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Surabaya International Community Services: Climate Resilience through Community Empowerment in Surabaya

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Abstract. Universitas Airlangga is fully committed to participating in achieving the SDGs through carrying out community service-based research that includes multidisciplinary knowledge, both from the realms of science and technology and social humanities. This commitment is realized in the implementation of the Surabaya International Community Service program which aims to provide an understanding of global issues that affect society today regarding climate change and the current environment, introduce green energy technology to the international community and encourage the adoption of green energy as an alternative energy source, as well as building a network of cooperation and collaboration between participants from various countries and to overcome global environmental problems. Universitas Airlangga encourages full efforts in realizing the thirteenth point of the SDGs, namely Handling Climate Change through a series of community-based learning activities, mangrove rehabilitation, and dissemination of solar panels as green energy.

Keyword:

Climate change, green energy, mangrove, SDGs

1. Introduction

The sixth IPCC synthesis report (AR-6) shows that the global climate has experienced significant warming. Observational data reveals that the global average surface temperature in the first two decades of the 21st century (2001-2020) is 0.99°C higher than in between 1850-1900. Increasing the earth's temperature not only has an impact on increasing the temperature of the earth's surface but also changes the climate system which affects various aspects of nature and human life [1].

Due to its geographical location, Indonesia's vulnerability to the negative impacts of climate change deserves serious attention. The threat of climate change in Indonesia can impact health both directly and indirectly, causing various diseases, psychological impacts, displacement, and even death. The danger of climate change in Indonesia in the future is characterized by (1) high risk of flooding in critical areas, (2) a decrease in annual precipitation, and (3) an increase in average surface temperature so that real action is needed by society to be able to adapt to the impacts of climate change [2]. According to the UNFCCC, the process of adaptation is the adjustment of ecological, social, or economic systems in response to actual or future climate forces and their impacts or effects. This refers to changes in processes, practices, and structures to mitigate potential damages associated with climate change [3].

To adapt to climate change and achieve the 13th Sustainable Development Goal (SDGs), namely "Action Against Climate Change", GLACIAL (Global Citizenship Conference of Airlangga) 2023, an international activity initiated by the Faculty of Science and Technology Ambassador Association, presented a sub-event entitled Surabaya International Community Services: Climate Resilience through Community Empowerment. Community development along the coastline could be an attempt to contribute a solution to achieving the 13th SDGs with a focus on implementing green energy and mangrove conservation to increase resilience to climate change.

Green energy plays an important role in efforts to reduce emission levels. Solar panels are green energy that has great potential to be developed in Indonesia. In 2020, the realized use of solar panels reached 0.15 GWp of the total solar energy potential in Indonesia that was accounted to be 207.8 GWp [4]. Solar panels are assessed as having an in-operated emission value or emissions during operation of 0 meaning they do not produce any carbon emissions at all. Using 1000 kWh of electricity from solar panels is equivalent to reducing more than 1400 pounds of CO_2, 8 pounds of sulfur dioxide, and 5 pounds of nitrogen oxide. Using solar panels for 28 years is also predicted to be able to reduce CO_2 by 100 tons [5].

Meanwhile, mangrove ecosystems play an important role in the global carbon cycle. The flow of carbon from the atmosphere to vegetation occurs in two directions, binding CO_2 into biomass through photosynthesis and releasing CO_2 into the atmosphere through the processes of respiration, decomposition, and combustion. The high capacity of mangroves in binding carbon shows their potential in the "Clean Development Mechanism" program [6] with carbon absorption capacities of 553.43 kg-C/ha/day (*Avicennia marina*) and 401.99 kg-C/ha/day (*Rhizophora apiculata*) [7].

Through this activity, it is hoped that it can inspire and encourage the active participation of the international community to play a role in the development and application of innovative green energy technology in Surabaya, Indonesia. The activity was open for volunteers coming from around the world. Therefore, the exchange of knowledge, ideas, and experiences in encouraging positive change in the green energy sector was made possible during Surabaya International Community Services: Climate Resilience through Community Empowerment. Based on the case, this study aims to review how the series of activities included in the program could bring forth assistance with meeting the objective of SDGs number 13: Action Against Climate Change.

2. Universitas Airlangga's Commitment to SDGs

To achieve the Sustainable Development Goals (SDGs), universities have an important role, especially in the realm of research related to the 17 points in the SDGs. Universitas

Airlangga as a higher education institution in Indonesia is committed to dedicating research results to contribute to achieving the SDGs. Universitas Airlangga become facilitator and catalyst for the implementation of SDGs to encourage public involvement and increase stakeholder commitment to participate in implementation, becoming centers of excellence with core competencies and mainstreaming SDGs in the education process. As well as, being a government partner in monitoring and evaluating the implementation of the SDGs and being a facilitator also supervisor of the SDGs Regional Action Plan.

A research is said to be SDGs related when its scope includes keywords that represent each of the SDGs points, such as “sanitation” for Good Health and Well-being (point 3) and “preservation” for Life on Land (point 15). The Meaningful Research and Community Development Program is one of Universitas Airlangga's work program platforms which emphasizes a culture of research, innovation, service, and community development based on scientific culture and social responsibility, as well as interdependence in the fields of health science, natural/life science, social-humanities science, and engineering sciences. The strategic initiatives emphasized are strengthening the meaningfulness of research and community service, especially in supporting the achievement of the SDGs.

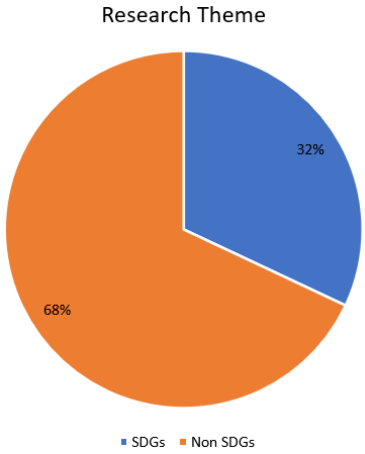

Figure 2.1 Proportion of SDGs Publications 2018-2022

Currently, Universitas Airlangga’s research focus is prioritized on SDGs to support innovation in sustainable scientific development. In the aspect of community service, Universitas Airlangga continues to be committed to increasing hexa-helix collaboration. This aims to expand the university's impact, on a local, national, and global scale. One of the community service activities that has been carried out is providing basic skills training programs for communities on several remote islands, such as how to create animal feed banks and disseminating information on livestock development that is effective and has high economic value.

Universitas Airlangga’s research and publications are expected be a solution to national and global problems, one of which is by referring to the SDGs issue. Publication has the potential to be a solution to a problem since it raises awareness between those who are being exposed to publication products, such as articles, posters, and videos [8]. Universitas Airlangga's SDGs publications vary from goals one to seventeen. Universitas Airlangga has made many contributions, especially to the third SDGs point, namely: good health and well-being, but is also moving to have an impact on other SDGs themes.

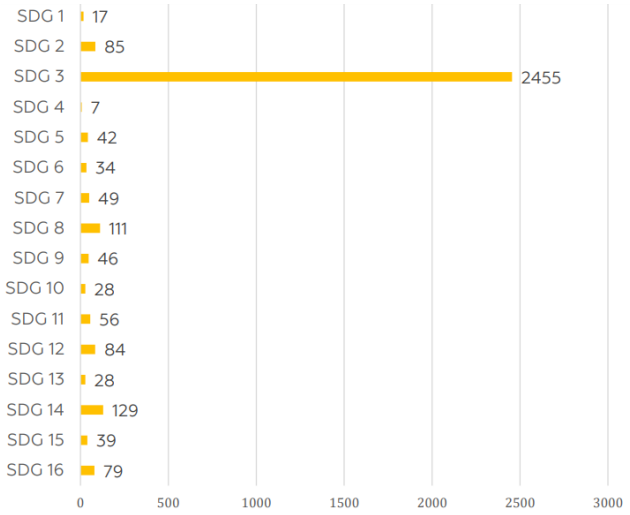

Figure 2.2 Number of Publications on Each SDGs Topic

3. Implementation

3.1 Community-based learning

Community-based learning programs were held with the aim that students could learn directly from local communities about strategies for dealing with the impacts of climate change that are occurring. The concept of community-based learning is learning based on experience where students and lecturers collaborate with the community to overcome problems. Simultaneously both gain knowledge, skills and advance personal development. There is a similar emphasis on helping the community and providing valid learning experiences to students. This activity was carried out in Jambangan Village as one of the pilot villages for the Climate Village Program (Proklim).

The Climate Village Program (Proklim) is a program to support climate change adaptation and mitigation efforts at the community level. The Climate Village Program is a strategic step by the government in grounding the global issue of climate change into joint action starting from the site level, where climate mitigation actions through waste management activities will continue to be developed by maximizing existing potential so that it can provide wider benefits to the community through circular economy. Jambangan Village, through the Climate Village Program (Proklim), developed an eco-print batik technique using organic leaf waste which can reduce water, soil, and air pollution when compared to the use of textile dyes. The aim of using this technique is to reduce organic leaf waste which can also increase the income of the elderly who do not have a fixed income. Plant parts that can be used include leaves, flowers, stems, or seeds. This part of the plant then becomes a batik motif which is strung on various types of fabric [9]. Products that can be produced from the eco-print technique are batik which can be processed into clothing models, headscarves, mukenas, shirts, bags, and wallets that have high economic value [10]. Apart from the economic and environmental aspects, this program provides benefits in the form of increasing interaction and intensity of meetings between residents, thereby increasing social cohesion.

Jambangan Village is proof of the success of the Surabaya City government in inviting its residents to increase environmental awareness through a bottom-up approach. Students can learn directly from the community about how to adapt to climate change that is currently occurring. Community based learning appears to be significant to student's academic

capability and problem solving skill [11], becoming relatable to one of the most critical environmental issues.

Figure 3.1 Community-based learning in Jambangan Village

3.2 Mangrove conservation and protection

The mangrove ecosystem is a typical type of ecosystem found along beaches or river estuaries which are influenced by sea tides. Mangrove forests are often found in coastal areas that are protected from the onslaught of waves and sloping areas [12]. Preserving the mangrove ecosystem is a very complex effort to carry out, because this activity really requires an accommodative nature towards all elements around the area and outside the area [13]. The rate of mangrove degradation is not commensurate with the rate of rehabilitation. It is recorded that the rate of mangrove degradation reaches 160.000-200.000 ha/year, the majority of which is caused by development activities and land conversion for ponds and agriculture [14], even though mangrove forests are able to absorb 3-5 times more carbon than terrestrial forests.

Community-based mangrove management is one strategy that can be used in mangrove conservation efforts. The community is actively involved in the rehabilitation, conservation, and protection of the mangrove ecosystem around where residents live. Universitas Airlangga, through the GLACIAL program, strengthens its commitment to rehabilitation efforts in mangrove areas by handing over 100 mangrove seedlings of the *Rizhopora mucronata* and *Avicienna marina* to residents in the eastern coastal area of Surabaya. *Rhizipora mucronata* and *Avicienna marina* are species that easily adapt to their natural habitat, so these plants contain many phytochemical compounds that have pharmacological, ecological, and toxicological properties [15]. Even the phytochemical compounds in these plants can be used as antibacterial compounds [16].

Figure 3.2 Handover of Mangrove Seeds and Visit to the Mangrove Processed Products Gallery

Universitas Airlangga in collaboration with the Surabaya Mangrove Botanical Gardens introduced students to various types of mangroves along with the protection efforts that have been made to support the protection of the mangrove ecosystem. Surabaya Mangrove Botanical Garden is prominent in Indonesia for the largest collection of mangroves with a total of 57 species out of 157 species throughout the world. The high value of this collection provides an opportunity for students to learn more about mangrove biodiversity and its role in climate mitigation efforts. Apart from that, students also had the opportunity to visit the gallery of processed mangrove products which are the result of local community innovation in managing mangroves into products that have economic value. It is shown that community-based system dynamics present a promising approach for shared language and ownership among stakeholders, leading to the understanding of local community contexts [17].

3.3 Maximizing solar panel dissemination

The use of green energy is currently starting to attract public and government attention in line with the increasing negative impacts of climate change that are currently being felt. Solar panels as an alternative energy source solution are considered capable of bridging the gap between increasing energy needs and rising earth surface temperatures due to greenhouse gases caused by the use of fossil fuels. In simple terms, a solar cell consists of a connection of p and n type semiconductor materials (p-n junction semiconductor) which, when hit by sunlight, will cause a flow of electrons. This flow of electrons is what is known as the flow of electric current. The main part that converts sunlight energy into electricity is the absorber, however, each layer also greatly influences the efficiency of the solar cell [18]. Unfortunately, the high potential for using solar panels as a source of green energy cannot be maximized, one of which is due to the lack of knowledge and readiness of society regarding the energy transition from conventional to renewable. The use of alternative energy is still relatively low among the public. This condition is caused because people are not used to using alternative energy and fossil energy is considered more practical to use. Apart from that, the availability of alternative energy sources is considered less sustainable.

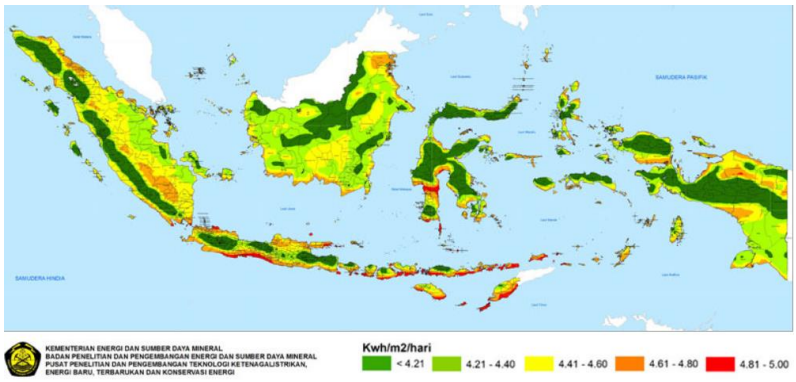

Figure 3.3 Potential Solar Radiation in Indonesia

Based on these problems, Universitas Airlangga through the Faculty of Advanced Technology and Multidiscipline supports efforts to socialize and disseminate information to the public regarding renewable energy sources by handing over solar panels to communities on the east coast of the city of Surabaya. These solar panels can be used by the community as a source of electricity for street lighting around residential areas so that they can save costs for street lighting. By providing electric lighting equipment powered by solar cells as a medium that not only provides education to residents but also encourages community

members to slowly utilize alternative energy. Solar cells operated under tropical climate have a maximum internal rate of return of 22% for the residential sector [19]. Thus, the use of green energy that was advocated by Universitas Airlangga would be able help the local community to thrive in the hopeful attempt to achieve strong climate resilience through real action.

Figure 3.4 Socialization and Hand Over of Solar Panel

4. Conclusion

GLACIAL (Global Citizenship Conference of Airlangga), provided by Universitas Airlangga, was effective to support the achievement of SDGs point 13, Action Against Climate Change, by implementing a series of activities in a community-based learning program. It acted as a forum to share knowledge with local communities regarding adaptation and mitigation efforts to climate change as well as decarbonisation efforts to reduce greenhouse gases through the use of green energy and mangrove rehabilitation.

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