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INTEGRATING EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD) IN HIGHER EDUCATION INSTITUTIONS TO REDUCE THE IMPACT OF CLIMATE CHANGE ON AGRICULTURAL INDUSTRIES

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ABSTRACT

Education for sustainable development (ESD) became a highlighted issue in the educational sector all around the world. The concept is to integrate the social, economic, and environmental aspects to create a more comprehensive solution to maintain planet sustainability. Higher education as an institution that creates agents of change in society must be adapted toward nowadays issues that are related to global development. Agricultural industries became an area that was also impacted by climate change. Higher education is an institution that also undertakes tri dharma that carries on their solution toward this issue. This research aims to explore how to integrate of Education for Sustainable Development in higher education institutions (HEI) to reduce the impact of climate change on agricultural industries. The research uses a systemic literature review related to the topic. This research result is a strategy to integrate Education for Sustainable Development (ESD) in higher education starting by making a commitment, program planning, and integrating into the curriculum to improve the university student's awareness about the impact of climate change on food security and planet sustainability. Higher education can make a broad effect on agricultural mitigation of climate change. This program can be implemented in a higher education institution to make a more relevant learning process that also supports "Merdeka Belajar" curriculum in Indonesia.

Keywords: Agriculture, Climate, Education, Industries.

INTRODUCTION

Climate change has an impact on many areas of human life, including agriculture, health, and infrastructure. Rising temperatures, extreme weather events, and sea level rise can all have an impact on food production, accelerate disease spread, and damage buildings and roads. Weather patterns can also lead to water shortages, which can impact industry, energy production, and overall economic development. Climate change has the potential to exacerbate poverty and

social inequality, especially in developing countries.

The recent climate change has had a significant impact on agriculture. (Huynh H T L Nguyen Thi L and Dinh Hoang N, Jan, 2020). Rising temperatures and shifting precipitation patterns can cause crop failure and yield losses. This can lead to food shortages and higher consumer prices. Demand for food is growing rapidly, but available arable land is limited. This yield-enhancing power has long-term ecological consequences, including biodegradation (Pani A and Mishra P, 2023). Droughts, floods, and storms are all examples of extreme weather events that can harm crops and farm infrastructure. This can have an impact on farmers' livelihoods as well as the agricultural sector as a whole. Another effect of climate change on agriculture is a shift in crop-suitable zones. As the global temperature rises, the zone where certain crops can grow changes, affecting farming practices and potentially leading to the extinction of traditional crops. Crop diversification, irrigation systems, and the use of pesticides are examples of adaptation measures.

Unfortunately, society still has a low concern about climate change issues that impacted human life. Here are some reasons why some people don't worry about climate change. One reason is a lack of understanding of the science behind climate change and its potential impacts. Without a clear understanding of the issue, it can be difficult for people to see the urgency of taking action. Another reason is that the effects of climate change may not be immediately visible or felt in some areas, leading people to believe that it is not a pressing concern. Additionally, some people may not feel that their individual actions can make a significant impact on the problem, leading them to feel discouraged or disengaged. There is also a lack of information and awareness from the government and media (Graminius C, 2022), which can lead to people not knowing the extent of the problem and possible ways to take action. Many people also prioritize other issues, such as economic stability and job security, over climate change. Lastly, some people may have doubts about the human-caused aspect of climate change or the ability of humanity to address it. Climate change deniers or skeptics may question the validity of scientific research or the potential effectiveness of proposed solutions. It is critical for governments, businesses, and individuals to work together to mitigate the effects of climate change on society.

Higher education institutions can play an important role as agents of social change. They can provide you with the knowledge, skills and critical thinking skills you need to tackle complex social and environmental issues such as climate change (Mallow S and van't Land H, 2020). One-way higher education institutions can act as agents of change is by incorporating sustainability and environmental stewardship into their curricula and research. By educating students about the causes and effects of climate change, as well as potential solutions, higher education institutions can prepare future leaders to take action on the issue. Higher education institutions can also act as agents of change by modelling sustainable practices on their own campuses. This can include implementing green building practices, transitioning to renewable energy sources, and promoting sustainable transportation options. By setting an example for their communities, higher education institutions can inspire others to take similar actions. Higher education institutions have research capabilities that can contribute to the understanding of the causes and effects of climate change, as well as solutions to mitigate it. They can also contribute by engaging communities and stakeholders in addressing the issue.

Higher education also can contribute to agriculture industry development including tackling the impact of climate change by educating the student. Higher education can foster lifelong learning skills

(Ortega-Dela Cruz R, 2020). The purpose of this study is to describe the integration of Education for Sustainable Development (ESD) in higher education institutions to reduce the impact of climate change on agribusiness.

RESEARCH METHODS

A systematic literature search is a systematic and comprehensive approach to identifying, evaluating and synthesizing all relevant findings on a given topic. It is a transparent and structured process of research, selection and critical evaluation of relevant research. This process helps minimize bias and increase the overall quality and reliability of the literature review. (Senivongse C Bennet A and Mariano S, 2017). The review typically starts with a clearly defined research question and a search strategy that is used to identify relevant studies. The studies are then screened for inclusion and exclusion criteria, and the selected studies are critically appraised for their quality and relevance. The study findings are then synthesized and analyzed to provide a comprehensive picture of the current state of knowledge namely how to integrate education for sustainable development in higher education related to reducing the impact of climate change on the agricultural industry. Systematic literature reviews are widely used in the medical and social sciences but can be applied to any field where there is a need to critically evaluate existing research. They are often used as a basis for developing new research questions, hypotheses, and theories.

RESULTS AND DISCUSSION

Higher education can play a key role in reducing the impact of climate change on society by educating students about the causes and impacts of climate change and training them in sustainable practices and technologies. This can include offering courses and degree programs in fields such as renewable energy, sustainable agriculture, and green building design. Universities can also lead by example by implementing sustainable practices on their own campuses, such as using renewable energy sources, promoting sustainable transportation options, and reducing waste and carbon emissions. Additionally, universities can conduct research on developing new technologies and methods to mitigate the effects of climate change and share their findings with the public and policymakers.

Impact of climate change in agricultural industries

Climate change has a significant impact on agriculture industries, affecting food production and farmers' livelihoods. Climate change is an absolute thing that cannot be avoided. This change refers to global warming which ultimately has a broad impact on aspects of life, including the agricultural sector (Sudarma I M and As-syakur Abd R, 2018). The changing temperature and precipitation patterns caused by climate change can lead to crop failures and reduced yields, resulting in food shortages and higher prices for consumers. Extreme weather such as droughts, floods and storms can also damage crops and agricultural infrastructure. Climate change is having a negative impact on productivity (Bai D Ye L Yang Z and Wang G, 2022). Climate change in question includes wind speed and temperature.

Climate change impacts agriculture and one of the most significant is the change in zones suitable for certain crops. As the global temperature rises, the zones where certain crops can grow will change, affecting farming practices and leading to the loss of traditional crops. The intensity of sunlight is important in agriculture, especially during the harvest and post-harvest management processes. In tobacco cultivation, the post-harvest processing includes ripening, chopping and drying, so the weather factor is very important because it affects the quality of the tobacco produced and also determines the selling price (Annisa Putri dan Suryanto F, 2012). This could lead to food insecurity and an

increase in the import and export of crops, which can affect the national economy.

Another impact is the change in the timing of crop growth, this can cause a mismatch between the growth of plants and the timing of pollination and harvesting, leading to reduced yields. The rise in temperature and increased frequency of heat waves can also affect the quality of the crops and their nutritional value. In line with this, (Sumastuti E and Pradono N S, 2016) through their research provided information that due to climate change due to global warming, there is an unequal period of time for the rainy and dry seasons. This condition affects the production of certain crops, one of which is rice, which really needs water under certain conditions.

Climate change can also affect the spread of pests and diseases, which can lead to crop failures and increased use of pesticides. This can have negative effects on the environment and human health. The impact of climate change can also be seen in the changes in water availability and soil quality. Rising temperatures and changing precipitation patterns can lead to water shortages, which can affect irrigation and lead to dryland farming. The increase in heavy rainfall and flooding can also lead to soil erosion and loss of fertile land. Certain plant genotypes, such as wheat, will become dominant in spring, whereas winter genotypes will only survive in areas with clearly defined temperature and vernalization in warmer climates in the future (Li Liu D Timbal B Mo J and Fairweather H, 2011).

Adaptation measures such as crop diversification, irrigation systems, and the use of drought-resistant seeds can help farmers adapt to the changing climate. Furthermore, reducing greenhouse gas emissions will help mitigate the long-term impacts of climate change on agriculture. Government policies, advisory services and research institutions can play an important role in helping and informing farmers to adapt to climate change.

Overall, the impacts of climate change on agriculture are complex and multifaceted, and it is important for farmers and agribusinesses to adapt to climate change and take action to reduce greenhouse gas emissions to mitigate impacts.

Education for sustainable development (ESD) in higher education

Teaching, research and systems in tertiary institutions should refer to competition and the principles of Education for Sustainable Development (ESD) in tertiary education. The concept includes courses and programs provided by tertiary institutions which of course focus on environmental, social and economic preservation, as well as initiatives to reduce the institution's own ecological footprint. By providing students with the knowledge and skills to understand and address the interconnected challenges of sustainable development, ESD in higher education can help to prepare the next generation of leaders and decision-makers for a more sustainable future. Additionally, it also helps institutions to be more sustainable in its operations and contribute to the development of a more sustainable society. ESD in higher education can help to foster critical thinking, creativity, and collaboration, which are key competencies for tackling complex global issues such as climate change, poverty, and inequality.

Higher education institutions play a critical role in promoting education for sustainable development (ESD) by preparing students to become responsible and informed citizens who can contribute to creating a sustainable future. ESD aims to develop the knowledge, skills, values and attitudes necessary for individuals to live in harmony with their natural environment and to meet the needs of present and future generations (Novo-Corti I Badea L Tirca D M and Aceleanu M I, 2018). Concretely, education is emerging as a key pillar in the process of sustainable development. This is consciously pursued because education enables people to understand and learn how to act in a more environmentally responsible way.

Higher education institutions can commit to ESD by incorporating sustainability principles into their curriculum and research activities. The educational module's curriculum design effectively integrates the cognitive, emotional, and psychomotor domains of the Bloom taxonomy, thus providing a holistic learning experience (Cassar C, 2022). This can include offering courses and programs that focus on sustainable development topics, such as environmental science, renewable energy, and sustainable business practices. Additionally, they can integrate sustainability into the broader curriculum by incorporating it as a cross-cutting theme in all courses. This concept promises that sustainable development courses effectively achieve their objectives, in particular to raise awareness and understanding of sustainable issues, thereby providing a qualitatively different experience (Wehrmeyer W and Chenoweth J, 2006).

Sustainability has made its way into higher education, but few universities have been successful in introducing sustainability holistically and integrating all the dimensions of the triple bottom line in a balanced way (Menon S and Suresh M, 2020). However, higher education institutions must still be committed to ESD by promoting sustainable practices on campus. This can include implementing green building practices, promoting sustainable transportation options, and implementing environmentally friendly operations and maintenance procedures. Additionally, they can engage students, staff and faculty in sustainability initiatives and provide opportunities for community outreach and engagement.

Furthermore, Higher Education institutions can also promote ESD through research activities by supporting and encouraging research on sustainable development issues and by providing opportunities for students to engage in sustainable development research projects, because in general students recognize and understand the main factors of sustainable development and support an integral approach to sustainability (Nikolic V Vukic T Maletaski T and Andevski M, 2020). Overall, higher education institutions have a unique opportunity to play a leading role in promoting ESD by providing a holistic education that prepares students to be responsible and informed citizens who can contribute to creating a sustainable future.

Step to integrate education for sustainable development in higher education

State a commitment in a policy.

A university's commitment to implementing education for sustainable development is an important first step in reducing the impact of climate change on society. This commitment can take various forms, such as incorporating sustainable development into the university's mission and vision, providing professional development opportunities for faculty, and dedicating resources to support sustainable education initiatives. With this commitment, universities can then begin to integrate sustainable development principles into their curriculum, engage students in sustainability-related research and service-learning opportunities, and promote sustainable practices on campus. Government engagement also requires sustained leadership that can transform society by refocusing education systems that help people acquire knowledge, skills, values and behaviors (Mohr S and Purcell H, 2020). This holistic approach to education for sustainable development can help to empower the next generation of leaders to address the complex challenges of climate change and create a more sustainable future. There are a lot of calls to engage sustainability in higher education. Strong calls or offers take a crucial role in moving toward sustainable development in higher education (Kohl K *et al.*, 2022).

Plan a university program.

Higher education planning programs to integrate education for sustainable

development (ESD) must of course have a holistic approach that addresses the curriculum and institutional operations. Here are some of the key components that could be included in the program:

1. Curriculum development: Developing and integrating ESD-related courses and programs into the curriculum across all disciplines. This can include courses and programs focusing on sustainable development topics, such as environmental science, renewable energy, and sustainable business practices. This is in line with thinking that the most important components in Education for Sustainable Development are the environment, society and the economy which are placed relevant to learning and curriculum (Lee S W Ma S C W and Lee N, 2016).
2. Campus operations: Implementing sustainable practices in the operations of the institution, such as green building practices, promoting sustainable transportation options, and implementing environmentally friendly operations and maintenance procedures. In essence, activities like these are hurdles often faced by higher education institutions, but still need to be achieved in order to develop better campuses. In this way, universities can develop or articulate policies, strategies and practices that promote sustainability on campus (Menon S and Suresh M, 2020).
3. Community engagement: Encouraging outreach and engagement by providing opportunities for students, staff and faculty to participate in sustainability initiatives and community projects. Community involvement, which is a major part of Indonesian university programs, can be an example of community involvement in action (Santosa D, 2020).
4. Research and innovation: Promoting and fostering research related to sustainable development matters and creating avenues for students to participate in sustainable development research initiatives is a crucial aspect of advancing sustainable development. Research plays a vital role in Education for Sustainable Development, as it enables us to anticipate future challenges and develop effective and efficient solutions. One potential approach for incorporating sustainability into the education of future managers and promoting interdisciplinary thinking is by utilizing the "T-Shaped" professional model, which adopts a systems-based approach (Saviano M Barile S Spohrer J C and Caputo F, 2017).
5. Professional development: Providing professional development opportunities for faculty and staff to deepen their knowledge and skills in ESD. ESD is seen as a significant force for change in society, through the provision of education. Therefore, ESD offers future professionals and leaders in all sectors. In the context of higher education, ESD plays an effective role in teaching and training practices for HR through special modules or courses on training (Mulà I *et al.*, 2017)
6. Assessment and evaluation: It is important to conduct regular assessments and evaluations of the ESD program's effectiveness and make necessary adjustments. This process also serves as an audit tool for curriculum development. As such, the ESD program should have an evaluation formula, including self-evaluation, which is an appropriate means of auditing the integration of ESD in academic programs. Therefore, Education for Sustainable Development plays a dual role as both a program and an auditing tool, emphasizing the importance of ongoing evaluation and improvement to ensure the effective integration of sustainable development principles into academic curricula. (Newman-Ford L Leslie S and Tangney S, 2020)
7. Leadership and governance: Establishing a leadership and

governance structure that fosters the integration of ESD throughout the institution is crucial. The structure should be supportive, functional, and cohesive, extending across disciplines, sectors, and organizations to facilitate seamless implementation of sustainable development initiatives. Collaboration and partnership among higher education institutions are essential to promote sustainable development and ensure successful integration of ESD principles. Therefore, it is essential to develop effective leadership and governance structures that support sustainable development efforts across institutions. (Sengupta E Blessinger P and Yamin T S, 2020)

Overall, the program should be designed with a comprehensive, long-term approach and involve active participation from all members of the institution's community, including students, staff, and faculty. Merdeka Belajar is a program of the Indonesian government that aims to provide independent and quality educational opportunities for all Indonesian citizens. This program is also focused on environmental education and sustainable development with the aim of increasing environmental awareness and improving the quality of life in the community. This program is also relevant to the aims of Education for Sustainable Development (ESD) which is to improve awareness of environmental, economic, and social issues.

CONCLUSION

Integrating Education for Sustainable Development (ESD) in higher education is a necessity to help society tackle the climate change impact including in agriculture industries. Climate change might make a significant impact on agriculture industries. Higher education can integrate ESD to reduce the impact of climate change in agriculture industries. The first step to integrating ESD is the state institutional commitment that higher education will be moving to create a new culture that will be more sustainable in all aspects of its operations. Then, higher education institutions must plan programs to reach their commitment. These programs can be 1) curriculum development; 2) campus operation; 3) community engagement; 4) research and innovation; 5) professional development; 6) assessment and evaluation; and 7) leadership and governance. This program also can be implemented in Indonesia because this program also supports the "Merdeka Belajar" spirit.

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