugar (Figure 5). The testing used 30 litres of palm sap that took 150 minutes to cook the sap into palm sugar (blocks) with the use of 14 kg of firewood.

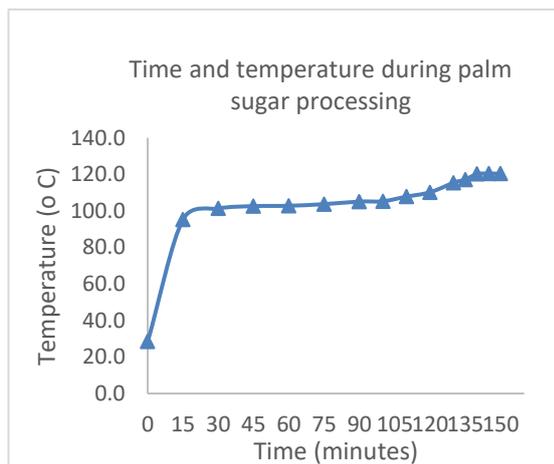


Figure 5. Temperature and time during processing palm sap into sugar

We also provide a comparison between a rocket stove built from this design and a traditional woodfire stove (Figure 6), along with palm sugar produced using both stoves (Figure 7), and the conditions of workers when cooking with the two stoves (Table 1).



Figure 6. Traditional woodfire stove (left) and the rocket stove (right)



Figure 7. Palm sugar produced using traditional woodfire stove (left) and palm sugar produced using rocket stove (middle and right)

The quality of sugar produced using traditional woodfire stove and the rocket stove was difficult to compare precisely because the sap used in both processes were obtained from different batches. Nevertheless, from Figure 7 it can be seen that the surface of the sugar produced by the rocket stove was better than the sugar produced by the traditional woodfire stove.

Table 1. Workers cooking conditions with traditional stoves and rocket stoves

Traditional stove	Rocket stove
<p>There was a lot of smoke pollution, the worker's body position was more bent, it was less hygienic, the stove was low so that it allowed dust and dirt to enter the cooking pan.</p>	<p>It had a chimney that reduced smoke pollution, worker was not too bent, it was more hygienic, the open part of the cooking pot was a bit far from the ground so that dust did not easily enter the pan and around the stove was not too hot.</p>

Most of the palm sugar industries obtain their products from palm sugar farmers. This condition results in the sustainability of the palm sugar industry to depend too much on palm farmers. Meanwhile, the use of firewood to process palm sugar is still the most preferred choice by palm farmers because the location of palm sugar processing is far from residential areas, making it difficult to obtain other types of fuel. This rocket stove is one of the appropriate technologies that can help palm farmers in processing palm sugar. By using this rocket stove the use of firewood to cook palm sugar is reduced, so the time needed for farmers to get wood fuel is shorter. In addition, the shorter cooking time of palm sugar using a rocket stove will provide more time for palm farmers to do other works. The benefits derived from the use of the rocket stove help palm farmers to continue to produce palm sugar as one of their sources of income, which in turn helps the sustainability of the palm sugar industry in Indonesia in general and in North Sulawesi in particular.

## V. CONCLUSIONS

The sustainability of an industry to support the community's economy is very important. The palm sugar industries in North Sulawesi generally obtain palm sugar from palm farmers who still use traditional woodfire stoves for the process of making palm sugar. This research designed a rocket stove which includes the design of the pan stand, the air intake chamber, the firewood and combustion chamber, and the chimney. Cooking sap into palm sugar was carried out to test the rocket stove that had been produced by measuring the time, temperature, and amount of use of firewood. The test results for processing palm sugar from 30 litres of palm sap using a rocket stove took 2 hours with the use of 14 kg of firewood. Because this study only designed a rocket stove that was used to cook 30 liters of palm sap, further research is recommended to make a rocket stove that can be used for cooking palm sap with a volume of more than 30 litres. This research is important to support domestic food security programs and export opportunities. Further research is needed that supports the productivity of palm sugar or other products from palm trees, so that people are motivated to keep planting palm trees which will ultimately help achieve environmental sustainability.

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# Analysis of Service Marketing and Blueprint for the Success of Service Business in Metro Boomerang College, Manado

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**Abstract**— The purpose of this academic paper was to provide analysis and produce strategic management tactics based on its blueprint for a certain service business provider. Essentially, this paper focuses more on certain areas of service marketing within the related service provider per se. The chosen-analyzed organization for this paper is Metro Boomerang College (MBC) located in Manado, Indonesia. It is a family-based business which has focused its venture in education industry. MBC is a training center which offers customized English Language courses targeted at local markets within the country. Since its operation, MBC has not provided accurate problem solving guidelines for its teaching and administrative personnel to take. This makes MBC's services and performances are not effectively done. It is clear that MBC has not fundamentally applied theoretical knowledge of service marketing during its initial operation. It conducted its service delivery based on 'gut-feeling' strategies. The research analysis for this paper was accordingly used a literature review and qualitative description integrated with personal tacit knowledge & business experiences to produce strategies for this specific service industry. Source of information for this paper was taken from its current and former students as well as teaching and administrative personnel. Having analyzed MBC's current practices of service blueprint delivery, Accordingly, MBC needs to evaluate the influential elements for its success such as analyzing the patterns and determinants of demand in relation to its affordable capacity, identifying fail-points and what strategies are needed to prevent or minimize them, establishing benchmarks for its service recovery strategies, and monitoring its service quality performance. This can be done based on its original blueprint. Furthermore, MBC must consider the strong support of its human capital for the overall success of its business due to the fact that its service delivery relies entirely in the hands of its staff.

**Keywords**— *Blueprint, Customers, Recovery, Service Marketing*

## I. INTRODUCTION

Our daily activities have been greatly impacted by the world of Marketing. It's an inevitable phenomenon in one's life. Since the daybreak up to the call of the day, we are greatly bombarded with Marketing aspects. In other words, whether we like it or not, Marketing activities have been all around us (Tjiptono 2019). Marketing a product is not always to exchange goods in forms of tangible products. Product is actually consisting of real product and services.

Most services are intangible because they are performances rather than objects. They cannot be counted, measured, inventoried, tested, and verified in advance of

sale to assure quality (Badudu 2015). As a result, companies may find it difficult to understand how their customers perceive services and service quality. There are many critical considerations that a company needs to evaluate in delivering its service since this 'type of product' is very sensitive to be directly assessed by customers.

Services industry has evolved into big deals over the world such as in tourism industry as well as educational services. To be able to survive in the business, it is a must for service provider to provide excellent and superb service to its customers. In order to provide superior services which, satisfy customers' needs and wants, a service business must monitor its performance and able to identify potential failures and then perform improvements.

This paper discusses how Metro Boomerang College (MBC) conducts its education business in relations to various aspects of service delivery such as managing demand and capacity, performing trainings, and providing supporting facilities for the success of the offered services. In its venture, MBC only offers customized English trainings/courses. This means that the classes are limited to certain number of students for general English and for English for specific purpose courses, MBC follows what its customers' wants and needs.

Pricing strategies for various courses will also be based on the set standard price for each course. However, it sometimes comes that customers bargain for the course fees. This is a sort of problem MBC has since it offers customized services.

Since its establishment in 1998, MBC has run its operations based on day-to-day operations which does not have formal guidelines of the trainings. This happen since the teaching and administrative personnel conduct their work based on individuals' own performance without having a uniformity considering this is a family business unit. Thus, problems usually arise during its service delivery and MBC was not able to take fast corrective actions. Occurred problems during its operations will somehow be delayed to be solved since there have no guidelines to be followed or taken. It goes the same to the problems of pricing the courses/trainings.

Thus, MBC needs to identify and anticipate future problems to be able to find great solutions shall problems reoccur. One way to do this is by establishing and analysing all related marketing activities within its service blueprint.

By mapping activities within a service blue print, MBC will be able to implement anticipative service recovery as well as monitoring its educational service performance.

## II. LITERATURE REVIEW

It has been decades that people learn and try to understand the term of Marketing since the term itself has evolved over times. Abdullah & Tantri (2018) proposed that marketing is the process of planning and making decisions about the price, promotion, and distribution of goods and services to meet the needs and wants of individuals or society. A circle of business life begins with human needs and wants. Thus, it is understood that marketing activities arise because of needs and wants from those of customers' needs. It has been actually added that marketing is not only meeting the needs and wants, but more than that, it delivers satisfactions more effectively and efficiently than competitors (Kotler et al. 2017). Accordingly, in its development, marketing is not only limited to product marketing activities in the form of goods but also marketing activities related to service products.

Even today the development of service marketing is very fast in line with the development of community needs for services (Sunyoto & Susanti 2015). As a result, products in the form of services have become a major part of the economy in a country, including Indonesia, as various services business have been in existence (Badudu 2015). This is partly due to the improvement in income, as well as an increase in the variety of individual and community needs. In fact, the need for service products dominates more than the need for non-service products. This means that people do not only see their needs as limited to the needs of food, clothing or shelter; which are apparently material. Furthermore, society has looked at the needs related to immaterial properties such as the need for comfort, health, safety assurance, pleasure, and so on that are non-physical or services, including the need for self-actualization in the field of educational services (Sunyoto & Susanti 2015).

Guswai (2014) mentioned that the development of service marketing cannot be separated from the development of goods marketing due to the fact that the existence of service marketing began with the growing level of community needs and desires toward the existence of goods and supporting product elements, such as services. In developed countries, the level of public need for services is also getting bigger. For example, banking services, educational services, business consulting services, security services, health services, entertainment services, et cetera. It should be remembered that people buy goods but also want satisfactory services from these goods (Lovelock et al. 2011). How much the content or involvement of services on non-service or material goods is closely related to product criteria. Nirwana (2006) stated that the education services sector clearly has a service levels greater than the material load. Meanwhile, in the tourism sector, the material and service elements have a relatively balanced contribution.

Service is a product that is different from a product that is not a service or is called a physically identifiable product. Because, service is a form of performance or service provided to customers. Kotler et al. (2017), Sunyoto &

Susanti (2015) & Tjiptono (2019) stated that there are four characteristics of services, namely:

1. Intangibility. Services are abstract and intangible.
2. Variability. Service is a non-standard variable and varies greatly.
3. Inseparability. Services are generally produced and consumed at the same time between service providers and service recipients.
4. Perishability. Services cannot be saved.

Lovelock et al. (2011) accordingly specified that being able to feel the service, the customer must consume the service. That is, services can be felt at the same time as consuming them. Services are often said to be intangible products, or are not physically identifiable, or intangible products. A service is an item or product that cannot be physically held; but the existence of services is more a form of benefits that can be felt by people who use these services. There are several definitions of service put forward by the authors of service marketing books. In principle, service is defined as an activity or performance that is not tangible that is offered to meet customer expectations (Kartajaya & Asmara 2014) & (Gibbons 2017). In addition, Kotler et al. (2017) defines service as a 'benefit' offered by one party to another, and the nature of the service is intangible, and does not result in the ownership of anything.

As for the production, it may or may not be associated with physical products'. According to Lovelock et al. (2007), 'services are activities or performances offered to customers. Services are also economic activities that are able to create value and profit for customers at the right time and an exact place. Moreover, services have value benefits because they can meet the needs and desires of service users. Thus, service users can be assessed or measured through their service consumptions (Tjiptono 2019). The real product of the services of a hairdresser cannot be seen, but the form of service from a hairdresser can be used as an indicator to assess the performance of the hairdresser's product. It will be just like the same to other types of service businesses. Likewise, in the education sector although it cannot be seen directly, but the results of the educational process in the form of services can be felt as benefits for students. Thus, the service is more of a service benefit from the process of using the service.

As the basic standard of marketing principles, each business entity needs to prepare its target market in carrying its marketing strategies and objectives (Abdullah & Tantri 2018) & Susilo (2021). In carrying out services in the education business, it is necessary to set a target market as well, that is formed and formulated from the customer segmentation to be targeted. By mapping the right segmentation processes, the target market for educational services, especially vocational studies, can be implemented more accurately and marketing strategies can be implemented more optimally. To be able to identify potential failures in implementing a service for a particular business, it is necessary to make a flowcharting analysis or blueprint that can identify potential failures in the service and implementation of these services (Lovelock et al. 2011 & Kotler et al. 2017).

By drawing a blueprint, service business owners can see where potential failures can occur. Thus, the blueprint mapping can provide in detail the anticipation that can be done in the failure processes. Lovelock *et al.* (2011) describes that there are three ways in developing blueprints:

1. First, identifying all the key activities involved in the creation and delivery of the service;
2. Second, detailing the interrelationships between these activities;
3. Third, correcting the activities if there are potential errors.

Blueprints can be used to define interactions between customers, employees and Managers. So the key characteristic of the service blueprint is to identify the customer experience and employee activities either 'in front of the screen' or 'behind the scene'. All in all, blueprint analysis can be a great reference for business service improvement.

Certainly, effective handling of potential failures will allow customers to at least accept or forgive mistakes made by the business provider. An effective service recovery will maintain the level of trust, satisfaction and customer loyalty for the business involved (Kartajaya & Asmara 2014). The implementation of service quality monitoring must still be carried out at every point in the blueprint. In addition, the success of a service business will be largely determined by the role of employees in the business because they also act as the spearhead who interacts directly with customers. In other words, the success of service marketing is highly dependent on reliable human resources.

Moreover, to achieve optimal results, direct involvement between service providers and consumers is needed. In service marketing, it takes more than just a series of classic marketing mixes (product, price, place, promotion); the role of people, process, physical evidence plays a significant role in the service transaction process (Sunyoto & Susanti 2015, p. 11).

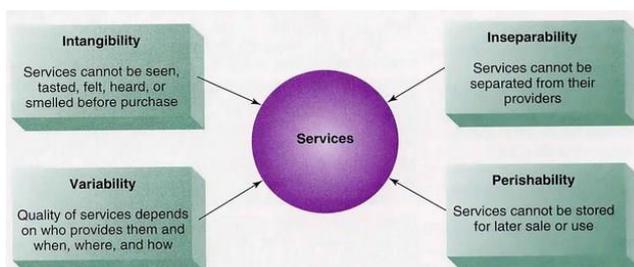


Figure 1. Characteristics of Service (Sunyoto & Susanti 2015)

In this case, employees are very influential on the impression received by customers. The interaction and manner of service of business personnel will determine the success or failure of a service transaction. Especially for services that have a high level of contact with customers, all staff or employees are "part time marketers" (Tjijptono 2019). Therefore, this type of service, including educational services, requires the support of reliable service personnel who are ready to provide customized services to their customers. In certain types of service businesses, personnel who have certain job descriptions can also serve

automatically as customer service, for example in the world of vocational education services.

A trainer/facilitator can also function as customer service. Thus, these facilitators or trainers must be able to demonstrate reliable service capabilities apart from performing their main role or designation within the service business per se. Having great customer service personnel has become a company's need because it supports long-term business growth. Therefore, service businesses need to pay close attentions in providing and empowering their service personnel to carry out their duties and work performance (Djawahir 2021).

### III. RESEARCH METHOD

To obtain data for this paper, the methodology was conducted through literature review by observing and analyzing relevant and related topics for this paper. The main topic which was elaborated in this paper focuses on how MBC be able to identify and analyze potential failures and take corrective actions through its blueprint. The method used is a qualitative method with descriptive, analytical and explorative approaches. The type of data obtained is primary data obtained from unstructured interviews and observation from the respondents. The data analysis technique uses qualitative descriptive in the form of data collection, data analysis and reaching conclusions.

Furthermore, the observation process in this paper was mainly obtained through direct contacts with students at MBC and internal memory recall. This was possible since the establishment and its operation of MBC was founded and managed by the author.

There were several interviews with previous and current students to help author get more insights on how the MBC's service should be accordingly carried out and to actually obtain their good personal opinions about their experiences when studying with MBC. Their supportive input contributes great insights for the author to formulate strategies on how to maintain customers. In addition, to support personal ideas and opinions, the author conducted interviews with a teacher and an administrator within the organization to get better perspectives on the current practices and challenges of MBC.

### IV. RESULT AND DISCUSSION

#### 1. Organization Background

MBC is a family-owned business, located in Kelurahan Karangria, Manado, North Sulawesi, which ventures its business in education services especially providing English & Business trainings. It's been in operation since May 1998 up to the present time and has served various types of customers either online and offline courses. The establishment of MBC was under the license from Education National Department, Manado Municipality registered number: 847/I/16.20/MS/98, dated 2 December 1998, in response to the Indonesian Government's campaign of improving human resource quality; especially in the sector of foreign language proficiency.

The establishment of this institution was during the time of massive impacts of the monetary crisis which hit Indonesia and other South-East Asian countries in 1997-1998. The founder perceived that this type of business would be able to survive and gain valuable success due to the fact that there would always be a demand for this particular service. Consequently, bearing the motto of ‘always and real’ MBC has been able to survive within its industry even though there are several big competitors in the city (English First, Go Global, Michigan College). It mainly conducts its business in slightly different ways; conducting courses at MBC’s premise and/or at participants’ places (house, office or clubs). In other words, MBC has been flexible in delivering its service.

Another distinct difference of MBC lies in its human capital support by which the office manager, English teachers and administrative staff are multi-skilled people; they are able to perform different tasks at different times such as being marketing agents and ‘back-up’ English facilitators. In other words, the administrative staff can also act as English teachers for certain cases. Table 1 depicts current registered students as per October 2021, teaching personnel & administrative staff.

Table 1. Number of students & personnel as per October 2021

Categories	Numbers	Descriptions
Current Active Students	26	Various studies
Teaching Personnel	3	
Administrative Staff	2	1 also acts a teacher

## 2. MBC’s Target Market and Service

Table 2 & 3 depict further information about MBC’s target market and its offered service.

Table 2. MBC’s target market

MBC TARGET MARKET CHARACTERISTIC	
<b>DEMOGRAPHIC</b>	
<b>Age</b>	Children (6 to 12), Teenagers (13 to 19) and Young Adult (20-30), Adult (31 and above).
<b>Gender</b>	both sexes
<b>Education</b>	Pre-schools, Primary, Junior & Senior High Schools, and University students, Workers
<b>Income</b>	Children & Students still depend on their parents, workers are self-payment
<b>PSYCHOGRAPHIC</b>	
<b>Personality</b>	Those who want to get higher achievement in terms of personal drives to get better self-actualization. However, for children, it mainly deals with self-familiarisation to a foreign language.
<b>Lifestyles</b>	Children and teenagers need to get more knowledge. Workers/adults look for specific advantages in their social life in terms of English Language mastery in order to get more self-esteem.
<b>GEOGRAPHIC</b>	
<b>Primary</b>	The main target covers the city of Manado (the capital of North Sulawesi, Indonesia).
<b>Secondary</b>	The other surrounding cities within the province.
<b>Tertiary</b>	The other cities outside the province.
<b>BENEFIT</b>	
Certain niche markets come from private and public institutions (banks, diving centres, and hotels), workers and students who want to continue studying overseas might seek more knowledge which is relevant to their	

interest and personal goals. Benefit segmentation is the process of grouping customers into market segments according to the benefits they seek from the product/service (Summers et al 2001).

Table 3. MBC’s service offer

MBC EXISTING SERVICES & SPECIFIC TARGET MARKETS		
Course Type	Market	Description
<i>English Grammar Studies</i>	Teenagers to adult, starting from Junior High schools	<ul style="list-style-type: none"> <li>The course consists of Elementary, Intermediate, Upper Intermediate.</li> </ul>
<i>Test of English as a Foreign Language (TOEFL)</i>	Teenagers to adult	<ul style="list-style-type: none"> <li>Courses for further studies (overseas) and university graduates.</li> </ul>
<i>International English Language Testing System (IELTS)</i>	Teenagers to adult, starting from senior high schools	<ul style="list-style-type: none"> <li>For further studies in Australia and UK.</li> <li>In response to AusAid Scholarship programs.</li> </ul>
<i>General Studies</i>	Teenagers to adult, starting from Junior High Schools	This course focuses on general knowledge of English Language covering the four aspects of language learning; Speaking, Reading, Writing, Listening.
<i>Children Classes</i>	Pre Schools and Primary Students	<ul style="list-style-type: none"> <li>To provide familiarisation knowledge of a foreign language.</li> </ul>
<i>English for Specific Purposes (ESP)</i>	Private & Public Employees.	<ul style="list-style-type: none"> <li>To conduct specific language in specific fields (ex. English for Banking).</li> </ul>

## 3. Patterns and Determinants of Demand

In services, companies must be able to forecast the forces determining the pattern of demand to their specific services so that they are able to build strategies in order to anticipate the future trend of demand. Thus, management must first grab good understanding on what aspects influence demand for particular services at specific times. To do this, Lovelock et al. (2004, p.302-303) propose four specific questions that companies need to analyze; Does the level of demand for the service follow a predictable cycle? What are the underlying causes of these cyclical variations? Do demand levels seem to change randomly? Can continual demand for a particular service be disaggregated by market segment? As a result, MBC needs to establish answers to the above questions in determining its demand analyses.

In addition, the determinants of demand may also come from psychological factors. In other words, the decision to spend one’s disposal income on specific purchase or other purchase alternatives involves important psychological determinants. Accordingly, the determinants can be used as segmentation variables (Kotler et al. 2017).

## 4. Blueprint of Service Delivery System

Blueprinting is a form of process flowcharting. The chart describes graphically what tasks are included in a process and the sequence in which they are performed (Gronfeldt & Strother 2006, p. 131). In addition, Lovelock et al. (2004, p.245) outline that blueprinting considers every activity – backstage as well as frontstage which are needed to deliver a service as well as specifying the links between these activities and the points of contact between staff and consumers. The development of the blueprint needs to involve a variety of functional representatives as well as

information from customers. In line with this, figure 2 & 3 present the established blueprinting for MBC.

Figure 2 & 3 clearly show that the frontstage incidents outnumber those of the backstage. However, MBC’s service delivery cannot be conducted without having the integrated supports of the frontstage and backstage operations. Accordingly, there is a line of visibility between the two stages. It is a line which distinguishes between what customers’ experience frontstage (customers can see) and backstage (customers cannot see) (Lovelock et al. 2010). The key implication of MBC’s blueprint is that management is able to better evaluate and analyze how well each activity performs and what improvement is needed throughout the service delivery.

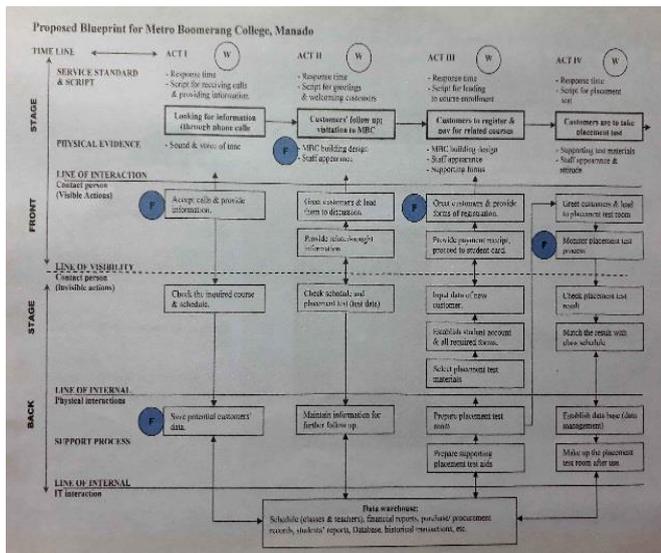


Figure 2. Proposed blueprint for Metro Boomerang College  
 Source: Adapted from Pemasaran Jasa, Manusia, Teknologi, Strategi, Perspektif Indonesia, Lovelock et al. 2010, Erlangga, Indonesia, p. 238-241

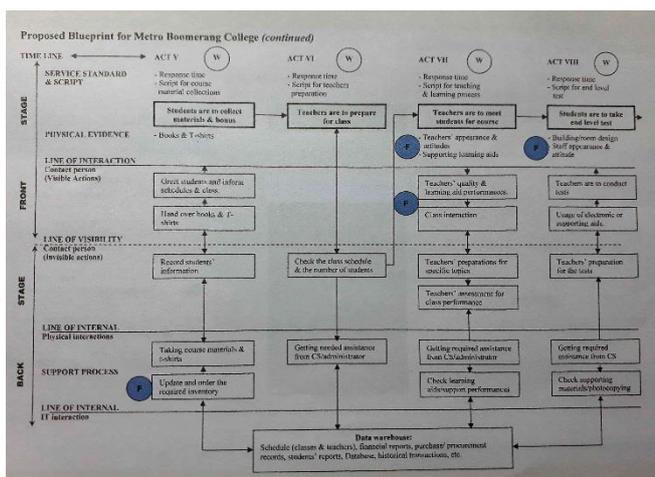


Figure 3: Proposed blueprint for Metro Boomerang College  
 Source: Adapted from Pemasaran Jasa, Manusia, Teknologi, Strategi, Perspektif Indonesia, Lovelock et al. 2010, Erlangga, Indonesia, p. 238-241

## 5. Potential Fail Points

It is commonly said that if you can’t define something, you can’t measure it, and what you can’t measure you can’t manage (Lovelock et al. 2004, p.98). Failure in service delivery is inevitable to every service provider. However,

the ability to forecast and identify potential failures in service delivery is essential for organizations so that they can anticipate and provide contingency plans for the particular ‘breakdowns’. Lovelock et al. (2010) propose that organizations may evaluate their blueprint as a way to detect potential failures in each stage/act of their service offers.

## 6. Recommended Improvements

Service providers must design ‘memorable personal experiences’ for their customers (Kotler et al. 2017). This can be done by elevating improvements for the service per se. MBC is no exceptions; management must be able to analyze strategies on how to improve its service delivery to meet all expectations of its target market.

### Managing Capacity and Demand

MBC needs to organize resources such as people and space in relation to low and peak seasons. Certainly, MBC wants to gain as much profits as possible by having many customers registered for its service. However, it will not be possible if the capacity cannot match the demand. Therefore, MBC should look for strategies on how to address this issue since capacity can also be determined by the degree of efficiency and effectiveness. In other words, capacity can be affected by the degree of flexibility in the service firm (Soeprajitno 2015).

### Demand Exceeds Capacity

In order to prevent business’ loss, MBC may try to manage demand by evaluating its available resources. This can be done by:

- Scheduling techniques - shifting classes to different times or days where demand is relatively low. In order to do this, pricing techniques may be generated such as giving discounts or bundled priced (two courses for one price) (Levy & Weitz 2004). Again, this should be analyzed carefully in terms of time allocation as well as revenue and expenses analysis.
- Renting spaces at available sites - a break-event-point analysis may be generated to calculate cost and revenues.
- Mobile training - MBC’s teachers may come and conduct courses at students’ premises.
- Online training – Another alternative, courses may be conducted through online courses using technology supports.
- Employing multi-skilled staff (the current strategy) – teachers with administrative skills and administrators with teaching skills (for certain levels of students). Certainly, quality guarantee must be considered thoroughly if this alternative must take place.
- Managing Waiting-Listers. There are times that students might be in the waiting-list when demand exceeds capacity. Therefore, MBC should provide techniques that holds ‘the waiting-listers’ not to run to MBC’s competitors. Relevant techniques to hold the waiting-listers are:

- Allowing them to use MBC’s facilities such as libraries for free (under certain conditions),

- Allowing them to follow the English Club so that they will also have pre-encounter experience with MBC,
- Allowing them to participate in any other activities such as excursions, social services, and religious English groups.
- Providing ‘teasing-advortorial views’ through internet link-connections displaying MBC success stories or best practices.

The purpose of providing this is to hold potential customers so that they may not feel bored due to the tedious and long waiting or feel of being ignored. The implications: when increasing capacity is simply not feasible, management should try to be creative and look for ways to make waiting more palatable for customers (Lovelock et al. 2010).

#### Capacity Exceeds Demand

To minimize time and money waste, MBC needs to generate marketing communication strategies in order to attract customers. This can be done by:

- a. Doing public relations/publicity as a form of non-paid ads (Belch & Belch 2007). This is due to the financial constraints of MBC.
- b. Generating ‘yield management’ strategy. Lovelock et al. (2004, p.289) identify that yield management strategies seek, whenever possible, to obtain some return from perishable capacity units rather than nothing at all. Thus, MBC can do this by giving much lower discounts. However, this should be considered so that it will not affect the image of MBC as well. This technique can be ‘disguised’ as social responsibility concerns toward community.
- c. Forming partnerships/alliances. Management can perform alliances with schools or private and public organizations in order to conduct courses and training & development programs as a means of improving students’ and workers’ capabilities and competencies.

#### Managing Customer Service Functions

Retailers should remember it is not the competition that puts them out of business, it is the customers – when they stop shopping with you, and when they tell others of the poor service they received from you (Sutari 2016) & Santosa (2015). This statement is not only addressed to retailers, but also to all businesses. Thus, MBC should bear in mind that if it delivers poor service; then, surely it will be out of business. To deliver good customer service functions, MBC needs to evaluate the competency of its human capital since they are the main ‘arrows’ in the service delivery. Therefore, strong integration of backstage and frontstage personnel should be maintained by all MBC’s employees. To do this, MBC should establish service standards especially at teachers’ level so that all teachers perform at the required and expected ‘delivery’. This will surely provide good image for target markets in that MBC provide standardized teaching quality.

#### Employee & Customer Service

MBC’s customers’ satisfaction is greatly influenced by the excellent collaboration of all entities within the institution. To perform this, MBC may want to adopt the ‘5 great values of customer service’ proposed by Rossell (2001); show respect, personalized the service, pay attention, show your care, and advocate. Applying these values will be beneficial for MBC since customers are most likely to be influenced by the performance of company’s personnel rather than the product/service itself (Suchaeri 2016).

#### Facilitating and Supporting Elements

It is imperative that MBC pays considerable attentions to its facilitating (information, payment, accessibility and facilities) and supporting (consultation, interpersonal, safety, exceptions) elements to the core service in elevating its business performance. This concept explains that supporting services are those which supplement and add values to the core service offering and serve to differentiate one service provider from another. On the other hand, facilitating services are those that facilitate the delivery and consumption of the core service (Lovelock et al. 2004, p.209). Figure 4 illustrates relevant elements that MBC needs to assess of its supporting and facilitating elements to the core service.

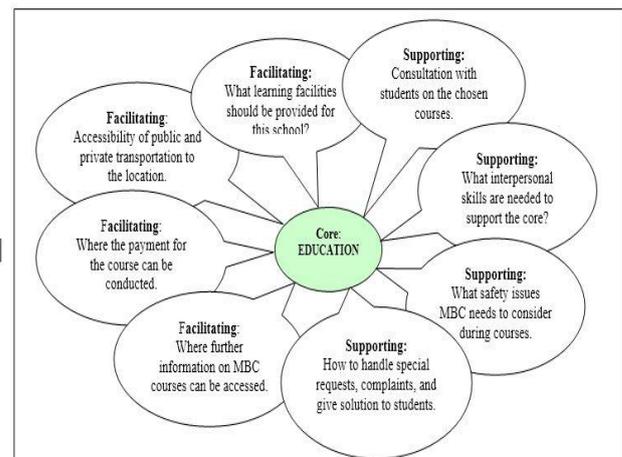


Figure 4: Facilitating and Supporting Elements for MBC  
 Source: Adapted from Services Marketing, 3rd edn., Lovelock (2004, p.210).

#### 7. Service Quality Monitoring Systems

An overall performance of monitoring should be established within a company. The monitor must be in all aspects of business elements, not only for a particular unit, in order to guarantee an integrated delivery of the business. Failure in one business unit will absolutely ruin the entire business processes. Therefore, MBC should monitor all aspects within its industry as outlined in the blueprint. The monitor processes need to be conducted in regular basis to ensure that any potential failures/damages can be prevented or, at least, minimized. A way to conduct monitoring service is through customer feedback and comparing service delivery with quality standards (Williams 2003). To do this, MBC can conduct research by conducting survey methods such as:

- a. Personal interviews: MBC can directly ask customers on how they evaluate the service delivery; whether they are satisfied or not.
- b. Observation: MBC can also conduct direct observations at different service delivery contacts; customer service and teaching. Direct observations will also be valuable since customers’ and employees’ behavior can be detected. Therefore, any ‘gaps’ can be identified and must be responded quickly.
- c. Electronic survey: Customers may not feel comfortable and unable to provide ‘true’ answers if interviews are taken; therefore, MBC can also apply an internet survey. This type of survey will ease respondents in providing feedbacks.

directly (by phone or face-to-face) or write letters/emails to the management. Undoubtedly, positive attitudes need to be carried by both management and staff.

#### Human Resources Performance

Employees are often central to an effective customer service function (Wood et al. 2004). In other words, customer satisfaction and service quality can be influenced directly by service employees (Lovelock et al. 2010). Therefore, MBC need to monitor its HR’s performances and competency during the business process. This can be done through monitoring employee performance by either observing employees in action or by utilizing employee questionnaires. Results obtained from monitoring should be discussed with the employees to alleviate any ambiguities in the employees’ minds about the appropriate actions to take when questionable situation arise (Hoffman & Bateson 1997, p.116).

Furthermore, MBC can focus its service quality monitor in two biggest areas; service delivery management and human resource performance.

#### Service Delivery Management

- a. Service Recovery  
 MBC must establish benchmarks for its service recovery strategies since it is very important for the ultimate customer satisfaction. Lovelock et al. (2004, p.135) proposed two main components for service recovery system that MBC can adopt in order to increase customers’ satisfaction and loyalty; do it right at the first time and effective complaint handling.
- b. Do it Right for the first time  
 MBC needs to bear in mind that providing excellent service delivery in the first encounter will certainly leave good impressions and certain ‘memories’ for the customers. Customers are likely to get ‘stuck’ with the service provider if the first encounter is well delivered and exceeds their pre-expectations. This is because so much customer service is poor; therefore, customer expectation is low (Gronfeldt & Strother 2006). Thus, MBC’s staff must be highly trained and empowered to perform this.
- c. Effective Complaint Handling  
 MBC should value customer complaints as valuable information for its better improvements in delivering service. Soeprajitno (2015) outlines that customers who take the time and trouble to complain are actually doing a favor for the organization in that they are helping the organization’s business grow and giving opportunities for the organization to keep them as customers. However, most organizations do not perceive complaints in this way; but rather, they ignore complaints and do not put effort to handle them effectively. MBC should take complaints as ‘good lessons’ to be learnt. Therefore, MBC needs to create a culture of welcoming complaints. It does not mean that MBC should always look for complaints; but rather MBC should see complaints as customers’ kind concerns for MBC’s growth. To welcome complaints, MBC can put a complaint box at the premise or encourage customers to talk

### 8. Resources Requirements

Table 4. Resource Management at MBC

RESOURCE MANAGEMENT AT MBC			
Resource	Why it is important	Potential drawbacks	How to overcome
<i>People</i>	Without the strong support of teachers and administrative staff, MBC cannot operate.	Shortage of teachers and/or administrative staff (customer service).	<ul style="list-style-type: none"> <li>• MBC should employ multi-skilled staff.</li> <li>• Conduct good analysis and scheduling of needed HR requirements &amp; skills.</li> </ul>
<i>Space</i>	Room management within the premise is crucial to accommodate the demand.	Available rooms may not suit the demand for specific time.	<ul style="list-style-type: none"> <li>• Conduct courses at customers’ premise.</li> <li>• Rent other spaces (local schools or public halls).</li> </ul>
<i>Money</i>	This is a vital resource that needs to guarantee the continuity of MBC.	Shortage of money to support operational costs.	<ul style="list-style-type: none"> <li>• MBC should conduct cost-cut awareness in its operation.</li> <li>• Conduct specific MC campaign to generate more customers.</li> </ul>
<i>Equipment</i>	As facilities and infrastructures, this is also crucial for the overall performance of MBC.	Old-dated and/or broken equipment.	<ul style="list-style-type: none"> <li>• Update the supporting materials.</li> <li>• Generate regular checks.</li> </ul>
<i>Suppliers</i>	To guarantee the course supplies readiness such as guide books, etc.	Lateness of supply delivery and non-standard requirements of learning materials.	<ul style="list-style-type: none"> <li>• Outline datelines.</li> <li>• Establish suppliers’ service guarantee and warranty.</li> </ul>

Business needs to consider the availability and readiness of its resources to be compatible with its business requirements. Therefore, resource management must be well assessed to guarantee a smooth operation of the business. Accordingly, MBC's resources lie in five big areas; people, space, money, equipment and suppliers. MBC's management is strongly required to conduct thorough evaluation and analysis for its resource management since each entity of its resource may cause a potential damage for the service delivery if it is not handled carefully. In line with this MBC can apply risk management principles to anticipate future drawbacks. Table 4 details the information of resource requirements at MBC together with analysis of potential damage and how to overcome it.

#### V. CONCLUSIONS

MBC's prime objective is to perform the best service delivery which satisfy all aspects of its customers' expectations throughout pre, during and post service deliveries. Thus, MBC must be able to identify any elements which might escalate or even fail the process of service delivery. To do this, it will be beneficial for MBC to draw a blueprint as an overall guideline and conduct analysis in which part it may perform well or vice versa; it will ease the organization to spot potential service failure at certain 'locations' within the blueprint itself. MBC needs to prepare a firm Standard Operating Procedure or Guidelines as well so that teachers or administration staff conduct their performances according to what have been outlined.

Furthermore, MBC needs to assess the demand and capacity management as well as the availability of supporting resources in order to provide good standard of service delivery. This is also crucial for MBC to consider so that optimal profit can be generated and, at the same time, resource allocation/requirements are used effectively and efficiently.

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# Application of an Appropriate Technology to Maintain the Economic Sustainability of Salt Farmers

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**Abstract**— Indonesia as a maritime country has many potential marine resources, one of which is salt. With the second longest coastline in the world, Indonesia has a great opportunity to be able to meet its national salt needs from its own salt production and not depending on import. Currently, Indonesia's salt production is dominated by salt farmers scattered throughout Indonesian coast, especially around Java and East Nusa Tenggara. The salt produced by local farmers is only able to provide salt with the purity of NaCl around 85-95%, whereas the industrial salt needs a minimum purity of 98.5% NaCl and impurity levels of Ca<sup>2+</sup> and Mg<sup>2+</sup> of a maximum of 0.1 and 0.06% respectively (based on the Indonesian National Standard). This condition makes Indonesia import industrial salt consequently. Many aspects need to be considered and resolved to improve this situation. The goal of our research is to improve the pond system that the local salt farmers usually use to produce salt. By using modeling and simulation, an integrated pond system can be redesigned. The integrated pond system may increase the salt productivity by 30-50% and the salt purity up to 99%. The integrated system is currently being constructed and tested on the island of Sabu, East Nusa Tenggara. By still allowing salt production to be carried out by salt farmers instead of big investors, a strong and sustainable economic system can be generated. Moreover, an appropriate technology is also more suitable for protecting the environment.

**Keywords**— *Appropriate Technology, Modelling, Sabu Island, Salt Farmer, Simulation.*

## I. INTRODUCTION

Salt is one of the basic needs in human life, especially NaCl salts. This salt is widely used both as raw materials in various industries as well as human and animal consumptions. The demand for industrial salt in Indonesia in 2018 reached 70% of the total salt demand and the rest 30% was consumption salt (Asosiasi Industri Pengguna Garam Indonesia – AIPGI). It can be seen as well that the total salt demand increases from year to year [1].

As a maritime country, Indonesia is surrounded by oceans which provide abundance natural sources of salt. So, it should be able to meet the needs of national salt independently. Unfortunately, domestic salt production has not been able to meet the quality required by the industrial salt yet. Thus, the industrial sector still needs to import the high-quality salt from foreign countries.

The main problem of the above situation is that most of the salt production are conducted by salt farmers using a

simple evaporation method. The salt produced contains a relatively high mineral impurity, thus only suitable for consumption salt not as raw materials in industries. Although their salt production is high, especially during the dry season, the salt price tends to drop, while the import remains high because the production is higher than the demand for consumption salt. However, the purity does not meet industrial salt requirements. This condition makes the salt farmers cannot improve their economic level. The low income causes them not to be able to support their children to get a better education. Without a good education they cannot improve their product quality and change their economic capability. This condition continues to spin without a solution.

So far, the design and construction of seawater evaporation pond systems in literatures and practices does not give enough attention to the fact that at a certain concentration in the seawater evaporation process, certain impurities can be precipitated easily. As a result, the impurities are not separated properly during the process and remains in the salt product. The size and shape of the pond have to be determined by considering not only the rate of evaporation but also the impurities precipitation during the evaporation process to achieve the highest possible salt production rate and purity.

Therefore, the goal of this research is to redesign the open pond of salt fields to be more efficient and thus give a higher salt production rate. Furthermore, the appropriate technology in salt production is also introduced, so that not only the salt quantity can be improved, but more importantly the salt quality (i.e., the purity of NaCl in salt) can meet industrial salt requirements.

The methodology used in this research was by modeling a traditional salt field based on mass balance of salts and water, surface area, time to evaporate, and height in each pond. The variables considered affecting the model were wind speed, sunlight intensity, temperature, pressure, humidity, and NaCl concentration changes. Then, the model was simulated using natural condition data in Sabu Island, East Nusa Tenggara. The economic analysis of the integrated salt production system was also provided based on the current market price.

By applying this integrated salt production system, theoretically the salt productivity could be increased by 30-50% and the purity could be improved up to 99%.

## II. LITERATURE REVIEW

In general, salt is produced through solar evaporation of seawater, mining of rock salt, and brine well. Depending on their sources, the raw salt has different composition. Solar evaporation of seawater is the most popular and common method to produce salt, since more than two thirds of our earth surface consists of ocean. Around 80,000,000 tons/year of salt produced in the world comes from this method [2].

In Indonesia, salt production from seawater is carried out by conventional methods using sunlight with several ponds served as a place for water storage (reservoir), evaporation, and crystallization. These ponds usually are built by salt farmers depending on the availability of the land area. The maximum of salt production and purity is 45-52.5 tons/hectare/month and 90% respectively. The salt purity has not met the industrial salt standards yet [3].

In the conventional methods, seawater with a salinity of 3.5-4°Be is firstly put into a holding pond. In this pond, sand and mud are precipitated. Clear seawater is then moved to a series of evaporation ponds. During the evaporation process, the seawater salinity is gradually increased, and certain salt impurity compounds are started to precipitate. When the salinity reaches 18-23°Be, the seawater is fed into a crystallization table to precipitate salt product which consists of mostly NaCl. The crystallization process is carried out until the salinity reaches 29°Be. At this salinity, the residual concentrated seawater, called bittern water, must be separated. The bittern water contains relatively high Mg salt. If the Mg salt is precipitated in a relatively high amount and contaminate the NaCl salt, it can make the salt product tastes bitter [4, 5].

In Indonesia, the conventional salt field is mostly made with only soil as the base. This can cause soil contamination of the salt product. This also can cause seawater loss during the process by permeating into the ground, thereby reducing the amount of salt production, and moreover contaminating the ground water. Currently, geomembrane has been used as liner for the salt field. Geomembrane is a synthetic polymer consisting of polyethylene, polypropylene, or polyvinyl chloride. The UV resistance of geomembrane is gotten from the addition of carbon black and antioxidants during its manufacturing, so it is safe to be used for salt production. In our research, it was assumed that the soil in the salt field was lined by geomembrane. So, the soil contamination of salt product and the loss of seawater during process could be ignored [6].

Seawater has different concentration of salt depending on the area from which the seawater is drawn. This is usually defined as salinity. The unit commonly used to express the salt concentration or salinity is degrees of Baume (°Be). At a certain degree of Baume there will be precipitation of certain salt compounds, depending on their solubility in water and K<sub>sp</sub> (solubility product constant) values [7]. So, during the solar evaporation, different salt compounds are precipitated. Since seawater also contains various salt compounds other than NaCl, the precipitation and separation of these other compounds is very important to produce high purity NaCl salt. Table 1 shows the relation between the salinity and the corresponding salt compounds precipitated at that salinity level.

Table 1: Salt Precipitation per °Be [8]

°Be	Precipitated salt
3.00-16.00	Mud/Sand/Fe <sub>2</sub> O <sub>3</sub> /CaCO <sub>3</sub>
17.00-27.00	Calcium sulfate (CaSO <sub>4</sub> )
26.25-35.00	Sodium chloride (NaCl)
27.00-35.00	Magnesium salts (Mg (OH) <sub>2</sub> , MgCl <sub>2</sub> etc.)
28.50-35.00	Sodium bromide (NaBr)

In Bassegio [4], an experiment was conducted to determine the amount of water evaporated and the amount of certain salt compounds precipitated at a certain Baume scale in the range of 3.5°Be to 29°Be. Different salt compounds precipitated in different range of concentrations expressed by degree of Baume. It was assumed that the salt compounds only involved CaSO<sub>4</sub>, NaCl, MgSO<sub>4</sub>, MgCl<sub>2</sub>, KCl, and NaBr, which were the major compounds in seawater.

To get the highest purity of NaCl salt, the crystallization process should be conducted around 26–29°Baume. Below and/or above that salinity range, other salt compounds would precipitate with a higher amount as well. Thus, the purity of NaCl product would decline.

Seawater evaporation is a process of reducing the water content and concentrating the non-volatile solutes in a brine solution simultaneously [9]. There are three phenomena, which can be observed during seawater evaporation, i.e., mass transfer, energy transfer, and salt precipitation. Mass transfer describes the mechanism of water vapor movement in the atmospheric air surface. Energy transfer is focused on the energy associated with evaporation. Salt precipitation concerns about the crystallization of various salt compounds during evaporation. Solar evaporation of seawater in open pond is affected by temperature, wind speed, sun radiation, pressure, salinity, surface area of water, and relative humidity [10, 11].

## III. RESEARCH METHOD

The method consisted of several steps. The block diagram, which illustrates the sequence of works in the method can be seen in the following chart (Fig. 1).

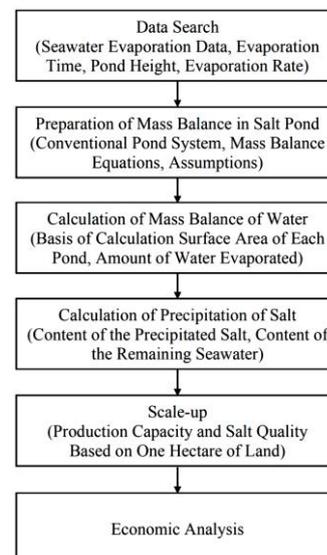


Fig. 1. Research Methodology.

### Data Search

The seawater evaporation data used in this research was taken from Bassegio [4], which included the amount of water needed to be evaporated and the salt content of the remaining seawater at each degree of Baume. The targeted increase of degree of Baume in each pond was then determined based on this data. The evaporation time (t) and the height of seawater in each pond ( $H_{pond}$ ) were fixed based on the common practices in the field.

The evaporation rate (u) was obtained from [12]. The study provided data of evaporation rate in Sabu-Raijua region, East Nusa Tenggara, in every month from 2013-2015 with the highest evaporation rate of 10 mm/day. This evaporation rate would be used in our salt pond modeling and simulation.

### Preparation of Mass Balance in Salt Pond

The pond model in this research was derived from a conventional pond system. As previously mentioned, the conventional pond system was usually divided into several ponds, serving as a seawater reservoir, a series of evaporation process, followed by crystallization tables.

If the evaporation rate (u), the evaporation time (t), and the height of seawater in each pond ( $H_{pond}$ ) were fixed, the mass balance for water in each pond could be calculated to give the surface area of each pond needed to evaporate the amount of water to achieve the targeted increase of degree of Baume in each pond. Using the data provided by Bassegio [4], the mass balance for each salt compound could then be calculated to predict the salt content of the precipitated salt and the remaining seawater in each pond.

It was assumed that geomembrane lining was used in each pond in the salt field. It meant no amount of seawater was loss by permeating into the soil during the process. The use of geomembrane was considered because it prevented the permeation of seawater that would reduce the production of the salt and also prevented the soil contamination that would reduce the quality of the salt produced.

The mass balance used to calculate the salt (i) that was settled ( $M_i^{precipitate}$ ) and flowed to the next pond ( $M_i^{remain}$ ) was given by Equation (1).

$$M_i^{in} = M_i^{precipitate} + M_i^{remain} \quad (1)$$

The mass balance used to calculate the amount of water (w) that was evaporated ( $M_w^{evaporate}$ ) and flowed to the next pond ( $M_w^{remain}$ ) was given by Equation (2).

$$M_w^{in} = M_w^{evaporate} + M_w^{remain} \quad (2)$$

The initial mass of brine solution in the pond was symbolized with  $M^{in}$  while subscript (i) was used to denote a certain salt compound involved in the process (i.e., NaCl,  $MgSO_4$ ,  $CaSO_4$ ,  $MgCl_2$ , NaBr and KCl)

### Calculation of Mass Balance of Water

The amount of seawater used as a basis for calculation was 1,103 L with the same salt composition as described in

Bassegio [4]. The mass of seawater in each pond could be calculated as follows:

$$M^{in} = V_{brine} \times \rho_{brine} \quad (3)$$

The surface area of each pond could be determined from the volume of seawater in each pond and the pond height as follows:

$$A_{pond} = \frac{V_{brine}}{H_{pond}} \quad (4)$$

Once the surface area of each pond ( $A_{pond}$ ) was known, the amount of water evaporated could be determined by multiplying the evaporation rate (u), the evaporation time (t) and the surface area of the pond ( $A_{pond}$ ). The mass balance of water then could be used to estimate the degree of Baume that could be achieved in each pond.

### Calculation of Precipitation of Salt

Once the amount of water needed to be evaporated in each pond was determined, the mass balance for each salt compound could be calculated to predict the salt content of the precipitated salt and the salt content of the remaining seawater in each pond using the seawater evaporation data provided by Bassegio [4].

### Scale-up

So far, the calculation was done using the volume of seawater of 1,103 L as a basis. The total land used from the first evaporation pond to the crystallization table was very small. This basis could be scaled up so that the total land used was about one hectare. All calculations were recalculated to obtain the amount of seawater that could be fed into the system as well as the amount and NaCl purity of the amount of salt produced from one batch in one hectare of land.

### Economic Analysis

The feasibility analysis of this integrated pond system, derived from the modeling and simulation, was also conducted.

Revenue was obtained from the amount of salt produced multiplied by the price of salt. The price of salt was set at the average price of salt in East Nusa Tenggara in 2020 of Rp.600/kg with the lowest price at Rp.200/kg and the highest price at Rp.1,000/kg depending on the supply of salt in the market [13]. The production time was only during dry season, which was estimated around 8 months. So, the revenue for one year was obtained from the revenue for 1 month multiplied by 8 months.

The total investment cost consisted of the cost of purchasing and installing the geomembrane, the cost of renting the heavy equipment, and the cost of labor to construct and prepare the salt farming ponds and other facilities. All the cost was calculated from the current construction project in the field. The total investment cost was around Rp.350,000,000.

The manufacturing cost consisted of the operational cost and the depreciation cost. The operational cost consisted of the labor cost, the fuel cost, the maintenance cost, and

miscellaneous cost. The operational cost was estimated based on the experience in the field at Rp.20,000,000 per month. The depreciation cost ( $d_k^{SL}$ ) was calculated using the straight-line method (SL) by dividing the total investment cost ( $FCI_L$ ) with the economic age/life of the salt fields ( $n$ ), which was assumed to be 5 years. The salvage value ( $S$ ) was assumed to be 0.

$$d_k^{SL} = \frac{FCI_L}{n} \quad (5)$$

The labors worked in the salt field for harvesting the salt product, controlling the water intake, controlling the concentration of brine in each pond and so on. The labors were assumed to be 10 persons. All the labors were working part-time and paid at Rp.1,250,000 per person.

The feasibility of this project was measured in several economic indicators, such as the Return on Investment (ROI), the Payback Period (PBP), the Internal Rate of Return (IRR) and the Net Present Value (NPV). The time frame used in the analysis was 10 years.

To calculate these economic indicators, the Earning After Tax, Interest and Manufacturing Cost ( $EAT_k$ ) in every year ( $k$ ) was calculated as follows:

$$EAT_k = Revenue - Manufacturing Cost - Tax - Interest \quad (6)$$

with the revenue and the manufacturing cost calculated using the method described above. Interest was assumed to be zero and tax was determined based on the current tax regulation in Indonesia.

The cash flow ( $C_k^f$ ) in every year ( $k$ ) was calculated using this formula:

$$C_k^f = EAT_k + d_k^{SL} \quad (7)$$

The Return on Investment (ROI) was calculated with this formula.

$$ROI = \frac{EAT_k}{FCI} \quad (8)$$

The Payback Period (PBP) was determined as follows:

$$PBP = n + \frac{ACF_{k-1}}{CF_k} \quad (9)$$

where  $ACF_{k-1}$  was the negative accumulative cash flow in year  $k-1$ ,  $CF_k$  was the cash flow in year  $k$  where the accumulative cash flow began to be positive, and  $n$  was the year which had the negative accumulative cash flow.

The Net Present Value (NPV) was calculated using the formula:

$$NPV = \sum_{k=1}^{10} \frac{C_k^f}{(1+i)^k} - FCI_L \quad (10)$$

where  $i$  was the discount rate, assumed to be 10%,  $C_k^f$  was the cash flow in each year, and  $k$  was the number of years.

The Internal Rate of Return (IRR) was calculated using Equation (10) by trial and error, so that the NPV calculated using a certain discount rate, called IRR, must be zero.

The sensitivity analysis was also conducted to understand the effects of fluctuated economic parameters to the feasibility of the project. For this analysis, the economic parameters chosen to be varied and analyzed are the total investment cost (increased by 25-50%), the manufacturing cost (increased by 25-50%) and the salt price (decreased to Rp400-Rp500).

#### IV. RESULT AND DISCUSSION

##### 1. Modeling, Simulation, and Implementation Result

The modeling was conducted by using the salt and water mass balance, supported by various correlations and data, such as the pond surface area, the pond height, the evaporation time, the evaporation rate, and the amount of salt precipitated at a certain brine concentration (i.e., degree of Baume).

By solving the model, it was found that the salt precipitated when the salinity passed through 11.94<sup>o</sup>Be is CaSO<sub>4</sub>. The NaCl salt itself precipitated when the salinity passed through 26<sup>o</sup>Be. The precipitation of NaCl happened in the crystallization table, operated in the salinity range of 26-29<sup>o</sup>Be. The purity of NaCl salt obtained was relatively high at 99% (dry basis). So, it met the industrial salt requirements.

From this study, it was also found that the main impurity in the NaCl salt is CaSO<sub>4</sub> (calcium sulfate). This was due to the data provided by Bassegio [4] used in this study that neglected the CaCO<sub>3</sub> (calcium carbonate) as one of the possible precipitated salt compounds. Since the salt precipitation in the crystallization table was kept in the salinity range of 26-29<sup>o</sup>Be, other salts such as magnesium and bromide salts were very low and not detected.

From the scaling-up, the salt production could potentially reach 66.9 tons/month/hectare. This value was higher than the salt production of conventional salt fields in general, ranging from 45-52.5 tons/hectare/month [13]. The percentage of area used by each pond type and the design parameters of each pond for 1 hectare of land is given in Table 2 and Table 3, respectively.

Table 2: The Percentage of Area Used by Each Pond Type

Pond Type	%
Evaporation Ponds	86,89
Crystallization Tables	13.11

Table 3: The Design Parameters of Each Pond for 1 Hectare of Land

Pond	Area (m <sup>2</sup> )	H <sub>pond</sub> (m)	Time (days)	°Be
Evaporation A	3237.97	0.3	4	6.49
Evaporation B	1850.54	0.2	4	8.68
Evaporation C	1727.59	0.15	4	16.83
Evaporation D	1871.95	0.15	4	24.94
Crystallization	1311.95	0.05	3	29.00

The results from this study have been implemented on the seashore of Sabu Island, East Nusa Tenggara. The following picture (Fig. 2) shows the progress of salt field construction.



Fig. 2. (A) Ponds A, (B) Ponds B, (C) Ponds C, (D), Ponds D, and (E) Crystallization Table (note: color printing)

From the simulation, the salt production was predicted around 66,9 ton/month and the purity of salt was around 99%. The real results from the field, based on this design, have not yet been available. A slight deviation may occur in the field since the simulation in this study was based on the seawater evaporation data from the literature.

In the literature, the seawater only contained  $\text{CaSO}_4$ ,  $\text{NaCl}$ ,  $\text{MgSO}_4$ ,  $\text{MgCl}_2$ ,  $\text{KCl}$ ,  $\text{NaBr}$ , and  $\text{H}_2\text{O}$  at a certain concentration. By using this data, at the end of the crystallization process at 26-29°C, the simulation found that the precipitated salt was  $\text{NaCl}$  at 99% purity and the rest was  $\text{CaSO}_4$ . In the real situation, seawater can have a wide variety and concentration of salt compounds [4, 8]. In addition, the crystallization techniques used may differ between the literature and the field operation. Farmers need to crystallize the salt in a certain range of seawater salinity to obtain the level of purity that they want to achieve. For example, the purity of 99%  $\text{NaCl}$  (dry basis) can be obtained when the crystallization is conducted at around 26-29°C, where the formation of other salts such as magnesium or bromide salts were minimized.

The salt production data in Sabu Island, obtained from interviewing the farmers, was around 60 tons/month/hectare. This value is close to the simulation results with a difference of 10.31%. There are various reasons that may explain the difference. The evaporation rate may vary depending on, for example, the wind speed, the ambient temperature, the seawater concentration fed to the system, and the pond design. The wind speed changes over time. If the wind speed is lower, the evaporation rate will be lower as well due to the slower replacement of saturated air in the evaporation surface. The changes of temperature cause the changes in vapor pressure, which in

turn affects the evaporation rate, since the vapor pressure in the air as well as in the seawater surface are directly affected by temperature. The salt concentration in seawater affects the vapor pressure on the seawater surface. Greater seawater concentration will make the evaporation slower [10, 11, 14]. The pond design may cause a difference in pond surface area and production efficiency which in turn changes the productivity of the field.

## 2. Economics Analysis

The economic analysis is necessary to give a better understanding of the project feasibility, especially for salt farmers and regulators in the country, when considering using the results of this simulation. The salt production in the field can be carried out typically for at least 8 months during dry season. The economic indicators of this project can be seen in Table 4.

Table 4: Economic Indicators

Economic Indicator	Value
Revenue (1 month)	Rp.39,000,000
Revenue (1 years)	Rp.312,000,000
EAT (1 years)	Rp.112,800,000
ROI	0.32
PBP (years)	2.31
PBP discounted (years)	2.70
NPV	Rp.563,160,616
IRR	0.29

From Table 4, by using this salt production system, the Earning After Tax (EAT) was about Rp.112,800,000. This value was compared to the average income data of traditional salt farmers in Indonesia. Based on the data from 2017, the average income earned by salt farmers in Indonesia was Rp.5,000,000 to Rp.15,000,000 per harvest, which was much smaller than EAT obtained in the simulation. Another data, found in literature, said that the profit of salt farmers will increase to Rp.30,000,000 or more by using geomembrane on their field [15].

The salt farmers in Indonesia generally still use conventional technology carried out from generation to generation. It can be said that our production system has a great potential to be developed and implemented. To implement our system, the salt farmers need to be trained so that they understand the principle and have the skills to operate the system properly.

It should be noted that the length of dry season and the seawater evaporation rate may differ from time to time and from place to place so the results of this study should be read carefully by taking these factors into account and if necessary, the analysis can be reevaluated by changing those conditions to better suit the user needs.

The sensitivity analysis was conducted by varying some economic parameters, such as the manufacturing cost, the investment cost, and the price of salt. The results are presented in Table 5, 6 and 7, respectively.

From Table 5, higher manufacturing cost resulted in lower ROI, NPV, IRR, and longer PBP. Increasing manufacturing cost reduced EAT, because the revenue was taken a lot due to the increase of manufacturing cost.

Table 5: Sensitivity Analysis Based on Varying Manufacturing Cost

Economic Indicator	Base Case	Increase 25%	Increase 50%
ROI	0.32	0.22	0.11
PBP	2.31	3.13	4.86
PBP Discounted	2.70	3.93	6.99
NPV	Rp563,160,616	Rp332,954,355	Rp91,879,231
IRR	0.29	0.18	0.05

Table 6: Sensitivity Analysis Based on Varying Investment Cost

Economic Indicator	Base Case	Increase 25%	Increase 50%
ROI	0.32	0.24	0.18
PBP	2.31	2.88	3.45
PBP Discounted	2.70	3.57	4.46
NPV	Rp563,160,616	Rp478,408,936	Rp390,908,936
IRR	0.29	0.20	0.14

From Table 6, higher investment cost had a similar effect to ROI, NPV, IRR, and PBP as higher manufacturing cost. The investment cost would affect the depreciation cost. Since the depreciation cost only affects the tax calculation, the effect of higher investment cost was less severe than the effect higher manufacturing cost in this project.

Table 7: Sensitivity Analysis Based on Varying Price of Salt

Economic Indicator	Ideal	Rp500	Rp400
ROI	0.32	0.18	0.04
PBP	2.31	3.50	7.29
PBP Discounted	2.70	4.14	-
NPV	Rp563,160,616	Rp260,631,818	-Rp55,060,779
IRR	0.29	0.14	-0.03

The price of salt depends on the quality of the salt product and the price fluctuation in the market. The lower the price of salt, the lower the revenue would be. From Table 7, lower price of salt would reduce the economic performance of the project significantly, hence need to be taken seriously.

By using our integrated system, the salt productivity, thus the revenue, would increase by 27.43-48.67% compared to other salt production system in Indonesia in general [13]. With this increase, the salt farmers may have a monthly revenue per hectare of Rp.39,000,000 or a yearly revenue per hectare of Rp.312,000,000. However, it should be noted that in the real field the productivity will be affected by uncontrollable natural conditions, such as changing seasons, changing wind speed, etc. So, it is expected that the quantity of salts produced can be slightly fluctuated.

## V. CONCLUSIONS

The results obtained from this research show an increase in salt productivity to 66.9 tons/hectare/month, higher than the average salt productivity in Indonesia of 45-52.5 tons/hectare/month. The increase in salt productivity that can be achieved by this integrated system is up to 48.67% compared to the average salt productivity of other system in Indonesia in general. From the model, the purity of NaCl

can reach 99% with the assumption that only CaSO<sub>4</sub> impurity is present. The integrated system is currently constructed and tested on the field in Sabu Island, East Nusa Tenggara. If the system can be successfully implemented in Sabu Island, the system can be slightly adjusted and then confidently implemented in other places as well. To implement the results of this research, the salt farmers need to be facilitated. To adopt a new technology, they need a startup capital for constructing the right ponds system. Furthermore, they must be supported also on how to market their product, because currently, the salt price is determined by the middleman. Without all of that, this technology would be meaningless. The socioeconomic level of farmers will not change, and Indonesia will continue to import industrial salt.

## ACKNOWLEDGMENT

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# A Microcontroller based Pico Hydro Hydroelectric Power Generation System for Fish Pond Lighting

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**Abstract**— Electrical generator which uses renewable energy is the best solution to resolve the electrical crisis nowadays. One of the currently renewable energy sources is Pico Hydro Hydroelectric Power Generator. This electrical power generator is kind of similar to the general Hydroelectric Water Power Generator, but this one operates on a small scale. The utility of this Pico Hydro Hydroelectric Power Generator is that it can use water as a media with minor current and smaller media width. We can find several examples of this utilization such as in ditch and fish pond irrigation. The water resource in Koka Village is very overflowing that makes some villagers use it for fish pond irrigation, unfortunately the flowing water was wasted so it brings an idea for authors to design a Microcontroller based Pico Hydro Hydroelectric Power Generator as an alternative energy for fish pond lightning. This generator applies microcontroller-based technology as an alternative energy for fish pond lighting. This Microcontroller based Pico Hydro Hydroelectric Power Generator consists of Controller, Driver, Sensor and Peripheral. The supply energy for this generator is 5 – 12 Volt DC. The controller part has 2 (two) interconnected components, i.e. sensor and peripheral. Sensor functions as an object detector that detects objects and then sends data to the microcontroller to be processed while Peripheral roles as supporting components.

**Keywords**— *Electrical Power Generator, Renewable Energy, Microcontroller, DC, Sensor.*

## I. INTRODUCTION

The demand for electricity today is very high, even electricity has become an important part of daily life. Nowadays electricity has become a necessity that has an impact on every existing life, both in human life and natural life. Electricity has become our benchmark in the welfare of society.

There have been many government efforts to handle the development of electricity infrastructure, but there are still some that cannot be reached, also the existing population growth rate will make electricity become the main indicator in everyday life and this makes us forget about the nature around us. According to the projections of the BPPT MARKAL team, there are around 257.21 million people with a 1.01% growth rate [3], so it can be assumed that electricity will become a basic resource in everyday life.

For this reason, power plants require renewable energy to overcome the high electricity demand in the future. This can reach areas that do not yet have electricity supply, which

of course can keep the natural surroundings beautiful and not polluted.

One of the renewable energy sources is the Microcontroller based Pico Hydro Hydroelectric Power Generation System for fish pond lighting. This generator can be the right choice for lighting fish ponds because it can work well. This can be seen from the high water flow so that it can rotate the turbine quickly. Pico hydro itself is a term commonly used for hydroelectric power plants by utilizing the flow of water flowing into fish ponds.

There are some researches that use this pico hydro, i.e. the development of a Pico Hydro Power Plant by utilizing an alternator to help lighting the Kebun Salak [4]. Research on the utilization of irrigation canals for Pico Hydro Power Plant in Dusun Pagi Penebel Tabanan conducted by I Putu Ardana and Lie Jasa aims to utilize the irrigation canals as an efficient alternative energy source even in the dry season [5].

Research on the design of a Radial Flux Permanent Magnet Alternator Prototype for a Pico Hydro Power Plant conducted by Fauzi Rahman, Didik Notosudjono, and Dimas Bangun Fiddiansyah explained that a radial flux permanent magnet alternator can be defined as a converter of mechanical energy into electrical energy that will be used for generating electricity Pico Hydro Power [6].

Therefore, the author wants to take advantage of the surrounding environment in the form of water flows around the pond to be used as a Pico Hydro Hydroelectric Power Plant. This is very useful for the community, especially fish farmers whose ponds are not yet covered by PLN electricity. Thus, this plant can be the right solution and is very efficient and environmental friendly.

## II. LITERATURE REVIEW

### *Pico Hydro*

The Pico Hydro Power Plant is one of the small-scale power plants. As is known, this plant uses natural water resources as an energy source, so it can be used as an alternative to electricity generators, because water is a relatively easy source of energy.

Technically, it consists of three main components, namely:

1. Water as an energy source

2. Turbine (convert potential energy into energy of motion/mechanical)
3. Generator (convert mechanical energy into electrical)

The working principle of this plant is to take advantage of the difference in height of the amount of water discharged per second of the flowing water in a ditch, river or waterfall. This flow of water will rotate the turbine shaft to produce motion energy which is then converted into electrical energy by a generator.

### Water Turbine

The water turbine is a driving machine, where the fluid energy serves to rotate the turbine wheel. The function of the water turbine is to convert potential energy into mechanical energy. On the working principle of a water turbine, the turbine wheel construction has a blade, which is a plate with a certain shape and cross section. Water as a working fluid flows through the space between the blades, thus the turbine wheel/runner will be able to rotate and on the blades, there will be a working force. This force will occur because there is a change in the momentum of the working fluid of water flowing between the blades. The blades should be shaped in such a way that there can be a change in the momentum of the water working fluid.

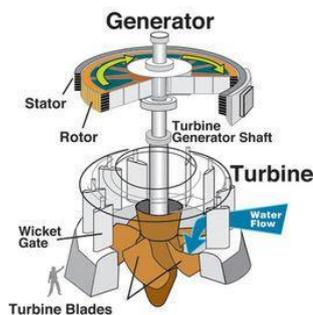


Figure 1. Water Turbine [2]

### Flow Sensor

Water Flow Sensor G1/2 is a tool that can sense the speed of fluid flow. Generally, this flow sensor is commonly used in flow meters or flow loggers to be able to record the flow of liquids. A common practice with all sensors is the need for absolute accuracy for calibration measurements. There are various types of flow sensors and flow meters, some of which have a vane driven by liquid, and can push the potentiometer to rotate along with similar devices.

## III. RESEARCH METHOD

### System Design

After getting a reference from the literature study, the author continues in the system design stage. In this stage the system is first described using a block diagram to facilitate reading the workings of the system to be built.

From the Figure 2, there are some main components (the dotted line). There are 4 main components that build up the system, namely, controller, driver, sensor, and peripheral.

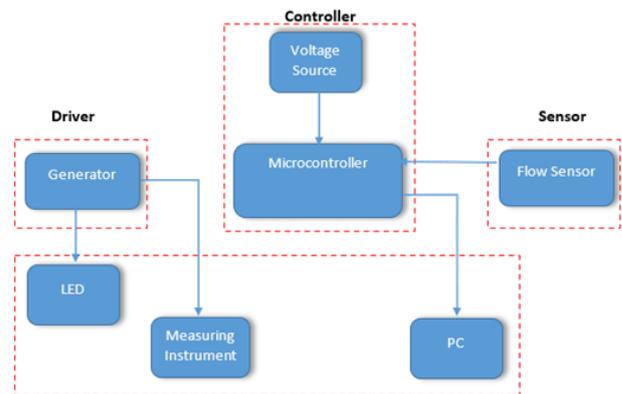


Figure 2. Peripheral

In the controller there is a voltage source whose function is to supply energy to the microcontroller so that the microcontroller can be active and can process data. The voltage required by the microcontroller is 5-12 volt dc (direct current). In the controller section there are 2 main components that are interconnected, namely sensors and peripherals.

The sensor will detect objects and the data obtained from the sensor is sent to the microcontroller for processing, while the peripheral is the supporting component of the system created. In the sensor part we use a flow sensor to calculate the speed of water flow. Then in the peripheral part there is a PC (Personal Computer) to monitor the output of the flow sensor.

Generator is included in the driving component where this component is interconnected with the peripheral. In the peripheral, LED and measuring instruments are connected to the generator. The generator in the system is a Pico Hydro Powered Generator which indicates that the output voltage does not exceed 5000 Watts.

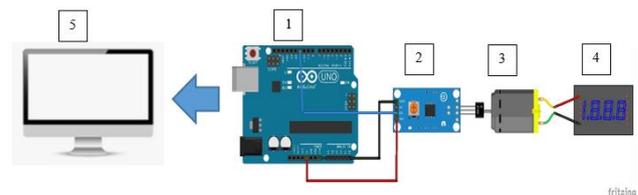


Figure 3. Wiring Diagram of Design System using Fritzing

The fritzing application allows for a 3D depiction of the system, making it easier to see the connectivity between components. The presence of 3D images will help further development of the existing system, as shown in figure 3. This figure shows a system design for testing the speed of a dc motor used as a generator of Pico Hydro. Visible numbering will help for easy reading. Component number 1 is a microcontroller with the Arduino Uno type, component number 2 is a sensor to detect the speed of a dc motor, component number 3 is a dc motor, which is used as a generator, component number 4 is a voltmeter to measure the voltage generated by the generator and number 5 is a generator. Figure 3 is a computer that will display the results of the rotational speed of the generator motor.

Figure 4 is a pico hydro system microcontroller programming flowchart.

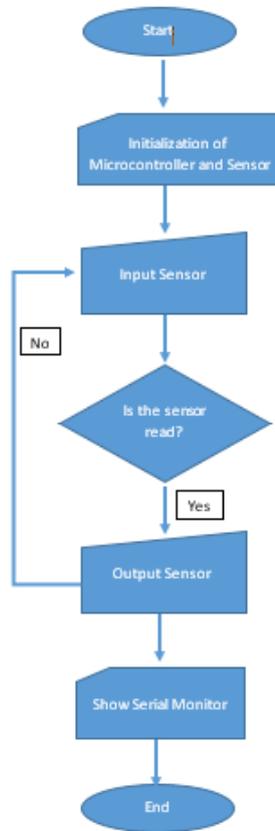


Figure 4. Microcontroller Programming Flowchart

#### Data Retrieval

At this stage, taking into account the system that has been designed, the tools and materials must be prepared for the testing and data collection process. Table 1 is data of the turbine and Table 2 is data of the dc motor.

Table 1. Data of Turbine Pico Hydro

No	Parameters	Value
1	Configurations; • Acrylik plastic material cover out • PVC plastic material cover in	Diameters 109 mm 150,1 mm
2	Spinner side in	Diameter ; 100 mm
3	Blade ; • PVC plastic material	Thickness 3.4 mm Length 5.5 cm
4	Bolt dan nut	3.5 mm
5	Cable	2.5 mm

Table 2. Data of dc Motor

No	Parameters	Value
1	Configuration	DC Motor
2	Voltage	3-12 volt dc
3	Current	MAX 1 A
4	Diameter Shaft	44.86 mm
5	Weight	74 gram
6	No load speed	64 rpm

#### IV. RESULT AND DISCUSSION

##### 1. Pyco Hydro Plant Testing of a Flowing Water in Koka Village

After passing the system design stage, the author tested the system that had been built. This test aims to retrieve data that will be used for further analysis of the development of an existing system. Data retrieval was evidenced by several pictures and system test data. The pictures below are some tests to take data samples in Koka Village.



Figure 5. Hose Installation on Generator

In Figure 5, a modified hose that has been fed with water will be connected to a Pico Hydro Generator. And Figure 4.2 shows the dc motor used as a Pico Hydro Generator has been rotating. But at this stage it was not yet known the amount of voltage generated by the generator. To measure the voltage, we used a voltmeter.



Figure 6. Rotating Generator



Figure 7. The results of data collection for voltage using voltmeter

It is the result of testing the installed generator. The data obtained was 0.74 volts with a dc motor (direct current).

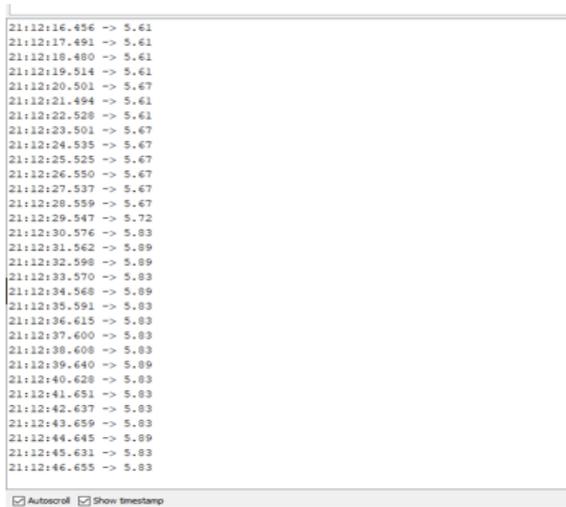


Figure 8. The results of data collection for RPS (Rotation Per Second)

Figure 8 above is the result of data collection for RPS (Rotation Per Second) or motor speed per second. The result showed 5.89 RPS for the highest value. The data was displayed on the monitoring screen using the Arduino serial monitor IDE application with a baud rate of 9600. The 5.89 RPS value was the result of the 0.74 volts voltage tested in Figure 7. Weather data was also taken at the time of testing which can be seen in Figure 9.

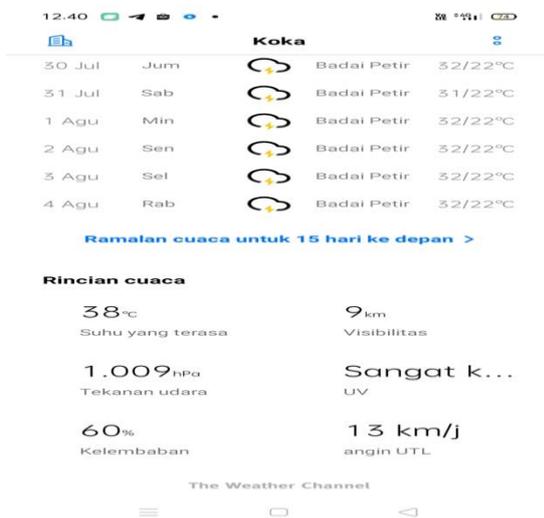


Figure 9. Screenshot of Weather using the Application of Weather Channel

Through the Weather Channel application, the position of the Koka Village has been read on the GPS system. Then from the weather details, the temperature that was read in the field was 38 degrees Celsius with 60% humidity, meaning it was a hot temperature and affected the water flow. The wind speed can also be seen in the application, which was 13 km/h.

## 2. Pico Hydro Plant Testing on LED

The next stage of testing was using LEDs. The test is no longer carried out in the Koka Village, but at the author's house. The test at this stage was to prove whether the

designed Pico Hydro Plant could turn on the LEDs as lighting for fish ponds or not. By referring to the data tested on the water flow in the Koka Village, which was 0.74 V with a temperature of 38 degrees Celsius, it meant that the water was in less condition due to the high temperature so that the water flow decreased. Testing using LEDs was evidenced by Table 3 and the following pictures.

Table 3. Testing of Pico Hydro Plant Generator

No	Voltage(V)	Current(mA)	Resistor (Ohm)	RPM	Counter (Raw Data)	Output(V)
1	0.03 V	0.00 mA	3.33 Ω	12	55	0.03 V
2	0.22 V	0.00 mA	3.33 Ω	22	830	0.22 V
3	0.70 V	2.20 mA	3.33 Ω	588	2154	4.84 V
4	1.07 V	3.67 mA	3.33 Ω	816	3004	4.84 V
5	1.36 V	5.70 mA	3.33 Ω	1020	3743	4.84 V
6	1.74 V	8.87 mA	3.33 Ω	1320	4861	4.84 V

From Table 3, it can be seen that the current started to be generated when it was in position number 3. With a voltage of 0.70V, the resulting current was 2.20 mA with an output voltage of 4.84 V. The output voltage of 4.84 could turn on a 5 volt LED. This test could be proven by the test image below.



Figure 10. Testing on LEDs



Figure 11. Testing and Monitoring of RPM



Figure 12. The Illuminated LED

From the pictures above, it clearly shows that several tests were carried out. For Figure 10 the test was carried out by adding a 5 Volt LED to the Pico Hydro Plant. For Figure 11 testing was done by adding a microcontroller as a monitoring RPM (Rotation Per Minute) of the generator, and Figure 12 was the evidence of a LED that lighted up with a rotation of 588 RPM, a voltage of 0.70V and a current of 2.20 mA.

The test voltage from Table 3 was obtained from the results of testing using a faucet by measuring the degree of the faucet opening. For more details can be seen in Table 4.

Table 4. Data of Voltage and Current Testing

Rotation	Voltage (V)	Resistor( $\Omega$ )	Current With Load(A)
0°	0 V	10 $\Omega$	0 mA
15°	0,03 V	10 $\Omega$	0 mA
30°	0,22 V	10 $\Omega$	24,3 mA
45°	0,70 V	10 $\Omega$	42,9 mA
60°	1,07 V	10 $\Omega$	51,1 mA
75°	1,36 V	10 $\Omega$	53,2 mA
90°	1,74 V	10 $\Omega$	54,7 mA

The results described in table 4 show the amount of test voltage starting from the tap opening of 15 degrees with a voltage of 0.03 volts. The test was done by calculating the current using a load resistor with a value of 10 ohms. Table 4 also showed that the faucet opening with 45 degrees refers to the equation for testing the water flow in Koka Village, which was 0.70 V. The result of a voltage with a value of 0.70V could turn on a 5 Volt LED. This is because at the output voltage, observable in table 3, that it could produce 4.84 V.

The change in voltage at the output increased because the author added an additional booster circuit to amplify the current and voltage. Therefore, even though the voltage generated by the Pico Hydro Plant was below 5 volts, the LED could still light up because there was a voltage gain or voltage multiplier added to the Pico Hydro Plant system.

## V. CONCLUSIONS

The research on the utilization of water flow around fish ponds that serve as Pico hydro hydroelectric power plants has already run well. This Pico hydro power plant is used as a power plant for fish ponds lighting. Observed from the results of data collection and testing on the system, it can be concluded that:

1. Motor speed 5.89 RPS (Rotation Per Second) produces a voltage of 0.74 Volt
2. The use of monitoring via a serial monitor using an Arduino IDE with a baud rate of 9600 to monitor the motor speed has been successfully implemented with the highest output of 5.89 RPS
3. The Weather Channel application can detect research locations via GPS
4. A voltage of 0.70 Volt can turn on the LED

Suggestions from system development that it is necessary to re-design both the motor generator and additional circuits to increase the voltage so that it can be accommodated in the battery and used as lighting.

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# The Use of Gadget in Distance Learning and its Effect on the Eye Health of Elementary School Students in Manado

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**Abstract**— This study aimed to see how students care about eye health in using the gadget in distance learning. In the Covid-19 Pandemic, technology is necessary when students do distance learning using zoom meetings, GoogleMeet, and similar media. This study used a mixed qualitative and quantitative method to see how the awareness of the 4th- 6th graders of three Catholic Elementary Schools in Manado on eye health when using gadgets. Researchers distributed a survey to students and interviewed their teachers (6) and parents (9) to collect data. The result of the study indicated that students are limited in using technology in Manado Schools. The condition minimized the danger of eye disorder. However, the potential of eye problems is still high and needs knowledge, awareness, and concern to maintain the problem. This study also showed that the knowledge and concern of parents and teachers regarding eye health will become the solution to the eye problem.

**Keywords**— Eye Health, Gadget, Gesture, Industrial Revolution 4.0, Technology

## I. INTRODUCTION

The rapid development of technology is closely related to the field of education [1]. Technology is not only a thing that supports the growth and success of education but has become a significant need and even a necessity that must be held [2]. The urgent need for technology in education is related to changes that occur so fast that only technology can be followed [3]; In addition, educational institutions deal with students who are the subject of learning called digital natives [3]. Today's students are considered to be very technologically literate and use technology in almost all their activities. During this Pandemic, the need for technology becomes even more urgent because schools can only choose distance learning and online learning to carry out education [4], [5].

The rapid development of technology must be followed by efforts to educate students, teachers, and parents regarding using technology appropriately to ensure excellent eye health [6]. Knowledge related to eye health includes the duration of time, frequency of use, the distance of use, position of use, and tips on how to rest your eyes from the screen [8] properly. This paper aims to anticipate the impact of using technology that can hinder students' success because they are impaired in their vision.

The researchers used three questions in this paper: (1) how often do schools in Manado use technology in online learning and how does the learning process take place (implementation); (2) how do the students arrange the duration, intensity, and body position in using gadgets in online learning to describe their awareness and knowledge to maintain their eye health. (3) how do the teachers and parents help students to know and aware about the eye health when using gadgets in learning.

These questions become very relevant when technology becomes a trend in today's global society and is closely related to the development of the education worldwide, including the development of 21st-century human competencies [7].

The study would show the crucial role of teachers and parents in educating students to maintain their eye health.

## II. LITERATURE REVIEW

The literature review discusses the importance of technology in the pandemic situation, the impact on eye health, and the risk of elementary school students using gadgets. The literature also would show the significant role of teachers and parents in helping students improve their eye health.

### *Technology as a necessity in the distance learning*

Yelubay *et al.* (2020) emphasize that technology integration in education is necessary for today's digital society. The characteristic of today's society is that people use technology as the primary means of living together. Educators must develop digital culture and competencies to be able to take part in social life. Hu *et al.* (2019) state that the imperative to use technology in education is related to the main focus of education itself, namely students who have high interest and technological competencies [8]. Presnky (2001) mentions that students are digital natives to illustrate that they can't separate from technology. The students use technological gadgets such as smartphones and tablets from a very young age [9]. Vanderkam (2013) mentioned that technology reduces costs and improves student learning outcomes [10].

Moreover, technology enables students to achieve 21st-century skills, including communication, collaboration, critical thinking and problem-solving, and

creativity and innovation [11]. With technology, students develop their way of thinking, the way of work, the way of life, and self-development. The necessity of technology becomes very real in the case of the Covid-19 Pandemic that spreads worldwide. Wahab Ali (2020) said that the Pandemic pushes schools to choose only the distance and online learning that need technology as the primary resources [1]. Online and distance learning became a necessity in the covid-19 pandemic era. All educational institutions use technology to support distance learning, and online learning practice during the Pandemic is increasing a lot [12]. The Covid-19 Pandemic is challenging education systems worldwide and forcing educators to switch to online teaching modes. Many academic institutions that were reluctant to change their traditional pedagogical approach have no choice but to switch entirely to online teaching [5].

#### *Technology increases myopia cases*

Agarwal *et al.* (2013) state that technology affects eye health. The use of the gadget in distance learning has increased the number of patients with eye complaints. People who have eye problems due to computers are named people with computer vision syndrome (CVS) [6].

Asroruddin *et al.* (2017) mentioned the negative impact of technology that can cause blindness when technology is not used correctly. Asroruddin stated that technological developments make children use gadgets more often for a long time, which is the cause of myopia [13].

Myopia or nearsightedness (shortsightedness) is an eye condition where a person cannot see far away clearly and sharply. Two known causes of myopia are (a) the length of the eyeball (axial length) that exceeds the average value, or (b) the refractive ability of the eye's refractive media (cornea, aqueous, lens, and vitreous) is unable to refract incoming light stimuli [14].

Several terms appear to describe the impact of technology on eye health. Firstly, the term technology addiction. Holden *et al.* (2016) tell people can access the internet (PC) for 5 hours a day and have not counted the time they peek at messages on their smartphones. Society can addict to technology. The addiction interferes with vision. Second, the term Digital Eye Strain is related to the effect of blue light from gadgets. Blue light creates a glare effect on the eyes that can cause dry eyes, blurred vision, headaches, nearsightedness, and eye fatigue. Digital Eye Strain is also known as vision fatigue [14].

Symptoms of digital eye strain are usually temporary, but long-term exposure to blue light can be severe. Prolonged exposure to blue light can contribute to photochemical damage, potentially harming retinal cells and making people susceptible to many eye disorders.

#### *Myopia and student achievement (school-age)*

Myopia can significantly affect student achievement in school after research shows that cases of myopia are increasingly occurring in younger people [15], [14]. Myopia that occurs in childhood and youth, usually continue into adulthood. The risk factors that can increase myopia and its progression are heredity (genetic) as the most essential and environmental factors. High genetic factors will increase a

person's probability of having myopia by about 70%, while environmental factors such as a history of prematurity and habits of close activity can contribute about 30%.

Holden *et al.* (2016) stated that myopia can cause blindness if the symptoms of refractive disorders are not corrected immediately. Therefore, myopia is the beginning of blindness. Further symptoms of myopia, which can lead to blindness, are exacerbated by the awareness of parents and children who only realize this when the level is severe. Holden *et al.* (2016) predicted that the global prevalence of myopia will increase from 28% (approximately 1.9 billion people) in 2010 to 34% in 2020 and increase again to 50% (5 billion people) in 2050, hence the so-called myopia boom. Holden *et al.* also mentioned that the global prevalence of severe myopia would increase from 4% (227 million people) in 2010 to 10% (938 million people) in 2050. That is a picture of a very significant increase in the prevalence of myopia globally.

#### *Children are most vulnerable to the negative impact of technology*

At this time, more and more elementary school-age children suffer from symptoms of myopia, or nearsightedness, or shortsightedness. With these data, the symptoms of myopia should receive greater attention, especially concerning the point that these symptoms are suffered by younger children, to mention that children are the most at risk of suffering from myopia.

Wong *et al.* (2020) said that children are at high risk for the impact of technology due to their limited self-control and self-awareness. Usually, children can't limit themselves when doing activities that they enjoy. Playing apps and games and surfing the internet are fun, and most kids don't have the self-control to set boundaries for themselves. Children, especially younger ones, need help and reminders to use digital display devices in an eye-friendly way [16].

Sundus (2018) says children spend more time than ever before staring at digital screens—on computers, tablets, TVs, smartphones, and other devices. Such practices can harm children's eye health [17].

With COVID-19 and the shift to online learning by many schools, children are spending more and more time looking at screens. Children are given leeway to use gadgets to help them stay entertained and socialize with friends virtually, as they spend more time at home to prevent the spread of the virus [16].

#### *Knowledge, awareness, and policies to maintain eye health in the technological era*

Some research results showed the danger of eye disorders that can impact to decreased learning achievement. Agarwal *et al.* (2013), who examined 150 people, said that the main eye complaints experienced by children who used computers for more than 6 hours were eye fatigue (53%), eye strain (53.8%), itching (47.6%), and sore (66.7%) [6].

Wiwik Norlita (2020) tries to prove that playing games are very influential on eye health [18]. Huseyin Kaya (2020) mentioned that online learning brings eyestrain [19]. Nur Muallima *et al.* (2020) said that gadgets with long duration,

long frequency, and close distance decrease visual acuity [20].

Andriana Krisna Puspa (2018) emphasized the dry eye factor, a technology use disorder [21]. Christo F. N. Bawalle *et al.* (2016) emphasized the relationship between the duration of smartphone use and visual function in students of the Faculty of Medicine, Sam Ratulangi University [22]. Devy Ristitya *et al.* (2012) stated that most respondents who always use gadgets as much as 36% suffered low visual acuity [23]. Sofiani *et al.* (2016) revealed the same data, researching high school students in Temanggung, Central Java [24]. Chinawa (2016) said that eye health problems are caused by ignorance [25].

This knowledge led to suggestions on protecting the eyes so that technology can still bring success in learning. Here are some ways to protect eyesight and protect student's eyes from overexposure to blue light [15], [14], [16]:

1. Set the duration of time in using the gadget.
2. Turn off all electronic devices at least two hours before going to bed. Blue light in the eyes can interfere with sleep, so the eyes need to be rested from the blue light before going to bed.
3. Increase your blinking speed. The normal blink rate is 15 times per minute, but this rate decreases by up to 50 percent when people use digital devices.
4. Take regular breaks from the gadget screen. A system is set to take screen breaks, i.e., taking frequent breaks every 20 minutes. This is known as the 20-20-20 rule. Every 20 minutes, look at something at least 20 feet away for at least 20 seconds.
5. Screen position. Make sure the screen on your child's desktop or laptop computer is slightly below eye level. Some experts recommend positioning device screens according to the 1/2/10 rule: phones ideally on one foot, desktops and laptops on two feet, and approximately 10 feet for TV screens (depending on how big the screen is).

This knowledge is fundamental to maintain the eye health. Matters related to caring are how parents pay attention and educate children regarding the importance of maintaining eye health [16]:

1. Provide knowledge to children about how to maintain eye health.
2. Talk to them and give examples.
3. Invite children to have their eyes checked regularly.

Policies related to eye health include making standard operating system (SOP) for teachers who carry out online learning to educate students. The government can launch a policy about eye-friendly screen protection for children and students [24].

### III. RESEARCH METHOD

This research used mixed methods, namely quantitative and qualitative method. The researchers used quantitative method to measure elementary school students' perceptions of the use of technology in learning, duration, intensity, and attitudes in using gadgets and information related to eye health awareness. Interviews with teachers and parents

confirmed the answers to the questionnaires given to these students to obtain context and reasons behind the quantitative responses. A total of 10 questions were given in the questionnaire to students to explore three things related to: (1) how far schools use technology in online learning and how the process is; (2) the duration, intensity, and attitude of students in using gadgets in online learning; (3) how is the awareness of students to maintain eye health when using gadgets.

The research population is elementary school students in Manado City and its surroundings, while the sample is grade 4-6 elementary school students in three Catholic elementary schools who can respond to the questionnaire quickly. The three selected schools, namely the SD St. Agustinus Warembungan, SD Santa Theresia Malalayang, and SD St. Martinus Lembean.

The Google form provided by two teachers in each school was responded to by 66 students, namely 40 students from Lembean, 17 students from Warembungan, and nine from Malalayang. Questionnaires were distributed during August 2021.

The qualitative approach supported the quantitative method through interviews with teachers and parents. The researchers interviewed six teachers (two teachers from each school) who became liaisons with students. In addition to teachers, we also interviewed three parents from each school, so nine parents were interviewed.

The researcher analyzed the students' answers based on the incoming responses. Quantitatively, the answers are seen and analyzed based on the percentage of answers.

The context and reasons behind the students' answers were obtained by analyzing the results of interviews conducted with teachers and parents. The data from the interview process are analyzed using within-case analysis and cross-case analysis. The within-case study is the process of examining the data of each school. In this phase, the researcher found the emergent concepts, categorized them, abstracted them in the properties, and propositioned them. The cross-case study analyzes and compares the data from every single school. The researcher saw beyond the initial impressions and looked at the evidence through multiple lenses. Based on the comparison of the three schools, the researcher built a report and connected the information with the quantitative data.

### IV. RESULT AND DISCUSSION

The section will explain the result and its discussion of the research.

1. Regarding the use of technology, 97% of students claimed to have used gadgets, 93.9% claimed to use mobile phones/smartphones the most.
2. Duration of cellphone use, 26% of 0-2 hours, 36% of 2-4 hours, 17% of 4-6 hours, and 18% of over 6 hours and not using 3%. Considering the duration of using tablets and laptops, around 50% of students admitted that they did not use either tablets or laptops.
3. In the duration of using cellphones, 34% of students admitted to using cellphones to study, 30% of students used cellphones to play games, 18% used cellphones to communicate, 16% of students used cellphones to

- watch and do social media activities, and 2% of students were consistent said not to use HP.
4. As a learning resource, 81.8% used internet sources, and 18.2% did not use internet sources at all. 93.9% study and do schoolwork using physical printed books, and 6.1% no longer use printed books. When asked to choose the most frequently used learning resources, 57.6% of students used physical printed books, 34.8% used internet sources, and 7.6% of students used electronic books.
  5. As many as 84.8% claimed to be aware and know how to maintain eye health and have received information about how to maintain eye health. However, 56.1% believe that the use of gadgets during this Pandemic has an impact on eye health problems

#### *Awareness to use technology is still limited*

It is exciting to look at the existing figures which inform that students are already using information technology, namely 97% of students have used gadgets, and 93.9% have used mobile/smartphone type gadgets. However, this figure has informed that students use devices that are not ideal for learning because they use cellphones with minimal layers. Two students consistently stated that they did not use gadgets at all. Furthermore, this information says that only 34% of students use mobile phones for learning.

Their answers are consistent with their statement that in learning, as much as 57.6% more often use physical books, 7.6% use electronic books and 34.8% use learning resources from the internet. When asked whether students still use physical textbooks, 93.9% admitted using physical books for learning and schoolwork.

When confirmed with interviews with teachers and parents, it was explained that elementary students in several schools in Manado and its surroundings carried out learning by way of assignments, namely making assignments in the printed books they used. Gadgets and technology are used to communicate, namely to inform about tasks that must be carried out. Some teachers stated that they tried to use zoom meeting or google meet at first, but it turns out that they have limitations in using these technologies. More than that, it turns out that the students themselves find it difficult to use these facilities [26]. Some researches mentioned the technology is a necessity in education [2], [4].

In addition to the difficulties related to knowledge in using technology, the availability of gadgets and the cost of the internet is a problem in itself. With these limitations, the school finally decided to only use devices to inform about assignments, make reports, and submit assignments. Generally, teachers ask students to take photos of their work and send pictures of the work to the teacher [27]. Teachers didn't use the power of technology in education maximally ([1], [3]).

From the explanations given by the teachers, it was stated that online learning had not been going well in some Catholic schools in Manado City and its surroundings. The technology use is limited to communicating assignments and learning and photos of assignments when they are sent to teachers. The use of more advanced technology has not been carried out in the schools studied.

More than that, it can also be concluded that student learning during this Pandemic has experienced a drastic decline; namely, learning is generally limited to giving assignments to students without full explanation from the teachers.

#### *Students free from the condition of being addictive*

Regarding the duration of cellphone use, 26% of students used cellphones for 0-2 hours, 36% of students 2-4 hours, 17% of students 4-6 hours, and 18% of students over 6 hours. It is consistently stated that as many as two students or 3% of respondents do not use smartphones at all. It can be concluded that most students use smartphones only for around 0-2 and 2-4 hours a day. The data states that as many as 18% of students use smartphones for more than 6 hours. Judging from this information, if the use of gadgets in children is deemed to need to be closely monitored if the duration is 6% and above, then the number of students who need to be closely monitored in the use of gadgets is 18%. These numbers become smaller when you look at the percentage of tablet and laptop or PC usage. More than 50% of students do not use tablets and laptops [16].

When confirmed to teachers and parents, information was obtained that the majority of students still depend on their parents in using their gadgets. When carrying out the learning process, they generally use their parents' gadgets to carry out learning. This confirms the limitations of using devices on the student's part.

When considering that the use of gadgets in learning is still in a small percentage (34%), it can also be understood the explanation from the teachers above that online learning and the use of technology in education are still carried out on a limited scale. Learning is still in the form of assignments using printed books, while gadgets are used to provide information related to the tasks to be done and take photos of assignments sent to the teacher.

With this explanation, it can be understood that only 34% of students claim to use gadgets for learning and use other devices for playing games, watching social media, or communicating.

With lighter demands to carry out learning through gadgets, students avoid using devices for a long time. Regarding learning, the teacher informs that they usually contact by phone or video call for a maximum of 10 minutes. Most communication is done using WhatsApp groups.

#### *The danger of eye disorders can be minimized*

With a limited duration of gadget use and very minimal demands for learning, the danger of eye disorders in using gadgets can be minimized. With the explanations of the teachers, it can be said that the duration of students being obliged to use gadgets in learning is only when they receive a brief order from the teacher related to the tasks to be done either by telephone, video call, or WhatsApp message, as well as the time of taking photos and sending photos of work to the teacher.

Nevertheless, it is still necessary to pay attention to the duration of students using gadgets for entertainment. It is very important to understand the healthy steps that need to

be taken in using gadgets and the time to use gadgets that should be limited appropriately [24].

#### *Limited knowledge about efforts to maintain eye health*

Some students claimed to have received information about the importance of maintaining eye health and already know how to apply it to themselves. However, when confirmed to teachers and parents, information on maintaining eye health was still minimal. Usually, teachers and parents only admonish children that they should not use gadgets for too long. Parents and teachers never took the initiative to explain the dangers of radiation, the risks of blue light, the importance of using devices with a good body position and adequate lighting [28].

Even parents and teachers admit that they do not understand healthy ways to use gadgets properly. Teachers and parents do not understand the importance of staying away from gadgets 1-2 hours before bedtime and do not understand about blue light that can interfere with sleep; they also don't understand the importance of blinking 15 times per minute. Therefore, they have no information that the blink rate decreases by 50% when people use gadgets. Parents and teachers have also recently heard of the 20-20-20 formula, which means that every 20 minutes, a gadget user must look away from the screen, looking at something 20 feet away for at least 20 seconds. They also do not have information about the ideal screen distance when using the gadget.

The researcher noted that the points above related to efforts to maintain eye health are essential to convey to the broader community, including teachers, parents, and students. This is related to the increasingly widespread use of gadgets. Moreover, future trends show that the use of devices will continue to grow and become a demand to achieve the 21st-century competences.

#### V. CONCLUSIONS

Researchers used quantitative and qualitative approaches to examine students' awareness of eye health in using technology in online learning. This paper raises the background of problems related to the increasing use of gadgets today, especially related to online learning during a pandemic which can increase cases of eye disorders. This paper aims to examine students' knowledge and awareness in maintaining eye health related to technology in learning. In the minimal challenge of using technology in education, students' attention to preserving eye health and knowledge related to eye health is limited.

Some points of research results, namely: (1) Awareness to use technology is still limited. Schools didn't use online learning to its full potential; (2) Gadgets have not caused addiction for elementary school students in Manado city and its surroundings because the challenges in using them are still very limited related to the use of gadgets in learning which are limited to delivering task information and sending assignments to teachers; (3) The danger of eye disorders can be minimized because the demands for using gadgets in learning are still minimal; (4) however, it was found that the knowledge of students, teachers, and parents on the importance of maintaining eye health was still minimal. They lack information about ways to use gadgets in a

healthy manner and tips on maintaining eye health in this technological age.

This study informs that the negative impact of gadgets on eye health has not been significant when technology and the internet have not been used optimally. Children are not active in using gadgets because they only borrow devices from their parents. Children are also limited in using gadgets when parents have not prepared complete internet access. Moreover, they use gadgets only to share information and submit assignments. Thus, they do not use the internet for a very long time.

Due to the above conditions, elementary school-aged children are not yet free to search for information on the internet. Therefore, they avoid the situation of being addictive.

However, the potential for eye damage due to gadgets is enormous if parents give their children leeway to use and even have gadgets related to online learning obligations. Therefore, many solutions need to be prepared regarding eye health problems.

The solution is related to knowledge, awareness, and concern for maintaining eye health. For example, knowing the duration of time using gadgets, knowing the dangers of blue light to the eyes, understanding the number of healthy blinks; understand a healthy amount of time and the right distance to be in front of a screen; also, knowing the exact position of the screen.

This paper has limitations in the scope of the study only on school students in three locations around the city of Manado. Schools in Manado are very varied, and the number of Catholic schools and students in Catholic schools is still relatively small compared to public schools and schools fostered by Christian Foundations. Further research needs to reach students in public schools and schools within the Christian Education Foundation.

This research can be an essential recommendation for the government, Catholic Education foundations, and the community. They have to be aware that technology is already very urgent to meet the world's rapidly changing world. Schools and society will be left behind if they ignore the vast contribution that technology can make.

This research can also recommend parents and teachers about the importance of understanding the basic steps to maintain eye health. When the use of technology continues to be intensified in learning in the 21st century, knowledge about eye health becomes imperative so that the negative impact of technology on eye health can be anticipated from the start and solutions are found.

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# Behavior Analysis of Using E-Wallet Features in the Covid-19 Pandemic Era by Applying Technology Acceptance Models

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**Abstract**— This study aims to analyze and understand consumer behavior in using electronic wallets (e-wallets) including pay later derivative features during the Covid-19 pandemic. Technology Acceptance Model (TAM) was used to measure the “perceived usefulness” and “perceived ease of using” e-wallet. In addition, the perceived risk and user experience effect on the behavior of using digital wallets is also measured. The method used is an online survey to electronic wallet users through direct messages to followers of the official Instagram social media accounts of the top 5 electronic wallet companies in Indonesia. The mean score, multiple linear regression, and moderated regression analysis (MRA) were used to analyze and hypotheses testing. The results showed an increase in the use of e-wallet during the Covid-19 pandemic, but respondents still felt a high risk in using the pay later feature. The ‘perceived usefulness’, ‘perceived ease of use’, and user experience positively influences e-wallet reuse interest. The user's perceived risk becomes lower with more frequent use, this makes the interest in continuing to use high. Especially for the risk of using the pay later feature, respondents are still hesitant to use it so that it has a negative relationship with the behavior of using the pay later feature in digital wallets. The perceived risk acts as a quasi-moderator in the relationship between post-use evaluation and interest to use continuously.

**Keywords**— *Mobile Payment, Perceived Ease of Use, Perceived Risk, Perceived Usefulness, Post-Purchase Evaluation.*

## I. INTRODUCTION

This research is a marketing research in e-commerce, especially regarding consumer behavior in the way of payment, namely electronic payments, or known as electronic wallets. E-wallet is an electronic payment application that makes it easy for users because it can be used via a computer or smartphone on an internet network. The use of e-money and e-wallet continues to accelerate throughout the Covid-19 pandemic. Changes in people's habits in conducting transactions can be seen very clearly as one of the impacts of Covid-19. The current use of e-money is a trend for non-cash payments and is increasing in Indonesia at this time [1]. Likewise, using e-wallets, one can make transactions or do shopping only from home. The existence of e-wallet and e-money makes it safer to minimize the transmission of Covid-19 because people shop and make transactions of any need without physical contact with other people [2], [3]. The topic of e-wallet payment media has attracted the attention of several recent studies

[4]–[6]. Electronic payments are growing following the development of e-commerce.[7]–[9].

One of the studies about the use of electronic wallets in Indonesia was conducted by Neurosum. The sample in the study is 1,000 respondents of active e-commerce users of productive age (19-45 years) simultaneously in 8 big cities in Indonesia, namely the Greater Jakarta area, big cities on the island of Java, and other big cities in Indonesia, for the last 3 months (November 2020 – January 2021). Neurosum research results found that in the last three months, the digital wallet competition arena has become more dynamic with the presence of a new player, namely Shopee-Pay [10], [11].

This study obtains the behaviour pattern of using e-wallet from the supporting and inhibiting factors. From the existing research, not many have examined user perceptions about the additional feature, namely, pay later from the e-wallet. With this research, we can get an idea of what makes consumers more interested in trying and increasing payment transactions using digital wallets during the Covid-19 Pandemic or payment transactions in a cashless way. Second, do consumers feel the benefits and conveniences as well as positive evaluations so that they are interested in continuing to use or even try other digital wallet brands, or new features such as pay later? Third, how perceived risk moderates the effect of the determinant on behaviour intention to -use e-wallet.

An online survey was conducted to collect primary data, to a sample of e-wallet users, namely followers of the top 5 e-wallet accounts on Instagram, where social media is becoming a trend in marketing [12]. To analyse consumer behaviour for the sustainable use of this e-wallet including the pay-later feature as an online loan, statistical analysis is used to answer research questions.

## II. LITERATURE REVIEW

E-money is a digital payment that uses electronic media, namely computer networks, and active internet networks. Electronic money has been present in Indonesia since 2009 which was ratified in Bank Indonesia Regulation Number 11/12/PBI/2009 regarding Electronic Money later updated to PBI Number: 18/17/PBI/2016 [11]. Electronic money is also commonly referred to as digital money, digital cash, electronic cash, and electronic money. An e-wallet is an e-money application used to make online payments using

the internet network and compatible smartphones or other gadget devices [4], [13].

#### *Perceived Usefulness and Perceived Ease of Use*

According to TAM, interest in using technology is determined by the benefits and conveniences felt by the user [14], [15], [16]. Perceived usefulness indicators [17] consist of:

1. Increasing productivity;
2. Increasing effectiveness;
3. Reducing transaction time;
4. Very useful.

This means that the level of user confidence will help improve the performance of the system itself. If someone feels that information technology is useful to simplify processes in everyday life, then he will use the system [16], [18].

The level of user confidence that the process of using an information technology does not require a lot of effort makes them happy to use something easy. [18]. A system that is often used can prove that the system is easy to understand [17]. The four dimensions of perceived ease of use are:

1. The interaction between the individual and the system in technology is clear and understandable;
2. To interact with the system, people were not required a lot of mental effort;
3. It is easy to use the system in technology;
4. It is easy to do what he/she wants to do by the system.

In this study, “perceived usefulness” is the benefits and utility of e-wallet. Meanwhile “perceived ease of use” indicated it is easy to learn, understand, and using an e-wallet.

#### *Post-use Evaluation*

In the consumer decision-making process, there are 3 stages, namely the input stage, the process stage, and the output stage. The input stage is the factors that influence consumers, both within themselves (e.g. socio-cultural background factors) and from outside (e.g. marketing mix, promotional efforts from marketing). The process stage is the stage where consumers make decisions influenced by their psychological factors. The last stage is the output stage, where purchase decisions are made and evaluated after the purchase [19].

When consumers buy a product (or brand) for the first time and buy in small quantities, then this purchase is a trial purchase. So, in the trying stage, this is an exploratory phase in buying behavior in which consumers try to evaluate the product through direct use [9].

#### *Behavior Intention to Use (Repeat-use)*

Repurchase interest arises because of previous post-purchase evaluations. When their expectations are met or exceeded, positive disconfirmation occurs, consumers feel satisfied or very satisfied. Conversely, if their expectations are not met, negative disconfirmation occurs, consumers will feel dissatisfied. Post-purchase evaluation in

the form of satisfaction or dissatisfaction is what influences their next purchase decisions.

The next purchase decision occurs when the new brand that has been tried is felt to be more satisfying than other brands, consumers are more likely to repeat purchases. Repeat purchase behavior indicates brand loyalty [7]. Unlike the first decision, which is a trial purchase, repeat purchases usually indicate that the product is satisfactory and consumers will use it again and again in greater numbers.

#### **Perceived Risk**

In addition to the perceived benefits and convenience, as well as post-purchase evaluation, the perceived risk also needs to be analyzed to get a more balanced picture of its effect on repeat use interest. Perceived risk harms trust and behavioral intention to use mobile payments [20][21]. It is also found that the perceived risk of behavioral intention to use mobile payments on digital natives is stronger than digital immigrants [22]. A technology adoption model using TAM added with perceived risk which is then measured its effect on trust and finally on behavior intention and actual usage [23].

The decision to use an e-wallet is influenced significantly by convenience, security, and cost savings [24], [25]. Electronic wallets as a payment medium have a large market potential along with the development of e-commerce [26]. More educated users can experience the benefits and reduce the perceived risks [27]. The risk and trust of early users, because they are not used to using it can hinder the adoption of the use of e-wallet [7], [28]. Another study states that the convenience and benefits lead to an interest in continuing to use it. This interest in turn triggers actual behavior. [29].

In its development, there are many security problems in cashless transactions. Threat security in transactions such as cybercrime is a concern for research today. These problems are the concern of service providers by continuously improving security, convenience, as well as ease of transactions [21]. Consumer privacy is becoming an important issue with more and more data-sharing practices to third parties and beyond. This creates pressure on the government and companies to comply with legal and ethical principles so that consumers’ safety can be properly protected. [28].

From empirical research, it can be understood that repurchase intention is positively influenced by perceived benefits and convenience. In addition, privacy and security factors are also highlighted as risks and differences in user generation in the use of products or technology. However, no one has highlighted the risk factors associated with new product features, which require new knowledge to adopt because they are related to online loans. The risk here is not only the risk of transaction security and privacy but rather the risk of not being able to pay so that it will be burdened at a later date. Consequently, this research can deepen the analysis of consumer behavior in product use as well as interest in trying the pay later feature of e-wallet. The research questions are 1. How is the “perceived usefulness”, “perceived ease of use”, “perceived risk”, “post-use evaluation”, and “behavior intention to re-use” e-wallet

during the Covid-19 pandemic; 2. How do those determinants affect the interest in e-wallet use; 3. How does perceived risk moderate those effects?

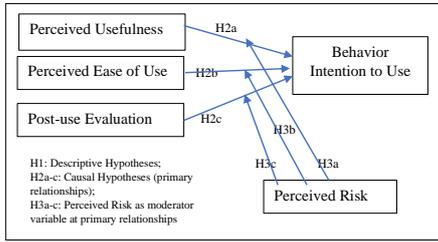


Fig. 1: Research Models

The research hypotheses that need to be tested are as follows: Descriptive hypothesis (H1) is: “perceived usefulness”, “perceived ease of use”, “post-use evaluation”, and “behavior intention to use e-wallet”, increased positively during the Covid-19 pandemic while perceived risk decreased; Causal hypotheses (H2a-c) are: the higher the “perceived usefulness”, “perceived ease of use”, and “post-use evaluation”, the higher the “interest in e-wallet use”, in other words, the relationship is positive; Causal moderate hypotheses (H3a-c) are: “perceived risk” moderate the effect of “perceived usefulness”, “perceived ease of use”, and “post-use evaluation” on “behavior intention” to-use e-wallet.

Reference [30] used the MRA to measure the influence of moderator variables on the relationship between variables. We had to compared these regression equations to determine of moderating effect [31], [32]. It used comparison of

$$BI = \alpha + \beta_1 PU + \beta_2 PE + \beta_3 PoUEv + \varepsilon \quad (1)$$

with

$$BI = \alpha + \beta_1 PU + \beta_2 PE + \beta_3 PoUEv + \beta_4 PR + \varepsilon \quad (2)$$

$$\text{and } BI = \alpha + \beta_1 PU + \beta_2 PE + \beta_3 PoUEv + \beta_4 PR + \beta_5 PU * PR + \beta_6 PE * PR + \beta_7 PoUEv * PR + \varepsilon \quad (3)$$

Description:

- BI : “behavior intention” to use
- PU : “perceived usefulness”
- PE : “perceived ease of use”
- PoUEv : “post-use evaluation”
- PR : “perceived risk”

### III. RESEARCH METHOD

The primary data collection method for this research is an online survey through Instagram social media for 2 months. The questionnaire as a research instrument was composed of 5 constructs and the measurement scale used was a Likert Scale from Strongly Agree to Strongly Disagree (5-1 scale) with adjustments for negative statements, the scale would be reversed [33]. A purposive sample was used in this research. The sampling frame was e-wallet users who are official account followers of the top 5 e-wallet accounts in Indonesia. Users were sent an online questionnaire via direct message. The sample was selected based on the answers to the preliminary criteria in direct messages. Respondents who have and used e-wallet applications in the last 3 months – 1 year can participate in this study. The sample-to-variable ratio suggests a minimum observation-to-variable ratio of 5:1[34]. Testing the validity and reliability of the data and classic

assumptions were carried out to ensure that in Ordinary Least Square (OLS), the Best, Unbiased, Linear, and Estimation (BLUE) data could be analyzed further. Descriptive statistics were used to answer the first research question. Meanwhile, multiple linear regression analysis was used to test hypotheses 2(a-c). MRA were used to test hypotheses 3(a-c) [31], [35].

### IV. RESULT AND DISCUSSION

#### Respondents' Characteristics

After the data was collected and screened, from the 197 who sent their answers, 178 respondents filled out the data completely and according to the requirements.

Table 1: Samples' Characteristics

No.	Characteristics	Options	Total	Percentage
1.	Gender	Female	121	68
		Male	57	32
		Total	178	100
2.	Age	17-25	117	65.7
		26-35	27	15.2
		36-45	17	9.6
		Age over 45	17	9.6
		Total	178	100
3.	Have more than 1 e-wallet account	Yes, have more than 1	166	93.3
		No, only have 1	12	6.7
		Total	178	100
4.	E-wallet account owned and used (answer can be more than 1)	OVO	151	26.49
		Shopeepay	133	23.33
		Gopay	125	21.9
		Dana	109	19.1
		Linkaja	44	7.7
		i-saku	8	1.4
		Total	570	100
5.	Screening Question: Have an e-wallet account Using e-wallet in the last 3 months-1 year	Yes	178	100
		Yes	178	100

Source: the primary data were processed

Whereas 19 more results which were not completely, could not be analyzed. From Table 1, women are 68%, the most age group of 65.7% is 17-25 years, 93.3% of respondents have e-wallet accounts more than 1. The most widely owned and used accounts are OVO at 26.49% followed by Shopeepay at 23.33%.

#### Descriptive Analysis of Research Variables (Descriptive Hypothesis, H1)

##### Perceived Usefulness

The highest average score in Table 2 is Perceived usefulness (4.375).

Table 2: Average Score of Variables

Variable	Average score	Std. Deviation
Perceived Usefulness	4.375	.5583
Perceived Ease of Use	4.316	.5260
Post-use Evaluation	4.159	.4551
Perceived Risk	3.885	.493
Behavior Intention to Use	3.635	.5249

Source: the primary data were processed

This means that with an average score of 4.375 respondents agree that e-wallet provides benefits for them in saving time, eliminating the hassle of carrying cash, facilitating various transactions, helping keep track of their expenses, and get other benefits such as promotions. This results are support [16], [17], [23], [29].

##### Perceived Ease of Use

The mean score for “perceived ease of use” was 4.316 as seen in Table 2. This means that respondents agree that they

feel easy to learn, to understand, to use, and to check e-wallet balance. If there is an error or transaction cancellation, it is easier and faster to refund an e-wallet than when it occurs in banking, the use of an e-wallet is easier and cheaper than using a credit or debit card from a bank. This results are support [16], [25], [26].

#### Post-use Evaluation

The post-use evaluation average score was 4.159 as seen in Table 2. The respondents agree with the benefits of e-wallet in the form of promotions in shopping, comfortable in using e-wallet as a payment media, the experience of getting cashback/promotions that make them happy. Some of the e-wallet used to prefer one over the other because it has advantages such as free top-up fees, being able to transfer to other e-wallet users and being suitable for online shopping and taxi online applications that are often used. However, specifically for the pay-later feature, respondents received negative responses, respondents did not agree that the advantages of the e-wallet used were because it had the advantage of having a pay-later feature. This results are support [16], [19], [27], [36].

#### Perceived Risk

The perceived risk average score was 3.885 as seen in Table 2. In this case, the risk is considered low because the respondent is between neutral and agrees that the data provided to the e-wallet application is safe, confidential, and does not risk leaking to irresponsible parties, the balance is safe in an e-wallet, transactions via e-wallet are always accurate, if there is an error in the transaction, the e-wallet balance must be returned/refunded. Perceived risk is high for the pay-later feature because respondents consider that the pay-later feature is a high-risk loan, making them debt-ridden, although on the other hand respondents also agree that a pay-later feature is a form of loan that helps in an urgent time. This results are support [20], [21], [25], [26], [36], [37].

#### Behavior Intention to Use

Behavior intention to use average score was 3.635 as seen in Table 2. This means that with an average score of 3.635 respondents are between neutral and agree to have interest in keep using the e-wallet. Intention to use is high for general e-wallet usage, like continuing to use it in daily transactions, continuing to top-up its' balance, increasing the number of transactions, and the amount of top-up balance. However, specifically for the pay-later feature, the score is low because the average respondent is not interested in trying or continuing to use the pay-later feature. Don't like debt and worry about not being able to control themselves and paying bills are factors that make interest in using the pay-later feature low. This results are support [3], [5], [19]. This analysis answers the first research question.

#### Classic Assumption Test

##### Normality Test

This test is to ensure each variable in the research model and all linear combinations of relationships between variables were distributed normally. From Kolmogorov-Smirnov

one-sample test .753 on Table 3, it can be seen that the residuals are normally distributed with a significance value of  $.622 > .01$  [31], [33].

Table 3: Normality Test

One-Sample Kolmogorov-Smirnov Test	
Kolmogorov-Smirnov Z	.753
Asymp. Sig. (2-tailed)	.622
a. Test distribution is Normal.	
c. Based on 10000 sampled tables with starting seed 299883525.	
Source: the primary data were processed	

##### Multicollinearity Test

This test is to test whether among the independent variables orthogonal or there is no correlation.

Table 4: Multicollinearity Test with Coefficient Correlations

Model		Coefficient Correlations <sup>a</sup>			
		PoUEv	PE	PU	
1	Correlations	PoUEv	1.000		
		PE	-.283	1.000	
		PU	-.285	-.536	1.000
	Covariances	PoUEv	.007	-.002	-.002
		PE	-.002	.007	-.004
		PU	-.002	-.004	.006
Source: the primary data were processed					

The correlation matrix (Table 4, correlation  $<.95$ ) and the value of VIF  $<10$  and tolerance  $>.1$  (Table 5), it is concluded that there is no multicollinearity or all independent variables orthogonal in the linear model [31].

Table 5: Multicollinearity Test by counting Tolerance and VIF

Model		Coefficients <sup>a</sup>						
		Unstandardized Coefficients		Standardized Coefficients		Collinearity Statistics		
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	.504	.321		1.569	.118		
	PU	.254	.080	.271	3.187	.002	.506	1.974
	PE	.104	.085	.104	1.231	.220	.507	1.973
	PoUEv	.377	.086	.327	4.370	.000	.653	1.531
a. Dependent Variable: BI								
Source: the primary data were processed								

##### Heteroscedasticity Test

This test is to ensure the linear model is homoscedasticity [31]. Park Test is one of the heteroscedasticity tests which shows variance is the function of independent variables (Table 6).

Table 6: Heteroscedasticity Test

Model		Coefficients <sup>a</sup>				
		Unstandardized Coefficients		Standardized Coefficients		Sig.
		B	Std. Error	Beta	t	
1	(Constant)	-1.384	4.173		-.332	.740
	PU	-.154	1.038	-.016	-.148	.882
	PE	-.474	1.101	-.046	-.430	.667
	PoUEv	.187	1.121	.016	.167	.867
a. Dependent Variable: LnRES1						
Source: the primary data were processed						

There is no heteroscedasticity in the regression model (Sig  $>.05$ ).

**Validity Test**

Construct validity shows that all questions for each construct show significance at 1% so that it can be used for further analysis. Or in other words, it can be said that all variables show good construct validity (Table 7).

Table 7: Validity Test

Question No.	Perceived Usefulness	Perceived Ease of Use	Post-use Evaluation	Perceived Risk	Behavior Intention to Use
1	.769**	.720**	.516**	.629**	.618**
2	.776**	.731**	.573**	.512**	.677**
3	.861**	.699**	.616**	.681**	.707**
4	.760**	.738**	.732**	.555**	.695**
5	.655**	.708**	.752**	.603**	.614**
6			.586**	.575**	.684**
7			.323**	.370**	.523**
8			.718**		.427**
9					.222**
10					.415**

\*\*Correlation is significant at the 0.01 level (2-tailed)  
 Source: the primary data were processed

**Reliability Test**

Reliability testing (Table 8) shows that all variables show a Cronbach alpha score > .7. Where the score >.7 indicates good reliability [31].

Table 8: Reliability Statistics, Cronbach

No.	Variable	Cronbach Alpha	N of item
1	Perceived Usefulness	0,869	5
2	Perceived Ease of Use	0,834	5
3	Post-use Evaluation	0,780	8
4	Perceived Risk	0,701	7
5	Behavior Intention to Use	0,764	10

Source: the primary data were processed

*Multiple Linear Regression (Hypothesis 2a, 2b, 2c Testing) for The Relationship between Determinant “Perceived Usefulness”, “Perceived Ease of Use”, and “Post-use Evaluation” on “Behaviour Intention to Use”.*

$$BI = \alpha + \beta_1PU + \beta_2PE + \beta_3PoUEv + \epsilon$$

Table 9. Hypothesis Testing (H2a,2b,2c) (t statistic test and F statistic test)

Model	Coefficients*	Unstandardized Coefficients		Standardized Coefficients		Hypothesis Testing		
		B	Std. Error	Beta	t	Sig.	F	Sig.
1	(Constant)	.504	.321		1.569	.118		
	PU	.254	.080	.271	3.187	.002		<b>2a accepted</b>
	PE	.104	.085	.104	1.231	.220		<b>2b rejected</b>
	PoUEv	.377	.086	.327	4.370	.000		<b>2c accepted</b>
	Regression						32.924	.000*

a. Dependent Variable: BI  
 Source: the primary data were processed

The output of Equation “(1)” is

$$BI = 0,504 + 0,254PU + 0,104PE + 0,377PoUEv + \epsilon$$

It means that perceived usefulness and post-use evaluation have a positive significant effect (sig <.5) towards behavior intention to use. This result means that we cannot reject hypotheses 2a and 2c. The results support [5], [8], [26]. Meanwhile, “perceived ease of use” has also a positive effect although not significant (sig. 220>.1) than hypothesis 2b rejected (Table 9).

*MRA (Hypothesis 3a, 3b, and 3c Testing) for The Moderator Effect “PR” Towards the Relation between “PU”, “PE”, and “PoUEv” on “BI”*

To measure the moderating effect of perceived risk, it is compared to the three equations below:

$$BI = \alpha + \beta_1PU + \beta_2PE + \beta_3PoUEv + \epsilon \tag{1}$$

$$BI = \alpha + \beta_1PU + \beta_2PE + \beta_3PoUEv + \beta_4PR + \epsilon \tag{2}$$

$$BI = \alpha + \beta_1PU + \beta_2PE + \beta_3PoUEv + \beta_4PR + \beta_5PU * PR + \beta_6PE * PR + \beta_7PoUEv * PR + \epsilon \tag{3}$$

Table 10: Equation “(2)” is

$$BI = \alpha + \beta_1PU + \beta_2PE + \beta_3PoUEv + \beta_4PR + \epsilon$$

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.	F	Sig.
		B	Std. Error	Beta					
1	(Constant)	.286	.320			.895	.372		
	PU	.175	.081	.186	2.149	.033			
	PE	.072	.083	.072	.861	.390			
	PoUEv	.301	.087	.261	3.448	.001			
	PR	.263	.081	.248	3.256	.001			

a. Dependent Variable: BI  
 Source: the primary data were processed

Equation “(2)” result (Table 10), the linear regression output is:

$$BI = 0,286 + 0,175PU + 0,72PE + 0,301PoUEv + 0,263PR + \epsilon$$

Table 11: Equation “3” is  $BI = \alpha + \beta_1PU + \beta_2PE + \beta_3PoUEv + \beta_4PR + \beta_5PU * PR + \beta_6PE * PR + \beta_7PoUEv * PR + \epsilon$

Model		Unstandardized Coefficients		Standardized Coefficients		t	Sig.	F	Sig.
		B	Std. Error	Beta					
1	(Constant)	6.299	2.296			2.743	.007		
	PU	1.149	.591	1.222	1.945	.053			
	PE	.904	.618	.906	1.461	.146			
	PoUEv	-2.889	.707	-2.504	-4.084	.000			
	PR	-1.402	.642	-1.318	-2.182	.030			
	PU*PR	-.229	.152	-1.639	-1.509	.133			
	PE*PR	-.206	.157	-1.409	-1.311	.192			
	PoUEv*PR	.816	.179	5.232	4.552	.000			

a. Dependent Variable: BI  
 Source: the primary data were processed

Equation “(3)” result (Table 11), the linear regression output is:

$$BI = 6,299 + 1,149PU + 0,904PE - 2,889PoUEv - 1,402PR - 0,229PU * PR + 0,206PE * PR + 0,816PoUEv * PR + \epsilon$$

Table 12: Comparison of Significance Difference

Equation	Coefficient Significance						
	β1	β2	β3	β4	β5	β6	β7
(1)	.02	.220	.000				
(2)	.033	.390	.001	.001			
(3)	.053	.146	.000	.030	.133	.192	.000

Source: primary data processed

From the equation “(2)” and “(3)” above, the significance of the regression coefficient is compared to determine whether “PR” is a moderating variable [31], [35]. PR is a pure moderator if “(1)” and “(2)” are not different, but must be different from “(3)”.

Hypothesis 3a which states that PR is a moderator in the relationship between “PU” and “BI” cannot be accepted because (β 4 ≠ 0; β 5=0) indicates that PR is not a moderator but an independent variable. Similarly, the same applies to hypothesis 3b which states that PR is a moderator in the relationship between “PE” and “BI” cannot be accepted (β 4 ≠ 0; β 6=0) so that “PR” is an independent variable. For hypothesis 3c, “PR” is a quasi-moderator because (β 4 ≠ 0; β 7 ≠ 0), so hypothesis 3c states that PR

is a moderator in the relationship between “PoUEv” and “BI” can be accepted. This answers the third research question (Table 13).

Table 13:Hypothesis Testing (H3a,3b,3c)

Hypothesis	Pure Moderator	Quasi Moderator	Independent/ Predictor	Coefficient Significancy	Conclusion
3a	( $\beta_4=0$ ; $\beta_5\neq 0$ )	( $\beta_4\neq 0$ ; $\beta_5\neq 0$ )	( $\beta_4\neq 0$ ; $\beta_5=0$ )	( $\beta_4\neq 0$ ; $\beta_5=0$ )	Rejected, PR as independent
3b	( $\beta_4=0$ ; $\beta_6\neq 0$ )	( $\beta_4\neq 0$ ; $\beta_6\neq 0$ )	( $\beta_4\neq 0$ ; $\beta_6=0$ )	( $\beta_4\neq 0$ ; $\beta_6=0$ )	Rejected, PR as independent
3c	( $\beta_4=0$ ; $\beta_7\neq 0$ )	( $\beta_4\neq 0$ ; $\beta_7\neq 0$ )	( $\beta_4\neq 0$ ; $\beta_7=0$ )	( $\beta_4\neq 0$ ; $\beta_7\neq 0$ )	Accepted, PR as quasi-moderator

Source: primary data processed

## V.CONCLUSIONS

This study analyzes consumer behavior in the use of digital wallets as payment media using internet technology. The use of technology according to the TAM, is determined by the benefits and convenience felt by its users. To continue to reuse it, according to the consumer decision process, consumers base it on evaluations after the use of digital wallets. The perceived risk of using a digital wallet is also considered as a determining factor of interest in continuing to use it because it relates to the security of transactions and consumer personal data.

The results showed that during the Covid-19 pandemic, respondents felt an increase in the benefits and ease of using digital wallets. The post-use evaluation and re-use interest are very positive considering that the increasingly varied use of various e-commerce platforms can meet their needs. The perceived risk of using digital wallets decreases as transactions become more secure due to improvements made by digital wallet providers and the more experienced users are. This matter is accepted since the more experienced someone in using this payment media will feel the benefits, convenience, and positive evaluations such as getting additional benefits in using an e-wallet, for example getting benefits from promotions and cost savings. This is support several research [16], [27], [36]. Perceived risk decreased for using e-wallet as payment media, but only on risk about pay later as a new feature of e-wallet still high. The majority feel that it is a high risk to use the pay-later feature although they also agree that this feature can help them in a desperate situation when they need funds. Promotions that are intensified by e-wallet so that consumers use this feature are considered less attractive because they are only given at the beginning as attractiveness. This can be understood by the existence of an e-wallet that temporarily withdraws this feature. This is support several studies [20], [21], [25], [26], [36], [37].

This study also found that perceived usefulness and post-use evaluation were the determinants of interest in using an e-wallet. Meanwhile, perceived ease of use also affects interest but not significantly. The diverse benefits of using an e-wallet also support interest in continuing to use it. The increasing utilities of e-wallet like can be used on various e-commerce platforms and offline stores, make users feel the greater benefits. In addition, the interest in repeat using the e-wallet or continuously is also supported by the ease of operation, such as payment validation that only uses fingerprints or short and uncomplicated codes such as the m-banking application which is less user

friendly. These results support the relationship between variable in several research [16], [17], [23], [25], [29].

Finally, perceived risk was found to play a role as a determinant of interest in reuse. The lower risk makes the user more comfortable to use it again. However, for the pay later feature of this e-wallet, respondents still view it as a high-risk product so they tend not to be interested in using it. These results are support several studies [20], [21], [25], [26], [36], [37] where perceived risk acts as a determinant of interest in repurchasing behavior. As for the relationship between post-use evaluation and behavior intention to use, perceived risk acts as a quasi-moderator. These findings can be re-examined with further research by focusing a more in-depth analysis on the factors that make consumers willing to adopt new features of a product, which in this study is paying later features or a kind of online loan.

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# Analysis of Risk Factors Affecting Musculoskeletal Disorder in Workers

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**Abstract**— Skeletal muscle complaints felt by a person ranging from very mild complaints to very painful are called musculoskeletal disorders. This happens because of excessive muscle contraction due to giving too heavy work with a long duration of loading. Several risk factors for musculoskeletal disorders are age, gender, Body Mass Index, exercise frequency, history of muscle compliance, working hours, type of activity at work, and years of service. These risk factors need to be identified to look for risk factors that are most associated with musculoskeletal disorders in workers. This aim of the research was to identify risk factors associated with these disorders. A descriptive correlational study was used in this study. Respondents were workers who can communicate well, are able to read and write and were willing to be research respondents. The number of respondents in this study was 101 people obtained by proportional random sampling. Questionnaires were used to collect data for this research. **Results:** This study showed that there was a significant relationship between all these risk factors and the fear of falling ( $p < 0.05$ ). Age and history of muscle compliance were the risk factors most closely associated with musculoskeletal disorders ( $p = 0.000$ ). Age and history of muscle complaints were the strongest risk factors that influenced musculoskeletal disorder in workers.

**Keywords**— Workers; Musculoskeletal Disorders

## I. INTRODUCTION

Almost all workers who work in offices have experienced Musculoskeletal disorders (MSDs), the effects of these disorders are very detrimental to the health and productivity of workers [1]. Health problems that occur in MSDs are muscles, tendons, bones, ligaments, and nerves. The most common complaint that appears is pain [2] which begins with fatigue. Most of the symptoms that appear are not noticed by sufferers, because they think that this is a normal thing [3].

Office workers are occupations that have a high prevalence of MSDs. Several factors that cause MSDs are old age, gender, type of work, length of work in a day, length of work, and history of previous musculoskeletal complaints. MSDs can occur in the hands, neck, arms, shoulders, and wrists of office workers [4].

Based on the International Labor Organization (2017), as many as 860,000 workers worldwide encounter work-related accidents and diseases every day [5]. The prevention of Occupational Diseases informs that MSDs have a prevalence of 59% of the total disease records found

in Europe [6]. According to data obtained from the Labor Force Survey (LFS) in the UK, proving that MSDs occur in workers is very high, namely 1,144,000 cases with a distribution of 493,000 cases affecting the back, 426,000 upper limbs or neck, and 224,000 upper limbs. MSDs cases in Malaysia based on a report from the Social Security Organization (SOCSO), increased rapidly to 675 incidents seen from 2005 to 2014 (7). Based on the results of basic health research, the percentage of MSDs is 11.9% examined by health workers in Indonesia and the results of the examination or signs are 24.7% experiencing MSDs (6).

Based on the results of a study conducted by observing and interviewing employees at the Indonesian Ministry of Health's Personnel Bureau, which was conducted in March 2020, there were 18 employees out of 20 employees who experienced MSDs due to working with an unnatural sitting posture due to the non-ergonomic chair design with sitting time long enough in front of a computer or laptop, most of the complaints that occur are pain in the neck, shoulders, lower back, and other parts at work (8). This affects the productivity of workers in carrying out their work activities. Seeing the existing problems, the researcher feels the need to conduct a study with the title "Analysis of Risk Factors Affecting Musculoskeletal Disorder in Workers" to find out which factors are the strongest that cause MSDs so that they can determine the appropriate intervention.

## II. LITERATURE REVIEW

Age was the first factor investigated in this study. Old age causes a worker to be more at risk of developing MSDs. Physiologically, young workers have good muscle performance until the age of 33 years. In addition, recovery time for musculoskeletal injury in young people is relatively short. In a study, it was shown that the prevalence of MSDs was higher among older workers than young workers, especially complaints on the lower back because the elderly will experience degenerative changes in muscles, tendons, ligaments and joints contribute to the pathogenesis of musculoskeletal disorders [9]. Isabel et al. [10] explain in his study that age was factors that influenced MSDs. 46 years old people or older were 3.48 times more susceptible to injury than younger people (<29 years). Other studies showed that people over 49 years old and more experienced workers were more susceptible to become MSDs compared

to young people because apart from aging, another thing that can lead to MSDs is self-confidence which results in underestimating potential work hazard. Other studies showed that there was no difference in the incidence of injury between old and young people. Furthermore, Peek-Asa et al.[11] reported that there is no significant relationship between age and the incidence of injury or risk level of MSDs among young workers compared with older workers. People over 55 years old had the same risk of injury as those under 55.

The next factor is gender. Some study showed that men were less at risk of developing MSDs when compared to women. Another study also explained that female office workers was greater prevalence of MSDs[12–14]. Study conducted by Ardahan and Sismek showed that the incidence of MSDs was higher in women, because women have difference in physiology and anthropometry and it makes them more susceptible than men[15]. In addition, culture in Indonesia emphasizes that women have an obligation to organize their homes on the sidelines of busy work so this causes physical tension that can trigger MSDs. Some studies noted that men posed a risk of MSDs in several parts of the body [16], and also showed pain more often than women[17,18]

The next factor is the working hours. Everyone who works in an office can spend about 8 hours or more a day during his work. Working hours caused MSDs in workers, especially those who spent more time in front of the computer [16]. Study conducted by Celik et al. explained that spent time at work was highly correlated with MSDs, and this study was also accompanied by an analysis of sitting duration affecting multiple body regions [13]. Lee et al. also revealed that long working time increased the MSDs prevalence because the body must have carry out activities for a long time[19]. Another study was explained that people who work for long time a day, they can lost the time for recovery and stress relief from fatigue [20], which can harm the body and cause MSDs.

The period of work also affects the occurrence of MSDs. Based on the results study conducted on pottery craftsmen in Minahasa, Indonesia, it was explained that between period of work and musculoskeletal complaints in pottery craftsmen was correlated in a statistical calculation. Factor that influence the emergence of musculoskeletal complaints is the period of work. This theory based on the conducted by Tarwaka, namely, musculoskeletal complaints are chronic diseases that require a long period of time in development and manifestations [21]. Tarwaka said that when muscles receive excessive workloads that are carried out repeatedly and for a long period, grievance will arise caused by injury of joints, ligaments, and tendons, these complaints are called musculoskeletal complaints[22]. Based on an initial survey conducted by researchers, it was found that some pottery craftsmen often felt pain or pain while working, of which pain most often appeared in the hands, followed the shoulders, back of the neck, back, and legs. Meanwhile, some craftsmen complain of aches or pains that arise due to their long working period and arise when their workload increases. In another study conducted with 103 respondents, it can be seen that there are 41 employees or (55.4%) with MSDs complaints, base on that situation a conclusion can be

drawn that there is a relationship between period of work and MSDs grievance in employees at the Indonesian Civil Service Bureau with the results of the p-value analysis test by 0.020. Research conducted by [23] obtained the results of the chi-square test with a significant value of 0.000 (p-value <0.05). So conclusion can be drawn that there is a relationship between tenure and MSDs complaints in Giriloyo batik, Bantul Regency. Based on study conducted by Sulistyoe et al. obtained a p-value of 0.002. MSDs will occur because tenure is a risk factor that can influence individuals to be at risk of musculoskeletal complaints. If the worker is not on ergonomically position for a long time, there will be an increased risk because the muscles get repetitive static loads and for a long time period, so that it can lead to complaints such as damage to joints, ligaments, and muscles[24].

Risk factors for a history of musculoskeletal complaints also influence the occurrence of MSDs. Workers who have a history of MSDs tend to experience MSDs complaints 9,818 times compared to workers who do not have a history of MSDs. It is known that the history of MSDs as an affects of the occurrence MSDs complaints. So conclusion can be drawn that the history of MSDs is one of the important factors that influence the occurrence of MSDs. Every workers who have a history of MSDs take various ways to overcome the disease. Most of them do massage and get enough rest to deal with it. In addition, some workers also check with doctors and take medicine to overcome them. However, many of the respondents complained that the MSDs still recurred (not fully recovered). This triggers workers to often experience complaints in their muscles and bones[25].

### III. RESEARCH METHOD

This study was conducted in both private and government institutions. Ethical clearance was approved by the ethical committee on health research STIKES Katolik St. Vincentius a Paulo Surabaya. A descriptive correlational study was used in this study. The total respondents was 101 workers determined by a simple random sampling technique. All of the respondents signed the Informed consent. Age, gender, Body Mass Index, exercise frequency, history of muscle complaints, working hours, type of activity at work, and work period as the independent variables, and musculoskeletal disorder as a the dependent variable. Online questionnaire was used to obtained the data. The questions in questionnaire were about age, gender, Body Mass Index, exercise frequency, history of muscle complaints, working hours, type of activity at work, and work period. Question about age in the questionnaire, respondents had to fill in year. For the data of working hours in “hour/day” and work period in “year”, respondents completed data regarding their weight in kilograms and their height in meters. BMI was calculated by the researcher by means of the respondent's weight (in kilograms) divided by the respondent's height (in meters). For the data of the muscle complaints, respondents had to choose "yes" or "no" in the questionnaire. To obtain the musculoskeletal Disorder's data, the Nordic Scale Questionnaire was used with Cronbach's alpha value = 0.885. Spearman test and Contingency Coefficient were used to identify the

correlation between Independent variables and musculoskeletal disorder. Binomial logistic regression was used to identify the risk factor.

#### IV. RESULT AND DISCUSSION

The average age of the respondents was late adulthood (37,6 years old) and 69.3% were male. Of the 101 respondents, it was found 54.5% had BMI with overweight. Most of the respondents (56.4%) were more than 10 years of service, 42.6% was fewer sports activities. Most respondents worked 5-8 hours a day and 81.2% of respondents experienced muscle complaints in the last 1 year. According to the data found, as many as 87.1% of respondents was in a low risk of MSDs (Table 1).

Table 1: Characteristics of respondents

Variable	Sub Grup	Total n= 101	(%)
Age (Year)	Average	37.62	
Gender	Female	31	30.7
	Male	70	69.3
BMI	Underweight (17-18,4)	1	1.0
	Normal (18,5-25)	45	44.6
	Overweight (25->27)	55	54.5
Occupations	Office Workers	61	60.4
	Medical Workers	35	34.7
	Housewife	5	5.0
Length of work (years)	1	8	7.9
	>1-5	12	11.9
	>5-10	24	23.8
	>10	57	56.4
Exercise Time	Nothing	41	40.6
	1-2 hours a week	43	42.6
	> 2-5 hours a week	14	13.9
	> 5 hours a week	3	3.0
Length of work in a day	< 5 hours	8	7.9
	5-8 hours	64	63.4
	> 8 hours	29	28.7
History of previous musculoskeletal complaints	Yes	82	81.2
	No	19	18.8
MSDs	Low Risk (28-49)	88	87.1
	Moderate Risk (50-70)	13	12.9

Spearman test and Contingency Coefficient were used to identify the correlation of Independent variables with musculoskeletal disorder. The analysis correlation showed that there was a correlation between age and MSDs and muscle complaints with MSDs.

Binomial logistic regression test was used and indicate that age and muscle complaints were the strongest risk factor for MSDs (Cox & Snell R Square = 0.108).

MSDs became a problem among young workers (<25 years) and elderly workers (>55 years). Old-aged workers were more risky to MSDs than younger workers because older workers were decreased in physical capacity. Occupational injuries could occur in older workers due to work needs and physical work capacity(25).

Table 2: Correlation about the variable with MSDs

No		rs	Takut Jatuh C	p
1	Age	0.595		0.042 <sup>a</sup>
2	BMI	0.912		0.492 <sup>a</sup>
3	Occupations		0.067	0.506 <sup>b</sup>
4	Length of work (years)		0.135	0.177 <sup>b</sup>
5	Exercise Time		0.013	0.896 <sup>b</sup>
6	Length of work in a day		0.135	0.179 <sup>b</sup>
7	History of previous musculoskeletal complaints		0.422	0.000 <sup>b</sup>

<sup>a</sup> : Uji statistik Spearman'Rho

<sup>b</sup> : Uji statistik Contingency Coefficient

Table 3: Multivariat Analysis result

	B	Sig.	Cox&Snell R Square
Age	1.017	0.000	
History of previous musculoskeletal complaints	1.331	0.001	
			0.108

This study showed that the average age of the respondents was 37, 62 which is included in late adulthood. The result of correlation test was  $p = 0.042$ , which means that there was a correlation between age and MSDs. A multivariate test was performed afterward and showed that age had the strongest relationship with MSD with Cox & Snell R Square = 0.108. Respondents who had a moderate risk of experiencing MSDs were respondents aged >35 years old. According to research conducted by Shobur, one of the factors that affects muscle work is age, because as a person ages, muscle strength decreases. The results showed that there was a correlation between age and musculoskeletal complaints and workers who were above 30 years old had 4.4 times risk of experiencing high levels of musculoskeletal complaints than workers aged <30 years[27]. Other studies also showed the same result that respondents had high complaints of MSDs in the age category which is dominated by the age of respondents >37 years (66.0%). Results Based on statistical tests, it was known that age is related to MSD complaints in worker at the Ministry of Health's Personnel Bureau ( $p$ -value 0.001) [8]. Furthermore, study conducted by Tambuwun, et al, indicate a significant relationship between age and musculoskeletal complaints in workers  $p$ -value = 0.002 ( $\alpha = 0.05$ ) [28].

The strongest factor influencing the occurrence of subsequent MSDs was a history of musculoskeletal complaints. In this study, it was stated that 81.2% of respondents had a history of musculoskeletal complaints. The correlation test stated that a history of musculoskeletal complaints had a relationship with MSDs ( $p = 0.000$ ). Respondents in this study described that most had MSDs risk even though it was low (87.1%). This is comformable with the study conducted by Wita regarding the relationship between a history of MSDs with MSDs complaints in workers in the Polishing section of PT. Surya Toto Indonesia. Tbk in 2011 as shown in the following table, there are 64.7% do not have a history of musculoskeletal complaints but have MSDs. The results of statistical tests signify that there was a significant correlation between a history of musculoskeletal complaints and MSDs in Polishing workers PT. Surya Toto Indonesia. Tbk in 2011.

In addition, there was an OR value of 9.818 which means that workers who had a history of MSDs tend to experience MSDs complaints [25]. This is due to a static work position. As many as 60.4% of respondents were people who work in offices, where working in an office has a dominant position when working is sitting for a long time and standing for a long time. This position causes several muscles in the body to work continuously which will result in muscle fatigue. This muscle fatigue causes complaints of muscle pain and cramps which are included in musculoskeletal complaints. Under the research that has been done on workers, the value of  $\text{sig} = 0.000$  ( $\alpha = 0.05$ ) showed that there was a correlation between the work position obtained by workers and perceived musculoskeletal complaints. The next cause is exercise habits. This study illustrated that as many as 83.2 had minimal exercise habits (0-120 minutes/week). Exercise habits are said to contribute to the incidence of MSDs. Where according to the theory, the minimum frequency of exercise for an untrained person is 150 minutes/week. Results of the analysis study that has been carried out, it was found that the correlation between habits of exercise and MSDs complaints in workers showed that most of the 29 respondents did not have exercise habits and only 9 workers had exercise habits. Based on the level of complaints, it is known that the level of complaints of MSDs in the high category is mostly experienced by workers who do not have the habit of exercising as many as 4 respondents (know). Sport is a structured, planned, and repetitive body movement carried out by a person in maintaining or improving physical fitness. Exercise habits will affect the level of freshness of a person's body. The high risk of musculoskeletal complaints, especially muscle complaints, is influenced by the level of body freshness. Musculoskeletal complaints will increase due to lack of muscle flexibility due to increased physical activity without being followed by sufficient physical fitness. The next cause is BMI where most (54.5%) respondents had a BMI in the overweight category. Having an abnormal BMI such as being underweight, overweight, and obesity can lead to several musculoskeletal disorders [29]. Examples include knee osteoarthritis due to excessive stress on the knee, lower back pain due to mechanical stress on the spine, and heel pain due to excessive loading of the plantar fascia when standing or walking.

## V. CONCLUSIONS

Strong predictors of musculoskeletal disorders in workers are age and muscle complaints. To prevent the occurrence of MSDs in workers, business owners should give time to exercise and provide education on ergonomic positions at work to reduce musculoskeletal complaints. The correct implementation of exercise and how to determine the ergonomic position for workers is the domain of physiotherapists who are health workers who deal with problems of movement and function. So, business owners can work with physiotherapists to arrange a physical activity and design ergonomic positions for workers to avoid musculoskeletal disorders. This study has limitations, one of which is the number of risk factors studied, for further research, it would be better if more risk factors were studied.

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# The Role of Youth in Disaster Mitigation

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**Abstract**— Disasters are an event caused by natural, non-natural and human factors that can threaten and disrupt people's lives and their environment. Disaster can be happen anywhere. The city of Surabaya as one of the areas with a high disaster risk index must be aware of the occurrence of disasters. One of the negative impacts caused by a disaster can be reduced by implementing mitigation involving various parties, including youth. Youth as the largest age group and are active individuals do not seem to have a significant part in the disaster mitigation process. Therefore, purpose of this study was to identify roles are played by youth in the disaster mitigation process especially in areas that have a high disaster risk index. This study was a quantitative descriptive study with survey method. Respondents of this study was 170 youth spread throughout the sub-districts Surabaya. The results showed that of the 15 activities/roles that can be carried out in mitigation activities, both active and passive, the most roles performed by adolescents was in sufficient roles. Meanwhile, when viewed from each role performed, out of 15 roles that can be performed by youth activities for the implementation of environmental conservation have the highest average value of 2.8. Based on the results of these studies indicated that the optimization of the role of youth in mitigation actions still needs to be improved. Generally, youth already have basic knowledge related to disasters that they gain knowledge by searching for themselves. Youth are needed to strengthen knowledge, train and facilitate to be more actively involve in disaster mitigation.

**Keywords**— *Disaster, Mitigation, Youth*

## I. INTRODUCTION

Disaster is defined as a condition of serious disruption to the functioning of a community or society at various scales, caused by the interaction between a distress event and conditions of exposure, vulnerability and unpreparedness. This situation can have an impact at least one of the following: human casualties, material losses, losses economy, and environmental damage” [1]. In many disaster situations, the impact caused by disaster events can actually be minimized, by implementation of disaster mitigation

Disaster mitigation is an action taken to eliminate or reduce the impact of hazards and risks through proactive measures taken before a disaster occurs. Mitigation activities can be done in terms of development of the physical environment, raise awareness and increase the ability of communities to deal with the threat of disaster [2]. Activities in disaster mitigation are divided into two types, active mitigation and passive mitigation [3]. Appropriate

and comprehensive mitigation efforts really need to be done, since Indonesia is quite vulnerable to disasters.

Many disaster happens in Indonesia. National Disaster Management Agency were recorded 1549 natural disasters happens in Indonesia during 2020, ranging from hurricanes, floods, landslides, forest fires, waves tides, droughts, earthquakes, and volcanic eruptions [4]. In 2018, to be exact, from August to October, there were several earthquakes that made everyone grieve. Like the earthquake in Lombok, Donggala and the recent one in East Java, precisely in Situbondo in the early hours of the morning. Although there was no potential for a tsunami, there were casualties [5]. Various disaster conditions were predicted to recur in the following years [6], and can be occur in many areas including Surabaya city.

Surabaya as the second largest metropolitan city in Indonesia and capital city of East Java province [7] has a high risk of disaster. In the 2020 Indonesia Disaster Risk Index, Surabaya is ranked 7th in East Java (out of 38 cities) and is categorized as an area with high disaster risk [8]. Various forms of disasters can occur in Surabaya, especially those related to hydrometeorological disasters and predictions of the possibility of an earthquake [9], so mitigation disaster efforts are needed to prepare for disasters and to minimize impact of disaster. Good mitigation actions need to be supported by the participation of individuals in society who are quick to work, adaptable and understand technology [10]. These characteristics are owned by a group of youth.

Numerous study identify young people are citizens aged 16-30 [11] who often face serious impacts when a disaster occurs and they also face difficulties in finding solutions related to unexpected events such as when a disaster situation occurs in their lives, but also has the potential to reduce the risks and impacts of disasters [12]. Generally, the role of youth is very important to minimizing disaster risk. Planning and preparedness efforts in dealing with disasters have been published in a number of previous studies, where the results of the research show that the involvement of young people plays a very important role [13]. Youth characterized by individuals who have flexible thinking abilities, adapt to tough situations, and able to analyze information from various sources to be used in planning and organizing something better, and focused on the specific task [1]. The age group of youth people is the largest

percentage of the age group in Indonesia, where based on data in 2020 the group of young people reaches 14.8% (40 million) of the total Indonesia population [14]. Such characteristics are very suitable to be able to optimize their role in disaster mitigation activities. However, current research has not shown specifically what role youth can play especially in disaster mitigation activities and more specifically in areas that have a high disaster risk index such as Surabaya city. This role of youth actually can be formed by building their capacity in coping mechanisms and their involvement creates trust between them and pave the way for an independent community [15]. Therefore, this study aims was to identify roles are played by youth in the disaster mitigation process especially in areas that have a high disaster risk index.

## II. LITERATURE REVIEW

Youth are citizen at the ages of 16-30 years and this age is important in the process of growth and development [11]. Youth people have characters like flexible thinking abilities, adapt to tough situations, and able to analyze information from various sources to be used in planning and organizing something better, and focused on the specific task [1]. Some literature also confirms that young people are an age group that is energetic, dynamic and easy to interaction with other and is a potential resource for the future [16][17]. In various disaster situations, adolescents are one of the groups that are vulnerable to disasters, but on the other hand they are capable and resilient resources in dealing with crisis situations including disasters [17]. A number of study was published the significant of early involvement of youth people in disaster planning and preparedness.

According to the regulation of the BNPB No. 4 2008 [3] as regard the preparation of planning in disaster management, mitigation of disaster can be divided into two categories; active mitigation and passive mitigation. Several roles can be performed by youth in disaster mitigation activities. In active mitigation youth has role to develop a warning signs, give attention to the implementation of regulations on spatial planning related to disaster prevention, basic disaster training, education and increasing public awareness, develop routes of evacuation, involved in the construction of the physical environment related to disaster prevention and reduce the impact of disasters, and protect the environment to avoid disaster risk. In passive mitigation youth has role to Give suggestion/involve develop of laws and regulations, Mapping of problems and vulnerability areas, develop of guidelines/standards/procedures, develop a brochures/posters, identify characteristics of disaster, analysis of disaster risk, involved in disaster response team, and strengthening of social organization in the community.

Several studies conducted showed that some of the activities carried out by youth during disasters both individual and organized. A young woman from England when she saw the unnatural behavior of the sea on the morning of the Aceh tsunami, she convinced more than a hundred people to move away from the beach before the attack a few minutes later [18]. After the Hurricane Katarina

in 2005, a group of young people who are members of the Vietnam American Association of Louisiana takes an active role in evacuation, efforts to provide relief and process of recovery [12]. They also were able to provide information related with safe location of evacuation and food distribution by translation the language. Plan International has organized youth people to apply significant role in their community such as developing maps of risk disaster, developing community emergency plan designs, initiate early warning systems, and how to response, mitigation and develop plans to reducing risk of disaster, among other activities [1].

Research conducted by Pradika (2018) [19] identifies the role of youth in reducing disaster risk in Sleman Yogyakarta during the Merapi disaster. Base on the data, Sleman Yogyakarta as an area with moderate level of disaster risk index [8]. In this study, youth has a role in training, disaster socialization, participatory mapping, disaster simulation, monitoring and communication, community radio, and environmental conservation.

There are two important factors for successful disaster mitigation:

1. Micro element; is the development of human knowledge and awareness, mindset and pattern of life or attitudes in everyday life. Knowledge of disaster was a directly or indirectly factors can be affect the process and outcomes of disaster management [20][21] [22]
2. Macro element; is the development a safe environment for living things as well as the environment itself. For this reason, it is necessary to pay attention to environmental characteristics and natural laws [20] [22]

## III. RESEARCH METHOD

This study was a quantitative descriptive study with survey method to identify what roles are played by youth in the disaster mitigation process especially in areas that have a high disaster risk index. The data collection was done with a purposive sampling approach to 170 youth people which are spread throughout the sub-districts of the Surabaya city. Each respondent filled out an online questionnaire survey. The questionnaire used refers to the guidelines from BNPB which explain what activities are carried out in the disaster mitigation process. In this questionnaire, respondents were asked to choose how often they do each role with ranging from never (score 1), sometimes (score 2), often (score 3), always (score 4). The final result of the questionnaire will be categorized into three categories; good role if the score is > 25.61; sufficient role if the score was between 15.87-25.61; and less role if the score is < 15.87.

## IV. RESULT AND DISCUSSION

Based on the respondent's characteristic data, it showed that most of the respondents (97%) received information about disaster mitigation and the majority (82.35%) was good knowledge. As well as attitudes, where most (98.8%) of youth people had a positive attitude towards disaster mitigation.

Meanwhile, the role played by youth in disaster mitigation showed that of the 15 existing roles, the most

categories are in sufficient roles 81.2%. The role was highest score is protect the environment to avoid disaster risk role with a score of 2.8.

Table 1 Characteristics of Respondent

Information about disaster mitigation		
Ever	165	97%
Never	5	3%
Environmental conditions for activities		
Safe	150	88.23%
Not Safe	20	11.77%
Level of Knowledge about disaster mitigation		
Good of Knowledge	140	82.35
Sufficient of Knowledge	25	14.7
Lack of Knowledge	5	2.95%
Attitudes		
Positif	168	98.8%
Negatif	2	0.2%

Table 2 Mean Each Roles of Youth

Role	Mean
Give suggestion/involve develop of laws and regulations	1.1
Mapping of problems and vulnerability areas	1.15
Develop of guidelines/standards/procedures	1.15
Develop a brochures/posters	1.48
Identify characteristics of disaster	1.35
Analysis of disaster risk	1.4
Involved in disaster response team	1.22
Strengthening of social organization in the community	1.24
Develop a warning signs	1.21
Give attention to the implementation of regulations on spatial planning related to disaster prevention	1.15
Basic disaster training	1.48
Education and increasing public awareness	1.58
Develop rotes of evacuation	1.2
Involved in the construction of the physical environment related to disaster prevention and reduce the impact of disasters	1.17
Protect the environment to avoid disaster risk	2.8

Table 3 Categories of Role Performed

Categories of Role	Percentage
good role	14.7
sufficient role	81.2
Less role	4.1

Based on the results of the study, it was shown that the score of the roles performed by adolescents was in sufficient roles, when viewed from the level of knowledge of adolescents about disasters, it showed that they had good knowledge and positive attitudes. This is not in line with previous research where knowledge is an important factor to support activities in disaster mitigation. Knowledge of disaster was a direct or indirect factor that affect the process and outcomes of disaster management [23] [24]. In this study, knowledge of youth people related to disasters had not been implemented in their activities. This is possible because they have not been organized to be directly involved in disaster mitigation, the curriculum in schools had not provide space specifically related to disaster mitigation [25]. They gain knowledge by searching for themselves and are not able to implement their knowledge in daily activities so that their role was insufficient. To better assist young people in implementing their roles in disaster mitigation, focus on attracting young people insiders find problems and ways to solve them by using play scenarios (games), and the scenarios which can be adjusted according to age and ability. Another study also give suggestion that provide support and opportunities for young people to take responsibility in emergency situations is very importance [13]. In addition, the research data also shows that most of the respondents (88.23%) feel that their living environment were safe from disasters. This condition also encourages that they do not need to carry out role in disaster mitigation.

## V. CONCLUSIONS

In conclusion, the results of the study show that the most role played by youth people was sufficient in carrying out their role in disaster mitigation. Therefore, to maximize the role of youth people in disaster mitigation, they need to be well organized and well trained both in the surrounding environment and in the school environment so that their abilities can be used optimally, especially in disaster mitigation activities. For the next study, it is important to analyze what factors influence the implementation of the role of youth in disaster mitigation, especially in areas with a high disaster risk index

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# Disaster Mitigation on Utilization of Telecommunication Infrastructure and Services

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**Abstract**— A disaster is a disturbance that causes critical information resources to become inoperative for a certain period of time, having the effect of endangering the public interest. The disruption can last from a few hours to a few days, depending on the extent of the damage to the information resource. Indonesia's territory includes many areas that are prone to natural disasters in the world. Even in some areas natural disasters have occurred such as areas prone to earthquakes, tsunamis, floods, landslides, and forest fires. As a form of social responsibility to the community in the form of the availability of services and communication networks in disaster-prone areas, telecommunications equipment can certainly be used as a communication tool that can provide quick emergency response information to the community to anticipate losses due to the impact of natural disaster situations that can occur at any time. The complexity of the disaster problem requires a careful arrangement or planning in its management, so that it can be carried out in a directed and integrated manner. The preparation, handling and recovery carried out by telecommunication operators so far have not been based on systematic, structured and planned steps. Preparation for natural disasters includes all activities carried out prior to the detection of signs of a disaster in order to facilitate the use of available natural resources, request assistance, and plan for rehabilitation in the best possible way and possibility. Preparedness for natural disasters starts at the local community level. If local resources are insufficient, the region can request assistance at national and international levels. There are 3 stages in disaster mitigation that can be carried out by network and service providers: Preparation Phase for Telecommunication system and network/infrastructure, Preparation phase for human resources in dealing with disasters, and Response and Recovery Phase.

**Keywords**— *Disaster, Mitigation, Infrastructure and Services Telecommunication*

## I. INTRODUCTION

In Indonesia, around 4000 earthquakes can be detected every year, while earthquakes measuring above 5.5 SR and earthquakes that can be felt by humans occur on average about 70–100 times per year, and tectonic earthquakes that cause damage occur between 1-2 times per year. From 1991 to 2011 there have been 186 destructive tectonic earthquakes.

Indonesia has already had three observation tools, namely earthquake observations with seismographs, observations of earth crust deformation with GPS, and tsunami observations with tide gauges, buoys, CCTV, and

tsunami radar. The data will be sent to the center at the BMKG through a communication network and processed to obtain scenarios for the threat of natural disasters. The Indonesian Tsunami Early Warning System (InaTEWS) is the only tsunami early warning system in operation in Indonesia. Moreover, all regions in Indonesia are required to adapt to this system.

## II. LITERATURE REVIEW

The definition of disaster contained in Law No. 24 of 2007, disaster is an event or series of events that threatens and disrupts people's lives and livelihoods caused, both by natural and/or non-natural factors as well as human factors, resulting in human casualties, environmental damage, property losses, and psychological impacts.

### *Impact and Disaster Lost*

In addition to direct impacts that threaten human life, there are also other impacts that indirectly affect people's social life, one of which is the impact of disasters on the telecommunications sector.

Table 1: Impact of disasters on telecommunication sector

Natural Disaster		
Earthquake	<ul style="list-style-type: none"> <li>• Telco facility damage</li> <li>• Duct damage and FO cable break</li> </ul>	
Tsunami	<ul style="list-style-type: none"> <li>• Telco facility damage</li> <li>• Damage to electricity supply in coastal areas</li> </ul>	
Flood	<ul style="list-style-type: none"> <li>• Cable damage</li> <li>• Damage to electricity supply in affected flood areas</li> </ul>	
Strong winds	<ul style="list-style-type: none"> <li>• Damage/collapse on the pole/tower</li> <li>• Physical damage to Aerial infrastructure</li> <li>• FO aerial cable disconnect</li> </ul>	
Forest fires	<ul style="list-style-type: none"> <li>• Burning of the Pole / Tower</li> <li>• FO cable disconnect</li> </ul>	
Landslide	<ul style="list-style-type: none"> <li>• Destruction of Duct</li> <li>• Failure of the building structure</li> </ul>	
Non-natural Disaster		
Technology Fail	<ul style="list-style-type: none"> <li>• Telco facility damage</li> <li>• Duct damage and FO cable break</li> </ul>	
Failed Modernization	<ul style="list-style-type: none"> <li>• Telco facility damage</li> <li>• Duct damage and FO cable break</li> </ul>	
Epidemics & Disease Outbreaks	<ul style="list-style-type: none"> <li>• Overloaded voice traffic at the start of the disaster</li> <li>• Overloaded voice traffic during healing</li> </ul>	

*References Minimizing the Impact of Disaster with Disaster Recovery Preparedness (Benchmark)*

Natural disaster management or mitigation is a continuous effort to reduce the impact of disasters on people and property. Fewer people and communities will be affected by natural disasters by mobilizing this program. Differences in the level of damages can be overcome by moving different mitigation programs according to the nature of each natural disaster.

Preparation for natural disasters includes all activities carried out prior to the detection of signs of a disaster to facilitate the use of available natural resources, request assistance, and plan for rehabilitation in the best possible way and possibility. Preparedness for natural disasters starts at the local community level. If local resources are insufficient, the region can request assistance at national and international levels.

In areas that have a high level of danger (hazard), vulnerable, natural disasters do not have a wide impact if the local community has disaster resilience. The concept of disaster resilience is an evaluation of the ability of systems and infrastructures to detect, prevent, and deal with serious challenges from natural disasters. This system strengthens disaster-prone areas that have a large population.

### III. RESEARCH METHOD

The research was conducted based on the results of a literature review and interviews with basic telephone service providers via network, satellite, and internet access services. From the results of the interview, it was found that several steps were taken as mitigation measures against disasters that could damage and disrupt telecommunications facilities.

#### *Preparation phase*

In the context of disaster mitigation, it is necessary to design a disaster prevention network/telecommunication infrastructure. In the case of an earthquake natural disaster, things that must be done as a precautionary measure include observing earthquake-resistant building design standards; avoid installation on active earthquake faults; strengthen the materials used in the main and supporting telecommunications facilities; prevention of liquefaction (soil liquefaction) in the main hole; improved duct joint and seismic simulation; perform the installation of a vibration mitigation or control system; and installing a health monitoring system.

Preventive measures in the event of a tsunami include placing the Central office and cable routes in high places; strengthening central trunk backups by setting up physical network loops; laying cables under the riverbed (better than laying cables along bridges near river mouths); and making sure that an emergency mains power supply is available. Prevention of areas that are always prone to flooding include: limiting the installation of telecommunications infrastructure in potentially flooded zones; installing concrete structures on sites where ground displacement is likely to occur due to heavy rains; installing retaining structures or guardrails between telecommunications facilities and steep slopes; installing waterproof doors; installation of waterproof cables and manholes; and

covering the end of the plastic duct (in the manhole / underground infrastructure hole) with foam filler.

Handling of areas that have the potential for strong winds can be carried out by considering the design criteria for protection against strong winds; installing brace polish and steel wires when the wind speed exceeds 40 Mill/s; using bracing between poles in windy locations; and using vibration dampers to protect the cable. Areas that have the potential for landslides are avoided for the installation of telecommunications equipment but, if necessary, it is by increasing slope stability.

To prevent forest fires, it is necessary to manufacture fire breakers (isolation with clean soil/without trees), especially in rural areas; protect facilities outside the infrastructure with non-combustible materials; and use non-combustible materials in the cable structure.

Apart from natural disasters, there are also unforeseen events such as the COVID-19 pandemic and social conflicts that have resulted in a burden on communication media, especially the internet: perform traffic overload protection, ensure there are various routing or dynamic rerouting in case of traffic overload, reserve capacity, and protect social media and Instant Messaging from SARA and Hoax actions.

These guidelines cannot be implemented effectively if human resources have not been prepared to deal with unexpected conditions, both natural and non-natural disasters. Several aspects that must be prepared include personnel readiness, the existence of an emergency response unit, an asset data collection team, the location of a rehabilitation center, a memorandum of agreement in disaster management, and disaster preparedness training.

#### *Response and recovery phase*

At the recovery response stage, service providers are required to carry out the following activities: first, check facilities and reporting, namely, asset data collection team personnel assessing damage to the network, personnel reporting the results of investigations and current conditions to the Ministry of Communications level, operators providing information related to data during disasters such as CDR (call details records).

The second stage Repair of networks and facilities, namely preparing spare parts for equipment and facilities, repairing equipment and facilities.

The third stage, namely customer access and information dissemination. Operator creates a helpline number and provides a free number including numbers to affected communities, the operator ensures that customers/communities can communicate for basic services, including if the user balance deposit is low, using the Disaster message board service according to recommendations ITU E.108, Communication uses Mobile satellite, Operators convey messages to the community around the location and also other locations through messaging services, Voice call services in other forms such as SMS, email, and SMS are carried out via data/IP networks.

The fourth stage is the provision of telecommunications services, namely providing communication equipment for communication to the control room, as well as communication for parties involved in disaster management

such as police, disaster management agencies, medical teams, SAR etc.

The fifth stage is the Control room, namely the placement of the control room in a safe area closest to the location of the disaster incident and for communication between the parties involved, the Control room is used for 24 hours when the disaster repair period ends.

The sixth stage is Sharing resources, i.e. Operators who have agreed to work together can share telecommunications resources/infrastructure for communication for the parties involved and also for communities in disaster-affected areas, and if there is only a single BTS owned by the operator, it can be accessed to increase transmit power.

Seventh stage Equipment deployment is implementing transportable and compact (cellular) and satellite-based BSC Deploy mobile BTS for the provision of cellular services to disaster-affected areas. Cellular BTS needs must be sufficient so that the service can continue to run and be affordable, within 4-5 hours, any location that is part of their network coverage, using burst mode EDFA, and mobile battery.

#### IV. RESULT AND DISCUSSION

Factors of disaster threats/hazards and vulnerability will be able to position the community and the region concerned at different levels of risk. The relationship between hazard, vulnerability and capability can be written by the following equation:

$$\text{Risk} = f(\text{Hazard} \times \text{Vulnerability/Capabilities}) \quad (1)$$

The higher the hazard threat in an area, the higher the risk of the area being affected by a disaster. Likewise, the higher the level of vulnerability of the community or population, the higher the level of risk. On the other hand, the higher the level of community capacity, the smaller the risk they face. By using the calculation of risk analysis, the level of risk faced by the area concerned can be determined. As a simple step for risk assessment is the identification of hazards/threats in the area concerned. All the hazards/threats are inventoried, then the probability of occurrence (probability) is estimated with the following details:

- 5 Definitely (almost certainly 80 - 99%).
- 4 Most likely (60 - 80% will happen next year, or once in 10 years)
- 3 Likely to happen (40-60% happen next year, or once in 100 years)
- 2 Low probability (20 - 40% in 100 years)
- 1 Very low probability (up to 20%)

If the above probability is accompanied by an estimate of its impact if the disaster does occur, taking into account the impact factors, including:

- number of victims;
- property loss;
- damage to infrastructure and facilities;
- wide coverage of disaster-affected areas; and
- socio-economic impact.

then, even this impact is weighted as follows:

- 5 Very Severe (80% - 99% area destroyed and completely paralyzed)
- 4 Severe (60 - 80% area destroyed)
- 3 Moderate (40 - 60% of the affected area is damaged)
- 2 Mild (20 - 40% damaged area)
- 1 Very Light (less than 20% damaged area)

Table 2: Potian Disaster Threats

No	Hazard Types	Probability	Impact
1	Earthquake Followed by Tsunami	1	4
2	Landslide	4	2
3	Flood	4	3
4	Drought	3	1
5	Tornado	2	2

The description of potential threats above can be displayed with other models with three different colors which can also describe priorities as follows:

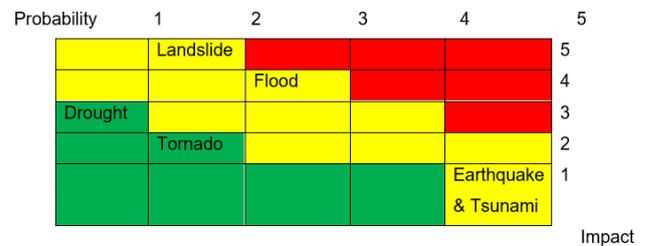


Figure 1: Potential Disaster Threats

#### V. CONCLUSIONS

Disaster is a disturbance that causes critical information resources to become inoperative for a certain period of time, having the effect of endangering the public interest. The disruption can last from a few hours to a few days, depending on the extent of the damage to the information resource.

In Indonesia, around 4000 earthquakes can be detected per year, while earthquakes with a magnitude of above 5.5 on the Richter Scale and earthquakes that can be felt by humans, occur on average about 70-100 times per year, and tectonic earthquakes that cause damage occur between 1-2 times per year. From 1991 to 2011 there have been 186 destructive tectonic earthquakes.

Natural disasters can cause damaging impacts on the economic, social and environmental fields. Infrastructure damage can disrupt social activities, such as death, injury, illness, loss of shelter and community chaos, while environmental damage can include the destruction of forests that protect land.

Preparation for natural disasters includes all activities carried out prior to the detection of signs of disaster in order to facilitate the use of available natural resources, request assistance and plan for rehabilitation in the best possible way and possibility. Preparedness for natural disasters starts at the local community level. If local resources are insufficient, the region can request assistance at national and international levels.

There are 3 stages in disaster mitigation that can be carried out by network and service providers, namely:

1. Preparation Phase for Telecommunication system and network/infrastructure
2. Preparation stage for human resources in dealing with disasters
3. Response and Recovery Stage

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# The Effects of Perceived Risk, Travel Constraints, Fear of Covid on Hotel Visit Intentions during the Covid - 19 Pandemic

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**Abstract**— Tourism industry is one of the most impacted sectors during the Covid – 19 pandemics. This sector has struggled hardly to be able to survive in the mids of visitor's crisis in almost two years of pandemic. The pandemic has impacted on the declining numbers of visitors that create only 20% of the occupancy rate and the reduction of the hotel room rates to 30 – 40%. People are now restrained to travel and visit hotels to avoid Covid. This research explored the effects of perceived risk (physical risk, financial risk, performance risk, social psychological risk, time risk, health risk) and travel constraints on hotel visit intention moderated by the fear of Covid-19 pandemic situation. This research used the “Fear of Covid” related to hotel visit intention, that is seldom used in previous studies. This research was expected to provide an overview of consumer behavior on perceived risks that will give an insightful contribution for hotel management to survive during the pandemic. The survey was conducted by distributing questionnaires using the convenience sampling to 267 respondents in June – August 2021. Quantitative method was done with Sequential Equation Model – Partial Least Square (SEM-PLS) to test the hypothesis. The findings revealed that among six variables of perceived risk, only health risk has a negative effect toward hotel visit intention. Structural constraints and Intrapersonal constraints found to have a negative effect on hotel visit intention. Meanwhile the fear of covid was found to have a positive effect on hotel visit intention.

**Keywords**— *Perceived Risk, Hotel Visit Intention, Fear of Covid, Travel Constraints*

## I. INTRODUCTION

Corona virus that started the pandemic in the whole world was a global disaster. First case was detected in Wuhan, China, December 2019. Covid-19 is not a disease to be underestimated as the spread of the virus is speedy and aggressive. After spreading from China, the evolution of this virus was quite significant due to its spread throughout the world and impacted all countries, [1][2]. March 2020, the Covid-19 pandemic began to spread to Indonesia with a cumulative infection curve showing no decrease in cases to date. Therefore, the Indonesian government has made several travel restrictions policies to and from cities in Indonesia that are in the red zone of transmissions of the corona virus pandemic situation to break the chain of transmissions [3].

The Large-Scale Social Restrictions (Pembatasan Sosial Berskala Besar or PSBB) regulation executed by citizen of Indonesia discovered that the popular virus truly existed in

nowadays society and and is an inevitable threat [4][5][6]. Steps follows the policy that has been implemented based on the Government Regulation of Indonesia Number 21, 2020, during the Covid-19 pandemic. The PSBB policy was first implemented on April 10, 2020, in Jakarta, followed by other regions in Indonesia [7]. As stated by WHO Indonesia [8], Coordinating Minister for Maritime and Investment Affairs announced that the government would rule out Covid-19 deaths as one of the indicators to determine the level of restrictions on public activities (Pemberlakuan Pembatasan Kegiatan Masyarakat (PPKM)) after PSBB policy in the past year. Stated on August 19 in year of 2021, reported by numbers of 22.053 positive Covid-19 cases confirmed, rose from the previous day to 3.930.300 cases. During the rising of positive cases in Indonesia, it was reported that the rate of death rose by 1,492 to 122,633. On the other hand it was confirmed that the number of recovered patients rose by 29.012 to 3.472.915 [9].

This kind of pandemic named Covid-19 has advanced in the global tourism crisis and it has weakened the economics activity in almost all countries in the world. One of the most impacted business is the hotel industry. It has received a huge impact in this pandemic situation. Many hotels that have been affected are forced to shut down because there are no more visitors and other hospitality businesses that are not running commonly [10]. Research about the impact of Covid-19 pandemic in hotel industry located in Indonesia and China explained that hotel's occupancy declined to 40 percent which influence the business stability of the hotel [2]. During the Covid-19 pandemic, it has affected hotel closure of around 1.674 in 31 provinces in Indonesia [11]. According to Badan Pusat Statistik (BPS) in 2019, the total numbers of accommodations in the form of hotels that get affected and closed are almost 50% compares to the total hotels operating in the previous year [12].

The averse to conducting activity of a specific holiday and explore someplace during and later after the pandemic is perceived by the visitors themselves. While travel and tourism always involve risks, and health risks are the major concern of most tourists when visiting a destination or hotel property [13]. Certain risks will inevitably occur, so it is necessary for tourists to anticipate these happenings through perceived risks. There is a study which shows a point of view that human need currently is a trip [14]. There are many risks that provide the potential to be faced. Many

tourists are challenged by these risks because they have high counteraction to a lot of risks forecasted to happen in the future vacation. There are many supporting results of previous research, explaining that tourists consider the potential high risk of travel to be an attractive part of the tour [15]. The characteristics of current tourists are easy to adapt to, especially when experiencing changes in their travel journey. In addition, they have the ability to adapt to another place and see the distinct thing with no preparation to mobile [16]. The purpose of this research was to examine the effect of perceived risk, travel constraints, and fear of covid-19 toward intention to visit hotels in the context of the pandemic situation is the purpose of this research. While many previous studies have explored the effect of perceived risk toward intention to visit a hotel, not many studies explore the effect of fear of covid-19 as the moderation variable related to leisure during the pandemic.

## II. LITERATURE REVIEW

### *Perceived Risk*

There is a story behind the definition of risk. In the ancient period, risk refers to "rhiza" from Greek, related to the disaster near the rocks in the sea [17]. The risk definition is drawn up as the representation of chance or probability of the emersion that will bring several damage and loss in the future [17].

Based on several sources, perceived risk studies are divided into different categories. The first division is called as pre-purchase. This is related with the interest of customers before making the buying decision [17]. According to preceding research, perceived risk has the closest meaning with the probable losses related to the uncertainty in buying a kind of thing that business provided [18]. Before deciding to purchase any tourism product or service or all along with the consumption of it, tourists may perceive several risks. Through scientific research, the practitioners of the tourism marketing field have to explain some risks in the future that are potentially perceived by hotels' guests so they can take the fit provision to confine the spread out of these risks. The security of tourism places security issues to be more important, because the fragility of the pandemic condition. Other researchers succeeded to examine the effect of perceived risk on the intention [19] [20] [21].

In the tourists' point of view, the perceived risk makes it possible to give an influence on the destination and the tourist travel behavior [22]. According to several sources, the perception of tourists has a necessary influence on the field of hotel or tourism industry. Perceived of risk influences tourists' choice to travel, especially during crisis times [23] towards their decision to select a specific destination or product. Furthermore, perceived risks has impact on tourists' future behavioral and purchasing intentions [24] and their image of a destination [25]. In another way, risk perception in tourism is defined as the perception of the possibility that will be caused such a hazard that can influence the travel decisions [26]. The terms that belongs to the risks are predicted coming from performance risk. Product risk which is not as expected leads to perceptions of financial, time, health, and

psychosocial losses [27] as it was introduced by the theory of risk-as-feeling, which emphasizes the influence of risk perceptions specifically on affective aspect on certain behaviors [28].

Currently, during the pandemic situation and concerning into tourism, risk has been the main thing as a major variable for tourists to visit certain places [13]. Because a person is closely related to the behavior of paying attention to the need for safety and security when deciding to visit a certain place in a state of uncertain risk [29]. Several studies were conducted to expand the field of research related to risk perception by analyzing the relationship of tourists' prior knowledge, risk perception, and information-seeking behavior [30]. Tourist concerns can vary as a function of situational factors, which depend on the individual experience and expectations of these elements [31]. Travel decision-making is considered complicated because of its characteristics. Services in the tourism industry cannot be tested or experienced before they are purchased, and therefore costs incurred before experiencing a trip are not recoverable if it is not fit with the expectations. Therefore, customers as tourist exposed to several levels of financial risk [32].

Artuğer argues the relation between the tourist and the destination are even more vulnerable to risk and uncertainty [33]. Since travel may not be a primary need of consumption, travelers are more aware with security and concern about the risk. They are intended to postpone or leave their traveling idea to prevent the risks. Especially in deciding to stay at a hotel, there are quite a lot of considerations regarding the risks perceived by visitors. This is even more relevant today, because of the Covid-19 pandemic that has hit the whole world. There are results of research conducted by Utama and Setiawan [34] which have been processed and tested, it is concluded that the four hypotheses carried out in this study were all rejected. Hypothesis testing conducted on 79.9% of respondents aged 16-25 years. It was found that there was no straight influence between risk perception and travel intention. The increase of perception of risk, financial risk, time risk, socio-psychological risk, and health risk did not directly influence the intention to travel.

### *Physical Risk*

Several researchers have found the same variable on the physical risk dimension. It has been studied in the context of goals that have a specific risk referring to motivation to perform an activity or behavior [35][36][37]. It is belonging to individual safety concern such as disease during the several activities [38]. Previous similar studies analyzed the role of physical risk and contend that destinations have an important role in taking steps that can reduce perceptions of physical risk and assist to appealing more foreign visitor [19][26]. The perceptions of physical risk are increasing, such as the Covid-19 pandemic. Based on the previous research, there are the hypotheses:

H1: Physical Risk has a negative effect toward Hotel Visit Intention

### *Financial Risk*

The Covid-19 pandemic has had an intense influence on business. Thus, risk and uncertainty are still more concerned than the business environment before the Covid-19 pandemic occurred. Perceived financial risk is one of the most common risks and it is a great concern to customers related to their experience [39]. Financial risk is also the most important risk in hotel destinations based on the result of research conducted reference [40]. The perception of travel risk has become an important topic in the tourism industry due to Covid-19 pandemic in the business environment. The effect of perceived trip risk on travel intentions has been set up in the material and it is extremely recognized that the guests commonly propose to choose safe, peaceful, and stable destinations for planned trip [41]. Based on research that has been done previously, there are further hypotheses in this study, namely:

H2: Financial Risk has a negative effect toward Hotel Visit Intention

### *Performance Risk*

Performance risk can occur when customers get something they want that doesn't match what was advertised [42]. Research on perceptions of performance risk concerned to hospitality services in India led to the development of a negative view of the destination among young female tourists [19].

H3: Performance Risk has a negative effect toward Hotel Visit Intention

### *Socio-psychological Risk*

Well defined, psychological risk as bad feelings of discomfort comes from forecasted post-behavioral emotions such as fear and strain [43]. Meanwhile, the social risk is defined as the prospected loss of self-esteem, respect, and fellowship propose to consumers by others [42]. So, based on the recent research there are further hypotheses:

H4: Socio-psychological Risk has a negative effect toward Hotel Visit Intention

### *Time Risk*

Time risk is a concept about time that expected, beneficial, or performance possible to be useless when a purchased product is refitted or shifted [44]. Risk is about the possibility of travelers experiencing a time-wasting travel experience or concerns about the risk that time using a product or service will take too long [18].

H5: Time Risk has a negative effect toward Hotel Visit Intention

### *Health Risk*

As part of the dimension in perceived risk, the health risk is described as the element that could threaten the tourist's safety and the feeling of protection [58]. In the case of the hospitality industry, the health risk is determined from the consumers' perceived risk toward the physical health that was come from the uncertain situation. Events such as political, terrorism, pandemic, and natural disasters are perceived as risky for travelers and caused them to delay

or canceled their visitation to tourism destinations or hotels [59]. The situation of the Covid-19 pandemic has created a bigger challenge for the business practitioner in the hospitality industry due to the tourist avoidance to travel is related to the health concern.

Previous research conducted during the SARS epidemic has found that there is an effect between perceived health risk toward travel behavior [60]. In the situation of Covid-19 pandemic research was also found the relationship among health risk, travel pattern, and tourist travel behavior that result in the traveler hesitant to travel. This happened because they were afraid of getting infected and will affect their health [61]. The concern of health problems during travel is mostly found in the less experienced tourists compare to the more experienced traveler which concerns more on the cultural impediment [62].

H6: Health Risk has a negative effect toward Hotel Visit Intention

### *Travel Constraints*

The barrier that hinders tourists from traveling to the destination and impedes the pleasure of leisure action define as travel constraints [45][46][47]. According to previous research, the travel constraints will create a negative influence on travel experience [48][49]. At the beginning of the study of leisure constraints developed in 1987 [50] [51]. This study broadens to the year 1993 called hierarchical leisure of constraints which is divided into three classifications, interpersonal constraints, intrapersonal constraints, and structural constraints [52] [53].

The first constraint among the three hierarchical leisure of constraints theories is called intrapersonal constraints. This constraint has set a specific psychological condition that heads people's judgment based on their personal interest, skill, value, self-concept, belief, to refuse or agreed on leisure activity. The other factor that influences intrapersonal constraints is the influence of subjective form that can become from their family, friends, or personal relationship. The second type of leisure of constraints namely interpersonal constraints, which mostly influence by the unavailability of other people in the tourist personal circle. It came from the deep interaction with others (family or friends). Meanwhile, structural constraints have been considered as the most critical barriers of leisure due to their ability to block the tourist interpersonal and intrapersonal to engage in the leisure activity. It is determined as a discouraging factor of preference, satisfaction, and participation that came from the lack of money, time, and opportunity. It divides the individual preference of leisure activity with actual participation of leisure [49] [54][55].

The effect of travel constraints toward visit intention varies in different research [56]. The structural constraint was found to have a negative effect toward intention to travel with motivation as moderation variable while interpersonal and intrapersonal were found not significant in the same study. This study is in line with reference [47] discover that one dimension out of three has a significant negative effect on revisit intention. The negative relationship between travel constraints toward travel intention was found in three dimensions of travel constraints such as intrapersonal, interpersonal, and structural constraints [46]. In the context

of Chinese tourist visits to US, the travel constraints negatively affected the travel intention or revisit intention [47][57].

H7: Structural Constraints has a negative effect toward Hotel Visit Intention

H8: Interpersonal Constraints has a negative effect toward Hotel Visit Intention

H9: Intrapersonal Constraints has a negative effect toward Hotel Visit Intention

#### *Fear of Covid*

Fear is a psychological emotion that would trigger a human to respond in a specific way toward danger, suffer, and torment [63]. The uncertainty situation as Covid-19 will create a human emotional response which will reflect through their fear and later created psychosomatic reactions such as nervous, worried, and anxiety. According to a study of reference [64], the psychometric scale to assess the degree of fear has been created to measure the level of fear caused by Covid-19.

The moderating effect of Covid-19 that strengthens or weakens the relationship between factors of consumer behavior has been found in reference [65]. It is found that the fear of Covid – 19 moderates the relationship of ease of purchasing and the intention to buy a healthy product [66]. On the contrary reference [67] on their study stated that negative news regarding covid will create a negative intention to booking hotels in the future.

Reference [68] showed that emotion regulation has an ability to moderate the effects between perceived risk and revisit intention in the case of the Covid-19 pandemic. It is described as the ability to modify emotional state to facilitate adaptive behavior and may partially alleviate the exacerbation of mental problems. The emotional regulation ability could strengthen or weaken the effect between perceived risk the revisit intention in the context of the Covid-19 pandemic. In the context of a luxury brand, the study conducted during the Covid-19 pandemic has found that fear of Covid-19 [69] moderates the relationship between perceived risk toward purchase intention in the context of the luxury brand.

A study conducted by reference [66] found that during an uncertain and unsafe situation (such as on pandemics) people tend to have a negative perception toward traveling. The existence of the negative perception was built from the news came from broad types of media. The flow of information from the television, newspaper, or internet showed a failed business, bankruptcy, numbers of the victim, infected people, or the news about termination of the employee during the unsafe situation. This news then grows people's anxiety and therefore reduces willingness and intention to travel. The negative perception was developed in the mind of people each time they have seen the destination as an unsafe place to visit. When the perceived level of safety going declines hence the intention to travel is weakened [14][66][70][71].

H10: Fear of Covid has a negative effect toward hotel visit intention

H11: Fear of Covid moderate the effect of Perceive Risk toward Hotel Visit Intention

H12: Fear of Covid moderate the effect Travel Constraints toward Hotel Visit Intention

The Conceptual Model was proposed as below:

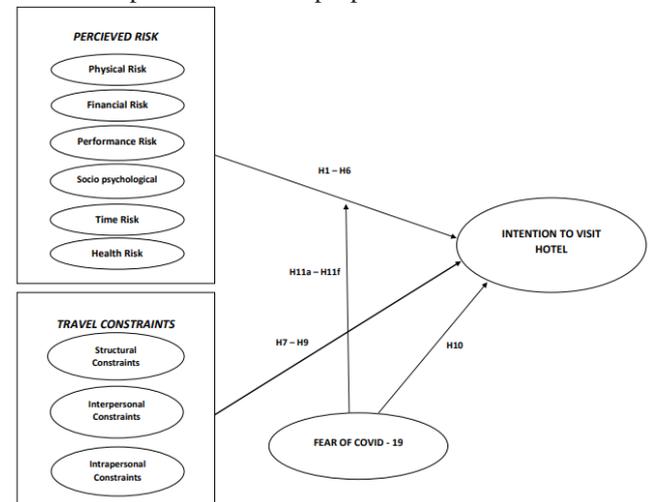


Fig. 1. Research Framework

### III. RESEARCH METHOD

This research was conducted with a qualitative method using a survey-based questionnaire, which according to reference [72] defined as a scheme of gathering data to describing, comparing, and explaining people's knowledge, attitude, and behavior. To aggregate the data about the consumer's perceived risk, travel constraints, fear of covid-19, and intention to visit a hotel, the convenience sampling method was used with Indonesian male and female respondents at a minimum age of 17 years old. The age of the respondent was determined because at the age of 17 years old is considered an adult and assumed ready to make an independent decision concerning traveling and visit a hotel. The convenience method is a selection of data taken from the population that readily and efficiently provide the information [73]. This method is used mostly in quantitative research. The respondent of this research being asked to answer questions based on the situation of the Covid-19 pandemic that happens during the research has been made. The minimum number of respondents was set by using the 10 times rules [74] depending on the number of variables of this research. The 18 constructs are directed to the dependent variable; therefore, a minimum of 180 questionnaires should be collected. After the spreading of the questionnaire, there are 267 questionnaires received and fulfilled the fitness of data analysis for further data processing.

#### *Measurement*

The instrument developed in this research was adapted from the previous research. There are 19 item indicators for perceived risk including physical risk, financial risk, performance risk, Social Psychology risk, Time risk was adapted from reference [19], while four-item indicators for health risk-adapted from reference [59]. Any 12 item indicators for variable Travel constraints such as structural

constraints, interpersonal and personal constraints adapted from reference [19], while fear of covid-19 item indicators was adapted from reference [64]. Visit intention item indicators were adapted from reference [19] [75]. To measure the construct of the assessment using 7 Likert scales, which range from 1 to 7, from strongly disagree to strongly agree.

#### IV. RESULT AND DISCUSSION

##### Data Analysis

Out of 267 respondents, 68.50% were female and the remaining were Male 31.5%. According to the age group, 49.55% were age 17 – 25 years old while the second age group was 26 – 34 years old (32.58%). Most respondents enrolled in bachelor’s degrees (45.32%). Most of the respondents are professional workers such as staffs in a private or government companies (40.45%) with income ≤ IDR 2.500.000. During pandemic Covid-19 most of them have ever experienced staying in the hotel 1 – 3 times (48.31%) for staycation or holiday purposes (45.5%). The Socio demographic showed in Table 1.

##### Assessment of Measurement Model

To estimate the model and testing the hypothesis the analytical tool of Structural Equation Model (SEM) was used. The Partial Least Square (PLS) version 3 was used to investigate the validity and reliability of the model, through the assessment of convergent validity and discriminant validity. Composite reliability and Cronbach alpha were used to test reliability. Convergent validity figures the breadth to two measures to capture an accepted construct [76] while discriminant validity is assessing the construct that should be measure but not any other construct of interest [77]. The first phase was by conducting the convergent validity through the checking of loading factor, average variance extracted (AVE), and composite reliability. According to reference [74], the loading factor should be at least 0.5, with the ideal loading 0.7 or higher. In this research 0.7 was applied which several indicators under 0.7 should be dropped. The indicators are PR1, PR3, PeR1, SC3, SC4, SC5, SC6, SC7, INET3, and FOC3 were deleted because they do not meet the loading factors criteria. The Average Variance Extracted of all variables should be exceeded the value of 0.50 [72]. Composite Reliability values range from 0.832 to 0.977 which exceeded the criteria value of 0.70 [72]. To process reliability, composite reliability and Cronbach alpha showed the result of Fornell Locker value more than 0.6 and bigger than the other interaction values (Table III), The Value of Cronbach Alpha should be 0.7 or higher however there is weakness on PR and SC which result from 0.623 and 0.628 respectively, which showing weakness, but this result is not less than 0.60 which is acceptable. The cross-loading result showed in the Table IV indicated that all the variables have higher values on their relative latent variable as compared with other constructs.

Table 1. Socio Demographic information of respondents (n=267)

Demographic Characteristic	Frequency	(%)
<b>Gender</b>		
Female	183	68.50
Male	84	31.5
<b>Age Group</b>		
17 – 25	132	49.44
26 – 34	87	32.58
35 – 43	35	13.11
44 – 52	4	1.50
> 53	9	3.37
<b>Education Level</b>		
High School	73	27.34
Associate College Degree	11	4.12
Bachelor’s degree	121	45.32
Postgraduate Education	62	23.22
<b>Occupations</b>		
Legislative Officers, High Officials, and Managers	5	1.87
Professionals	108	40.45
Administrative Officers	6	2.25
Entrepreneurs	30	11.24
Agricultural and Livestock Business	2	0.75
Machine Operators and Technicians	1	0.37
Armed Forces or Police	1	0.37
Students	105	39.33
Others	9	3.37
<b>Income per month (in IDR)</b>		
≤ 2.500.000	120	44.94
2.500.001 – 5.000.000	74	27.72
5.000.001 – 7.500.000	30	11.24
7.500.000 – 10.000.000	21	7.87
> 10.000.000	22	8.24
<b>Frequency of staying at Hotel during Pandemic Covid - 19 (2020 - 2021)</b>		
1 – 3 times	129	48.31
3 – 6 times	32	11.99
6 – 10 times	8	3.00
More than 10 times	6	2.25
Never	92	34.46
<b>Reason of Staying in Hotel during Pandemic Covid - 19</b>		
Family / Personal matters	19	10.05
Family Events / Wedding	18	9.52
Preparation of Vaccination	2	1.06
Quarantine	2	1.06
Staycation / Holiday	86	45.50
Test / Examination/ Interview	8	4.23
Transit	12	6.35
Working / Business Travel	38	20.11
Other	4	2.12

Table 2. The results of measurement model and descriptive analysis

Construct and item measure	Mean	SD	Factor Loading	CR	AVE	CA
<b>Physical Risk (PR)</b>	4.96067	1.36599		0.832	0.714	0.623
PR2			0.755			
PR4			0.927			
<b>Financial Risk (FR)</b>	4.25094	1.48026		0.856	0.666	0.749
FR1			0.742			
FR2			0.858			
FR3			0.843			
<b>Performance Risk (PeR)</b>	3.27622	1.25498		0.856	0.597	0.776
PeR2			0.78			
PeR3			0.749			
PeR4			0.791			
PeR5			0.77			
<b>Social Psychology Risk (SPR)</b>	3.61704	1.49014		0.918	0.736	0.881
SPR1			0.89			
SPR2			0.875			
SPR3			0.84			
SPR4			0.825			
<b>Time Risk (TR)</b>	3.49438	1.52324		0.896	0.742	0.83
TR1			0.87			
TR2			0.83			
TR3			0.884			
<b>Health Risk (HR)</b>	4.77715	1.62625		0.954	0.837	0.935
HR1			0.867			
HR2			0.918			
HR3			0.942			
HR4			0.931			
<b>Structural Constraints (SC)</b>	4.34831	1.57471		0.843	0.729	0.628
SC1			0.844			
SC2			0.864			
<b>Interpersonal Constraints (INET)</b>	4.43446	1.70867		0.873	0.775	0.718
INET1			0.833			
INET2			0.925			
<b>Intrapersonal Constraints (INAT)</b>	4.397	1.49369		0.87	0.692	0.779
INAT1			0.801			
INAT2			0.926			
INAT3			0.759			
<b>Fear of Covid (FOC)</b>	4.30275	1.43525		0.895	0.587	0.87
FOC1			0.828			
FOC2			0.795			
FOC4			0.774			

FOC5					0.752	
FOC6					0.708	
FOC7					0.734	
<b>Hotel Visit Intention (HVI)</b>	4.06667	1.74947			0.977	0.893
HVI1					0.905	
HVI2					0.956	
HVI3					0.941	
HVI4					0.962	
HVI5					0.959	

Note : Indicators are PR1, PR3, PeR1, SC3, SC4, SC5, SC6, SC7, INET3 and FOC3 were deleted due to low loading factors. SD = Standard Deviation; CR = Composite Reliability; CA = Cronbach Alpha

### Assessment of Structural Model

The R-square assessed the main evaluation criterion of the goodness of the model structure in the SEM-PLS including the level of significance of the part coefficient and the coefficient determination. The R-Square value is considered as approved when it is considerably strong at the value of 0.26 and above, moderate at the value of 0.13 to 0.25, and weak at the value interval of 0.02 and 0.12 [78]. The result of the study has found that the R-square showed 0.419 which suggested that 41.9 percent of the variance in visit intention can be explained by the dimensions of perceived risks, travel constraints, and fear of covid-19.

Table 3. Discriminant validity – Fornell Larcker Criterion

	FOC	FR	HR	HVI	INAT	INET	PR	PeR	SC	SPR	TR
FOC	<b>0.77</b>										
FR	0.24	<b>0.816</b>									
HR	0.47	0.367	<b>0.915</b>								
HVI	-0.1	-0.21	-0.55	<b>0.945</b>							
INAT	0.33	0.46	0.788	-0.61	<b>0.832</b>						
INET	0.25	0.3	0.512	-0.43	0.628	<b>0.88</b>					
PR	0.39	0.422	0.532	-0.23	0.503	0.249	<b>0.845</b>				
PeR	0.27	0.603	0.386	-0.2	0.499	0.363	0.305	<b>0.773</b>			
SC	0.23	0.47	0.641	-0.52	0.733	0.583	0.436	0.441	<b>0.854</b>		
SPR	0.29	0.508	0.598	-0.42	0.665	0.541	0.393	0.643	0.646	<b>0.858</b>	
TR	0.27	0.427	0.477	-0.32	0.524	0.434	0.269	0.538	0.552	0.722	<b>0.862</b>

Table 4. Result of Cross Loading

	FOC	FR	HR	HVI	INAT	INET	PR	PeR	SC	SPR	TR
FOC1	<b>0.828</b>	0.179	0.445	-0.117	0.303	0.209	0.351	0.108	0.197	0.197	0.166
FOC2	<b>0.795</b>	0.182	0.416	-0.08	0.249	0.192	0.355	0.208	0.166	0.23	0.211
FOC4	<b>0.774</b>	0.099	0.247	-0.065	0.149	0.116	0.29	0.091	0.112	0.116	0.112
FOC5	<b>0.752</b>	0.123	0.279	-0.012	0.2	0.181	0.229	0.249	0.162	0.225	0.18
FOC6	<b>0.708</b>	0.292	0.322	-0.062	0.292	0.213	0.245	0.411	0.217	0.321	0.333
FOC7	<b>0.734</b>	0.215	0.323	-0.062	0.25	0.23	0.224	0.334	0.195	0.267	0.293
FR1	0.186	<b>0.742</b>	0.272	-0.196	0.372	0.199	0.448	0.402	0.35	0.426	0.284
FR2	0.213	<b>0.858</b>	0.309	-0.146	0.348	0.269	0.293	0.505	0.383	0.401	0.395
FR3	0.192	<b>0.843</b>	0.315	-0.169	0.392	0.269	0.259	0.572	0.412	0.402	0.373
HR1	0.486	0.322	<b>0.867</b>	-0.444	0.641	0.426	0.441	0.31	0.558	0.485	0.401
HR2	0.42	0.337	<b>0.918</b>	-0.473	0.733	0.436	0.518	0.345	0.553	0.513	0.429
HR3	0.395	0.364	<b>0.942</b>	-0.574	0.78	0.553	0.508	0.401	0.662	0.623	0.479
HR4	0.426	0.317	<b>0.931</b>	-0.494	0.719	0.442	0.477	0.345	0.561	0.552	0.431
HVI1	-0.094	-0.133	-0.434	<b>0.905</b>	-0.508	-0.337	-0.169	-0.13	-0.44	-0.328	-0.218
HVI2	-0.111	-0.217	-0.532	<b>0.956</b>	-0.571	-0.404	-0.226	-0.21	-0.496	-0.425	-0.329
HVI3	-0.118	-0.205	-0.545	<b>0.941</b>	-0.592	-0.421	-0.229	-0.186	-0.489	-0.387	-0.311
HVI4	-0.114	-0.232	-0.527	<b>0.962</b>	-0.592	-0.434	-0.243	-0.214	-0.529	-0.428	-0.336
HVI5	-0.106	-0.213	-0.535	<b>0.959</b>	-0.597	-0.435	-0.224	-0.219	-0.511	-0.407	-0.315
INAT1	0.37	0.299	0.696	-0.452	<b>0.801</b>	0.439	0.583	0.244	0.572	0.445	0.365
INAT2	0.236	0.448	0.74	-0.644	<b>0.926</b>	0.638	0.408	0.48	0.76	0.648	0.48
INAT3	0.23	0.396	0.498	-0.356	<b>0.759</b>	0.457	0.259	0.544	0.429	0.557	0.479
INET1	0.206	0.259	0.332	-0.302	0.445	<b>0.833</b>	0.086	0.343	0.438	0.461	0.386
INET2	0.232	0.271	0.539	-0.439	0.635	<b>0.925</b>	0.315	0.308	0.571	0.494	0.384
PR2	0.232	0.265	0.38	-0.136	0.357	0.174	<b>0.755</b>	0.209	0.3	0.284	0.16
PR4	0.395	0.422	0.505	-0.237	0.48	0.24	<b>0.927</b>	0.294	0.421	0.371	0.274
PeR2	0.172	0.578	0.328	-0.176	0.421	0.272	0.399	<b>0.78</b>	0.398	0.54	0.464
PeR3	0.175	0.623	0.323	-0.162	0.399	0.288	0.265	<b>0.749</b>	0.394	0.466	0.428
PeR4	0.286	0.297	0.257	-0.159	0.329	0.271	0.106	<b>0.791</b>	0.281	0.459	0.376
PeR5	0.21	0.323	0.276	-0.127	0.391	0.295	0.134	<b>0.77</b>	0.27	0.524	0.383
SC1	0.144	0.388	0.453	-0.432	0.584	0.504	0.294	0.393	<b>0.844</b>	0.546	0.489
SC2	0.246	0.413	0.637	-0.46	0.665	0.491	0.446	0.362	<b>0.864</b>	0.558	0.455
SPR1	0.197	0.467	0.52	-0.399	0.599	0.49	0.308	0.534	0.611	<b>0.89</b>	0.627
SPR2	0.301	0.39	0.528	-0.323	0.564	0.445	0.336	0.537	0.545	<b>0.875</b>	0.576
SPR3	0.265	0.475	0.568	-0.408	0.626	0.492	0.388	0.567	0.553	<b>0.84</b>	0.638
SPR4	0.22	0.392	0.409	-0.28	0.461	0.415	0.306	0.577	0.492	<b>0.825</b>	0.639
TR1	0.192	0.357	0.39	-0.284	0.458	0.391	0.226	0.497	0.512	0.683	<b>0.87</b>
TR2	0.254	0.36	0.351	-0.203	0.386	0.313	0.214	0.418	0.405	0.524	<b>0.83</b>
TR3	0.265	0.386	0.473	-0.32	0.493	0.402	0.251	0.468	0.494	0.638	<b>0.884</b>

Figure 2 showed the result of bootstrapping analysis. According to the path coefficient result among eleven hypotheses proposed (including moderation), it is only four hypotheses that were approved by comparing alpha equal with 0.10 and 0.05 (H6, H7, H9, H10). Hypothesis 6, which proposed the negative relationship between Health Risk and Hotel Visit Intention, was supported with a path coefficient of -0.242, t-statistic of 2.75, and p-value 0.006, which supported H6. Hypothesis 7, which proposed the negative relationship between Structural Constraints and Hotel Visit Intention, was supported with a path coefficient of -0.155, t-statistic of 2.048, and p-value 0.041, which supported H7. Hypothesis 9, which proposed the negative relationship between Intrapersonal and Hotel Visit Intention, was supported with a path coefficient of -0.242, t-statistic of 2.75, and p-value 0.006, which supported hypothesis 9. Meanwhile, H1, H2, H3, H4, H5, H8, H10 were not supported, because t statistics is smaller than 1.96. This research also examined the moderating of Fear of Covid between perceived risk to intention to visit a hotel based on the t-statistics. It did not prove that it strengthens or weakens the effect between both variables. Through the bootstrapping, also indicated that Hypothesis 11a to 11f is not significant. The list of bootstrapping results showed in Table 5.

Table 5. Path Coefficient and Hypothesis Testing

Hypothesis	Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation ( O/STDEV )	T Statistics ( O/STDEV )	P Values	Decision
H1	PR -> HVI	0.09	0.097	0.06	1.49	0.137	Not Supported
H2	FR -> HVI	0	-0.004	0.079	0.001	0.999	Not Supported
H3	PeR -> HVI	0.107	0.11	0.087	1.234	0.218	Not Supported
H4	SPR -> HVI	-0.066	-0.073	0.096	0.687	0.492	Not Supported
H5	TR -> HVI	0.03	0.036	0.071	0.416	0.678	Not Supported
H6	HR -> HVI	-0.242	-0.217	0.088	2.75	0.006**	Supported
H7	SC -> HVI	-0.155	-0.157	0.076	2.048	0.041**	Supported
H8	INET -> HVI	-0.055	-0.053	0.069	0.801	0.423	Not Supported
H9	INAT -> HVI	-0.379	-0.383	0.095	3.991	0.000**	Supported
H10	FOC -> HVI	0.124	0.081	0.073	1.698	0.09*	Supported
H11a	PR*FOC -> HVI	-0.049	-0.036	0.084	0.587	0.558	Not Supported
H11b	FR*FOC -> HVI	-0.115	-0.101	0.087	1.32	0.187	Not Supported
H11c	PeR*FOC -> HVI	0.175	0.147	0.121	1.451	0.148	Not Supported
H11d	SPR*FOC -> HVI	0.062	0.063	0.113	0.544	0.587	Not Supported
H11e	TR*FOC -> HVI	-0.047	-0.043	0.084	0.56	0.576	Not Supported
H11f	HR*FOC -> HVI	-0.003	-0.013	0.078	0.038	0.970	Not Supported

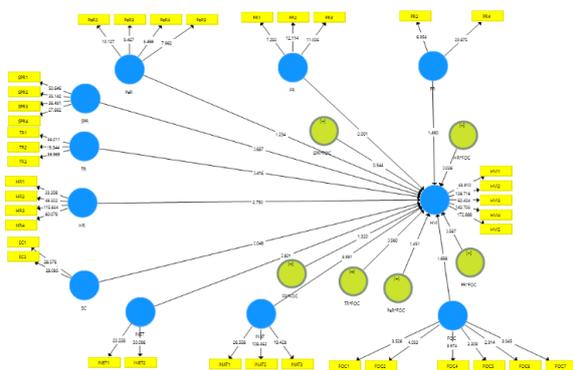


Fig. 2. The Output of bootstrapping analysis

Notes: \*\*refer to p= <0.05 \*refer to p= <0.10

The result showed that perceived risk (physical risk, financial risk, time risk, social-psychological risk, performance risk) except health risk do not influence intention to hotel visit during a pandemic. In many research, perceived risk consists of physical risk, financial risk, time

risk, social-psychological risk, performance risk that resulted to have a negative effect on intention [60][69][79][80].

Especially for this research, the indicators of perceived risk-adjusted with the pandemic Covid – 19 situations were found that it does not give significant effects on the intention to visit the hotel. This happens because the situation of Covid – 19 in Indonesia is on the highest level of spreading while this research is conducted where the risk in terms of time, performance, financial, social-psychological was not the main concern. The government regulation of implementing small-scale lockdown (PSBB) limited the movement of people that create stress and high willingness to take a vacation. It is needed to distinguish based on the linked to tourists’ sociodemographic background for example their lifestyle, patterns or motives of travel behavior, mode of risk-oriented information used, level of risk-taking propensity, and tourists perceived personal health situation to assess perceived risk [61]. Excluding the result of other perceived risk dimensions, Health risk in this research is found to have a negative effect on the intention to visit the hotel. This result is in line with reference [60][61][80][59] that found health risk has a significant role on intention and decision making on traveling. The health risk is considered as the main concern among other risks because covid – 19 pandemics have shown that it brings a health problem. It is required to prepare risk management especially during a pandemic for the hotel service provider to provide risk mitigation that pays attention to the health risk of the potential guest.

Risk mitigation in the hotel industry can be in a form of robot service and reservation technology. Reference [60][80]; has proposed the development of communication strategies, the fact that information, especially found on the Internet or social networks, can have an impact on risk perception. Robot cleaning, advanced cleaning system, employee cleaning can be also implemented to lowering the perceived health risk with a contactless technology [59]. In Indonesia CHSE certification regulated by the government might be one of the alternatives to make sure that the hotels applied the protocol required for cleanliness, health, and safeness to meet that standard of health protocols especially during a pandemic.

Structural and intrapersonal constraints were found to have a significant negative effect on hotel visit intention. The result is in line with study references [57] and [81]. Among 7 indicators of structural constraints, only two indicators are valid and the valid indicators state about the “no time to visit the hotel during a pandemic” and “kept themselves to visit the hotel during a pandemic”. This might happen because of the awareness of the consumer to the safeness of doing mobility during the pandemic situation and the role of government regulation related to covid. It would be important for the hotel service industry to provide information through their website and social media about the program to avoid covid implemented on the hotel to show consumers about the protocol applied to lowering the hygiene and cleanliness issue during the pandemic.

Fear of covid indicates to have a positive relationship with intention to visit hotel which respondent showed the willingness to keep visit the hotel despite to have a fear

toward covid. The need to entertain and having a recreation is bigger than the fear of covid itself. It is not covid – 19 diseases that the respondent worries about but the effect of covid such as health risk, the stress, or the economics problem because of closes business or staying at home.

## V. CONCLUSIONS

This paper focuses on the perceived risk including health risk. It gives some impact on the willingness of the consumer to visit a hotel. Some practical suggestion has been discussed on the previous part to give insight for practitioners according to previous research and sources by using technology to provide contactless services.

The finding on the structural and intrapersonal constraints has contributed to the development of research that in the context of pandemic situations intrapersonal constraints have influenced consumers to visit the hotel. The result of fear of covid-19 has devoted to the development of leisure research especially when having a tourism activity during pandemic situation for the consumer demographics, culture, lifestyle, knowledge will influence their intention to keep going to stay at the hotel or traveling. The insignificant effect of perceived risk toward intention to visit a hotel has consequences to the no moderating effect of fear of covid on perceived risk toward the intention to visit the hotel.

The result of this study contributes to future research by exploring the role of health risk and fear of covid that was found to have an influence on the hotel visit intention. There is finite research that has used it in the context of hospitality research during the pandemic situation. There are inadequate studies that explored the health risk role as one dimension of perceived risk. Among the other dimension of travel constraints, the intrapersonal constraints were found to have a major effect on visit intention. The result has shown that in the pandemic situation, the constraints of travel mostly came from the personal decision of the consumer to withhold a stay in a hotel.

This research only used the specific area of the country as respondents therefore the result of this research is limited to the Indonesian study on leisure behavior. In future research, it is suggested to not only use a specific country instead do the comparison between two or more countries to compare the behavior. This study did not use the demographic information (age, gender, education level, income) or the level of knowledge about covid-19 as moderating variable or different test since several studies suggested that the different demographics of the consumer will influence the level of perceived risk, travel constraints and fear of covid. The media coverage about covid-19 also influences the level of knowledge of travelers that will need to be extended in the future study.

## DISCLAIMER

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# Design of a Non-Pyramidal Modeled Waveguide Horn Antenna for WLAN 2.4 GHz Communication System

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**Abstract**—The indoor antenna characteristic measurement is usually affected by electromagnetic wave reflection and other signals interference which cause the strength of a received signal decreased or sometimes increased. With a standard scientific methodology i.e., literature review, analysis for antenna measurement, and design, we suggest a method for using a Non-Pyramidal Modeled Waveguide Horn Antenna as a transmission antenna or receiving antenna to reduce the effect of reflected waves and other signals interference in order to get a good received signal strength. Based on our research in Electrical Engineering Telecommunication Laboratory, in azimuth field the proposed antenna has a “power pattern” of -3.15 dB at 3400 and of -2.48 dB at 200, so the HPBW was 400. In an elevation field this antenna also had a “power pattern” of -3.59 dB at 3400 and of -2.08 dB at 200, so the HPBW remains 400. These unidirectional radiation pattern characteristics gave the best output for WLAN 2.4 GHz communication system, especially better design of transmission antenna and receiving antenna for internet network. A reliable internet network with wisely used parameters will support high quality communication and targeted information transfer that mainly contributes on improving people quality of life and the sustainability of environment.

**Keywords**— *Electromagnetic Wave Reflection, Interference, Horn Antenna, Power Pattern, Unidirectional*

## I. INTRODUCTION

For a period of time the measurement of indoor antenna in Electrical Engineering Telecommunication Laboratory, Universitas Katolik De La Salle Manado was conducted using  $\lambda/4$  monopole antenna. The antenna radiation pattern was omnidirectional which radiated the multipath reflection from everything that have conductive characteristic in that room or could be also the reflection from the laboratory walls (phenomena from small-scale fading) [11], so the result of signal measurement at receiver antenna did not appropriate with the signal strength that came directly from the transmitter antenna (Line-of-Sight).

In addition, the laboratory was not equipped with an anechoic chamber capable of electromagnetic wave absorbing walls, with no reflection. Such anechoic chambers are very expensive. Therefore in this research a Non-Pyramidal Modeled Waveguide Horn Antenna that has a unidirectional radiation pattern was designed to minimize the effect of electromagnetic wave reflection signals [9][10].

This Horn Antenna was made from aluminum sheet material that being formed into a rectangle shape which one of its front sides was emptied (no wall side), so it was formed a ‘tunnel’. Driver for this antenna used monopole  $\lambda/4$  antenna that injected at the bottom side,  $\lambda/2$  distance from the back wall, as shown in figure 1. A waveguide was purposely used, instead of a ‘tunnel’ like a typical Horn Antenna. This was done to get the smallest possible antenna space angel beam. This Horn Antenna can be used as a transmitter antenna or receiver antenna for antenna characteristic measurement operates in WLAN 2.4 GHz communication system.

This proposed antenna has Half Power Beam-Width (HPBW) radiation pattern in 400 azimuth field and HPBW in 400 elevation field, which refers to unidirectional radiation pattern.

In communication systems, signal strength of a received antenna is one of the important parameters that helps people around the world to communicate smoothly and uninterruptedly. Such great signal strength output and proper implementation would help areas that usually have difficulty receiving internet signals to have better expectation to receive reliable signals to support them in communication, learning process, and getting updated information.

## II. LITERATURE REVIEW

Horn Antenna has been used in many applications as a feed element in parabolic antenna with wide diameter that is usually used in radio astronomy, satellite tracking, and communication systems found in all over the world [8][9]. Its wide applications were caused by its simple construction, easy to extract, multi-function, high antenna gain, and the whole performance is preferred [9].

This designed Horn Antenna has a quite narrow HPBW (400), narrower from previous HPBW research (900) conducted by Mahendra Singh Meena and Ved Prakash [1], and narrower from HPBW (600) conducted by Stefania Diana, Danilo Brizi, and Agostino Monorchio [2].

### A. Waveguide

Above 2 GHz, waveguides are short enough to allow practical and efficient energy transfer in different ways [3]. A waveguide is a conduction tube through which energy is emitted in the form of electromagnetic waves. The tube acts

as a boundary that confines the waves in an enclosed space. Figure 1 below shows the waveguide.

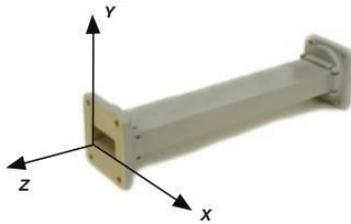


Figure 1. Dimension X, Y, and Z at a Rectangular Waveguide

The Faraday cage effect prevents electromagnetic effects from appearing outside the guide. The electromagnetic field is propagated through the waveguide by reflection against its inner wall, which is considered to be a perfect conductor. The field intensity is very large at the center along the X dimension, and must decrease to zero at the end of the wall because the presence of any field parallel to the wall at the surface can cause an infinite current to flow in a perfect conductor.

There are many ways for the electric and magnetic fields to regulate themselves in a waveguide for frequencies above the low cut-off frequency. Each field configuration is called a mode. These modes can be separated into two groups. The first, called TM (Transverse Magnetic), has a magnetic field that is completely transverse to the direction of propagation, but has an electric field component in the direction of propagation. The other type, called TE (Transverse Electric), has an electric field that is completely transverse, but has a magnetic field component in the direction of propagation.

The mode of propagation is identified by a group of letters followed by two numbers located below the line. For example, TE<sub>10</sub> TM<sub>11</sub>, etc. The number of possible modes increases with frequency for a given waveguide size, and there is only one possible way, called dominant mode, for the lowest frequency to be transmitted. On a rectangular wavefront, the critical dimension is X. This dimension must be more than 0.5 at the lowest frequency to be transmitted. In practice, the Y dimension is usually made nearly equal to 0.5 X to avoid the possibility of operating at frequencies other than the dominant mode. In this study we used the TE<sub>10</sub> mode.

If the waveguide is left open at one end, the waveguide will radiate energy so that the waveguide can be used as an antenna [5], not as a transmission path. This radiation can be increased by forming a pyramid at the open end of the waveguide so that it is in the form of a ‘tunnel’, therefore this antenna is called a ‘tunnel’ antenna or better known as a Horn Antenna which has a unidirectional radiation pattern [6]. But in this study, the pyramidal ‘tunnel’ was not used. this was done to get a radiation pattern with a narrow HPBW.

### B. Theoretical Basis

The wavelength of ( $\lambda$ ) *Electromagnetic* that propagates in free space can be calculated using the following equation 1 [10]:

$$\lambda = \frac{c}{f} \quad (1)$$

where:

- $c$ : speed of light in free space ( $3 \times 10^8$  m/sec)
- $f$ : operation frequency (2.4 GHz)
- $\lambda$ : wavelength in free space (m)

For rectangular waveguide in this research a TE<sub>10</sub> mode was used. *Cut-off* frequency can be calculated using the following equation 2 [9][10]:

$$f_c = \frac{1}{2a\sqrt{\mu_o \epsilon_o}} \quad (2)$$

where:

- $\mu_o$ : air permeability
- $\epsilon_o$ : air permittivity
- $a$ : length dimension *waveguide* (X)
- $f_c$ : *cut-off* frequency

The wavelength in *waveguide* can be calculated using equation 3 [9][10]:

$$\lambda_g = \frac{\lambda}{\sqrt{1 - \left(\frac{\lambda}{\lambda_o}\right)^2}} \quad (3)$$

where:

- $\lambda$ : wavelength in free space
- $\lambda_o$ : *cut-off* wavelength ( $\lambda_o = 2X$ )
- $\lambda_g$ : wavelength in *waveguide*

### C. Antenna Measurement

There is an electromagnetic wave radiation pattern difference between outside of the antenna which divided into two regions, the field near the antenna, called the “near field” [4], or the Fresnel region, and the field at a distance from the antenna, called the “far field”, or Fraunhofer region, as shown in Figure 2 below.

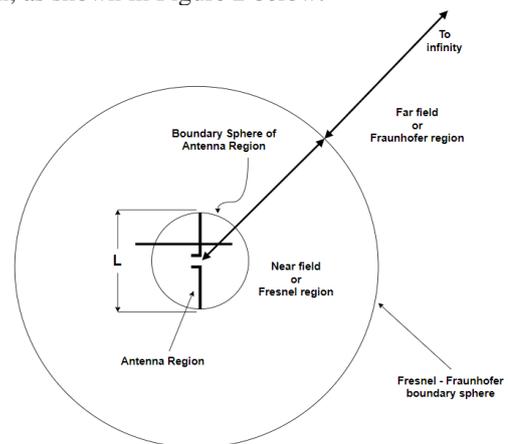


Figure 2. Antenna Regions: Fresnel region and Fraunhofer region

The boundary between these two regions is spherical with a radius in equation 4 [10]:

$$R = \frac{2L^2}{\lambda} \quad (4)$$

where:

- $L$ : boundary sphere of antenna region
- $\lambda$ : wavelength in free space
- $R$ : Fresnel and Fraunhofer border radius

In Fraunhofer region, the components of the electric field ( $E$ ) and magnetic field ( $H$ ) are perpendicular to each other (transverse), and the shape of the field pattern is independent of the radius (radius) at which the measurement is taken. In the Fresnel region the field components  $E$  and  $H$  change considerably depending on the radius, and the shape of the field pattern is a function of the radius [10].

### III. RESEARCH METHOD

This research was to design a non-Pyramidal modeled waveguide Horn antenna for WLAN 2.4 GHz communication system based on a standard scientific methodology:

#### Literature Review

A literature study was conducted to collect related reading materials from textbooks and journal articles which can be used for theory and analysis. There were old textbooks had been used as reference because of their main contribution to the basic antenna measurement theories [9][10][11].

#### Analysis for Antenna Measurement

Analysis was carried out using formula of Electromagnetic wavelength, Cut-off frequency, and Waveguide wavelength. Then an electromagnetic wave radiation pattern difference between outside of the antenna (“near field” or Fresnel region and “far field” or Fraunhofer region) was calculated and set-up before measurement.

The antenna measurement used in this research is a radiation pattern measurement to measure the Half-Power Beamwidth (HPBW)

#### Antenna Design

Based on literature study and analysis, A Non-Pyramidal Waveguide Horn Antenna in the form of a rectangular shape was designed. Supporting devices were smartphones and a spectrum analyzer. Several observations for received power (dBm) and normalized (dB) were made.

### IV. RESULT AND DISCUSSION

The designed Horn antenna is very simple, has a rectangular shape made from aluminum where one of its front sides was open (no wall) and formed a ‘tunnel’ as described in the following Figure 3.

The Horn Antenna was 20 cm in length (dimension Z), 10 cm in width (dimension X), and 5 cm in height (dimension Y). The wavelength was calculated in free space  $\lambda = 12.5$  cm, while the cut-off wavelength ( $\lambda_0 = 2X$ ) was  $2 \times 10$  cm = 20 cm. Then refers to (3) we had wavelength in waveguide  $\lambda_g = 16$  cm. This means that the length of the designed antenna (20 cm) is  $1.25 \lambda_g$ . It was concluded that this length of our designed antenna was enough for electromagnetic wave propagation in waveguide.



Figure 3. Horn Antenna

The antenna measurement used in this research was a radiation pattern measurement to measure the Half-Power Beamwidth (HPBW), because the goal for using this antenna was to avoid the reflection wave from the laboratory walls and devices inside the laboratory [7]. The radiation pattern measurement configuration can be seen in this following figure 4:



Figure 4. Radiation Pattern Measurement Configuration

The distance between transmitter antenna and receiver was 2 meters, while the boundary between the Fresnel and Fraunhofer regions was based on equation (4), where  $L = 25$  cm (the length of the antenna diagonal) and the wavelength in free space = 12.5 cm, thus the radius  $R = 1$  m was obtained. Measurements were already in the “far field” of the antenna in the Fraunhofer region, where the components of the electric ( $E$ ) and magnetic ( $H$ ) fields are perpendicular to each other (transverse), and the shape of the field pattern is independent of radius again.

As a transmitter TP-Link TL-MR3420 access point was used, and as a receiver Rohde & Schwarz Spectrum Analyzer FSL18 was used to measure the received signal power.

Measurement has been done by rotating the *Horn* Antenna from 0° to 360° angles in increments of 10° at two polarization fields, i.e. azimuth field and elevation field [9][10].

The measurement results for the received signal power in azimuth field and elevation field are shown in Table 1.

Table 1: Power Pattern in Azimuth Field and Elevation Field

Azimuth			Elevation		
Direction [°]	Received Power [dBm]	Normalized [dB]	Direction [°]	Received Power [dBm]	Normalized [dB]
0°	-62.16	0	0°	-61.87	0.00
10°	-62.71	-0.55	10°	-62.18	-0.31
20°	-64.64	-2.48	20°	-63.95	-2.08
30°	-68.35	-6.19	30°	-66.77	-4.90
40°	-70.85	-8.69	40°	-70.70	-8.83
50°	-72.23	-10.07	50°	-65.97	-4.10
60°	-71.36	-9.2	60°	-65.39	-3.52
70°	-71.3	-9.14	70°	-68.23	-6.36
80°	-70.9	-8.74	80°	-68.51	-6.64
90°	-70.45	-8.29	90°	-69.88	-8.01
100°	-66.68	-4.52	100°	-64.99	-3.12
110°	-65.56	-3.4	110°	-64.15	-2.28
120°	-66.14	-3.98	120°	-66.06	-4.19
130°	-71.55	-9.39	130°	-69.40	-7.53
140°	-66.82	-4.66	140°	-66.52	-4.65
150°	-66.4	-4.24	150°	-64.95	-3.08
160°	-65.06	-2.9	160°	-64.82	-2.95
170°	-67.69	-5.53	170°	-68.65	-6.78
180°	-65.23	-3.07	180°	-70.02	-8.15
190°	-65.38	-3.22	190°	-67.58	-5.71
200°	-65.23	-3.07	200°	-65.37	-3.50
210°	-65.18	-3.02	210°	-63.36	-1.49
220°	-66.56	-4.4	220°	-64.35	-2.48
230°	-71.33	-9.17	230°	-68.13	-6.26
240°	-68.8	-6.64	240°	-70.77	-8.90
250°	-65.72	-3.56	250°	-70.96	-9.09
260°	-65.4	-3.24	260°	-68.98	-7.11
270°	-69.08	-6.92	270°	-67.98	-6.11
280°	-68.13	-5.97	280°	-68.79	-6.92
290°	-70.14	-7.98	290°	-73.54	-11.67
300°	-68.02	-5.86	300°	-70.09	-8.22
310°	-67.81	-5.65	310°	-65.85	-3.98
320°	-71.03	-8.87	320°	-66.82	-4.95
330°	-67.25	-5.09	330°	-74.22	-12.35
340°	-65.31	-3.15	340°	-65.46	-3.59
350°	-63.98	-1.82	350°	-61.97	-0.10

The *Half-Power Beamwidth* (HPBW) measured in normalized received signal power was half of the received maximum power, or -3 dB [9][10]. From table 1 it is seen that in azimuth field, angle 20° and 340°, the received signal power approaches -3 dB, therefore it is concluded that the antenna HPBW in azimuth field is 40°.

The radiation pattern in azimuth field is described in this following Figure 5.

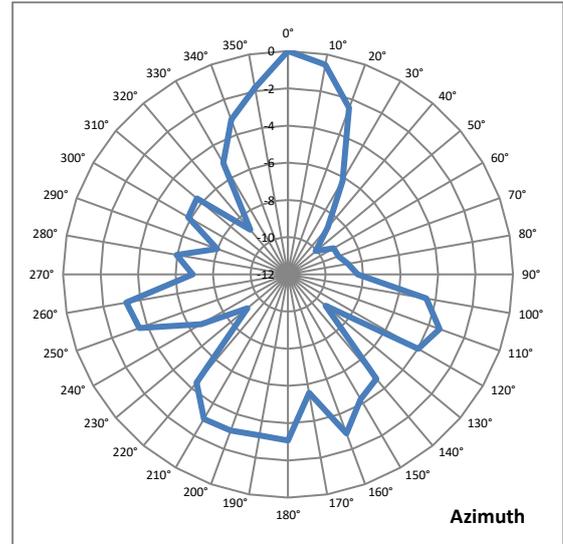


Figure 5. Radiation Pattern in Azimuth Field

Figure 5 shows the *Main Lobe* is occurred in 0 dB maximum received power, in 0° angle. *Side Lobe* is occurred in 110°, 160°, 210°, and 260° angles that caused by *multi-reflections* from walls and devices inside the laboratory room, that is also occurred for *Back Lobe* in 180° angle.

In elevation field, angle 20° and 340°, the received signal power approaches -3 dB, so we concluded that antenna HPBW in elevation field is 40°.

The radiation pattern in elevation field can be seen in this Figure 6.

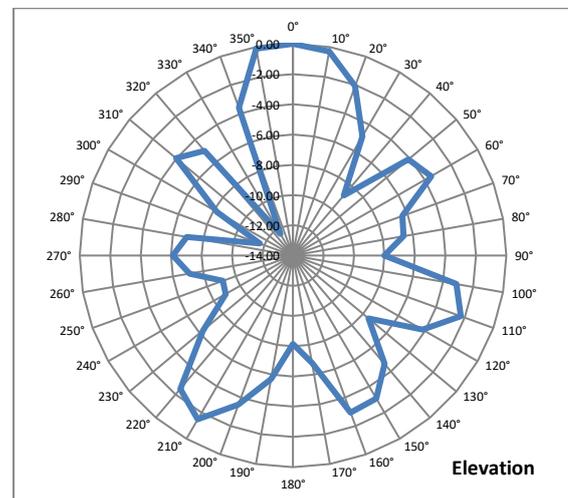


Figure 6. Radiation Pattern in Elevation Field

Figure 6 shows that *Main Lobe* is occurred in 0° angle. *Side Lobe* is occurred in 60°, 110°, 160°, 210°, 270°, and 310° angles caused by *multi-reflections* from walls and devices inside the laboratory room.

The measurement results confirm that the *Horn* Antenna designed has better performance of HPBW (40°), narrower from the previous HPBW research (90°) conducted by Mahendra Singh Meena and Ved Prakash [1], and narrower from HPBW (60°) conducted by Stefania Diana, Danilo Brizi, and Agostino Monorchio [2].

## V. CONCLUSIONS

The new waveguide Horn antenna with non-Pyramidal model can be proposed for WLAN 2.4 GHz communication system, which is applicable as a transmitter antenna or receiver antenna.

The measurement results and antenna prototype have been informed in this research and the effect of Horn Antenna parameter in the received radiation pattern also has been analyzed and suitable for unidirectional antenna application for WLAN system antenna measurement.

Both in azimuth field or elevation field, the radiation pattern of the proposed antenna fulfills the requirement of 2.4 GHz for WLAN operation. This Horn Antenna has HPBW 400 in azimuth field and HPBW 400 in elevation field that can overcome the occurring of small-scale fading caused by reflections of walls and devices inside Telecommunication laboratory room.

The usage of this Horn antenna in WLAN system antenna measurement can be used as an alternative replacement for the usage of anechoic chamber that usually costly, and also alternative design for reliable communication system.

Future works can be conducted for designing a long ‘tunnel’ rectangular shape to achieve narrower HPBW and just very few reflections that perfectly generate a strong signal strength.

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# The Impact of Good Corporate Governance (GCG) Implementation and Internal Control on State Owned Enterprises (BUMN) Performance

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**Abstract**—Organizations apply Good Corporate Governance (GCG) and internal control not only to increase high-satisfactory earnings by considering stakeholder interests, but also to improve shareholder and financial performance, reduce risk associated with self-interest, and increase investor confidence. State-Owned Enterprise (BUMN) is a business entity that covers various sectors such as agriculture, transportation, telecommunications, trade, electricity, finance, and construction. BUMN is required to implement good corporate governance and internal control consistently and sustainably as the operational foundation to improve corporate accountability in realizing shareholder value in the long term while taking into account the interests of stakeholders, others, and based on laws and regulations and ethical values. This study aims to examine the implementation of good corporate governance and internal control on the performances of State-Owned Companies (BUMN) in the financial sector listed on the Indonesia Stock Exchange (IDX) focusing on banking state-owned enterprises such as Bank Rakyat Indonesia (BRI), Bank Negara Indonesia (BNI), Bank Tabungan Negara (BTN), and Bank Mandiri. The research is exploratory in nature and focuses on good corporate governance, internal control, and BUMN performance. The findings are good bank governance and internal control do not continuously impact the performance of Bank BRI and BTN, have a moderate impact on the performance of Bank Mandiri, and do not have a significant impact on the performance of Bank BNI.

**Keywords**— *BUMN, Company Performance, Financial Sector, Good Corporate Governance, Internal Control*

## I. INTRODUCTION

When company operations are not always controlled directly by the owner and management concerns are left to the agent, agency theory emerges. Agency theory is extended by the responsibility of corporations to stakeholders other than shareholders. Agency theory was developed by Michael Jensen and William Meckling in 1976 that when agent is hired by principal to deliver a service and decision-making authority is delegated to the agent, agency relationships are formed. Managers have a better understanding of internal information and future business possibilities than owners (shareholders). The manager is required to provide signal to the owner of the company's status by disclosing accounting information such as financial statements. The performance of a company will be affected by policies and decisions made in the context of compiling financial statements. The goal of the company's

performance evaluation is to determine how successful the company's operations are.

The state-owned enterprises (BUMN) is one of national economy players whose existence is governed by Law No. 19 of 2003 [1]. BUMN's total assets hit Rp 8,400 trillion at the end of 2020, up 7.1 percent from 2019. BUMN contributed around 55% of Indonesia's nominal GDP of Rp. 15,434 trillion to the GDP. Total profit for the same time was Rp 28 trillion, down 77 percent from Rp 124 trillion in the preceding quarter. As of February 1, 2021, there are total of 113 state-owned enterprises comprises of 14 state-owned general companies, 16 public companies, and 83 state-owned limited liability companies.

The goal of BUMN is to assist state finances and to promote the welfare of the people, therefore, BUMN is required to be handled professionally and accountably as a public organization that has some power over the lives of many people. BUMN must also be able to offer added economic value in the forms of dividends, taxes, and other economic responsibilities in order to promote national development as a business entity. In terms of becoming development agents, BUMN has played a key role by actively participating in national priority projects and pioneering business operations that have yet to be adopted by the private sector in order to promote equitable development [2, 90].

BUMN performance can be measured by the implementation of good corporate governance and internal control. Good corporate governance is the principles applied by the company to create stakeholder trust in the company. Companies that have implemented good corporate governance will have good financial performance followed by good market performance as seen in the company stock value. Previous research have examined the relationship between good corporate governance and firm performance in various sectors such as: manufacturing firms [3], regional development banks [4]. Internal control is a process in organizational and information systems to ensure that activities in the organization is running as planned. Internal control can provide information about how to assess the company's performance. Previous research demonstrated the relationship between internal control and firm performance [5][6].

The lack of prior studies on good corporate governance, internal control, and firm performance especially in BUMN

encouraged the author to perform this study. Thus, the purpose of this research is to examine the implementation of GCG and internal control on bank performance particularly banking state-owned enterprises such Bank Rakyat Indonesia (BRI), Bank Negara Indonesia (BNI), Bank Tabungan Negara (BTN), and Bank Mandiri. Good corporate governance will be assessed from the implementation of the five principles, internal control will be assessed from bank internal control system, and firm performance (financial performance) will be measured from the profitability ratio.

The study is organized as follows: Section II describes the literature review on good corporate governance, internal control, and company performance. Section III describes the research method. Sections IV describes result and discussion of the present study. Section V presents the conclusions, limitations, and suggest further research opportunities.

## II. LITERATURE REVIEW

### A. Good Corporate Governance (GCG)

The current condition of the business world is increasingly dynamic, changing situations and conditions of ups and downs are commonplace when running a business even for the future. With the increasingly dynamic business world, firms are required practicing good corporate governance (GCG). Cadbury Report explain corporate governance as “a system in which companies are directed and controlled” [7, 15]. The supervisory function may be maximized and the authority of all parties in the company can be organized with GCG to limit the incidence of fraud perpetrated by various parties in the company for its own benefit [8]. Companies that have adopted corporate governance should have followed GCG principles by delivering timely, accurate, adequate, clear, and comparable information to stakeholders in line with their rights.

GCG is a system that regulates and controls companies that create value added to stakeholders [9]. It has the objective to enhance firms' performance by supervising or monitoring management performance and ensuring that management is accountable to other stakeholders while still adhering to the appropriate laws and regulation framework. The copy regulation of the State Minister of State-Owned Enterprises Number: PER-01/MBU/2011 concerning the implementation of good corporate governance in state-owned enterprises has defined the principles of GCG, namely: transparency, accountability, responsibility, independency, and fairness.

### B. Internal Control

Managers are responsible for creating a controlled environment in their organization as part of their resource management responsibilities thus managers must grasp the necessity of implementing and maintaining strong internal controls. According to **Error! Reference source not found.**, internal control is a process influenced by management's, the board of commissioners', or other employees' activities and designed to provide reasonable assurance regarding the achievement of objectives in terms

of (1) operational effectiveness and efficiency; (2) financial information reliability; and (3) compliance with applicable laws and regulations. Internal control ensures to achieve goals and objectives of the company in line with the Institute of Internal Auditors (IIA) in the Standards and Guidelines for The Professional Practice of Internal Auditing.

The 2013 Committee of Sponsoring Organizations of the Treadway Commission (COSO) Framework focuses on five integrated components and 17 principles of internal control, namely: control environment, risk assessment, control activities, information and communication, and monitoring activities. [11] state that the internal control components comprises of: (1) control environment refers to the general factors that define the nature of the organization and affect its employees' control over it; (2) risk determination that identify, analyze, and respon of risks that interfere with the achievement of internal control objectives; (3) control activities refers to policies and procedures are developed by the company to deal with risks includes segregation of duties, proper authorization of transactions and activities, sufficient documents and records, physical control of assets and records, and independent examination of performance; (4) information and communication; and (5) supervision.

Internal control must be integrated properly into the policy of business and the standard operating procedure (SOP) documents. The SOP acts as a guide for every organization, especially those with a broad scope, is a method of defining goals and criteria for the execution of control for each firm. The SOP will assist the firm in regulating its operational operations, including its operational costs. It is envisaged that there would be no deviations since all actions will be seen as a whole and compared to determine if they are according to company's goals and standards.

### C. Company Performance

Evaluating company's performance is the goal to determine if the company's operations is successful or not. It is necessary to analyze the cumulative financial and economic impact of a choice and analyze it using comparative measures in order to evaluate a company's performance. One of the indicators of an organization's effectiveness and efficiency in achieving its objectives is its financial performance. **Error! Reference source not found.** defines financial performance as the company's ability to manage and control its resources. Financial ratios can be used to assess company financial performance **Error! Reference source not found.** One of the financial ratios is the profitability ratio that describes the company's ability to generate profit. Bank Indonesia Circular Letter Number 13/30/DPNP concerning the guidelines for calculation of financial ratio (profitability ratio) including ROA, ROE, BOPO and NIM.

#### 1. Return On Assets (ROA)

ROA ratio measures bank assets's ability to generate profits . The formula for calculating the ROA ratio is:

$$ROA = \frac{\text{Net Profit}}{\text{* Average Total Assets}} \quad (1)$$

\*(beginning of year assets + end of year assets)/2

The higher the ROA ratio, the better the bank's profitability ratio in terms of using its asset.

## 2. Return On Equity (ROE)

ROE ratio measures equity/capital's ability to generate profits. The formula for calculating the ROE ratio is:

$$ROE = \frac{\text{Net Profit}}{\text{Equity/Capital}} \quad (2)$$

\*(Owners capital or paid-up capital by shareholders)

The higher the ROE, the more effective and efficient the company in using its capital.

## 3. Operational Expenses towards Operational Revenue (BOPO)

BOPO ratio measures the ability to effectively manage operational expenditures. The formula for calculating BOPO is:

$$BOPO = \frac{\text{Operating Expenses}}{\text{Operating Income}} \quad (3)$$

The smaller the BOPO ratio, the more effective the company in managing their operational costs.

## 4. Net Interest Margin (NIM)

NIM ratio measure the ability of productive assets to generate net interest income. The formula for calculating the NIM is:

$$NIM = \frac{\text{Net interest income}}{\text{Earning Assets}} \quad (4)$$

The higher the NIM ratio, the higher interest income on earning assets managed by the bank.

### III. RESEARCH METHOD

In this exploratory study, four Indonesian state-owned banks, namely Bank Rakyat Indonesia (BRI), Bank Tabungan Negara (BTN), Bank Negara Indonesia (BNI), and Bank Mandiri were analyzed on their implementation of GCG, internal control, and banking performance. As for the CGG measurement parameter is the GCG formulation, internal control parameter is bank internal control system, and financial performance parameter is profitability ratios from the annual report of state-owned banks published in 2016-2020.

### IV. RESULT AND DISCUSSION

The annual report 2016–2020 of Indonesian state-owned banks (BTN, BNI, BRI, and Bank Mandiri) highlighted corporate governance implementation as well as internal control and financial performance concerns.

#### A. Good Corporate Governance, Internal Control and BUMN Performance

The following GCG formulation is adopted from the annual report of each bank. BRI applies GCG principles in improving company value and performance (Table 1).

Table 1: BRI GCG Formulation

Governance Principles	Description
Transparency	<ul style="list-style-type: none"> <li>- The Company or Bank features a arrangement to reveal vital data required by the partners.</li> <li>- The Company or Bank unveils data in agreement with winning laws and controls counting the Bank's vision</li> </ul>

and mission, trade values and targets and procedures, money related condition, composition and compensation of the Board of Commissioners and Board of Executives, controlling shareholder, organizational structure, hazard administration, inside control framework, and usage of GCG and compliance.

Accountability	<ul style="list-style-type: none"> <li>- The guideline of data divulgence does not diminish the commitment of Bank and Clients secret data in agreement with pertinent controls.</li> <li>- The Company or Bank sets up long-term and short-term trade targets that are responsible to shareholders and partners.</li> <li>- The Board of Commissioners and the Board of Chiefs yield the yearly report and money related responsibility within the GMS.</li> <li>- The Company or Bank submits the report in agreement with the pertinent arrangements to the supervisory specialist of the Bank and other partners as appropriate.</li> <li>- The Company or Bank should decide the obligations and duties of the Board of Commissioners, Board of Executives and corporate organs as well as their subordinates in line with the Bank's vision and mission.</li> <li>- The Company or Bank guarantees on the accessibility of competencies of the Board of Commissioners and the Board of Executives as well as all levels underneath in agreement with their obligations and gets it their part in GCG usage.</li> <li>- The Company or Bank guarantees on the accessibility of structures, frameworks and SOPs that can safeguarded the operation of check and adjust instrument in accomplishing the Bank's vision and mission.</li> <li>- The Company or Bank has an compelling inside control framework.</li> </ul>
Responsibility	<ul style="list-style-type: none"> <li>- The Company or Bank follows to the standards of judiciousness and ensures the authorization of controls, articles of affiliation and inside directions of the Bank.</li> <li>- The Company or Bank keeps up nature preservation through loaning arrangement and other approaches that back the characteristic assets conservation</li> <li>- The Company or Bank acts as a great corporate citizen through social and natural duty.</li> </ul>
Independency	<ul style="list-style-type: none"> <li>- The Company or Bank maintains a strategic distance from the dominance of any party, unaffected by certain interface, free of strife of intrigued and any impact or weight so as to act equitably.</li> <li>- The Company or Bank performs its capacities and obligations in understanding with the Articles of Affiliation, inside Bank rules and controls.</li> </ul>
Equality and Fairness	<ul style="list-style-type: none"> <li>- The Company or Bank gives reasonable and rise to behavior to the partners in understanding with the advantage and commitment made to the Bank.</li> <li>- The Company or Bank gives openings for partners to supply input and pass on suppositions for the interface of the Bank and get to data divulgence.</li> </ul>

Bank Mandiri follows GCG principles in its corporate operations (Table 3).

Table 2: Bank Mandiri GCG Formulation

Governance Principles	Description
Transparency	<ul style="list-style-type: none"> <li>- Company unveils data in a oportune, satisfactory, clear, exact and comparable way and can be gotten to by interested parties (partners).</li> <li>- Company discloses information which consolidates but isn't limited to the vision, mission, commerce targets, company strategy, company's budgetary and</li> </ul>

	<p>non-financial conditions, the composition of the Board of Chiefs and the Board of Commissioners. Controlling shareholders, chance organization, supervisory and inward control systems, execution of compliance capacities, systems and utilization of corporate organization as well as texture data and realities which is able affect investors' choice.</p> <ul style="list-style-type: none"> <li>- Company arrangements must be composed and communicated to partners who are entitled to get data approximately the arrangement.</li> <li>- The guideline of openness should still watch the arrangements of Company insider facts, position privileged insights and individual rights in understanding with pertinent directions.</li> </ul>
Accountability	<ul style="list-style-type: none"> <li>- The Company sets business goals and strategies to be accountable to stakeholders.</li> <li>- The Company establishes clear about tasks and responsibilities for each of the members of the Board of Commissioners and Board of Directors as well as all levels under them which are in line with values of the Company, the vision, mission, business objectives and strategies of the Company.</li> <li>- The Company must ensure that each member of the Board of Commissioners and the Board of Directors as well as all levels below them has the competence in accordance with their responsibilities and understands their role in the implementation of corporate governance.</li> <li>- The Company establishes a check and balance system in the management of the Company.</li> <li>- The Company has performance measures for all of the Company's ranks based on agreed measurements that are consistent with the corporate value (Core Values), the Company's business goals and strategies and has a rewards and punishment system.</li> </ul>
Responsibility	<ul style="list-style-type: none"> <li>- The Company adheres to the principles of prudence (prudential banking practices) and ensures compliance with applicable regulations.</li> <li>- The Company as a good corporate citizen cares about the environment and carries out social responsibility appropriately</li> </ul>
Independency	<ul style="list-style-type: none"> <li>- The Company dodges unnatural mastery by any partner and isn't affected by one-sided interface and is free from clashes of intrigued.</li> <li>- The Company makes choices equitably and is free from any weight from any party</li> </ul>
Fairness	<ul style="list-style-type: none"> <li>- The Company pays consideration to the interface of all partners based on the standards of correspondence and decency (rise to treatment).</li> <li>- The Company gives openings for all partners to supply input and express suppositions for the interface of the Company and open get to to data in agreement with the guideline of openness.</li> </ul>

BNI believes that if the Bank follows Good Corporate Governance (GCG) principles consistently, properly, and accurately, good performance may be sustained over time and different business opportunities can be achieved. As a result, GCG implementation is more than simply about meeting responsibilities; it is also about maintaining the Bank's management's openness and responsibility to the public. BNI is dedicated to upholding high standards when it comes to the application of GCG principles (Table 5).

Table 3: BNI GCG Formulation

Governance Principles	Description
Transparency	<ul style="list-style-type: none"> <li>- The Bank uncovers data in a convenient, satisfactory, clear, precise and comparable way and can be gotten to by partners concurring to their rights.</li> <li>- The Bank unveils data which incorporates but isn't constrained to the vision, mission, trade destinations, Bank technique, money related condition,</li> </ul>

	<p>composition and stipend for the administration, Controlling Shareholders, official officers, hazard administration, inner supervision and control frameworks, compliance status, frameworks and usage of great corporate administration as well as fabric data and actualities that can impact investors' choices.</p> <ul style="list-style-type: none"> <li>- The rule of openness should watch arrangements on bank mystery, position insider facts and individual rights in agreement with appropriate directions.</li> <li>- Bank approaches must be composed and communicated to partners and those entitled to get data approximately the arrangement.</li> </ul>
Accountability	<ul style="list-style-type: none"> <li>- The Bank sets commerce objectives and methodologies responsible to partners.</li> <li>- The Bank builds up a check and adjust framework within the administration of the Bank.</li> <li>- The Bank has execution measures of all organizational organs based on concurred estimations and in line with the Company's values (Corporate Culture Values), the Bank's commerce objectives and techniques and features a rewards and discipline framework.</li> <li>- The Bank must ensure that all of the Bank's organizational organs are competent in accordance with their responsibilities and understand their role in implementing good corporate governance</li> </ul>
Responsibility	<ul style="list-style-type: none"> <li>- The Bank follows to the prudential bank hones and guarantees compliance with pertinent controls.</li> <li>- The Bank as a great corporate citizen cares approximately the environment and carries out social duty reasonably.</li> </ul>
Independency	<ul style="list-style-type: none"> <li>- The Bank dodges inappropriate mastery by any partner and should not be influenced by one-sided interface and should be free from strife of intrigued.</li> <li>- The Bank makes decisions objectively and shall be free from any pressure from any party</li> </ul>
Fairness	<ul style="list-style-type: none"> <li>- The Bank takes into account the interests of all stakeholders the principles of equality and fairness (equal treatment).</li> <li>- The Bank provides opportunities for all stakeholders to provide input and convey opinions for the Bank's interests as well as open access to information in accordance with the principle of openness.</li> </ul>

BTN adheres to Good Corporate Governance (GCG) principles to fulfill its responsibilities and as a requirement for maintaining openness and accountability in the management of the firm to all shareholders and other stakeholders (Table 7). BTN understands that a company's business continuity is determined not only by its financial performance and increasing profits, but also by its internal management.

Table 4: BTN GCG Formulation

Governance Principles	Description
Transparency	<ul style="list-style-type: none"> <li>- The Company unveils data that incorporates but isn't restricted to the vision, mission, commerce objectives, technique, budgetary and nonfinancial conditions, composition of the Board of Executives and the Board of Commissioners, controlling shareholders, hazard administration, supervision and inside control framework, usage of compliance work, framework and usage of corporate administration, as well as fabric actualities and data that can impact shareholders' choices.</li> <li>- The Company's approaches are organized in writing and communicated to the entitled partners</li> <li>- The straightforwardness guideline takes under consideration the arrangements of the Company's Code of Conduct, secrecy of position and individual rights in understanding with pertinent controls.</li> </ul>

Accountability	<ul style="list-style-type: none"> <li>- Use of the website for transparency to public by referring to the Asean Corporate Governance Scorecard.</li> <li>- The targets set by the Company are portion of the responsibility to partners.</li> <li>- The Company employments chance administration and inner review strategies and open reviewers in administration and supervision.</li> <li>- The Company sets execution measures for all positions with measures that are reliably concurred upon along side the Company’s Corporate Culture Values called “AKHLAK”.</li> <li>- The Company emphasizes the significance of anti-corruption culture, which is socialized to all partners. One of them is an exertion to coordinate with the Debasement Destruction Commission (KPK).</li> </ul>
Responsibility	<ul style="list-style-type: none"> <li>- The Company sets a clear definition of commitments and commitments of each organ in line with the Company’s vision, mission, values, exchange objectives and strategy.</li> <li>- The Company follows to the rule of prudential keeping money hones and guarantees compliance with pertinent directions.</li> <li>- The Company as a good corporate citizen develops environmental awareness and carries out social responsibilities appropriately</li> </ul>
Independency	The Company includes a number of compliance devices that are connected with the point of giving sensible limits to any out of line mastery by any partner and struggle of intrigued
Fairness	The Company gives openings for all partners to supply inputs and express conclusions for the interface of the Company and make accessible get to to data in agreement with the guideline of straightforwardness.

GCG has been shown to have a beneficial influence on BUMN's performance when implemented consistently. Such recognitions come from the Asean Corporate Governance Scorecard (ACGS), The Indonesia Institute for Corporate Governance, the ASEAN Corporate Governance Scorecard (ACGS) standard, Corporate Governance Perception Index (CGPI), the GRC (Governance, Risk & Compliance) & Performance Excellence Award. The success of implementing GCG in bank operational operations is supported by the recognition and achievements awarded to BRI, Mandiri, BNI, and BTN. BUMN demonstrated that the GCG mechanism should be implemented or properly functioning in the company in order to increase investor confidence and bank performance.

Table 5: Internal Control

BUMN	Description
BRI	BRI follows an international standard set by The Treadway Commission's Committee of Sponsoring Organizations (COSO).
Bank Mandiri	Bank Mandiri’s internal control consists of eight components that are interconnected and referred to the COSO Model. It consists of: 1. Internal Environment 2. Objective Setting 3. Event Identification 4. Risk Assessment 5. Risk Response 6. Control Activities 7. Information & Communication 8. Monitoring
BNI	BNI refers to COSO framework for internal control system guidelines covering 5 (five) key interrelated elements in the Bank’s internal control system including: 1. Management supervision and control culture Risk 2. Risk identification and assessment 3. Control activities and separation of functions 4. Accounting, information and communication systems 5. Monitoring activities and deviations/weaknesses correction actions

BTN	BTN’s internal control framework referred to COSO framework.
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According to the 2020 assessment, BRI and BNI has adequate internal control systems although improvements are needed, Bank Mandiri has a fairly good internal control system, and BTN performed good quality of internal control system.

Table 6: Profitability Ratio

Description	2016	2017	2018	2019	2020
BRI					
ROA	3.84%	3.69%	3.68%	3.50%	1.98%
ROE	23.08%	20.03%	20.49%	19.41%	11.05%
BOPO	68.93%	69.14%	68.48%	70.10%	81.22%
NIM	8.00%	7.93%	7.45%	6.98%	6.00%
Mandiri					
ROA	1.95%	2.72%	3.17%	3.03%	1.64%
ROE	11.12%	14.53%	16.23%	15.08%	9.36%
BOPO	80.94%	71.17%	66.48%	67.44%	80.03%
NIM	6.29%	5.63%	5.52%	5.46%	4.48%
BNI					
ROA	2.7%	2.7%	2.8%	2.4%	0.5%
ROE	15.5%	15.6%	16.1%	14.0%	2.9%
BOPO	73.6%	71.0%	70.2%	73.2%	93.3%
NIM	6.2%	5.5%	5.3%	4.9%	4.5%
BTN					
ROA	1.76%	1.71%	1.34%	0.13%	0.69%
ROE	18.35%	18.11%	14.89%	1.0%	10.02%
BOPO	82.48%	82.06%	85.58%	98.12%	91.61%
NIM	4.98%	4.76%	4.32%	3.32%	3.06%

ROA, ROE, and NIM ratios were decreased from 2016 to 2020. BOPO ratio was increased, despite a slight decreased in 2018. It demonstrates that BRI's ability to manage assets, equity, and productive assets to generate profits or interest income has decreased, as well as its ability to manage operating costs has not been optimal or reducing operational expenses.

ROA and ROE ratios was increased from 2016 to 2018 and was decreased in 2019 and 2020. BOPO ratio was decreased from 2016 to 2019 and was increased from 2019-2020. NIM ratio was decreased from year to year (2016-2020). It demonstrates that Bank Mandiri's ability to manage assets and equity in order to generate profits is still inadequate, managing productive assets to generate interest income is not properly done, and that interest income continues to decline from year to year. It also demonstrates that Bank Mandiri's ability to manage operational costs is inadequate when compared to its ability to increase operating income.

ROA and ROE ratios remained stable from 2016 to 2017, a slight increase in 2018 and was declined in 2019 and 2020. BOPO ratio was decreased from 2016 to 2018 and was increased in 2019 -2020. NIM ratio was decreased year after year from 2016 to 2020. It demonstrates the lack of BNI's ability in producing interest income and bank's ability to reduce operating expenses and maximize revenue not yet optimal.

ROA, ROE, and NIM ratios were decreased from 2016 to 2020. BOPO ratio was increased from 2016 to 2020 with a slight decreased in 2017. It demonstrates that BTN's ability to manage assets, equity, and productive assets to generate profits or interest income is decreasing, and that BTN's operating expenses are not being managed optimally.

State-owned enterprises (BUMN) play an important role in assisting government initiatives in achieving independence, prosperity, sustainability, equity, and equality. BUMN recognizes GCG implementation is important to lay the foundation for achieving vision and purpose, ensuring company sustainability and providing value-added to stakeholders. Good corporate governance helps to retain investor confidence which may assist to help finance growth, as well as assure firm success and economic growth. As a result, good corporate governance rules must be implemented.

The adoption of corporate governance principles that are supported by good legislation is intended to avoid different types of financial statement fraud and improve the company's performance. Furthermore, because various components apply GCG principles, the extent to which those BUMN carrying out GCG would reflect on the financial performance. It will lead to improved financial performance and long-term advantages, such as increased net profit and a better and healthier firm. The adoption of GCG principles has been found to have an impact on rural banks' financial performance [14].

Internal control is a monitoring mechanism established on an ongoing basis and implemented at every level of the organization. An effective internal control is important bank management and as the basis for healthy and safe bank operations. BRI, Mandiri, BNI, and BTN referred to the Committee of the Sponsoring Organizations of the Treadway Commission (COSO) in establishing internal control framework. The evaluations of internal control according to COSO model are:

1. Control Environment. Based on the observations, the control environment in BUMN can be said to have been running effectively. This is evidenced by the company's Standard Operating Procedure (SOP) related to the company's internal control. SOP is a force in the company's internal control system as a guideline regarding business processes. The division of tasks and authorities in this division has also been good in accordance with the organizational structure as outlined in writing. So that there are responsibilities and authorities of each in carrying out their duties in each division. The division of tasks is good to ensure that each section knows and carries out its duties properly, so that good cooperation can be established between sections. The company also tries to provide

training to employees in advance to know more about their duties.

2. Risk Assessment. A related risk assessment is the costs incurred by the company are not comparable to that produced.
3. Control Activities. Policies and procedures for control activities are:
  - Performance Review. Companies that require employees to meet the criteria set by the company. The company also always strives to motivate and encourage employees to adapt to changes. For example, there is adequate training before carrying out their duties demand employees to follow the company's standards. Employees are also constantly motivated and encouraged to adapt to changes by the firm. For example, prior to performing their tasks, they receive appropriate training.
  - Segregation of Duties. In carrying out their duties, each employee in this area division has a proper division of authority and responsibility for each employee in the company, so that each division clearly knows what their duties are and to whom they must be responsible. This is good for improving work efficiency and effectiveness in carrying out the company's operational activities
  - Application Control. Every document that will be inputted always includes a Document Inspection Checklist, where the Checklist includes a serial number making it easier for employees to input data.
  - General Control. Having physical control over property and records also serves to reduce the possibility of error and embezzlement.
4. Information and Communication. This component is an important part of the management process, as well as information and communication in BUMN that are interrelated. For example, when inputting source documents into the system is less accurate and an error occurs, the output issued in the form of a report is less accurate. And this will hinder the process to the next division. However, based on the available information, inaccurate data should rarely occur because before the document is input, a review of the source document is carried out and the system used has been applied properly, so that the report (output) issued is a truly valid report.
5. Monitoring. Monitoring is the process of assessing the internal control structure over time. Monitoring of the internal control structure is carried out directly by the supervisor in each division, who has the authority to give approval to activities and documents that will be sent every day. However, structurally there is also an independent party, namely an internal auditor whose task is to conduct centralized monitoring at the head office.

## V. CONCLUSIONS

Companies employ Good Corporate Governance (GCG) and internal control to enhance net profits by taking into

consideration stakeholders's interest. Previous research found that GCG and internal control impact on firm performance, despite the fact that the profitability ratio or financial performance in this study shows that it is not always the case. GCG can encourage organizational management to be more democratic as a result of the involvement of many interests, more accountable as a result of a system that holds everyone accountable for their actions, more transparent, more responsible as a result of the responsibility to follow laws and regulations, and more equitably as the consequence of responsibility to fulfill the rights of stakeholders. Good internal controls ensure the company to accomplish goals and objectives, to comply with applicable laws and regulations, to prepare financial statements both timely and accurately,

This study contributes to the enrichment of studies on good corporate governance, internal control, and firm performance. In regard to limitation of study, it is limited on the sample study of BUMN financial sector. Future research can address the relationship of good corporate governance, internal control, and firm performance on a broader sample.

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# The Urban Waste Treatment Using RDF Method for an Industry Alternative Fuel in Indonesia

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**Abstract**— This study examined the potential for Refuse Derived Fuel (RDF) production from a mixture of municipal solid waste (MSW) using bio-drying technology, to be used as an alternative fuel industry in Indonesia. The most suitable waste to produce RDF are waste that has high carbon content after being separated from recyclable waste. This bio-drying method is usually carried out by an aerobic process. The advantage of the bio-drying process is that it reduces waste mass, emissions of CH<sub>4</sub>, CO<sub>2</sub>, SO<sub>2</sub>, NOX, and dust emissions from landfill waste into the atmosphere. An economic model for the use of RDF in the Indonesian industry, especially the cement plant, was created. This model produces RDF material as an alternative fuel to replace coal which is currently used. The cost analysis carried out indicated economic savings and is environmentally friendly and can be used for other industrial fuels. In this study, urban waste processed into RDF were 120 tons/day. Research indicated that adding 58% RDF as a substitute fuel, was equivalent to 70 tons/day of fuel used in a cement kiln, that would save 70 USD/day in petcoke costs, with 65.8 tons/h of CO<sub>2</sub> being emitted into the atmosphere. The bio-drying process allowed a decrease in the water content of the waste up to 59% thus resulted in an increase of the calorific value of the waste (LHV) by 600% (14.55 MJ/kg).

**Keywords**— Municipal Solid Waste, Bio-Drying, Refuse Derived Fuel, Alternative Fuel

## I. INTRODUCTION

Along with population growth and increasing urban economic activities, impacts urban environment, especially urban waste. This must be accompanied by an increase in waste management facilities and infrastructure so that it can relieve landfills (Fig. 1).



Fig.1. Municipal Waste in landfill

According to the National Waste Management Information System (SIPSN, August 2021), Indonesia has piled household and household-like waste of 33.42 million

tons per year, of which managed waste is 62.39%, unmanaged waste is 37.61%, and the largest type of waste is food waste by 39.8% [1],[2]. Collective sewage systems are essential for controlling environmental damage from the release of untreated waste residues. In Indonesia, municipal solid waste, comes from various sources such as household activities, commercial areas, and public facilities) are high water content and about 75 percent are biodegradable and non-flammable [3]. It is estimated that only about 60% of the waste in big cities of Indonesia are able to be transported to an Integrated Waste Management (Tempat Pengolahan Sampah Terpadu-TPST), which is mainly a landfill operation [4].

Illegal open dumping is the most common form of disposal in the country (90%), causing leachate that contaminates groundwater and contributes to the proliferation of pests and disease-carrying pathogens. Some of the uncollected waste if burned adds to urban air pollution, while others will clog rivers and canals, exacerbate flooding and cause the spread of contaminated water to low-lying residential areas [5].

Therefore, current waste management strategy is to encourage material recycling, energy recovery, and waste stabilization before landfilling. Solid waste landfilling, composting, recycling, and incineration are commonly used as methods of solid waste disposal or treatment. Currently landfilling in many places are challenges in many areas, especially as landfill space are increasingly scarce.

The high water content of municipal solid waste can reduce the efficiency of energy recovery and beneficial utilization. To overcome this problem, there is an innovation in waste processing technology, one of which is the Bio-drying Process. Bio-drying technology, which aims to remove water through microbial activity. Bio-drying is considered a good solution to reduce the moisture content of wet organic wastewater. Bio-drying or biological drying is a bioconversion reaction in a Mechanical-Biological Treatment (MBT) which can be used as an alternative solution for mixed waste where the process will interact with microorganism activity [6].

The product produced from this bio-drying process is Refuse Derived Fuel (RDF) where there is potential for thermal recovery due to the removal of large water content. By converting energy from waste, there are two objectives

that can be obtained, namely as a supplement or substitute as a fuel in appropriate plants (grate or fluid bed plants, cement factories, etc.) and reducing landfill waste [7],[8]. This alternative mainly involves reducing the wastewater content, which will increase the calorific value of the resulting product and reduce leachate production in the case of landfilling of waste substances if no further stabilization treatment of organic matter is used [9].

## II. LITERATURE REVIEW

Refuse Derived Fuel (RDF) is an alternative fuel derived from a mechanical process with mixed raw materials for urban waste where non-combustible waste is set aside to produce a homogeneous mixture. In general, the RDF system has two functions, namely production and combustion. In the production process, recyclable waste such as glass and iron is set aside so that it does not enter the RDF production stage. Meanwhile, other types of waste such as organic waste, paper, and plastic can be used as raw materials and chopped to be reduced which is then processed to produce RDF products such as fluff or pellets. The most appropriate waste for RDF production is waste that has a high carbon content after being separated from recyclable waste. The RDF system is divided into two, namely: shred and burn system (in this system, there is no provision to set aside non-combustible waste), and simplified process system (this type of system is carried out by separating non-combustible, recyclable, and ferrous waste from mixed waste). Furthermore, the waste is put in the shredder to homogenize the size of the waste, which is 100-150 mm to optimize energy recovery during the combustion process [10]. RDF produces neutral CO<sub>2</sub>, and as an alternative energy [11]. Research result showed that RDF produced from municipal solid waste processing has a calorie value of 14,65-20.93 MJ/kg [12]. Other research result : In Indonesia, RDF calorie value has 12.5 MJ/kg, moisture <20%, and size <50 mm [13], The heat generated by the RDF material is the highest around 3578 kcal/kg, with a moisture content value of 20-30% and an optimum time of 17-22 days [14]. RDF parameters that currently do not meet international standards are ash content, fixed carbon, and also organic carbon. The quality of RDF is strongly influenced by the composition of the feed. Although it cannot meet all the parameters as the international standard of RDF, the product can be used as additional fuel to replace coal or other fossil fuels for industrial activities [14]. The sustainability of RDF processing was analyzed using Integrated Sustainability Waste Management (ISWM). Below (table 1) is the ISWM framework regarding to Nikhitul [15].

Table 1: RDF criteria

Parameter	Finlandia	Italia	Great Britain	Indonesia	Thailand
Calorific value (MJ/kg)	13-16	15	18.7	12.5	N/A
Moisture (% wet)	25-35	max 25	7-28	< 20	< 30
Ash content (% wet)	5-10	20	12	N/A	N/A
size (mm)	N/A	N/A	N/A	≤ 50	< 30

On bio-drying, this waste drying technique relies on the biological activity of microorganisms (bacteria and fungi) to reduce the water content by increasing the calorific value (increasing in the range of 30-40%) waste with high moisture content can be transformed into solid fuels that can be used in the future to come [16]. In contrast to composting, bio-drying takes about 2-3 weeks [17]. In addition, bio-drying helps to reduce the water content of urban waste and the organic degradation that occurs to a minimum so as to maintain the heating value. Whereas in composting, organic degradation is carried out as much as possible for full bio-stabilization which aims to produce humus to improve soil quality [18]. The advantage of the bio-drying process is that it reduces waste mass and emissions of CH<sub>4</sub>, CO<sub>2</sub>, SO<sub>2</sub>, NOX, and dust emissions from landfill waste into the atmosphere [19]. On bio-drying process, measurements were made using a pilot scale bio-dryer that allows the recording of data as air flow, temperature (at the entrance, at the exit and inside the waste), and weight loss [8]. Other researcher said that the bio-drying process resulted in the weight of the mixed municipal solid waste substrate was reduced up to 33.94% in 20 days of reaction and the average moisture reduction was 20.81% (reduced from the initial value of 61.25% to the final value of 48.5%). [20] The purpose of this study were to discover the sustainability of RDF as a potential alternative to industrial fuel by paying attention to the aspects that influence it, consisting of the economic aspect by comparing the price of RDF with coal, technological aspects by comparing the calorific value using bio-drying with minimal criteria, environmental aspects by projecting avoidable Greenhouse Gas (GHG) emissions and social aspects (the perceptions of scavengers and looking for the right engagement approach). Previous finding indicated that the unit price of ready-to-use RDF is IDR 293 thousand per ton [13]. This price is similar to the unit price of rice husks, but RDF has a higher calorie value than rice husks. The sustainability process can only be achieved if all aspects are met.

## III. RESEARCH METHOD

This research project was conducted in Cilacap City, Central Java Province (Indonesia) from around October 2012 to July 2017 (part of feasibility study). The construction period for the RDF plant starts from August 2017 to October 2018. The data was part of a feasibility study collected from research results in other countries listed in journals, several universities in Indonesia, relevant agencies in Cilacap City, the condition of the research area (including the characteristics of scavengers) and several waste manufacturing companies. This research was focused on fuel for the cement industry, in consideration that the research location was conducted near to one of the largest cement factories in Indonesia.

This study examined three main aspects of bio-drying method, the calorific value of RDF, averted of CO<sub>2</sub> emissions by using RDF, and the inclusion of scavengers. The averted GHG emissions were calculated based on the projected emissions that could be released if municipal solid waste were stockpiled (based on the volume of coal replaced

as fuel, start on 2022) [21]. The perceptions and inclusiveness of scavengers were analyzed descriptively.

After delivery of fresh waste (approximately 120 tons of mixed municipal solid waste), a screening unit is used to categorize it by size in fractions <150 mm, and <15 mm. Waste fraction <150 mm during experiment 1 and fraction <15 mm during experiment 2 were subjected to landfill. Bio-drying cycle is valid for 21 days per cycle. This enables effective waste filtration to separate recyclable materials from high calorific value materials in the form of components of fine organic fractions.

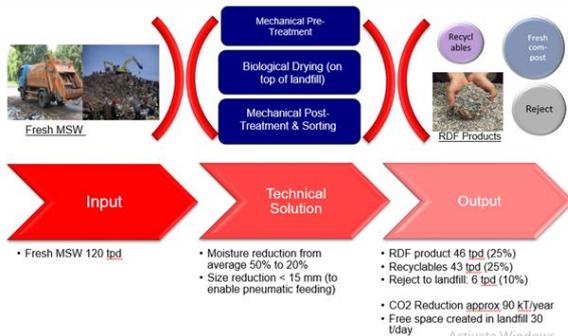


Fig.2. RDF process methodology



Fig.3. Bio-drying method (*convaero* system)

1 Bay bio-drying is capable of processing about 35 tons of fresh waste drying. This means that 1 bay of bio-drying machine takes about 3 days to process 120 tons of fresh incoming waste.

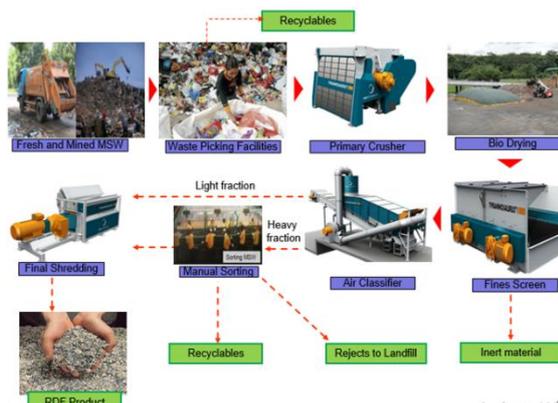


Fig.4. Detailed Technical Proposal

The reason for this research using the bio drying method was to reduce the amount of leachate produced in the waste treatment process (zero leached)[22]. The RDF processing method uses the simplified process system method (see Fig.1), while the bio-drying process uses a *convaero* system (see Fig.3), and all equipment process can be seen in the detailed technical diagram (see Fig.3)

#### IV. RESULT AND DISCUSSION

This study was aimed to determine the effect of using a bio drying system in producing RDF in order to increase the calorific value of waste. The results of the material properties in this research are shown in table 2 (comparison before and after using bio-drying). While the efficiency parameters after the feeding process in the kiln can be seen in table 3. This research also reduced the volume of landfill waste to 120 ton/day.

Table 2: RDF Result

Parameter	Incoming waste	Output
Calorific value, average (MJ/kg)	2.97	14.55
Moisture, average (% wet)	59	22.45
Ash, average	10	17.47

From Table 2 it can be seen that the effect of drying the bio-drying system waste is very beneficial where the calorific value is almost 600% of calorific value of the incoming waste for processing. Table 3 also shows that the processing of RDF as an alternative fuel to replace coal is very significant which has the advantages of reducing urban waste accumulation. This shows that the circular economic and sustainability process occurs in this urban waste management.

Table 3: Feeding to kiln Criteria

Parameter	Before feeding	After feeding
Volume max (ton/days)	120	70 (58%)
CO2 saving (ton)	N/A	65.8
Reduction Greenhouse Gas emissions (GHG) tax (USD/day)	N/A	0.35
Clinker production average (ton/day)	213.18	216.38
Coal saving (USD/day)	N/A	70

Table 4: RDF, Rice Husk and Coal Criteria (Comparison)

Parameter	RDF	Rice Husk	Coal
Calorific value, average (MJ/kg)	14.55	10.05	18.21
Moisture, average (% wet)	22.45	27	23
Ash, average	17.47	18	7

Table 4 shows that the RDF criteria as an alternative fuel (based on calorific value, moisture content and ash) are still superior to rice husks, and almost resemble coal criteria. For the social aspect, the scavengers can still work in this urban waste processing area with a total of 100 people.

Figure 5 shows that until now the processing of urban waste into RDF to be used as an alternative to industrial fuel is still ongoing and there are no significant obstacles.

This study examines three main aspects that have proven to be very useful and good, namely having the calorific value of RDF which is almost the same as the calorific value

of coal (shown in table 4), reducing CO<sub>2</sub> emissions (shown in table 3), lower production prices than coal (shown in table 3), and as well as creating jobs such as the entry of scavengers and operators.



Fig.5. RDF Plant and Process situation

The Bio-drying method to process urban waste into RDF which can be used as an alternative to industrial fuel is the first in Indonesia and many other countries are currently starting to use this method as well.

## V. CONCLUSIONS

This study concluded that urban waste processed into RDF for alternative industrial fuels in Indonesia is highly recommended because it has many advantages. The results of this study are in accordance with the results of previous studies, namely: from the financial aspect, the price is in the range of rice husk prices; technical aspects, the calorific value of RDF is more than 14 MJ/kg so that it can be used as a substitute for coal fuel; and eco green aspect is environmentally friendly, which can avert CO<sub>2</sub> emissions of more than 65 tons per day. The social aspect must be considered, where the social inclusion of scavengers can be a solution for that. Technological aspects are also used in research so that the waste processing process is fast and controlled.

This research requires a large investment, so that further research should be carried out at a lower cost but provide maximum results. And it is also hoped that in the future the RDF system can be used for other industrial fuels such as power plant, textile industry and so on where before being used as fuel, this RDF can be processed again into pellets method or other things first so that the water content is more optimal but also takes into account the production costs.

Solid waste treatment technology using the Bio-drying process (Biological drying) is an appropriate alternative for mechanical-biological bioconversion to treat waste. Waste temperature fluctuated in all reactors. In general, the highest temperature on the second and third day. On the sixth day, all reactors showed a graph of a relatively uniform increase and decrease in waste temperature.

An inability to fully grasp the problem of waste generation has resulted in MSW being one of the most challenging problems of urban environmental degradation. There is also an absolute necessity to integrate the informal sector (which consists of rag pickers and illegal or unauthorized recyclers) into the mainstream waste

management process as they handle a substantial amount of waste without the mandatory environmental safeguards.

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# Increasing the Income of Local Organic-Farmer through a Social Friendship and Sustainable Farming: A Field Case Study in the Light of Laudato Si and Fratelli Tutti

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**Abstract**— Local organic-farmers have a limited slot of garden, limited capital and access to market. Due to the fact of ecological crisis occurrence, they choose organic-farming and try to maintain the fertility of soil and the healthy condition of their farming production. They cannot increase their income due to the commercial system dominated by middle-class, who determine the price. There are a lot of imported and non-organic farming products dominating local markets. This brings difficulties for local organic-farmers to sell their products. This study will be supported with a field case-study and a depth-interview with local organic farmer in Eco Camp, Bandung, to hear their struggle. We choose this local community in Bandung because we have a regular communication and interaction with them. This study will be supported with literature research of Laudato Si (for the idea of prospective agriculture) and Fratelli Tutti (for the idea of communal-based life), to find the theological support to local organic-farmers, hoping that this will help them understanding the way the church supports the poor, in “preferential option for the poor.” Researchers will find a model to increase the income of local organic-farmers through social-friendship with consumers aware of the ecologically friendly way of life and want to pay an appropriate price. This is known as Community Supported Agriculture, a promising experiment in terms of sustainable economy, ecology, and the integrity of creation.

**Keywords**— *Community Supported Agriculture, Organic Farmer, Social Friendship*

## I. INTRODUCTION

There is a significant connection between our life style and our environment. Human life style has a very big impact to the nature and its ecosystem. Our choice of food, clothes, transportation, houses, and works will affect our environment. For example, the more we eat imported food, the greener house gases used for transportation added to global warming.

Our life style has also some correlation to the problem of poverty. For instance, the more we buy and consume imported foods, then we contribute to the suffering of local farmers who cannot compete with imported foods. Indonesia still import rice, flour, corn, soy bean, meat, and even sugar, salt, fruits, and vegetables.

At the same time, our life style will also impact our natural environment. The more we consume conventional or highly pesticides agricultural products, the more we destroy our soil, water, and air. Our ecosystem is deteriorating very fast. We are facing a very serious

ecological crisis and climate crisis. Gliesman in his book (2007) said that there are some negative impacts as a side-effect of the conventional farming; for example, the decreasing of the soil fertility, the decreasing of the land/soil humidity, the effect of destroying the surrounding ecosystem, causing the erosion (flood), and the more serious and negative impact of the use of pesticides on the health of human being and the nature.

This is a field case study supported by indepth-interview with a local organic farmer and a qualitative research with some documents. We will visit Eco Camp organic farming in Bandung and interview a local organic farmer who is responsible for that organic farming.

We will also study carefully Laudato Si (2015; will be abbreviated as LS) and Fratelli Tutti (2020; will be abbreviated as FT) and other sources in theology and spirituality from Catholic tradition in order to find some insights and possible solutions. We need to view this topic through the lens of LS and FT because those two papal documents talk very much about the issue we are dealing with in this research. For example, LS give a strong endorsement to go back to agriculture and develop a good agriculture technology (LS 164, 180). And also FT gives us a strong endorsement as well to community-and-global-solidarity-based life for human being and for all the creations.

This paper is also a fruit of our active and intensive involvement in ecological awareness movement with Eco Camp since 2014 and with people from various background. With this study, we try to find a viable solution overcoming our ecological crisis towards Indonesia 2045 which is better, just, and environmentally sustainable society. At the same time, we hope we can also offer a possible solution to increase the income of local organic farmers and also to protect our environment.

This study combines two complementary methods. First, we use field case study with Hendro, a local organic farmer who is carefully selected because of his experiences and his struggles. We choose him because he represents his community of farmers under his mentorship and surveillance. He's been actively involved in the development of agriculture in the rural area outside of Bandung city, because we do know that most of the local-traditional farmers are of rural area. And besides, he is very persistent in organic farming and will continue in this choice. He is alone, but at the same time he has some network with other local organic farmers.

With indepth-interview, we want to understand his dream, values, efforts, struggles, etc. We want to know his strategies, approaches, obstacles, difficulties, and also hope and solution. Hendro represents his fellow organic farmers who have similar experiences, struggles, hope, and solution. Our interview was followed by some WhatsApp communication. We to have made an indepth-interview with a Priest, who since 2014, has dedicated his life to the development of organic farming in Megamendung, Bogor. His name is Fr. Yulius Enggo CP. His main concern is the empowerment and the conscientization of the consumers as a main supporting system for the progress and the betterment of organic farming in Indonesia.

Secondly, we use qualitative literature study for two important documents from Pope Francis: *Laudato Si* (LS) published in 2015 on caring our only home which is planet earth and *Fratelli Tutti* (FT) published in 2020 on fraternity and social friendship. The inspiration taken from LS document has moved many people all around the world. Many people and community try to establish a community of consumers using the organic product. Many communities try to apply the inspiration taken from LS for their own community based on a daily practice. Not only lay people, but also priest and religious people establish their own community to realize the principles taken from LS. From those informations and references we can easily see how CSA is supported by the church community. Those references also strongly point to the fact the there is a close relationship between LS and the ideal of CSA.

Besides these two documents, we also use other documents in theology and spirituality related to these two documents. With this qualitative literature study we are looking for theological and spiritual foundation to support local organic farmers in increasing their income.

We also hope we can help local organic farmers to acknowledge the support from Catholic church for grass roots movements especially local organic farmers through social friendship and sustainable farming.

## II. OUR FINDINGS

Here we describe our findings from field case study. These findings are from our interviews with Hendro Prasetya Wibowo and Fr. Yulius Enggo, C. P.. Hendro is 26 years old. He graduated in Industrial Engineering from Institut Teknologi Surabaya. He took his master degree in entrepreneurship from University of Nottingham in England. For more than seven years he chooses a life as a local practitioner organic farmer. So Hendro is a farmer not because of his educational background. Hendro's mentor is Budi Erwin, a mechanical engineer from Airlangga University in Surabaya. They are both farmers not because of their educational background but because of their passion and experiential learning. Fr. Yulius is a Catholic Priest dedicated his life for promoting and developing the organic farming in Bogor. Different from Hendro, Fr. Yulius has a formal academic background in philosophy and theology, but then at his own initiative he studies agricultural sciences especially related to the movement of organic farming system. Most of his “knowledge and ability” in this field is gained through in daily basis of practice and involvement with the local farmers in Megamendung.

Hendro and Budi say that they learn from mother earth which is the nature. Fr. Yulius says that it is very important for him and his men to make a continual daily dialogue with the mother earth. This is his way of learning from the living mother earth. It is also the vision of Eco Camp: to care and to learn from mother earth for some more qualified human beings. Their academic background (engineering, philosophy and theology) does not hinder them to learn a new way of learning which is working together with living beings in nature. In nature we must learn how to respect nature and all living being in its ecosystem. Nature has its own way that human being cannot fully control. Human being and nature should work together in harmony and respect.

For Hendro and also for Fr. Yulius, the only responsible and sustainable way of farming is organic farming. As practitioners of organic farming they do strongly believe that the soil gives and supports life for every creature (including human being). That is why they (especially Fr. Yulius) always say that they should learn from the soil (mother earth) on they way to give and support life. This is the basic knowledge they learn from the mother earth. One of the principle is to give enough if we want to receive enough. In organic farming farmers provide enough compost to feed living beings.

Hendro and Yulius are now working with other farmers to help each other in terms of a more sustainable farming system and direct selling system to consumers. They want to empower the surrounding local farmers. Fr. Yulius especially wants to establish and develop the idealism of the presence-pastoral (pastoral-kehadiran) approach via the activity of organic farming. Fr. Yulius involves in the life struggle of the local organic farmers to develop the ideals of organic farming system in the middle of the presence of the giant conventional farming system which they consider to have a very bad impact for the surrounding ecological system. They present the alternative to this conventional farming system for the sake of the good and the environment.

In terms of farming, Hendro has been learning farming from Budi Erwin who discovers a colony of microbes to support their sustainable farming system. The colony of microbes is called “Bio Compound” as their own brand name of microbes. In the market, there is EM4 which is also a colony of microbes which is widely used for composting. There are also many kinds and brand names of colony of microbes used in farming available in many agriculture shops. Fr. Yulius also with his own experiment tries to learn the technology of enzyme by learning from Prof. Hiromi Sinya (an expert and specialist of enzyme from Japan). And besides Yulius develops his own composting system while learning also from the knowledge of Hendro in Eco Camp, Bandung. Yulius and Hendro always used to say that they establish the living communication with the mother earth with the help of their bio-compound and composting system.

Hendro said that Bio Compound is working very effectively because they can compost all kinds of organic waste including chemical waste and all kinds of oil. The time needed for composting is not so long. In a few days, without waiting for the composting process to finish,

farmers can directly use organic waste with Bio Compound for their growing media in farming.

Hendro is also trying to sell their products directly to consumers to get better prices for farmers but less expensive price for consumers. In a global world, the system is known as Community Supported Agriculture.

So this two interviews with a very selected resources person, provide enough insights to understand the situation of farming, its problems and challenges, and also to see some possible solutions. There are only two persons that we have interviewed but they represent their own respective local-farmer community. They are the spokesperson for their community. They voice out the voice of their respective community of farmers.

We divide our findings into three important stages. First, a description of the situation. Secondly, a reflection of the situation. Thirdly, action plan after understanding the situation. We want to propose an alternative model to support local organic farmers and including increasing their income through social friendship and sustainable farming.

#### *Insights from Interview*

Nowadays, very few young people are interested and pay attention to farming. Some think that farming is a dirty thing. Soil is considered as something dirty. Farmers are exposed to heat, rain, humidity, wind, and unpredictable climate. Farming is not easy because it is about living organism which cannot be fully controlled as it is in industry. Farmers must wait weeks and months collaborating with living organism and climate for harvesting. Many times the harvest is not as good as it is expected. Sometimes the harvest is failed because of pest and climate condition. Farming needs patience which many people are difficult to have.

Moreover, for our young people, our education system and our life style prefer working in an office setting than as farmer. Working in offices as government employees (pegawai negeri) and business for many are white collar jobs. They prefer to go to work in offices and factories rather than in farming. Farming and becoming a farmer is only the last option if young people fail to find the so-called “better” job in the town (rural area).

The average age of farmers is already above 50 years. And it is getting higher and higher. Less and less young people, even from family of farmers in villages are willing to become farmer. Working as farmer is considered as a choice led to poverty. The nationally profile of our farmers can be categorized based on the average ages. There are 17,29% (more or less 6.61 million of labor force working in farming) of age less than 30 years. Then there are 29,15% (more or less 11,14 million) of age between 30-44 years old. There are 32,39% (more or less 12,38 million) of age between 45-59 years old. And finally there are 21,7% (surround 8,09 million) of age over 60 years old. From the total labor force working as farmer around 65,23 % have only level of education not more than elementary school or even without formal education at all. This is our real national condition of our farmers. So we can imagine the difficulty of putting so much heavy burden upon their shoulders for our national food supply.

More and more people, especially young people, leave their own villages to big cities. Globally, even in Indonesia, there are more people in cities than in villages. Many people living in villages think that city life style is more interesting. Urbanization is always a global trend. Our national problem is the regeneration of our farmers. People are so afraid of this problem. The average age of the farmers will have a direct impact upon their productivity in farming. Their ability to adapt is also low. Their ability to make innovations related to the modern technology is also out of dated. Only the millennials generation can adapt with this new development related to what Yuval Noah Harari calls twin modern revolution: biotechnology revolution and information technology revolution. This is the time and opportunity now for the millennials to take active role in the developing and especially in using and applying the modern farming technology. Our hope is our millennials generation to take the role of the old age farmers. But the problem is whether our millennials are ready or not to take such a strategic role.

At the same time, because of information technology, more online businesses are growing and attract young people. There are more working opportunities in a digital world, including online based transportation and logistics. Noah Harari again said that new modern technology creates new kinds of jobs, even jobs that cannot be imagined previously by older generation.

Because of urbanization, fertile land is converted to houses and factories. Some fertile lands are deserted because no more farmers are available. The quality of soil is decreasing because of the use of highly pesticides agriculture which destroy the fertility of soil.

The productivity of agriculture or the amount of harvest is also decreasing. The price of harvest is no longer competitive. Then we will face a problem of the availability of food for all. Less farmers mean less harvest. Less productivity means less food.

At the same time, our market is filled with imported foods which is even cheaper than local products. For instance, for making tofu and tempe as one of the most popular food for Indonesian people, the producers prefer to use imported soy bean because local soy bean is more expensive. Imported fruits are everywhere even in villages because it is not so much expensive and is more available.

The trading system makes life for farmers more difficult. For instance, farmers at Ciburial village where Eco Camp is located cannot sell their products to local markets in Bandung which is under the control of “tengkulak” or middleman traders who control the source and the price of agriculture products. It is almost impossible for farmers at Ciburial village to decide the price of their products and where to sell their harvest.

This is the situation which compelled Pope Benedict XVI to ask more people to invest in agriculture especially in poor and developing countries.

The presence and the role of the middleman for farmers in villages is almost unavoidable. The middleman usually gives the farmers the capital before planting season and decide the price of the harvest in advance. The price of harvest is very low in comparison to the price the consumers will purchase. In effect the farmers remain poor while the

middleman is richer and get the most benefit from this trading system. Consumers in cities buy agricultural products much higher than the price the farmers get for their harvest.

Because of this situation, farmers prefer to use non-organic farming system because it is easier and cheaper. Farmers in villages have no more patience to produce their own organic compost. They also do not have the infrastructure to produce compost. Many farmers do not have cows to have manure for composting. Even if farmers can get cow dung for free, they need money and transportation to get them. They also do not have time to wait for composting.

It is much easier just to buy chemically produced fertilizer and pesticides. They are cheaper, available, and easy to implement. Farmers get even subsidy from the government to buy chemically produced fertilizer and pesticides. But no subsidy for organic farming.

This situation led to the more destruction of fertility of soil. It looks like that farmers get more productivity in their harvest with chemical fertilizer and pesticides. But in a longer perspective, the fertility of soil is harmed. The quality of soil, water, and air is deteriorating because of the chemical pollution. Both Hendro and Fr. Yulius emphasized the importance of those natural elements for the life of the whole planet (not only human being, but they are included in it). Yulius even adds further the fourth elements that is the sun rays (so instead of mentioning three important natural factors, he mentioning four important natural factors). Yulius believes that those four natural elements are the important support for the natural-organic farming and at the same time avoiding the usage of the farm-glass-house system of technology.

In the beginning, the chemical approach of agriculture is more interesting because it brings more income for farmers. It looks like a miracle and brings happiness. But when we are aware of the pollutant effect of chemical fertilizer and pesticides to soil, water, and air quality, we realize that this chemical agriculture is not sustainable. It looks like a suicide for farmers because they destroy their own fertile land they depend on their lives including their whole families.

For example, in Brebes, Central Java, the red onion farming is so chemically dangerous that not only the farmers are affected, but also their wives and children.

We need a more sustainable farming system, both for the soil and also for the quality of the products in order to provide healthier food for all. A more sustainable farming is better for the soil, the farmers and their families, and for the consumers. We also want to guarantee the fertility of soil for a more sustainable harvest in the future.

Nowadays, people are more conscious of their health. It is very clear that chemically produced food is not healthy for human beings. Also because of the pandemic, people are more aware that health is so precious that we have to choose our food in a very responsible way. Our immunity is decreasing because of the pollution in the air and also in our body because of the food we eat. We need food which is free from chemical pollutant for our health.

### *Reflection*

In the past, when people began to learn how to produce food from nature, they started to cultivate the soil, clean and prepare for farming, and plant the food they needed to support their lives. They take care of the soil and their plants. They watered it and kept its fertility in order to get enough harvest. This whole process is called farming. In English it is “agriculture” which comprises of two words: *agricola* and *cultura*. *Agricola* means farmers. *Cultura* means culture, which is connected to cultivating the soil and plants. So agriculture originally means “the culture of the farmers,” the culture of cultivating soil, the culture of farming. There is an embodied element of cultural consciousness and civilization within this word. It means that people who are active in farming and cultivating the soil (*agricola*) are doing that activity in the context of living a cultural consciousness.

When agriculture was done in a very traditional context and when people did agricultural activity or farming as a way to provide their own food, then agriculture was not a problem for the ecosystem. It is a sustainable farming or sustainable agriculture. Farmers would cultivate their soil and kept the harvest for themselves. If they had more than they needed, they might barter or sell their harvest to have other things they needed. In this way of agriculture, the nature was in harmony with people and their agricultural activities. There was no significant negative impact or destruction to nature. People with sustainable agricultural or sustainable farming activities lived in harmony with nature. It is important and relevant here to adapt the information from one of the FAO document with the title “Training Manual for Organic Agriculture”. In proposing organic agriculture this document further quote IFOAM (standing for International Federation of Organic Agriculture Movements) saying that organic agriculture practices are based on the following four principles: “Principle of health, principle of ecology, principle fairness, principle of care.”

Significant changes in nature started to begin when “agriculture” became “agribisnis”. In agribisnis, a cultural activity in farming takes a different approach to nature. In agriculture, with cultural consciousness people respect and work together in harmony with nature. In agribisnis, people try to control the nature and put themselves as the owner of the nature who are free to do anything to nature. This completely different paradigm of agriculture and agribisnis has caused terrifying effect to nature because the relationship between farmers to nature is completely different. The respectful and harmonious connection between farmers and nature is being destroyed by agribisnis. What does really happen in agribisnis? Because of the mechanism of market and bisnis, the relationship is no longer based on respect, but on the supply and demand tension. When supply is higher than demand, then the farmers will receive less income. When demand is higher and supply is low, then the consumers will have to pay more.

This is also a situation when farmer and consumers are being controlled by middleman and traders. Agriculture products are no longer a cultural product. There is no freedom for farmers to produce what they choose. At the other side, there is no freedom for consumers because they also cannot choose what they need. The trading system or

the market become the one who controls both sides. Those who gain much are the traders. The farmers will remain objects of the market system and will remain poor.

In this situation, agriculture is no longer a cultural activity. Relationship and respect to nature is no longer exist. The broken relationship between people and nature can cause the destruction of ecosystem.

The problem of environmental crisis and its subsequent problems should be addressed by all human being. And these efforts should be pursued together to be more effective and efficient. But in order for people to work well together, as Pope Francis called for, then a new discussion space is badly needed (LS 135), where all those who are concerned about this ecological crisis can meet and design a better joint venture. The new discussion space is badly needed so that various related parties can sit together to formulate new, and more comprehensive approaches (LS 135) to this environmental deadly crisis. This comprehensive approach is related to the willingness to provide financial support to various autonomous and interdisciplinary research institutions. It is hoped that from within this new discussion space there will emerge a new light (LS 135) to better highlight the problems of the world.

*Solution: “Establishing CSA-Network”*

There are three major issues that become the focus of our concern. Those three issues are closely related to each other. Therefore, the solutions must be a holistic one. It means the solution must really give a way out those three problems. The first of the three is the living conditions of the farmers (both in rural and urban areas) who are increasingly marginalized. The second big issue is the ecosystem that is becoming badly damaged due to the exploitation of the nature. And the condition now is becoming more terrifying for the whole creature (including humanity). The natural exploitation itself is carried out by industrialization and even also by agricultural activities. In this connection then comes the third big issue, namely the living conditions of human being (and also every creation) are increasingly unhealthy. For example, the air is polluted by so many pollutants. The water is also contaminated by various toxic waste. The food also has been contaminated and polluted by so many chemical elements. The very process of producing food material has been polluted by so many chemical fertilizer and pesticides. The situation is really terrible. But do we have to succumb to grip of these anxiety and pessimism?

There have been, actually, some breakthroughs made by human beings in their effort to find a solution to this worrying situation that make our mind and heart are trapped in the cloud of pessimism. We do hope that those breakthroughs will be able to give hope and revive a sense of optimism in our lives. The solution to the dilemma already exist in a social movement known as “Community Supported Agriculture” (usually abbreviated as CSA). Driven by the awareness of the increasingly serious ecological crisis that afflicts and threatens human life, since the 1970a, the CSA movement has emerged in various countries in the world. And many churches (from various denominations) support this movement. But in recent years the CSA movement has begun to emerge and develop also

in several places in Indonesia. For example, we can find it in Bandung, in Bogor, and in Jakarta and in some other big cities of Indonesia (because CSA system of organisation aim mainly to support the needs of the urban population with the healthy organic products).

What is the essence of this CSA movement? Up to the present time, most of the efforts to increase the food security and sovereignty in various regions and countries in the world are directed and focused on the food producers, namely the farmers. To them governments allocated a lot of time, energy and also funds in order in increase their ability to produce foods. Surely all of this allocations are intended to educate farmers, improve their knowledge and skills so that they can produce better and healthier foodstuffs. This initiative surely is a very good one. We have to pay more attention to the farmers. Morally that should be our priority, because the tradition of the Catholic Church, through the social-moral teaching of its Popes, also places great emphasis on this priority so that peasants should be given serious attention.

Pope Francis pays serious attention to the local dimension precisely because of the uniqueness of the local. This local dimension is something that lack from the global dimension. In this case, according to the Holy Father, the local dimension can enrich the global community with its power that ferment the global community, enriching them with their perennial philosophy, for example in the form of subsidiarity mechanisms (which the Holy Father believes has been internalized by local people and communities. FT 142). When the church continuously talked about the principle of subsidiarity and solidarity, for example, local people actually practice these values throughout their whole life span. The local community strongly believes that solidity and social cohesiveness has been based on the principle of subsidiarity and solidarity. We must not forget the fact that in every society there are two important camps that always interact and are inseparable as well because they are both needed by human being, namely universal brotherhood and social friendship (FT 142). We should not separate the two because the separation will have a very bad impact on human social life. The Holy Father himself said that the separation would bring about a very dangerous polarization (FT 142).

One of the things that the Church has been fighting for due to the inspiration of Liberation Theology is the idea of “preferential option for the poor”. It must be realized that liberation theologians base their theological ideas on biblical inspiration, which does show God’s attitude and choice to give care and help to the poor and the oppressed. The most powerful biblical inspiration come from the book of Exodus which tells of Israel’s liberation from Egyptian slavery. In that story it seems very clear that God is on the side of the poor and the oppressed. Pope Francis is aware that the theological stance of “option for the poor” can only be a concern from afar, an attitude that make a distance from the poor and the suffering. But against that tendency the Holy Father himself emphasized that the theological attitude of “option for the poor” may become meaningless if it does not lead to “friendship with the poor” (FT 234). The Holy Father put a strong emphasis on this aspect because he is well aware that there are noble values, and there are unique

ways of living and realizing the faith from which all other human groups (even the rich) can learn (FT 234).

But over time people are also increasingly realizing that it is not enough for us just to give priority to farmers. We are also encouraged to give time, energy, attention and also fund to the other side of the scale, that is to the consumers. Nowadays it is increasingly realized that apparently the consumers must also be educated to consume. The education program for consumers is mainly directed and related to the process of raising awareness that as consumers they must start also consuming organic products of food. This is something very important. Maybe in the market place (especially in the super markets) there are many imported organic products. It is necessary to educate the local consumers to start consuming local organic products by this time. This is intended to make consumers aware of their health condition because usually they can know the information about its process. While on the other hand, they do not have a direct information related to the process of the production of the imported organic farming products. At present, by buying their food from local organic farmers, the consumers are educated to maintain their own health condition and also the good condition of the mother earth. By so doing the consumers can finally reward local farmers a fair price. In this way money from consumers is recirculated in the circle of micro-scale society. The money of the consumers is circulated among the people whom they know. It is not fall into the trap of anonymous and invisible hands outside there.

CSA is a form of consumer community (mostly from the middle-class and up) that establish a network of solidarity. CSA is best formed (established) by the initiatives of the farmers themselves. In this case it means that the farmers themselves are pro-actively looking for and making contacts to the potential consumers who are aware and willing to pay their organic farming products at a fair price. It should be realized that in supermarkets, the owner usually sells products that are worthy of acceptance only. For that purpose, they must select the best and discard the bad products. So sorting process in search for the best product (to be displayed and sold in their supermarket) is also not good for organic farming and farmers. This is the difference between the system of supermarkets and the CSA system. What is provided in the CSA network are all products that are fit for consumption and there is no selection or sorting out that usually leads to the disposal of the bad products. On the contrary, everything is taken or selected according to the condition of harvest time which surely varies from time to time.

But it is also possible that CSA was established by consumers who, with their good will and intention, want to establish solidarity and solidity with small organic farmers. Indeed, the most basic attitude that underlies this CSA model is the idea of solidarity which since the Pope John Paul II's document of *Sollicitudo Rei Socialis* has been proclaimed as a virtue and since then has also been re-echoed continuously by his successors through the formal ecclesial documents they published. Based on the ideals of solidarity, currently in some places in Indonesia, there are CSAs established by consumers to support the organic farmers. One example is CSA Santo Stephanus

Cilandak, South Jakarta. In contrast to the CSAs mentioned above, CSAs formed by consumer's initiatives usually begin to actively educate their own members so that they consciously choose or decide to work with local farmers who they know, recognize. They also believe that the local farmers can provide good products and also with smooth regular deliveries. It they have decided a certain group of partner, then they must also begin to commit to being fair in the process of buying farmers' products.

#### *Establishing an Ideal CSA*

The two previous CSA movements starts their initiatives either from farmers (farmer based CSA initiative) or from consumers (consumer based CSA initiative). In this section we want to talk about a more idealistic CSA. It is a CSA that founded as a cooperation between farmers and consumers based on the principle of solidarity. Because this CSA is a kind of a joint-venture (between farmers and consumers), then they also must have a joint planning. For example, they must determine in advance the price of the farming products. Their good cooperation will have a good impact also upon the environment. Perhaps in this connection we need to look at the vision of the Holy Father (Pope Francis) himself towards the peasants (farmers). We can find his vision, among others in *Laudato Si'* number 180. In that document, the Holy Father clearly encourages world bodies and financial institutions of related countries to provide financial assistance and every convenience to the local farmer communities. The Pope also clearly mentions the forms of local cooperatives and other social organizations that must be assisted (LS 80).

In this connection the Holy Father also put forward a very clear moral-ethical criterion. There are two ethical criteria. First these forms of local cooperatives and mass organizations must clearly demonstrate their fundamental commitment to defend the interests and the very life of the local small farmers. Secondly, those organizations must also demonstrate a clear and strong commitment to preserve local ecosystems (LS 80). These criteria are very important to ensure that the presence of those organizations, instead of improving the life of the local people, proved to cause damage to local farmers and their natural environment.

The priority in the future is to give more attention and opportunity to the model of CSA co-founded by farmers and consumers. It is considered to be more appropriate because this model of CSA starts from the mutual commitment (between farmers and consumers). And besides it is also promoted by the one and the same social and ecological concerns due to the present ecological disaster. As it is once strongly believed by Satish Kumar that the future of human being in this earth (soil) is definitely determined by human's basic attitude and vision toward what he calls "a new trinity" of our future life. And this "new trinity" consists in the soil (earth), soul (the inner core and force of human being), and then society within which human being exist and also co-exist. If so far there is already a wrong perception that to develop a good future human life, we must start from the society. Satish Kumar give a correction to this wrong perception. The starting point must be the soil. Says Kumar, "I put soil first, because it represents nature

and sustains the entire life-systems. Everything comes from the soil and returns to the soil.”

We, together with the environmental activists including organic farming activists, want to know the existence of various CSA movements in Indonesia, and collect the data about their existence. We want also to know their initiatives and activities that have been made so far related to the problem of environment and the propagation of the local community farmers. The long-term goal is to establish a net-work between various CSA based on the local context. It is hoped that in this network, CSA members can learn from each other. It is imagined that this network of CSA will become a certain communal space to share of knowledges and experiences. They can also share the difficulties they have gone through and the ways that have found to overcome them. This network will become a communal space to share inspiration and motivation.

There is already an initial model of CSA in Bandung. They call themselves CSA Seni Tani (CSA-ST). It is a system that connect directly the farmers (the producers of organic farming products) and the consumers. This system of CSA-ST is deliberately established as center for information so that the consumers can get the healthy food which is near to them, transparent, and also reliable. The consumers (members) are given the wide opportunity to know and also recognize the farmers who work to cultivate their daily source of food. And the more important thing is that the consumers are given the wide opportunity to know how their daily food supply are planted and cultivated. Its main final purpose is that this CSA want to invite the society (especially the members) to involve and take part in giving a positive and general impact for the sustainability of food, economy, social and environment.

### III. CONCLUSIONS

It has been clearly stated above that small farmers in rural areas confronts very serious difficulties to earn their daily livelihood. They are suffocated by a marketing system that has little mercy on them. Meanwhile, in the market place there are many competing products, such as non-organic agricultural products, or even worse imported organic products. They could barely keep up with all of them. It has also been said above that in fact the government has provided a lot of assistance to farmers, especially those engaged in non-organic agriculture. But it has not succeeded in changing their fate and standard of living.

In this regard, we would like to propose a recommendation and action. We propose to establish a Community Supported Agriculture (CSA). The main program in the CSA is not so much on the educating farmers, though this is still very important, but educating consumers. In this way we hope that there will occur the new awareness among the consumers of the life based on the organic-farming. One way to do this is to form a group to accommodate consumers who are given the awareness to consume organic cultural products. This group is then connected to a group of farmers engaged in organic farming. The products of the farmers will be bought by these consumers. There is a certainty that their farming organic products will be marketed to a certain buyer. On the other

hand, the consumers can assist the farmers by invest some of their money meant for their daily bread or vegetables. In this way, there will occur an integrated circle consists of the organic farmers and the consumers of organic farming products. This integration take place in the CSA contexts. Some critics of this movement may say that this movement is not effective. To respond to this criticism, we would like to say that there is still a hope for us to establish the similar movement everywhere. We do believe that the strong inspiration of *Laudato Si'* and *Fratelli Tutti* will able to endorse people to establish the CSA movement in their own local contexts. Through the CSA system, the organic farming will be able to survive and develop. Although not explicitly mentioning the organic agriculture, but one day, Pope Benedict XVI expressed his basic desire related to the development of human life here and now. Our previous Pope is fully aware that the manufacturing industry and agriculture still play an important role in sustaining human life. But considering the effects of ecological damage emerging so far from the consumeristic mentality of the society, our previous pope encourages human being to “...move beyond a purely consumerist mentality in order to promote forms of agricultural and industrial production capable of respecting creation and satisfying the primary needs of all.”

Finally, we recommend that APTIK in this matter can also play its important role to build CSA in their own place. CSA is a movement and the initiative of the people. It is something that in line with the principle of subsidiarity propounded in the social teachings of the Catholic Church. Establishing and developing CSA are also means to support the application of the social teaching of the Church. Quoting Pope Benedict XVI, we believe that “*The motivation to do this comes from love: love for the poor, love that cannot tolerate injustice or deprivation, love that refuses to rest until poverty and hunger are banished from our midst.*”

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