

# DIGITALES ARCHIV

ZBW – Leibniz-Informationszentrum Wirtschaft  
ZBW – Leibniz Information Centre for Economics

Ramli, Yanto; Imaningsih, Erna Sofriana; Shiratina, Aldina et al.

## Article

### Environmental sustainability : to enhance organizational awareness towards green environmental concern

#### Provided in Cooperation with:

International Journal of Energy Economics and Policy (IJEPP)

*Reference:* Ramli, Yanto/Imaningsih, Erna Sofriana et. al. (2022). Environmental sustainability : to enhance organizational awareness towards green environmental concern. In: International Journal of Energy Economics and Policy 12 (4), S. 307 - 316.  
<https://econjournals.com/index.php/ijeep/article/download/13275/6844/30768>.  
doi:10.32479/ijeep.13275.

This Version is available at:  
<http://hdl.handle.net/11159/12291>

#### Kontakt/Contact

ZBW – Leibniz-Informationszentrum Wirtschaft/Leibniz Information Centre for Economics  
Düsternbrooker Weg 120  
24105 Kiel (Germany)  
E-Mail: [rights\[at\]zbw.eu](mailto:rights[at]zbw.eu)  
<https://www.zbw.eu/econis-archiv/>

#### Standard-Nutzungsbedingungen:

Dieses Dokument darf zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden. Sie dürfen dieses Dokument nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, aufführen, vertreiben oder anderweitig nutzen. Sofern für das Dokument eine Open-Content-Lizenz verwendet wurde, so gelten abweichend von diesen Nutzungsbedingungen die in der Lizenz gewährten Nutzungsrechte.

<https://zbw.eu/econis-archiv/termsfuse>

#### Terms of use:

*This document may be saved and copied for your personal and scholarly purposes. You are not to copy it for public or commercial purposes, to exhibit the document in public, to perform, distribute or otherwise use the document in public. If the document is made available under a Creative Commons Licence you may exercise further usage rights as specified in the licence.*



## **Environmental Sustainability: To Enhance Organizational Awareness towards Green Environmental Concern**

**Yanto Ramli<sup>1\*</sup>, Erna Sofriana Imaningsih<sup>1</sup>, Aldina Shiratina<sup>1</sup>, Adnan Rajak<sup>2</sup>, Anees Janee Ali<sup>3</sup>**

<sup>1</sup>Universitas Mercu Buana, Jakarta, Indonesia, <sup>2</sup>Universitas Khairun Ternate, Ternate, Indonesia, <sup>3</sup>Universiti Sains Malaysia, Malaysia. \*Email: [yanto.ramli@mercubuana.ac.id](mailto:yanto.ramli@mercubuana.ac.id)

**Received:** 04 April 2022

**Accepted:** 26 June 2022

**DOI:** <https://doi.org/10.32479/ijeep.13275>

### **ABSTRACT**

The crude oil waste such as POME is huge destruction to the surrounding community and causes greater harm unleashing several skin issues, toxic infections, and digestion disorders. The issue attracts the attention of scholars; hence, the present study attempts to build an understanding of organizational awareness and how it could solve the stated issue and turn into useful elements such as potential green resources. For this, the study used green environment, innovation management, and environmental concern as an independent variable, organizational awareness as a dependent variable, and environmental sustainability as an intervening variable. This helps scholars and practitioners to solve the said issue which still happens to be unresolved. Moreover, it also helps to prevent further damage to the environment and community. To attain the objective of the study, the authors proposed a framework, and based on prior literature and empirical evidences, seven hypotheses were formulated. The study used purposive sampling and the projected population is the mills that are situated in North Sumatera province of Indonesia. The smart PLS methodology is opted to analyze sample data. The findings reveal that green environment amongst all has a stronger influence on environmental sustainability. The results also indicate that the firms need to consider the innovative ideas and build innovative teams which could help them to transform the disrupted POME into valuable green resources. At the end, the study also offers some implications and future recommendations which if considers, would add a valuable contribution in the existing literature.

**Keywords:** Green Environment, Innovation Management, Environmental Concern, Environmental Sustainability, Organizational Awareness

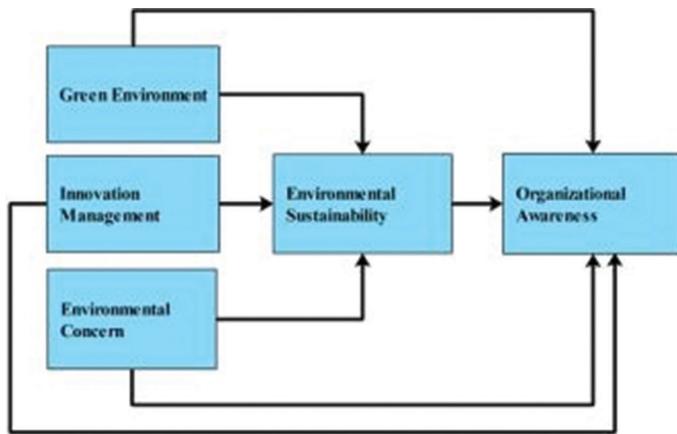
**JEL Classifications:** Q01, O44, Q55, O44

### **1. INTRODUCTION**

Indonesia is considered to be the largest and most competitive producer when it comes to producing high value-added products from crude palm oil production. The reason is that the country has abundant resources in terms of land and also has the availability of natural supported conditions. Moreover, the ministry of Indonesian industry also exhibits great effort to increase the productivity of CPO processing industries as they believe that the said industry is the backbone of national economic growth. As discussed, the country has now become the largest CPO producer all over the globe and the statistics also indicate that the contribution has almost reached 48% of world CPO production. Furthermore, the

Indonesian Ministry of the industry also now controls almost 52% of the CPO export market. According to the central statistics agency of Indonesia, in 2019 It is reported that Indonesia is of the countries that have the largest land area around the globe with around 13.2 million hectares of crude palm plantation. It is also constituted that Indonesia is also the largest CPO producer as its total production of CPO has reached to the level of 47 million tons. Figure 1 also depicts the remarkable increment in the production of CPO in the period of 2017-2018, which is almost 13%, and 10% in the period of 2018-2019. Also, the uprise graph indicates that the level of production will continue to increase in the future too as the government of Indonesia promotes the use of the compound of biofuel in the diesel fuel and avoids any further usage of fossil fuel.

Figure 1: Research framework



The data extracted from the Central Statistics Agency of Indonesia also pinpoints that the CPO production has been increasing since 2014 with the level of 29.28 million tones and reached up to 36.59 million tones in 2018 which shows a growth of almost 19.34%. In the past 5 years, the area of oil palm plantations is also increasing except in the year 2016 as in the following year, the country experienced a decline. The increment in the area throughout the years witnessed a jump from 2.77% to 10.55% per annum. However, in 2016 it was decreased by 0.52%. In the year 2014, the palm plantation area of Indonesia was documented at 10.75 million hectares which increased the following year and reached at 11.26 million hectares. This growth the growth of almost 5%. As discussed above, the 2016 year was not in favor of Indonesia hence witnessing a decline of 0.52% which shows that the 11.26 million hectares reduced to 11.20 million hectares. In 2017, it had increased again by 10.55% and now it is estimated to increase by 3.06% in 2018 which in numbers is almost 13 million hectares. In the future, it will continue to grow due to the high demands of CPO and PKO.

The palm plantation areas and CPO production cover almost 25 provinces of Indonesia. These are scattered in almost all the provinces which are situated in the Sumatra and Kalimantan islands, Java Island, Sulawesi, and Papua Island. Amongst all provinces, Riau which is situated in Sumatra Island has the largest palm plantation area and CPO production. It constitutes around 19.50% of the total CPO production. Following it, Central Kalimantan is the second 2<sup>nd</sup> largest CPO producer as it contributes 15.74%, the third-largest producer is North Sumatra having a contribution of 14.88% which is further followed by West Kalimantan and South Sumatra which contributes 8.40% and 8.31% respectively.

The production process of crude palm oil in the mill consists of sequential phases. In the first phase, the fresh fruit branches get harvested which are then processed into crude palm oil and palm kernel oil. The process further proceeds with the transformation of FFB into CPO which has been done through a series of methods including sterilizing, threshing, digesting, and finally pressing. Afterward, the palm oil will be purified through the process and stored in storage. Moreover, palm kernel nuts also dry out and crush into palm kernel oil and palm kernel shell. The further

waste finally is extracted from the sludge in the ponds and empty fruit branches.

As the production is done in a large capacity, it means that a high volume of crude palm oil may also generate a huge amount of polluted waste water which is termed as palm oil mill effluent (POME). It is observed that in 2018 the production of 36.59 million tonnes was responsible of around 14million tonnes of POME in the yearly crude palm oil production. This waste contains numerous suspended components such as cell walls, organelles, short fibers, carbohydrates of hemicellulose to sugars, nitrogenous compounds with the proteins and amino acids, organic acids, and mineral constituents (Ainou et al., 2022; Singh et al., 2010).

POME is one of the strongest pollutants with low pH because of the organic and free fatty acids that arise due to the degradation of palm fruits. Typically, POME’s characteristics are dependent on the raw material’s quality and the production process. However, it usually contains huge amount of total suspended solids (40,500 mgL), oil and grease (4000 mgL), chemical oxygen (50,000 mgL) and biochemical oxygen demand (25,000 mgL). Due to its highly toxic elements, it is considered to be the most polluted resource which causes a great amount of pollution to streams, rivers, and other related areas. A brownish, slimy, and smelly texture is harmful for living creatures as well as aquatic organisms (Chien et al., 2021; Iwuagwu and Ugquanyi, 2014).

This wastage, when discarded into rivers and streams, could cause harm to the people who live near the CPO mill which eventually causes a disaster at a broader level with several consequences such as skin diseases, infections, and digestion disorders. Hundred of cases have been reported to the government and Regional People’s representative assembly to demand solutions but to this date, all the cases remain unsolved and still, the cases are emerging hence making it one of the serious issues that could endanger the community’s right of living and risk their lives.

Building the strong argument with shreds of evidence and justifications, the present research intends to raise the environmental concern of the organization against the disrupted POME that may question the standard of living. Moreover, the research also aims to explore the way through which POME could be utilized innovatively in terms of green resources which could make a contribution in resolving the issue of palm oil mill effluent that is affecting the surrounding communities.

After synthesizing prior studies, it is argued that palm oil waste could be used as a potential fertilizer, fuel, and bio-oil (Sulaiman et al., 2010). Singh et al. (2010) also argued that POME and other solid wastes are rapidly causing major harm to the surrounding environment, therefore it is needed to deal with properly. Iwuagwu and Ugwuanyi (2014) highlighted that POME can be treated as a carbon source with little or no supplementation to achieve waste-to-value by producing food-grade yeast with a reduction in pollution potential. Fauzianto (2014) highlighted in his study that there is a need to analyze the situations and propose a framework in which A to Z implementation of waste utilization specifically from palm oil cultivation is explained and how it could be utilized

positively through to the torrefaction process so that it less impacts environment. Paryanto et al. (2015) and Sadiq et al. (2022) also proposed the idea in their studies which directed toward an integration strategy that helps in the development of engineering design of biodiesel plants integrated with palm oil mills.

Hambali and Rivai (2017) argued that POME is still an economical waste that can be used as an alternative in many cases such as fuel, fertilizer, biomaterial, and chemical compounds. Liew et al. (2017) also made a discussion in their study about mills waste such as POME and POMS. According to them such type of waste is further processed into palm oil fuel ashes (POFA) and palm oil clinker (POC). Leela et al. (2018) further elaborated that POME characteristics is the waste which is generated from crude palm oil, on the other hand, CPO is a raw material for biodiesel. Huang et al. (2021b) and Osman et al. (2020) argued that POME is shown to have an adverse impact on *P. purpureum*. Further research regarding the potential application of *P. purpureum* following phytoremediation of POME, such as biofuel production is warranted to evaluate its potential use to fit into the waste-to-wealth agenda.

Based on the above discussion which has been extracted from the preceding literature, we can deduce that almost all of the scholars have agreed to this point that there exists a need to handle POME properly in order to prevent further environmental disasters and water pollution that are being caused by POME. Additionally, many of the studies also highlighted the potential of POME as a renewable resource. Some studies even argued about the idea of POME turning into fertilizer. However, the discussions are vague and no clear solution has been provided to resolve the fact that how it can be utilized efficiently. Therefore, the present study tends to put an effort in this regard by focusing on the concepts which could turn POME innovatively into potential green resources as organic fertilizers. Moreover, the said research also plays a part in enhancing organizational awareness regarding the harmful effect of POME which may cause severe destruction in the surrounding communities.

## 2. LITERATURE REVIEW

### 2.1. Green Environment

Yuliawati and Enjang (2018) argued that a green environment promotes a clean and eco-friendly environment in order to secure current and future resources and generations. It also prevents the ecosystem from further damages that are being caused by humans. It is argued that the implementation of a green environment solves many issues such as air and water pollution, and health issues as these issues are increasing day by day hence becoming a strong indicator of pollution. According to Kotler and Armstrong (2018), the green environment includes both the internal and external green activities that may produce a valuable outcome for the organization and environment in short term. However, the outside green activities offer long-term results.

According to Van den Bosch and Sang (2017), green indoor and outdoor environmental activities are the significant attributes of nature-based solutions. It is argued by several scholars that a green

physical environment is crucial for eco-friendly organizations as in such firms these green performances sync with other services which are proved to be the key facet of product quality assessment (Han et al., 2018; Trang et al., 2019). According to Shuang et al. (2014), the indoor physical environment talks about the internal environment which affects the occupant of the building. This phenomenon includes all level of interactions among visitors and workers that happens in the premises of the building. In the context of green, a green indoor environment is a vital factor of nature-based solution for those firms that encompasses green spaces and items (Han and Hyun, 2017; Vujcic et al., 2017).

### 2.2. Innovation Management

According to Hapsi et al. (2017) innovation refers to “the ability to turn ideas into goods, services or processes to solve problems and take advantage of the opportunities it faces.” According to Leonidou et al. (2020), innovation is the phase that firms adopt through the utilization of their capabilities and utilities to develop new systems/processes/products/services to magnify their performance. As argued by Frishammar et al. (2019), innovation is linked to risk-taking factors that organizations intend to take to become a learning organization.

According to Tidd and Bessant (2013), innovation is triggered through the ability to foresee connections, to pick out opportunities, and then take benefits from them. It is not just a strategy to enter new markets. It basically offers new paths of serving to get sustainability. Innovation is not supposed to stick with manufactured products but it can be found in numerous processes and services (Huang et al., 2021a). Although the firms can earn a competitive edge through possession of assets or firm size. However, the trends indicate that organizations that are able to mobilize their knowledge and technological skills and experience to propose new offerings; are becoming more successful in achieving environmental sustainability. Moreover, firms, when have proper innovation management systems, may achieve higher growth in contrast to those who don't innovative or are not aware to tackle it (Aslam et al., 2020).

### 2.3. Environmental Concern

Cruz and Manata (2020) argued that environmental attitudes are similar to the traditional concept of attitudes hence they can be defined and organized in a similar way. In other words, we can define it as “one's attitudes toward specific environmental topics are distinct in some ways but are ultimately reflections of a single, broad environmental attitude which is sometimes referred to as the environmental concern.” According to Kotler and Keller (2016), environmental issues play a significant role in the designing and manufacturing of product. This is the reason many of the organizations show concern about it and finding ways to have minimal negative environmental impacts on business operations. Firms are now even changing their methods and shifting into eco-friendly procedures.

Hansla et al. (2008) argued that environmental concerns increase the emotional response of firms and individuals towards environmental issues. Therefore, it refers to “the positive/negative attitudes towards environmental challenges, degradations and

of course climate change.” Lee (2009) defined environmental concern as an attitude that reflects on the individuals’ worries and compassion toward the environment. Therefore, the said construct is a strong attitudinal predictor (Hamilton et al., 2014; Kollmuss and Agyeman, 2002). Felix et al. (2018) argued that mostly literature considered environmental concern as a critical construct as it helps in assisting environmental responsible behavior. Ibnou-Laaroussi et al. (2020) viewed environmental concern as a cognitive factor that evaluates the attitude for environmental protection.

## 2.4. Environmental Sustainability

The growing concern has been fueled by scholars and practitioners to green the economy disengage economic growth from the environmental pressure (Organisation for Economic Co-operation and Development, 2011). According to UNEP (2011), making the economy green demands effective strategies which derive sustainable transitions in consumer patterns. This is applicable when challenges of sustainable transitions at multilevel can be promoted and managed (Geels, 2010). According to Yuliawati and Enjang (2018), maintaining environmental sustainability is not a temporary initiative. Hence, we can not say that it is a seasonal trend. It basically demands a proper design and strategy which may affect the sensitivity of people so that they may cooperate and offer their support and assure their participation. Kotler and Amstrong (2018) argued that more and more firms are focusing towards environmental sustainability hence adopting such kinds of policies which covers both type of activities; internal and external. The reason is that this helps them to fulfill the objectives of firms and environment simultaneously.

The systematic debate on sustainability twisting with economic, social, and environmental goals has been growing for decades (Cillo et al., 2019). This also affects organizational practices as it can be seen that firms are now focusing their growth on sustainability and shifting their focus to environmental and social-related macroscopic issues (Pastré and Vigier, 2003). Due to its importance, firms have altered their production and consumption methods and processes to transform society and the environment with minimal negative social and environmental impacts (Dyck and Silvestre, 2018). Moreover, organizations tend to engage themselves in activities from which they could gauge the term environmental benefits (Rennings and Rammer, 2011).

## 2.5. Organizational Awareness

According to Harwani and Sakinah (2019), awareness is supposed to be the prime step to understanding and believing things under various situation. This belief builds the recognition through which a decision could be made. Kotler and Keller (2016) argued that awareness is the acumen which helps in reading about firms and individuals that they are informed about certain parameters and are persuaded to experience it.

According to Kim et al. (2019) organizational awareness is considered to be a strongest element as it binds the firms and creates a sense of unity. It is argued that organizational awareness is a key driven factor for businesses as success relies on it (Barney

et al., 1998). According to Gibs et al. (2017), organizational awareness is seen to be a critical factor as it involves in knowledge sharing attributes.

## 2.6. Hypotheses Development

### 2.6.1. Green environment and environmental sustainability

Yuliawati and Enjang (2018) argued that green environment helps in the development of eco friendly environment and simultaneously ensure the environmental sustainability in the longer run. It is also argued by the authors that green environments prevents the damages and destructions which are being caused by human beings, hence offering value added contribution to the ecosystem. It also prevents the ecosystem from further damages that are being caused by humans. It is argued that the implementation of a green environment solves many issues such as air and water pollution, and health issues as these issues are increasing day by day hence becoming a strong indicator of pollution. According to Kotler and Armstrong (2018), the green environment includes both the internal and external green activities that may produce a valuable outcome for the organization and environment in short term. However, the outside green activities offer long-term results. Therefore, we hypothesize that.

H<sub>1</sub>: The effect of a green environment on environmental sustainability to develop the POME into potential green resources.

### 2.6.2. Innovation management and environmental sustainability

Karakaya et al. (2014) argued that the strategy of sustainable innovation and diffusion are supposed to be the key-driven strategies that bring sustainable development and make the economy green. Sustainability-oriented innovation and processes have widely been discussed in sustainable literature. This growing importance regarding sustainable innovation practices activates the concern of scholars and practitioners which pushes them to prioritize the emphasis on sustainability issues and how it can be reconciled with innovation (Bates et al., 2008). Moreover, organizations tend to engage themselves in activities from which they could gauge the term environmental benefits (Rennings and Rammer, 2011). It is also argued by several scholars that specifically in green literature that innovation management and sustainability are known to be crucial elements that help firms to develop their competitive advantage (Gonzalez-Lafaysse and Lapassouse-Madrid, 2016; Marcon, de Medeiros, & Ribeiro, 2017). Therefore, we can say that innovation management surely plays a bigger role in environmental sustainability, hence could be fruitful factor to be use in the development of green resources through POME.

H<sub>2</sub>: The effect of innovation management towards environmental sustainability to develop the POME into potential green resources.

### 2.6.3. Environmental concern and environmental sustainability

According to Khoshoo (2008), firms show concern about environment thereby they prefer the way through which they could retain environmental sustainability. Further argued that organizations are now transforming themselves and adopting those eco-friendly procedures which do not harm environment. This positive attitude of firms show that they are greatly concerned about environment and perceive it as their responsibility to cause minimum destruction. Felix et al. (2018) also argued that mostly literature considered

environmental concern as a critical construct as it helps in assisting environmental responsible behavior. Ibnou-Laaroussi et al. (2020) argued that environmental concern is a cognitive factor as it helps to evaluate the attitude for environmental protection. Based on the argument, we propose that:

H<sub>3</sub>: The effect of environmental concern towards environmental sustainability to develop the POME into potential green resources.

#### 2.6.4. Green Environment and organizational awareness

In last few decades, organization are opting eco-friendly practices and strategies due as they are highly aware that creating green environment produces a significant amount of advantage in building environmental sustainability (Del Brío and Junquera, 2003). Considering the green environment, buildings are supposed to play a crucial part in the environmental strategies of firms. The reason is that they are considered to be major environmental pollutant. Therefore, an eco-friendly environment is linked with organizational awareness and could help firms to build competitive advantage and maintain environmental sustainability in the industry (Kato et al., 2009).

It is argued by Makower (1994) that increased organizational awareness and commitment provides environmental sustainability, therefore, firms who focus on green environment are highly aware of eco-friendly practices, hence keeping best environmental records which also helps in building a positive relation with environmental regulators. Therefore, we hypothesize that:

H<sub>4</sub>: The effect of green environment towards the organizational awareness to develop the POME into potential green resources.

#### 2.6.5. Innovation management and organizational awareness

Hapsi et al. (2017) reveal that innovation is the ability to turn ideas into goods, services, or processes to solve problems and take advantage of the opportunities it faces. Harwani and Sakinah (2019) in their research discussed that awareness is the first step to building an understanding and belief of something under different conditions by their recognition or remembrance of achievement that is taken into consideration to make decision making. Having said discussion, the argument can be concluded on the note that innovation management may impact organizational awareness in positive manner. Thereby, we can postulate our fourth hypothesis which states that:

H<sub>5</sub>: The effect of innovation management towards the organizational awareness to develop the POME into potential green resources.

#### 2.6.6. Environmental concern and organizational awareness

According to Cruz and Manata (2020), in their research stated that environmental attitudes are not fundamentally different from other types of attitudes, and so can be defined and organized in the same way. Harwani and Sakinah (2019) in their research discussed that awareness is the first step to building an understanding and belief of something under different conditions by their recognition or remembrance achievement that is taken into consideration to making a decision making. Having said arguments gives the enough room to postulate the hypothesis that environmental may positively associated with organizational awareness. Thereby, we postulate that:

H<sub>6</sub>: The effect of environmental concern towards the organizational awareness to develop the POME into potential green resources.

#### 2.6.7. Environmental sustainability and organizational awareness

Yuliawati and Enjang (2018) expressed that maintaining environmental sustainability is not a seasonal trend that is only highlighted as short or medium-term initiatives. Harwani and Sakinah (2019) in their research discussed that awareness is the first step to build an understanding and belief of something under different conditions by their recognition or remembrance achievement that are taking into consideration to make decision making. Based on these arguments, it can be concluded that environmental sustainability might have positive influence on the organizational awareness. Thus, the hypothesis that are formulated in this research is as follows:

H<sub>7</sub>: The effect of environmental sustainability towards the organizational awareness to develop the POME into potential green resources.

The research framework is presented in Figure 1.

## 3. RESEARCH METHOD

The present study opted primary method as it follows the method of operationalization, data collection, define the population of study along with calculated sample size. Moreover, the study also opted one of the sample techniques to carry out the analysis in order to test the proposed hypotheses. The study setting was in Jakarta in the period of November 2020-April 2021. The present study used causality method in order to find the relationship between variable. The said analysis is used to determine the effect of one or more than one independent variable on dependent variable in the presence of intervening variable. Based on the nature of the study, the present study also used descriptive methods. The main aim of the research is to be certain that organization of palm oil mill has awareness of POME and turning it in to potential green resources.

The chosen population for this study is the palm oil mill which situated in Sumatera Utara province. The chosen mill was selected randomly and the authors made sure that mill is agreed to participate. Moreover, the study conducted purposive sampling technique as the author assigned the sampling on the basis of specific characteristics which are in line with study's objectives (Ferdinand, 2014. p. 171).

n = 68

N = 156

e = 10% tolerance.

As there are 156 mills which are located in north Sumatera, however, the 68-sample size was calculated for this study.

The method chosen for data analysis was PLS method. The method is suitable when sample size is small. As the variance in this method is based on its statistical algorithm, thereby, there is no such need for it to be conducted (Hair et al., 2011). The PLS method has two steps; measurement model and structural model. In 1<sup>st</sup> step, measurement model is analyzed in which the reliability

and validity of construct is evaluated through CR, AVE, outer loading and collinearity assessment. In 2<sup>nd</sup> step, structural model is evaluated which includes hypothesis testing, adjusted Rsq, effect size and predictive relevance.

## 4. RESULTS AND DISCUSSION

### 4.1. Results

The findings of the study are proved to be a significant as it gives suggestion for the palm oil mill to manage and convert the disrupted palm oil mill effluent into green resources and used in the palm oil plantation rather than disturbing and damage the environment. There are 61 respondents consisted of the operational manager or assistant manager of the palm oil mill who perform the questionnaire through the google form sent to them after being approved by their local branch manager.

The measurement of the variabel is using Likert scale technique to measure the variables based on the respondents' assumptions which is using a scale of five-point that allow the individual to express from how they start with the lowest Strongly Disagree, Disagree, Neutral, Agree or Strongly Disagree with a particular statement.

Testing the Goodness of Fit structural model on the inner model uses the predictive relevance (Q2) value (Table 1). Q-Square value greater than 0 (zero) indicates that the model has a predictive relevance value. Predictive Relevance (Q2) for the structural model measures how well the observed value is generated by the model and also its parameter estimates include 0.02 (small); 0.15 (moderate); and 0.35 (large).

R<sup>2</sup> value indicates the stornig criterion and large Q value. The figure depicts that the proposed framework is overall significant and can be classified as fit. Simiarly, AVE value is greater than bench mark value which is 0.5, hence indicating that all of the constructs meet the criteria of discriminant validity. Also, it can be seen that all of the Cronbach values of constucts are more than 0.7 hence, we can say that the chosen variables are reliable and the outer model can also be classified as fit.

The measurment model indicates that all the indicators are valid as loading factors are >0.7. Table 2 illustrates the detail picture of measurement model.

The measurement model findings depict confirms the validity of all of dimension with the value of t count >t table (2.01). On the basis of varifatiave analysis, the concerning testing latent variable can be seen in Table 3.

It is to be noted that for path analysis the estimated value in

**Table 1: Goodness of fit model (gof)**

Variable	AVE	Composite Reliability	Cronbach's Alpha	R Square	Q Square
GE	0.687	0.838	0.831	-	0.288
IM	0.627	0.900	0.887	-	0.398
EC	0.701	0.883	0.853	-	0.374
ES	0.642	0.926	0.916	0.632	0.421
OA	0.763	0.919	0.899	0.546	0.404

Source: From Data Processing (2019)

structural model should be significant. The significant value can be achieved through bootstrapping procedure. It is needed to observe the value of coefficient and t-statistics in bootstrap algorithm. In order to find out whether it is significant or not, it can be seen from T-table at 0.05. further, the table would be compared with T-statistics which can be seen in Figure 2.

#### 4.1.1. Hypotesis testing

The findings indicate that in comparison with innovation management green environment impact environmental susitanbility in a great manner. Also, green environment also influences highly in direct manner against organizational awareness in comparison with innovation management and environmental concern. It can be

**Table 2: Loading factor between latent variables and dimensions**

Latent variables-dimensions	Loading factor (λ)	Standard error (SE)	T statistics ( λ/SE )
GE → Cleanliness	0.347	0.041	8.396
GE → Comfortable	0.381	0.037	10.317
GE → Plants Layout	0.521	0.043	12.049
IM → Product Innovation	0.204	0.034	6.030
IM → Process Innovation	0.158	0.025	6.276
IM → Position Innovation	0.309	0.031	10.018
IM → Paradigm Innovation	0.292	0.030	9.841
ES → Ecological Concern	0.446	0.031	14.484
ES → Ecological Paradigm	0.314	0.026	12.078
ES → Ecological Attitude	0.425	0.028	15.048
ES → Pollution Prevention	0.770	0.052	14.685
ES → New Clean Technology	0.819	0.043	18.948
OW → Product Stewardship	0.810	0.040	20.353
OW → Sustainability Vision	0.813	0.039	20.948
OW → Knowledge	0.738	0.043	17.002
OW → Attitude	0.682	0.058	11.757
Organizational Awareness → Action	0.672	0.068	9.815

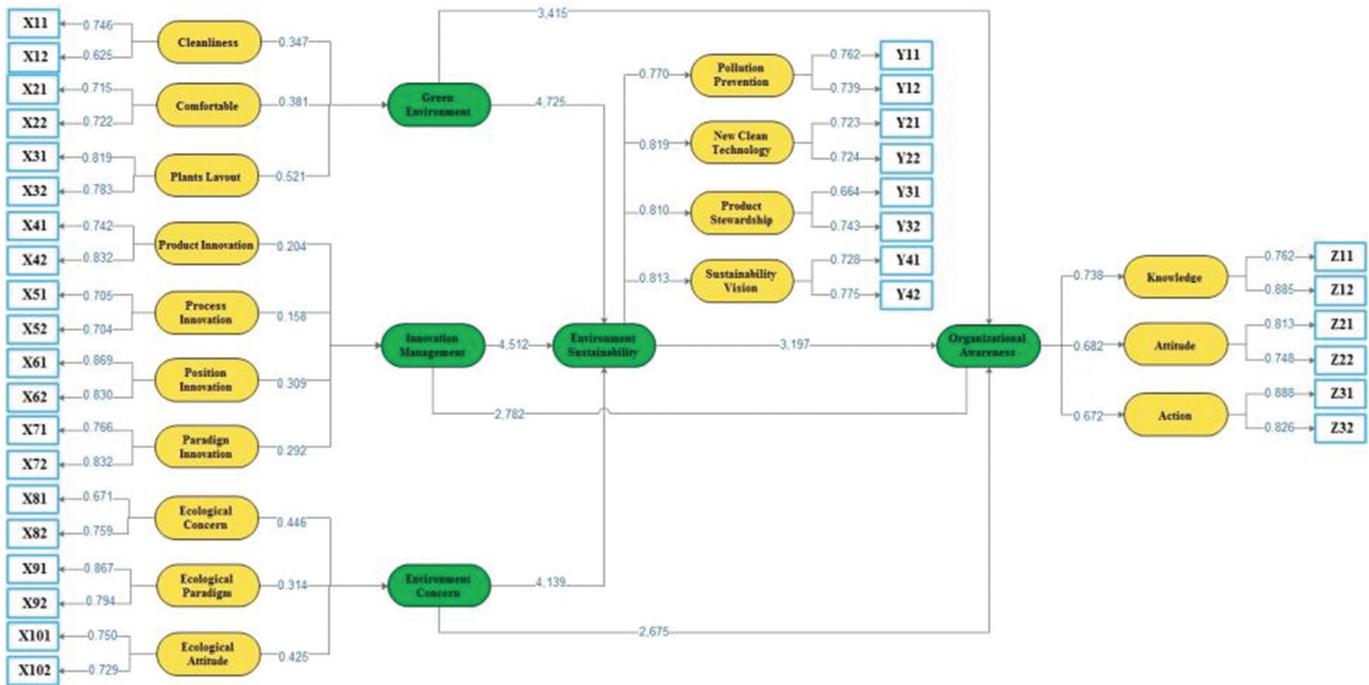
Source: From Data Processing (2021)

**Table 3: The measurement model findings**

Latent variables-dimensions	Loading factor (λ)	Standard error (SE)	T statistics ( λ/SE )
GE → Cleanliness	0.347	0.041	8.396
GE → Comfortable	0.381	0.037	10.317
GE → Plants Layout	0.521	0.043	12.049
IM → Product Innovation	0.204	0.034	6.030
IM → Process Innovation	0.158	0.025	6.276
IM → Position Innovation	0.309	0.031	10.018
IM → Paradigm Innovation	0.292	0.030	9.841
EC → Ecological Concern	0.446	0.031	14.484
Environmental Concern → Ecological Paradigm	0.314	0.026	12.078
EC → Ecological Attitude	0.425	0.028	15.048
Environmental Sustainability → Pollution Prevention	0.770	0.052	14.685
ES → New Clean Technology	0.819	0.043	18.948
ES → Product Stewardship	0.810	0.040	20.353
ES → Sustainability Vision	0.813	0.039	20.948
Organizational Awareness → Knowledge	0.738	0.043	17.002
OW → Attitude	0.682	0.058	11.757
OW → Action	0.672	0.068	9.815

Source: From Data Processing (2021)

Figure 2: T-statistics results



also be gauged from the results that environmental sustainability as an intervening variable is a significant construct in determining the impact of organizational awareness.

From the results of hypothesis testing, it was revealed that the green environment has the greatest influence on environmental sustainability compared to innovation management and environmental concern (Figure 3). Green environment also has the highest direct influence against organizational awareness compare to innovation management and environmental concern. Environmental sustainability is also an important factor in determining the effect of organizational awareness as the intervening variable.

4.1.2. Testing result

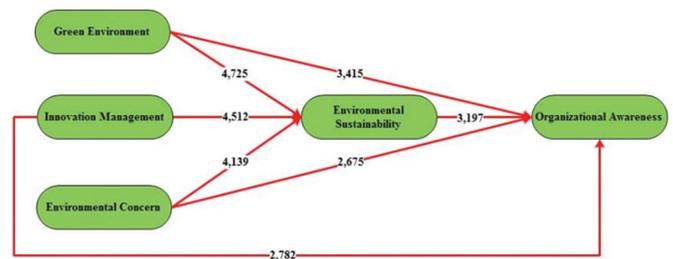
The overall findings revealed that green environmental greatly impacts environmental sustainability as the intervening variable with the figure of 4725, compare to innovation management with the figure of 4512 and environment concern with the figure of 4139. It can be observed from table that direct impact of green environment also exhibits strong influence on organizational awareness with the figure of 3415 compare to the direct effect of environment concern with the figure of 2782 and innovation management with the figure of 2675. Moreover, as an intervening variable, environmental sustainability also proved to be positive indicator when it comes to influence organizational awareness with the figure of 3197 which means that organization need to have better understanding of the environment sustainability in order to avoid disaster the surrounding community.

4.2. Discussion

4.2.1. The influence of green environment towards environment sustainability

The findings supports the third hypothesis which states that green environment has a positive and significant impact on environmental

Figure 3: Results of hypothesis testing



sustainability. With the positive coefficient value 0.297 and 0.001 significant value, it indicates that green environment is proved to be a significant factor and can be ignored if organizations needs to maintain environmental sustainability.

4.2.2. The influence of innovation management towards environment sustainability

The findings supports the second hypothesis which states that innovation management has a positive and significant impact on environmental sustainability. With the positive coefficient value 0.315 and 0.001 significant value, it indicates that innovation management is proved to be a significant factor and can be ignored in the presence of environmental sustainability.

4.2.3. The influence of environmental concern towards environment sustainability

The findings supports the third hypothesis which states that environmental concern has a positive and significant impact on environmental sustainability. With the positive coefficient value 0.246 and 0.001 significant value, it indicates that environmental concern is proved to be a significant factor and can be ignored in the presence of environmental sustainability.

#### 4.2.4. The influence of green environment towards organizational awareness

The results indicates that green environment has a positive and significant impact on organizational awareness. The findings also revealed that positive and significant relationship between these two variable as the original value is 0.321 and significant value is less 0.05. Hence the fifth hypothesis also stand correct.

#### 4.2.5. The influence of innovation management towards organizational awareness

The fifth hypothesis states that innovation management is positively correlated with organizational awareness. The findings also revealed that positive and significant relationship between these two variable as the original value is 0.193 and significant value is less 0.05. Hence the fifth hypothesis also stand correct.

#### 4.2.6. The influence of environmental concern towards organizational awareness

The findings supports the hypothesis 6 which states that environmental concern has a positive and significant impact on organizational awareness. With the positive coefficient value 0.175 and 0.01 significant value, it indicates that environmental concern is proved to be a significant factor and can be ignored in the presence of organizational awareness.

#### 4.2.7. The influence of environment sustainability towards organizational awareness

The results indicates that environmental sustainability has a positive and significant impact on organizational awareness. However, the significant is not much stronger as the  $P < 0.001$  with the beta value of 0.293. But the positive relationship indicates that organization need to be concerned and aware of developing a sustainable environment.

## 5. CONCLUSION

The present study proposed five hypotheses which are constructed on the basis of five established constructs; green environment, innovation management, environmental concern, organizational awareness and environmental sustainability. Among five variables three were treated as an independent variable which include green environment, innovation management and environmental concern. Organizational awareness was considered as a dependent variable in the proposed framework. Whereas, environmental sustainability acted as a mediator. The findings of the study conclude that green environment is a significant predictor hence it is suggested to firms to take the variable seriously in order to maintain sustainable environment. Moreover, it also helps in avoiding any factor that could harm the environment by spoiling the environment with the disrupted palm oil mill effluents.

The research aims to determine the basic issue which normally encountered by firm; situated in North Sumatera province, that is involved in palm oil production hence faces difficulty in manage POME waste. In order to culcate the issue, the research considered five variables to determine the main issue and its counter solution.

On the basis of hypotheses, the research recommends following points:

1. The organization need to understand and pay more attention concerning the green environment in order to be able to handle the disrupted POME properly to avoid harming the environment of the surrounding of the palm oil mill.
2. The disrupted POME must be managed innovatively in order to turn them into green resources such as fertilizer that are useful in the plantation.
3. The organization need to have the environment concern so as to understand the disrupted POME and manage to handle them properly.
4. The awareness of the organization concerning the sustainable environment is very important in order to help provide a better green environment to the society.

Like other studies the current study also has some limitation. Firstly, it only handles one of the POME in the palm oil mill. There is other palm oil mill waste that also need to be handle with care in order to avoid the problem that might arise from the surrounding environment. Secondly, The problem of POME is also not only taken place in the province of North Sumatera but also many of the other province in the island of Sumatera, the island of Kalimantan dan the island of Papua.

## REFERENCES

- Ainou, F.Z., Ali, M., Sadiq, M. (2022), Green energy security assessment in Morocco: Green finance as a step toward sustainable energy transition. *Environmental Science and Pollution Research*.
- Aslam, F., Aimin, W., Li, M., Ur Rehman, K. (2020), Innovation in the era of IoT and industry 5.0: Absolute innovation management (AIM) framework. *Information*, 11(2), 124-130.
- Barney, J. B., Wright, P. M. (1998). On becoming a strategic partner: The role of human resources in gaining competitive advantage. *Human Resource Management: Published in Cooperation with the School of Business Administration, The University of Michigan and in alliance with the Society of Human Resources Management*, 37(1), 31-46.
- Bates, B., Kundzewicz, Z., Wu, S. (2008), *Climate Change and Water*. Intergovernmental Panel on Climate Change Secretariat. Available from: <http://www.taccire.sua.ac.tz/handle/123456789/552>
- BPS-Statistics Indonesia. (2018), *Indonesia Palm Oil Statistics*. United Kingdom: BPS Catalogue.
- Chien, F., Sadiq, M., Nawaz, M.A., Hussain, M.S., Tran, T.D., Le Thanh, T. (2021), A step toward reducing air pollution in top Asian economies: The role of green energy, eco-innovation, and environmental taxes. *Journal of Environmental Management*, 297(1), 113420.
- Cillo, V., Petruzzelli, A.M., Ardito, L., Del Giudice, M. (2019), Understanding sustainable innovation: A systematic literature review. *Corporate Social Responsibility and Environmental Management*, 26(5), 1012-1025.
- Cruz, S.M., Manata, B. (2020), Measurement of environmental concern: A review and analysis. Original research. *Frontiers in Psychology*, 11, 363.
- Del Brío, J.Á., Junquera, B. (2003), A review of the literature on environmental innovation management in SMEs: Implications for public policies. *Technovation*, 23(12), 939-948.
- Dyck, B., Silvestre, B.S. (2018), Enhancing socio-ecological value creation through sustainable innovation 2.0: Moving away from maximizing financial value capture. *Journal of Cleaner Production*, 171, 1593-1604.

- Fauzianto, R. (2014), Implementation of bioenergy from palm oil waste in Indonesia. *Journal of Sustainable Development Studies*, 5(1), 100-115.
- Felix, R., Hinsch, C., Rauschnabel, P.A., Schlegelmilch, B.B. (2018), Religiousness and environmental concern: A multilevel and multi-country analysis of the role of life satisfaction and indulgence. *Journal of Business Research*, 91, 304-312.
- Ferdinand, A. (2014), *Management Research Method. Research Guideline for writing Management Paper, Thesis and Dissertation*. Semarang: Seri Pustaka Kunci.
- Frishammar, J., Richtnér, A., Brattström, A., Magnusson, M., Björk, J. (2019), Opportunities and challenges in the new innovation landscape: Implications for innovation auditing and innovation management. *European Management Journal*, 37(2), 151-164.
- Geels, F.W. (2010), Ontologies, socio-technical transitions (to sustainability), and the multi-level perspective. *Research Policy*, 39(4), 495-510.
- Gibbs, J.L., Sivunen, A., Boyraz, M. (2017), Investigating the impacts of team type and design on virtual team processes. *Human Resource Management Review*, 27(4), 590-603.
- Gonzalez-Lafayesse, L., Lapassouse-Madrid, C. (2016), Facebook and sustainable development: A case study of a French supermarket chain. *International Journal of Retail and Distribution Management*, 44(5), 560-582.
- Hair, J. F., Ringle, C. M., Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing theory and Practice*, 19(2), 139-152.
- Hambali, E., Rivai, M. (2017), The potential of palm oil waste biomass in Indonesia in 2020 and 2030. In IOP Conference Series: Earth and Environmental Science, 65(1), 012050.
- Hamilton, L.C., Hartter, J., Safford, T.G., Stevens, F.R. (2014), Rural environmental concern: Effects of position, partisanship, and place. *Rural Sociology*, 79(2), 257-281.
- Han, H., Hyun, S.S. (2017), Impact of hotel-restaurant image and quality of physical-environment, service, and food on satisfaction and intention. *International Journal of Hospitality Management*, 63, 82-92.
- Han, H., Lee, J.S., Trang, H.L.T., Kim, W. (2018), Water conservation and waste reduction management for increasing guest loyalty and green hotel practices. *International Journal of Hospitality Management*, 75, 58-66.
- Hansla, A., Gamble, A., Juliusson, A., Gärling, T. (2008), The relationships between awareness of consequences, environmental concern, and value orientations. *Journal of Environmental Psychology*, 28(1), 1-9.
- Hapsi, A., Mukhtar, R., Muspawi, M. (2017), Influence of transformational leadership and cultural organization toward chairman innovation of STAI: The college of islamic religion of private in Jambi province. *International Journal of Business and Commerce*, 6(2), 26-38.
- Harwani, Y., Sakinah, A.A. (2019), The influence of brand awareness, packaging design and word of mouth on purchase intention. *Advances in Economics, Business and Management Research*, 120, 245-252.
- Huang, S.Z., Sadiq, M., Chien, F. (2021), Dynamic nexus between transportation, urbanization, economic growth and environmental pollution in ASEAN countries: Does environmental regulations matter? *Environmental Science and Pollution Research*, Environmental Science and Pollution Research, 1-16.
- Huang, S.Z., Sadiq, M., Chien, F. (2021a), The impact of natural resource rent, financial development, and urbanization on carbon emission. *Environmental Science and Pollution Research*.
- Ibnou-Laaroussi, S., Rjoub, H., Wong, W.K. (2020), Sustainability of green tourism among international tourists and its influence on the achievement of green environment: Evidence from North Cyprus. *Sustainability*, 12(14), 5698.
- Iwuagwu, J.R., Ugwuanyi, J.O. (2014), Treatment and valorization of palm oil mill effluent through production of food grade yeast biomass. *Journal of Waste Management*, 2014, 439071.
- Karakaya, E., Hidalgo, A., Nuur, C. (2014), Diffusion of eco-innovations: A review. *Renewable and Sustainable Energy Reviews*, 33, 392-399.
- Khosho, T.N. (2008), *Environmental Concerns and Strategies*. India: APH Publishing.
- Kim, H., Gibbs, J.L., Scott, C.R. (2019), Unpacking organizational awareness: Scale development and empirical examinations in the context of distributed knowledge sharing. *Journal of Applied Communication Research*, 47(1), 47-68.
- Kollmuss, A., Agyeman, J. (2002), Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, 8(3), 239-260.
- Kotler, P., Armstrong, G. (2018), *Principles of Marketing*. 16<sup>th</sup> ed. England: Pearson Education Limited. Available from: <https://www.perlego.com/book/811681/principles-of-marketing-scandinavian-edition-pdf>
- Kotler, P., Keller, K.L. (2016), *Marketing Management*. 15<sup>th</sup> ed. England: Pearson Education Limited. Available from: <https://www.perlego.com/book/811681/principles-of-marketing-scandinavian-edition-pdf>
- Lee, K. (2009), Gender differences in Hong Kong adolescent consumers' green purchasing behavior. *Journal of Consumer Marketing*, 26(2), 87-96.
- Leela, D., Nur, S.M., Yandri, E., Ariati, R. (2018), Performance of Palm Oil Mill Effluent (POME) as Biodiesel Source Based on Different Ponds. Morocco: E3S Web of Conference.
- Leonidou, E., Christofi, M., Vrontis, D., Thrassou, A. (2020), An integrative framework of stakeholder engagement for innovation management and entrepreneurship development. *Journal of Business Research*, 119, 245-258.
- Liew, W.L., Muda, K., Azraai, M. (2017), Agro-industrial waste sustainable management-a potential source of economic benefits to palm oil mills in Malaysia. *Journal of Urban and Environmental Engineering*, 11(1), 108-118.
- Makower, J. (1994). *Beyond the bottom line: Putting social responsibility to work for your business and the world*. New York, Simon & Schuster.
- Nurato, F., Muhamad, M., Lamar, A. (2019), The effect of percentage of oil palm fibre on fatigue age of axial load on resin matrix composites. *Rotasi*, 21(4), 215-223.
- Organisation for Economic Co-operation and Development. (2011). *Towards Green Growth*. Paris: Organisation for Economic Co-operation and Development.
- Osman, N.A., Ujang, F.A., Roslan, A.M., Ibrahim, M.F., Hassan, M.A. (2020), The effect of palm oil mill effluent final discharge on the characteristics of *Pennisetum purpureum*. *Scientific Reports*, 10(1), 1-10.
- Paryanto, I., Ismanto, A., Hariana, M.D.S. (2015), Development of Biodiesel Plant Design Integrated with Palm Oil Mill for Diesel Fuel Substitution in Oil Palm Industry. *KnowledgeE Energy*, 1(1), 83-88.
- Pastré, O., Vigier, M. (2003), *Le Capitalisme Déboussolé: Après Enron et Vivendi: Soixante Réformes Pour un Nouveau Gouvernement D'entreprise*. Paris: La Découverte.
- Ramli, Y., Soelton, M. (2018), Implementing innovation management on market attractiveness and unique resources to enhance business performance on organic fertilizer industries in Indonesia. *Academy of Strategic Management Journal*, 17(2), 1-12.
- Rennings, K., Rammer, C. (2011), The impact of regulation-driven environmental innovation on innovation success and firm performance. *Industry and Innovation*, 18(03), 255-283.
- Sadiq, M., Ngo, T.Q., Pantamee, A.A., Khudoykulov, K., Ngan, T.T., Tan, L.L. (2022), The role of environmental social and governance in achieving sustainable development goals: Evidence from ASEAN

- countries. *Economic Research-Ekonomska Istraživanja*.
- Shuang, G.W., Kamaruzzaman, S.N., Zulkifli, N. (2014), Occupant's Perception on Indoor Performance of Historical Museum: A Case of Study of National Museum and Perak Museum, Malaysia. In 2<sup>nd</sup> International Conference on Research in Science, Engineering and Technology, Dubai (UAE).
- Singh, R.P., Ibrahim, M.H., Esa, N., Iliyana, M.S. (2010), Composting of waste from palm oil mill: a sustainable waste management practice. *Reviews in Environmental Science and Bio/Technology*, 9(4), 331-344.
- Sulaiman, F., Abdullah, N., Gerhauser, H., Shariff, A. (2010), A perspective of oil palm and its wastes. *Journal of Physical Science*, 21(1), 67-77.
- Tidd, J., Bessant, J. (2013), *Managing Innovation: Integrating Technological, Market and Organizational Change*. 5<sup>th</sup> ed. United States: John Wiley & Sons.
- Trang, H.L.T., Lee, J.S., Han, H. (2019), How do green attributes elicit pro-environmental behaviors in guests? The case of green hotels in Vietnam. *Journal of Travel and Tourism Marketing*, 36(1), 14-28.
- United Nations Environment Programme. (2011), *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*. Nairobi, Kenya: UNEP.
- Van den Bosch, M., Sang, A.O. (2017), Urban natural environments as nature-based solutions for improved public health-a systematic review of reviews. *Environmental Research*, 158, 373-384.
- Vujcic, M., Tomicevic-Dubljevic, J., Grbic, M., Lecic-Tosevski, D., Vukovic, O., Toskovic, O. (2017), Nature based solution for improving mental health and well-being in urban areas. *Environmental Research*, 158, 385-392.
- Yuliawati Y, Enjang, I.P. (2018), The analysis of green environment movement campaign in supporting national food security of Indonesia. *Global Journal of Human-Social Science*, 18(2), 29-33.