

INTEGRATION OF CARBON TRADING AND INDIGENOUS PEOPLES' KNOWLEDGE FOR FOOD SECURITY AND SUSTAINABLE DEVELOPMENT IN CENTRAL KALIMANTAN

Wahyu Akbar

State Islamic Institute of Palangka Raya, Indonesia

Email: wahyu.akbar@iain-palangkaraya.ac.id

Rahmad Fahreza Setiawan

State Islamic Institute of Palangka Raya, Indonesia

Ma Tin Cho Mar

Malaysia University of Science & Technology, Malaysia

Email: chomar@must.edu.my

Mirawati

Universiti Pendidikan Sultan Idris, Malaysia

Email: p20231001221@siswa.upsi.edu.my

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Corresponding Author:

wahyu.akbar@iain-palangkaraya.ac.id

Abstract

This paper investigates the integration of carbon trading with the indigenous knowledge of the Dayak community in Central Kalimantan as a strategy to enhance food security and bridge development disparities. Given the severe environmental and health risks posed by high carbon dioxide (CO₂) emissions, mainly from industrial activities, this topic is crucial for balancing economic growth with ecological sustainability in a region facing significant climate change and economic inequality challenges. The research employs a descriptive-qualitative approach, using an extensive literature review to explore the synergy between carbon trading mechanisms and traditional forest management practices. The study analyzes data on carbon trading, indigenous practices, and their combined impact on environmental conservation and community welfare in Central Kalimantan. The study finds that integrating carbon trading with the Dayak community's indigenous forest management practices can significantly reduce greenhouse gas emissions, preserve biodiversity, and enhance the economic well-being of local populations. This integration aligns with Islamic financial principles, emphasizing the balanced and sustainable use of natural resources. The findings suggest that this model can effectively improve food security, reduce development disparities, and support inclusive and sustainable development in Central Kalimantan. The insights gained from this study provide valuable guidance for policymakers addressing environmental and socio-economic challenges in regions vulnerable to climate change.

INTRODUCTION

Today, there has been a lot of news, and news has been heard that nature and the environment we live in today have suffered much damage due to many factors. One of them is artificial. Reported via Antara (Antara, 2023), According to NDMA or the National Disaster Management Authority, there were 1,862 disasters from January to July 2023 caused by humans (human-made). This happens due to several activities, such as illegal logging, industrial activities, and land use change. The global temperature increase is caused by carbon release due to human economic activities. These carbon emissions will impact temperatures worldwide over a long period and with uneven geographic variation (Cruz & Rossi-Hansberg, 2021). Global climate change is an environmental problem now a significant challenge that needs to be addressed urgently. As reported through The Conversation page (Forster, 2023), Greenhouse gas emissions on our planet are now at an all-time peak, with an annual amount of 54 billion tons of CO₂ equivalent. This is driven by the development of human civilization, which caused an increase in the earth's surface temperature to reach 1.14 degrees Celsius at the end of the 19th century, which is a rapid increase of 0.2 degrees Celsius every decade. As carbon emissions increase, global temperatures also rise. In addition to health problems, global warming can cause disasters such as floods, droughts, and fires that ultimately impact agriculture, ecosystems, and infrastructure. Global warming is also affecting melting ice in the Arctic, threatening the lives and habitats of many species.

Global environmental problems began to emerge along with the development of industrial and technological activities. According to Rypdal in the IPCC National Greenhouse Gas Inventory Guidelines, carbon dioxide (CO₂) emissions are one type of greenhouse gas emissions that cause global warming. Global warming is closely related to human activities.

According to the Intergovernmental Panel on Climate Change (IPCC), several sectors significantly impact global warming, including energy use, industrial processes, land use and forestry, and waste. In particular, industrial activities such as the production of cement, iron and steel, paper, petrochemicals, ceramics, and the use of carbonate materials in the production process are significant contributors to CO₂ emissions (Y. M. Pratama, 2021). As noted on the data page Indonesia. id (8 Kota dengan Tingkat Polusi Tertinggi di Dunia, 15 Agustus 2023, 2023), Carbon emissions exacerbate air pollution. Jakarta, one of the cities in Indonesia, ranks as the fourth most polluted city in the world. Air pollution that causes a decrease in air quality is closely related to the number of people with respiratory diseases, both toddlers and adults. The World Health Organization (WHO) states that about 3.8 million premature deaths occur due to air pollution. The causes of death were pneumonia as much as 27%, stroke as much as 18%, chronic obstructive pulmonary disease as much as 20%, ischemic heart disease as 27%, and lung cancer as much as 8%. (Sudaryanto et al., 2022). Some hydrocarbon components in vehicle exhaust, such as polycyclic aromatic hydrocarbons (PAHs) in diesel particulates, are known to cause cancer. Carbon emissions can also affect your blood's ability to carry oxygen, thus worsening heart disease (Strategi et al., 2021).

Energy consumption and industrial activities have a significant impact on generating carbon emissions and causing global warming. In 2022, it is estimated that human activities will produce CO₂ emissions of 40.6 billion tons, while the earth's sequestration capacity will only bear as much as 380 billion tons of CO₂ in the next few years. This amount of annual emissions in 2022 seriously threatens global climate stability. If emissions trends do not change, there is a 50% chance that average global temperatures will increase by 1.5°C within nine years (Jozwiak, 2022).

In Indonesia, especially in Central Kalimantan, climate change contributes to forest degradation, soil degradation, and increased risk of natural disasters. One of the mechanisms introduced to address the impacts of climate change is carbon trading, which aims to reduce greenhouse gas emissions through carbon credit allocation and trading systems. (Samasta, 2023, hal. 1) However, the effectiveness of carbon trading is often hampered by mismatches between global policies and local needs and conditions. Indigenous peoples in Central Kalimantan have a rich and diverse traditional knowledge system related to natural resource management. (Farina et al., 2024, hal. 9381) This knowledge includes conservation techniques, biodiversity maintenance, and sustainable agricultural practices that have stood the test of time. These practices are not only beneficial for maintaining the balance of the ecosystem but also contribute to local food security. The integration of indigenous knowledge in natural resource management can be an important bridge to align carbon trading policies with local needs and maintain environmental sustainability. Food security is one of the important aspects of sustainable development (Hapsoro & Bangun, 2020, hal. 93), especially in areas that depend on agriculture and forest management. Central Kalimantan, as an area with high biodiversity and abundant natural resources (Simanjuntak et al., 2024, hal. 156), facing major challenges in maintaining food security amid environmental and social pressures. Sustainable development requires an approach that integrates various aspects, including natural resource management, environmental protection, and community welfare.

The integration of carbon trading with indigenous peoples' knowledge offers significant synergy potential in addressing these challenges. By combining market mechanisms governed by carbon trading with local strategies based on indigenous knowledge, there is an opportunity to create more adaptive and

sustainable solutions. However, this integrative implementation requires a deep understanding of local dynamics and how global policies can be adapted to support the needs of local communities. This article aims to explore how the integration of carbon trading with indigenous peoples' knowledge can affect food security and sustainable development in Central Kalimantan. By analyzing the potential synergies, challenges, and impacts of this integrative approach, this study hopes to provide insights and recommendations for more effective policies and practices in achieving the sustainable development goals in the region.

LITERATURE REVIEWS

Carbon trading is a market system that uses a mechanism for negotiating and exchanging rights for greenhouse gas emissions. The Kyoto Protocol regulates this market mechanism, which can take place both at the national and international level, as long as the rights of negotiation and exchange are allocated fairly to all market participants. The ability to accurately calculate the amount of carbon stored is required to assess the value of forest land in terms of carbon storage potential. Using the latest technology, such as satellite imagery and computer modeling, can facilitate calculating carbon stocks quickly and accurately (Purnobasuki, 2012). Carbon trading involves buying and selling carbon credit certificates instead of carbon or gas. In this context, traded goods are efforts to control or reduce carbon emissions, represented in carbon credit certificates (Tampubolon, 2022).

Carbon trading plays a significant role in reducing carbon emissions in Indonesia. Using carbon trading mechanisms, Indonesian businesses can help reduce carbon emissions by selling carbon credits to other companies. This encourages businesses to adopt eco-friendly practices and improve energy efficiency, reducing emissions nationwide. Carbon trading in Indonesia has several advantages. For

example, it can help Indonesia achieve its Paris Agreement carbon emissions targets on climate change. Using carbon credit trading, countries or companies that produce carbon emissions can purchase carbon credits from other countries or companies that have successfully reduced their carbon emissions. Conversely, governments or companies that have successfully reduced their carbon emissions can sell their carbon credits to other countries or companies that still need to reduce their carbon emissions. This can help reduce overall carbon emissions (Cadizza, 2024). Carbon trading is the trading of carbon credit certificates. The goods being traded are carbon credit certificates, indicating that efforts have been made to reduce CO₂ emissions in the air through activities and projects related to reducing greenhouse gas emissions. So, carbon pollutants in the air are not sold in this buying and selling activity (Azizi MJ et al., 2023). Carbon trading has conditions like general trading, including sellers, buyers, prices, goods, and agreements. As mentioned earlier, the object traded is a certificate of reduction in greenhouse gas (GHG) emissions with a size of tons of CO₂. Carbon trading trades six types of greenhouse gases listed in the Kyoto Protocol. In carbon markets, carbon credits are products of reduced carbon dioxide (CO₂) emissions, which have been certified and meet applicable requirements and requirements. Typically, one ton of carbon dioxide (CO₂) is converted into one unit of carbon credit (Husen, 2018). Each unit that produces specific carbon emissions will have a quota. If the carbon emissions produced exceed the given quota, the unit can buy quotas or credits from other units with quota allotments.

At that time, Dr. Siti Nurbaya, Minister of Environment and Forestry, represented the President of the Republic of Indonesia when signing the Paris Agreement. After the Paris Agreement, the Indonesian government issued Law Number 16 of 2016. The Paris Agreement stipulates that Indonesia will reduce greenhouse gas (GHG) emissions by 29% by 2030,

compared to 2010 by its efforts and means, and with the help of other countries, will reduce GHG emissions by 41%. The Government of Indonesia expresses this commitment through nationally determined contributions through Nationally Determined Contributions (NDCs) (Barus & Wijaya, 2022). This agreement shows that the Indonesian government will actively participate in reducing greenhouse gas emissions.

This carbon trading system fulfills the Paris Agreement and the Indonesian government's efforts to address environmental issues. By reducing carbon emissions, the sustainability of living things and the environment will be better, and the effect of greenhouse gases can be reduced.

Dayak Ngaju Tribe

Central Kalimantan is a province in Indonesia located on the island of Kalimantan. Its capital city is Palangkaraya City. Central Kalimantan spans 153,564.60 square kilometers. The province has 2,202,599 residents, 1,147,878 men and 1,054,721 women, according to the 2010 census. The population of this province climbed to 2,660,209 in 2018, with 1,391,078 males and 1,269,131 females, according to Central Kalimantan BPS data from 2019. There are thirteen regencies and one city in Central Kalimantan (Central Borneo Guide, 2024).

On the island of Kalimantan alone, there are approximately 405 sub-tribes or ethnicities. Even with hundreds of them, these sub-tribes still have some characteristics and similarities both culturally and in others (Itsnaini, 2021). With a very extensive distribution, the Ngaju tribe is the largest sub-ethnic group of the Dayak tribe in Central Kalimantan. They are dispersed across many districts in the Central Kalimantan region, with the majority of them concentrated in Palangka Raya City, Pulang Pisau Regency, Gunung Mas Regency, and Kapuas Regency.

There is great diversity in the Dayak Ngaju people's culture and customs. Unfortunately, because the Dayak Ngaju tribe's customs and

culture are primarily passed down orally, very little information about them is publicly available. The sub-tribe is made up of 53 Dayak Ngaju tribe offspring, 8 Ma'anyan tribe offspring, 21 Lawangan tribe offspring, and 24 1979 Dusun Riwut offspring, despite the Dayak Ngaju tribe being the largest parent tribe of the four other tribes residing in the Kapuas watershed. The language used in Dayak Ngaju culture is both spoken and nonverbal. The Dayak tribe's oral traditions and artifacts, as well as transmitted and uncommunicated cultures, make up their local wisdom. The Dayak Ngaju group possesses a plethora of non-oral folklore in addition to oral folklore, some of which is oral in nature. One of the artifacts that the Dayak Ngaju community in Central Kalimantan owns is this non-oral folklore. The Dayak Ngaju group typically owns things with magical values and cultural emblems (Lastaria et al., 2022).

Food Security

According to Government Regulation of the Republic of Indonesia Number 17 of 2015 Food Security and Nutrition is the condition of meeting the needs of Food and Nutrition for the country to individuals, which is reflected in the availability of sufficient Food, both quantity and quality, safe, diverse, meets nutritional adequacy, is equitable and affordable and does not conflict with religion, beliefs, and culture of the community. to realize a good nutritional status so that they can live healthy, active, and productive lives sustainably.(Pemerintah Republik Indonesia, 2015)

Food is the most important need for every human being to be consumed every day to be able to live a healthy, active, and productive life sustainably, so food security is needed. Based on Law No. 18/2012 on Food, it is explained that Food Security is a condition for the fulfillment of food for the state to individuals reflected in the availability of sufficient food, both in quantity and quality, safe, diverse, nutritious, equitable and affordable and not contrary to the

religion, beliefs, and culture of the community.(Aidore et al., 2020)

Food security is an important and strategic thing, experience in the country shows that no country can carry out development well before being able to realize food security first.(Chaireni et al., 2020) Based on these definitions, it can be concluded that the food security of a country plays an important and vital role for the development of a country. Therefore, between development and resilience will be a very related reciprocity so that when food security is achieved, the development of a country will also be good and vice versa.

Sharia Economic

Islamic Shari'a, or the laws of Allah, is the foundation of the Islamic economic system. This system employs techniques that are inextricably linked to Islamic law and is based on Allah, who is also its ultimate objective. Man's economic acts, whether they are related to investing, saving, selling, or borrowing, must align with God's precepts. Islamic doctrine holds that all wealth belongs to Allah and that man is the caliph over that wealth. Furthermore, the Islamic faith forbids behaviors like Maishir, Gharar, Haram, Dzalim, Ikhtikar, and Riba. (Ansori, 2016).

Islamic economic theory is a branch of social science that examines the ways in which Islamic principles impact societal economic dynamics. The main concerns of Islamic and modern economics are same. Its features and volume actually differ from one another. Therefore, examining how the choice problem is treated can reveal the primary distinction between the two schools of economic science. (Bakar, 2020). Islamic economic concepts are based on tawhid, the Islamic belief in the unity of God, which underpins other principles such as zakat, the duty to donate a portion of wealth to those in need. Islamic economics also prohibits interest (riba), gambling (maysir), and speculation (gharar). Its primary objective is to ensure fair wealth distribution and build a just,

equitable society. In this framework, the market is a tool rather than an end, with the government responsible for ensuring adherence to Sharia law and providing a safety net for those in need. (Prakoso, 2023).

RESEARCH METHODS

This study uses a qualitative descriptive research approach. Qualitative Descriptive Research is research that is used to produce valuable outputs and results. This research uses the type of literature research or literature study. The sources used are secondary sources that make books and research journal articles related to carbon trading, food security, Dayak culture, and sustainable economy. The discussion of this research uses a qualitative approach that is studied holistically.

This study aims to explore the integration of carbon trading with indigenous peoples' knowledge that can affect food security and sustainable development in Central Kalimantan. The reason is, it is very bad and the magnitude of the greenhouse effect has an impact on global warming, the main trigger for carbon dioxide (CO₂) emissions, which is the remnant of several industrial activities. Therefore, this study discusses this integration in overcoming this in accordance with the principles of Islamic finance, which emphasizes the balanced and sustainable use of natural resources.

Researchers use documentation to search for and collect elements or variables related to the research, including journal articles, books, and several articles on the internet related to the problem being researched. The researcher established the basis of this research by collecting data from various sources, which was carried out gradually or from one aspect to the next. This study uses a qualitative descriptive data analysis method. This data was obtained from a literature study of Islamic economic perspectives on carbon trading which will provide a detailed overview of this research.

RESULTS AND DISCUSSIONS

Local Culture of the Dayak Tribe

Culture is a mechanism derived from hereditary behavior patterns in the social sphere. This pattern will work interconnectedly between the human community and its ecological environment. This "group way of life" also includes technology and the form of some community or economic organization, fixed patterns, social groupings, political organizations, religious practices and beliefs, and other forms. Suppose culture is widely seen as a system of behavior peculiar to a population, a connector, and harmonizer of human physical conditions. In that case, the view of culture as pattern-of or pattern-for is the second problem. Culture comes from patterns of behavior tied to specific groups, such as customs or how humans live (A. Pratama, 2013). One of Indonesia's provinces on the island of Kalimantan is Central Kalimantan. Palangkaraya City is its capital. The area of Central Kalimantan is 153,564.60 km². According to the 2010 census, the province has 2,202,599 inhabitants, with 1,147,878 males and 1,054,721 females. According to Central Kalimantan BPS data in 2019, the population of this province increased to 2,660,209 in 2018, with 1,391,078 males and 1,269,131 females. Central Kalimantan has thirteen regencies and one city (Central Borneo Guide, 2024).

There are approximately 405 sub-tribes or ethnicities on the island of Kalimantan alone. Even with hundreds of them, these sub-tribes still have some characteristics and similarities culturally and in others (Itsnaini, 2021). The Ngaju tribe, the largest sub-ethnic of the Dayak tribe in Central Kalimantan, has a fairly wide distribution. They are mainly concentrated in Palangka Raya City, Pulang Pisau Regency, Gunung Mas Regency, and Kapuas Regency and scattered in other districts throughout the Central Kalimantan region. The culture and customs of the Dayak Ngaju people are very diverse. However, not many cultures of the Dayak Ngaju tribe are publicized because their culture and

customs are only spread by word of mouth. Although the Dayak Ngaju tribe is the largest parent tribe of the four other tribes living in the Kapuas watershed, the sub-tribe consists of 53 children of the Dayak Ngaju tribe, eight children of the Ma'anyan tribe, 21 children of the Lawangan tribe, and 24 children of the 1979 Dusun Riwut. Dayak Ngaju culture consists of spoken and non-verbal language. The local wisdom of the Dayak tribe consists of communicated and uncommunicated cultures, such as oral traditions or relics. The Dayak Ngaju community not only has wealth in the form of oral folklore, some in the form of oral, but also rich in non-oral folklore. This non-oral folklore is part of the items owned by the Dayak Ngaju community as an artistic expression in Central Kalimantan. The types of goods owned by the Dayak Ngaju community generally contain magical values and cultural symbols (Lastaria et al., 2022).

Many verbal and non-verbal symbols are found in the local wisdom of the Dayak community that are interrelated to protect and preserve the environment to realize harmony and balance between nature and humans. These symbols guide action and explain their meaning in Dayak culture, especially the Ngaju Dayak Tribe in Central Kalimantan Province. In the dynamics of forest management in Central Kalimantan, Batang Garing, known as the Tree of Life by the Dayak people, symbolizes the balance between humans and nature. In addition to functioning to meet human needs, forests must also fulfill their rights to maintain the environment and natural resources that will be passed on to the next generation. A message or *peteh* lives in Dayak society: "Ingat peteh Tatu Hiang, petak danum akan kolunen harian andau" meaning remember the message from ancestors, land and water for the next human life. This concept forms the foundation for the sustainable utilization of wealth *alam* (Usop, 2020).

The culture of *handep hapakat*, or cooperation, is a value found in various activities

and local wisdom of the Dayak tribe. One of them is from human activities. They grew crops known as *manugal*, which began by hollowing out the soil with wooden sticks and then sowing plant seeds. The repudiation or people who are *manugal* will cooperate. Man urgently needs nature, created by God, to meet his needs, so human activities also pay attention to preserving nature. A sense of need and bonding is the foundation of good forest management. Because human activities will be disrupted if the forest is damaged (Djungan, 2021). Although some human activities still use the traditional way of clearing land, namely by burning, at this time, the community has begun to make the rest of the land clearing as organic fertilizer without burning as before.

The terms "tajahan" and "pukung himba" are part of local culture in forest management. Tajahan is considered a protected location by the Dayak tribal community, especially those who adhere to the *kaharingan* faith. This place has a small house with small statues that are considered the house of spirits. People believe that these statues are representations of family members or relatives who have died, and their function is to prevent them from disturbing the surviving family. In addition, Himba trawls are jungles that should not be cleared or exploited. This is because the trees are giant and old and have never been damaged by humans, so there is still much wildlife in them (Hujjatusnaini, 2016). It is forbidden to cut trees, hunt, or perform other actions that are considered to violate the *pali* in these two locations, which still seem haunted. This *Pali* is deemed to be able to harm those who violate it. In addition, according to Dayak beliefs, forest guardian spirits (*Gana*) are sent to the himba pukung area for rituals at the time of land clearing. In this situation, it sounds too mystical. However, if reasoning and understanding are carried out, it can be concluded that banning in the area positively impacts forest conservation.

Furthermore, the customary laws of the Ngaju Dayak tribe such as *jipen* and *singer*, are still applied by the people of Central Kalimantan. It is a customary fine imposed on a person who has committed an offense to the environment (nature) or a fellow human being. In 2018, PT Sawit Mandiri Lestari was fined Rp5,000,000,000 for destroying customary forests in Lamandau Regency, Central Kalimantan Province. In addition, perpetrators who use poison to catch fish in the Pangkut Village River in West Kotawaringin Regency are also fined Rp5,000,000. In these cases, the fine may change depending on how much or small the damage is caused by the perpetrator's actions (Setiawan & Lisnawati, 2023). The customary law and customary fines applied show the Dayak people of Central Kalimantan's concern for environmental sustainability.

The Implementation of Carbon Trading in Central Kalimantan Province

With carbon trading, Central Kalimantan Province gets new economic opportunities, which will also impact communities around forests. Well-maintained forests sequester atmospheric carbon, and forest management can yield financial benefits. Carbon trading and industrial and technological advances are crucial to reducing greenhouse gas emissions that damage the Earth's atmosphere. These greenhouse gas emissions cause the world to become hotter and result in a dangerous climate crisis. Indonesia's carbon market is still voluntary (Djaenudin et al., 2016). The same is the case with carbon trading implemented in Central Kalimantan Province.

According to the Paris Agreement in 2015, the Katingan Mentaya project, overseen by PT Rimba Makmur Utama (RMU) in Central Kalimantan, conducts carbon trading through carbon offsets. The Katingan Mentaya project, or KMP, conserves forests processed through carbon service businesses. Two strategies can be applied in carbon markets: trading and credits.

KMP uses a carbon offset system to operate. This means reducing carbon production in one location to offset excessive carbon production in another. In other words, carbon offsets are a reimbursement method for companies that produce carbon dioxide emissions by seeking to reduce their effects by reducing emissions in different regions. Over a 60-year concession period, an average of 7.5 million tonnes of CO₂ was stored yearly. This means eliminating emissions from 2 million cars annually in this KMP forest area. This results from carbon calculations of the Verified Carbon Standard (VCS) and Community and Biodiversity Standards (CCB). These carbon stores are sold using a carbon trading system known as carbon offsets. The proceeds will maintain and protect the ecosystem and help fund the company (Ulfa, 2023).

The existence of a carbon trading system shows community participation in terms of empowerment provided by the government and related private parties. On this occasion, the community participated in the empowerment carried out by PT Rimba Makmur Utama in collaboration with the Puter Foundation. These activities include rubber tree planting, fish farming, handmade souvenir making, and other activities without harming nature. The local Dayak Customary Council has power in its administrative area. DAD is tasked with resolving land disputes between companies and communities and maintaining forest and natural ecosystems by Dayak customary law and the belief in harmony and balance between humans and nature (Sukadi et al., 2020).

In addition, this KMP has succeeded in protecting the largest peat forest area in Southeast Asia, covering an area of 149,800 hectares, home to Central Kalimantan orangutan species such as Bornean proboscis monkeys (*Nasalis larvatus*), South Borneo Gibbons (*Hylobates albibarbis*), and Bornean Orangutans (*Pongo pygmaeus*). Carbon trading benefits economic, social, and environmental

sustainability, especially in the Central Kalimantan region, where there are many forests and the potential for local wisdom to support.

In addition, according to the Peatland and Mangrove Restoration Agency of the Republic of Indonesia (BRGM), mangrove forests have four to five times the carbon stock compared to terrestrial forest types. According to research conducted by the Indonesian Institute of Sciences (LIPI), Indonesia's mangrove forests can suck 52.85 tons of CO₂/ha per year. Thus, Indonesia has potential reserves to absorb or suck 177.8 million tons of CO₂/ha per year (Siagian & Arifin, 2022). In addition, Central Kalimantan has many mangrove forests, which can serve as carbon sequestration reserves. This is especially true for carbon trading in Central Kalimantan. The mangrove forest area, which includes Kahayan Kuala and Sebangau Kuala Districts, has a potential of approximately 17,574.12 hectares according to data provided by the Environment Office (DLH) of Pulang Pisau Regency, Central Kalimantan (Redaksi Metro, 2022). Mangrove forest areas and other forests on the mainland of Central Kalimantan have enormous economic potential, especially related to carbon trading. Therefore, all types of forests in Central Kalimantan require good management and preservation.

Integration of Carbon Trading and Indigenous Peoples' Knowledge of Food Security for Sustainable Development

The integration of carbon trading and indigenous peoples' knowledge of food security is an important strategy for sustainable development. Carbon trading is a mechanism designed to reduce greenhouse gas emissions by providing economic incentives for emission reductions. (Muhamad Iqbal & Ruhaeni, 2022, hal. 235) Meanwhile, indigenous peoples have invaluable traditional knowledge related to natural resource management and food security. (Surati, 2023, hal. 199) Combining these two elements can create a more holistic approach to the challenges of climate change and

achieve sustainable development goals. Indigenous peoples in Central Kalimantan have long developed agricultural methods (*Perladangan Masyarakat Adat Dayak Maayan*, 2024) and forest management that not only supports food security but also maintains the balance of the ecosystem. Their knowledge of crop rotation, agroforestry systems, and environmentally sound soil management contributes to a natural reduction in carbon emissions. (*Varietas Lokal dan Sumber Pangan Masyarakat Dayak di Kalimantan Tengah*, 2022) By leveraging this knowledge in carbon trading, we can create more effective solutions to reduce our global carbon footprint while strengthening local food security. Food availability is the first of three subsystems in the food security system and the base of efforts to realize food independence and sovereignty. The main capital in realizing food availability is the wealth of diverse resources, the availability of technology, and the development of strategic partnerships with various stakeholder components. (Chaireni et al., 2020)

Integrated carbon trading can harness this knowledge by providing incentives to Indigenous Peoples in Central Kalimantan to protect and manage forests sustainably. This can be done through social forestry schemes (*Integrasi Proyek Karbon dan Ekowisata Berbasis Masyarakat*, 2023), which allows indigenous peoples in Central Kalimantan to be given forest rights and reap the economic benefits of sustainable forest management. For example, a program that provides carbon credits for agroforestry practices managed by Indigenous Peoples in Central Kalimantan not only reduces emissions, but also increases soil productivity and strengthens food security. This approach can change the dynamics of the local economy by directly rewarding communities for their contributions to environmental protection. In climate change, food security is becoming increasingly important. (Aidilla et al., 2024, hal.

1212) Indigenous peoples in Central Kalimantan are often at the forefront of climate change impacts and have unique insights into how to manage natural resources in increasingly uncertain situations. The integration of their knowledge into carbon trading mechanisms can help create more inclusive and adaptive policies, thereby strengthening food security at the same time.

Using carbon trading to support sustainable agricultural practices and land management (Sunaryati, 2019, hal. 100) It can also help reduce conflicts between conservation goals and local economic needs. When Indigenous Peoples in Central Kalimantan benefit economically from safeguarding and maintaining the environment, they are more likely to support environmental initiatives that align with their needs. This creates a synergy between conservation and sustainable economic development. It is also important to ensure that indigenous peoples' rights to land and resources are maintained in carbon trading programs. Social and environmental impact assessments must be conducted to avoid conflicts and ensure that programs do not compromise the basic rights of communities. The success of this integration depends heavily on the application of the principles of social justice and respect for indigenous rights.(Sunaryati, 2019)

One example of this form of integration is the practice of carbon trading at the Katingan Mentaya Project in Central Kalimantan. The Katingan Mentaya project is a government effort to manage forests as sustainable conservation land by minimizing deforestation and forest degradation. This project is managed by PT. Rimba Makmur Utama (RMU) which was started in 2007. This project uses the REDD+ Scheme, which is a carbon trading scheme that allows corporations to invest funds used to prevent forest destruction in carbon-producing countries, and companies that successfully protect forests will be given additional carbon allowances or credits for their industries. In this

case, corporations/companies only ensure that the forest remains beautiful and untouched by human hands. REDD is considered the most tangible and cost-efficient way in terms of time and cost and mutually beneficial for countries that cooperate in implementing it because GHG emission reductions can be quickly achieved by implementing policy reforms without other mitigation instruments.(Sunaryati, 2019)

Another program is the Rimba Raya Project. Rimba Raya generates carbon credits from High Conservation Value (HCV) peat swamp forests in the carbon calculation area. Rimba Raya is an Infinite EARTH Project. Rimba Raya protects one of the world's most endangered ecosystems. Rimba Raya develops livelihood programs in surrounding villages (addressing all 17 UN Sustainable Development Goals) to provide education, jobs and hope for the future. Rimba Raya provides a buffer zone between the oil palm industry and Tanjung Puting National Park, home to one of the last remaining wild orangutan populations on earth.(*Rimba Raya Biodiversity Reserve*, 2024)

These two programs are examples of programs that integrate Carbon Trading and Food Security in supporting a sustainable economy in Central Kalimantan. Both programs that combine these aspects not only offer solutions to climate change issues but also strengthen food security and empower local communities. These programs provide a concrete picture of how innovative and inclusive approaches can be implemented to achieve more sustainable development.

Overall, the integration of carbon trading and Indigenous Peoples' knowledge of food security in Central Kalimantan offers great potential to advance sustainable development. By harnessing the power of traditional knowledge and innovative market mechanisms, we can more effectively address the challenges of climate change, support food security, and create equitable benefits for all parties involved. This approach not only benefits the environment

but also strengthens local communities and their well-being.

Sharia Economic Review of Carbon Trading Activities in Relation to Food Security

The Islamic economic system is based on Islamic Shari'a, or the rules of Allah. This system is centered on Allah, with the ultimate goal being Allah, and uses methods that cannot be separated from Islamic law. Whether in buying and selling, saving and borrowing, or investment, man's economic actions must be by God's provisions. According to Islamic belief, treasure belongs to Allah entirely, and man serves as caliph over that treasure. In addition, the religion of Islam strictly prohibits acts such as Maishir, Gharar, Haram, Dzalim, Ikhtikar, and Riba (Ansori, 2016). Islamic economic theory is a field of social science that studies how Islamic values affect the economic life of society. Islamic economics and modern economics are the same in terms of significant issues. There is a difference between its properties and volume. Therefore, the main difference between the two systems of economic science can be found by considering how the problem of choice is handled (Bakar, 2020). The concept of tawhid, namely the Islamic belief in the oneness of God, is the basis of Islamic economic principles. Other principles, such as the concept of zakat, namely, a person's obligation to give some of their wealth to people in need, are based on this concept. The prohibition of speculation (gharar), gambling (maysir), and interest (riba) is another principle of Islamic economics. One of the main goals of Islamic economics is to create a just and equitable society by ensuring that wealth is distributed fairly. The market is seen in Islamic economics as a means to achieve this goal, not as an end. The government is responsible for ensuring that economic activities are conducted by Sharia and providing a safety net for those in need (Prakoso, 2023).

Islam is very concerned about the preservation of the surrounding environment. In Islamic economics, the term *maslahah* is used.

Maslahah is divided into two, namely *al-mashlahah* and *al-muthabarah*, in which *maslahah* is used as evidence and signs, and there is no doubt in its implementation. Then the second is *al-maslahah al-mursalah*, which is defined as a benefit to humans and does not invite or cause harm and evil (Achyar & Hakim, 2023). In Q.S. Al-A'raf verse [56] which reads:

وَلَا تُفْسِدُوا فِي الْأَرْضِ بَعْدَ إِصْلَاحِهَا وَادْعُوهُ خَوْفًا
وَطَمَعًا إِنَّ رَحْمَتَ اللَّهِ قَرِيبٌ مِّنَ الْمُحْسِنِينَ

"And do no mischief on the earth after it has been (created) well. Pray to Him with fear and expectation. Indeed, the mercy of Allah is very close to the one who does good" (Al-A'raf[7]: 56).

This verse clarifies that man is not allowed to destroy the created earth and must take care of nature. This is also related to the principle of responsibility taught in Islam (Ratnasari & Chodijah, 2020). In this case, the responsibility lies in managing natural resources to meet economic needs and maintaining and preserving nature and the natural resources contained therein. Industrial activities that constantly exploit nature are, of course, prohibited and violate the responsibilities taught in Islam. Nature that Allah Almighty has created as a blessing that should be maintained because it has met human needs is not even used arbitrarily for human satisfaction and greed.

All human economic activities and other activities must also comply with the *maqasid* of sharia. Sharia *maqasid* is the values and principles that must be implemented and fulfilled to create benefits (Suardi, 2021). This principle consists of the maintenance of religion, the maintenance of the soul, the maintenance of reason, the maintenance of property, and the maintenance of offspring. This principle must be fulfilled to create a good balance and benefits,

From the perspective of Islamic economics, carbon trading and food security will undoubtedly be interesting. The carbon trading system and mechanism are still relatively new and not only have an economic impact but also

environmental responsibility and will have an impact on food security. If explored more deeply, carbon trading will be in accordance with sharia economic regulations. In terms of benefits, carbon trading has had many economic impacts, as well as the development of the potential of the region and its communities. This is because carbon trading empowers forest communities to carry out forest management projects that they have known for a long time and carry out various positive activities such as tree planting, fish farming, handicrafts, and many others without damaging the surrounding environment. In addition, in terms of environmental conservation, of course, carbon trading has a significant impact.

Good and fertile forests are needed to absorb carbon emissions in carbon trading activities, which will later be traded. Of course, forests are a significant asset in this activity. Actors or companies in this context must care for and maintain their forests and often even plant trees regularly, which will undoubtedly benefit the environment. Furthermore, if analyzed based on sharia maqasid, carbon trading also fulfills this principle.

The protection and maintenance of religion are central objectives for Muslims. Within the context of carbon trading, this activity represents an effort to reduce the global effects of greenhouse gases while simultaneously creating job opportunities for local communities. Islam views work as a form of worship, fulfilling personal needs while contributing to the broader society. Additionally, Islam assigns three key roles to humans on earth. (Langsa, 2022).

First, humans are expected to be enforcers of Ihsan (excellence in character) and justice. In the Qur'an, Surah An-Nahl verse 90 states, "Verily Allah commands (you) to do justice and do good, to give help to relatives, and He forbids (to do) evil deeds, evil, and enmity. He teaches you so that you can learn lessons." This verse highlights that excessive exploitation of natural

resources and the production of waste that harms the earth are disastrous acts. Such actions contradict the principles of Ihsan and justice in environmental management. Carbon trading, therefore, is an initiative that aligns with these principles by seeking to reduce environmental damage.

Humans are also entrusted as God's representatives (caliphs) on Earth. The Earth does not belong to humans; rather, it is entrusted to them by the Creator to be well-guarded. This is reflected in the Qur'an, Surah Az-Zumar verse 10: "Say (Prophet Muhammad), 'O My servants who believe, fear your Lord.' Those who do good in this world will gain good. The earth of God is vast." This verse underscores the responsibility humans have in caring for nature. Destructive behavior towards the environment is not only forbidden but also something for which humans will be held accountable. Through carbon trading, humans actively fulfill their role as caliphs, protecting the earth as they are commanded to do.

Furthermore, the role of the caliph leads to the prosperity of the Earth. As caliphs, humans must avoid behaviors that destroy the planet. The Qur'an in Surah Al-Araf verse 56 warns, "Do not do mischief on the earth after it has been properly arranged. Pray to Him with fear and expectation. Verily the mercy of God is very close to those who do good." This verse serves as a strong prohibition against environmental destruction. Those who destroy the earth will not be honored by Allah and will not be rewarded in the Hereafter for their greedy and tyrannical actions against nature.

Protection of life (an-nafs) is another critical objective. Caring for the environment is intrinsically linked to caring for the soul. Humans cannot survive without the earth and its environment; hence, the more damaged the planet becomes, the more human life suffers. Carbon trading is a crucial step in minimizing environmental damage and sustainably improving ecosystems. The relationship

between environmental care and the soul is evident, as a damaged environment can lead to various diseases affecting all living creatures on Earth.

The protection of intellect (*al-aql*) is also essential. Reason differentiates humans from other creatures, enabling them to think critically and distinguish between right and wrong. In the realm of carbon trading, communities benefit positively through various empowerment and conservation activities. These efforts not only protect the environment but also foster a mindset that values and safeguards nature, demonstrating the economic benefits that can arise from such responsible actions.

The preservation of property (*al-mal*) is another objective. Possessions are essential to human life, and various economic activities are necessary to meet these needs. Through carbon trading, wealth is preserved by engaging communities in activities that generate income, such as forest management and the production of handicrafts that do not emit carbon emissions. These activities not only provide financial benefits but also contribute to the sustainability of the environment.

Finally, the protection of lineage (*an-nasal*) is vital. By maintaining and caring for future generations, we ensure that our children and grandchildren grow up to be wise and responsible in managing and utilizing natural resources. Carbon trading provides a platform to introduce conservation projects to the next generation, allowing us to pass on a healthy and sustainable environment, ensuring that it remains viable for future generations.

In addition, in the context of food security, sharia economics emphasizes the importance of meeting basic human needs in a fair and sustainable way. Carbon trading can contribute to food security if the income from this trade is used to support green agriculture and the development of technologies that increase agricultural productivity without damaging the environment. It is important to consider how

funds from carbon trading are used in practice. In the sharia economy, investment in the environmentally friendly agricultural sector can be seen as a form of contribution to food security and sustainability. For example, projects that improve the efficiency of water, soil, and energy use in agriculture can help reduce the negative impact of climate change on food production.

However, there are challenges in the implementation of carbon trading in accordance with sharia principles. One is to ensure that carbon markets do not fall into harmful practices, such as transactions that contain elements of high speculation or market manipulation. Therefore, strict regulation and effective oversight are needed to ensure that carbon trading operates ethically. In addition, sharia economics teaches the importance of fair distribution of wealth. In the context of carbon trading, there must be a mechanism in place to ensure that the benefits of carbon trading are not only enjoyed by a few, but can also be used to help communities in need, including smallholder farmers and communities affected by climate change.

In practice, carbon trading regulated by sharia principles can support food security by providing funds for research and the development of sustainable agricultural technology. For example, technologies that reduce reliance on chemical fertilizers and pesticides, or agricultural techniques that are more efficient in the use of resources, can reduce the negative impacts of climate change and improve agricultural yields. To ensure effective integration between carbon trading and food security within the framework of the sharia economy, it is important to involve a wide range of stakeholders, including governments, financial institutions, and local communities. This collaboration will help create a carbon trading system that not only complies with sharia principles but also provides tangible benefits for food security and community welfare. Overall, sharia economics offers a holistic view of

regulating carbon trading and food security. By ensuring that the principles of fairness, transparency, and environmental responsibility are applied, carbon trading can be an effective tool for achieving sustainability goals and sustainable food security.

CONCLUSION

Carbon trading represents a significant and innovative step in mitigating the effects of greenhouse gases resulting from various human economic activities. This mechanism allows for the exchange of carbon credits or allowances, aiming to reduce overall emissions by providing economic incentives for companies and nations to lower their carbon footprints. As such, it plays a critical role in global efforts to address climate change.

The Dayak Tribe, with its deep-rooted cultural respect for nature, offers a unique and supportive perspective on carbon trading. Their traditional practices emphasize harmony with the environment, which aligns well with the principles of carbon trading. The integration of the Dayak Tribe's environmental ethos into carbon trading initiatives not only helps preserve natural habitats but also reinforces the synergy needed to foster a sustainable economy. By incorporating traditional ecological knowledge and practices, carbon trading can benefit from a culturally informed approach that enhances its effectiveness and acceptance.

Similarly, Islamic economics finds carbon trading to be a viable and appealing endeavor. The principles of sharia, which emphasize environmental stewardship and social justice, align well with the objectives of carbon trading. Islamic economics promotes activities that offer both economic benefits and environmental protection. Carbon trading fits within this framework by facilitating a market-driven approach to reduce emissions while contributing to economic growth. This is consistent with maqasid al-sharia, which aims to protect the environment, ensure fairness, and promote

sustainable development. For individuals and businesses adhering to Islamic principles, engaging in carbon trading can be seen as a form of worship, as it aligns economic activities with ethical and environmental considerations.

Future recommendations to enhance the effectiveness and acceptance of carbon trading include several key initiatives. First, partnering with indigenous communities, such as the Dayak Tribe, is essential for ensuring cultural sensitivity and leveraging traditional ecological knowledge. Policy development should align carbon trading with Islamic economic principles and sharia, promoting transparency and fairness. Increasing public awareness through education about carbon trading's benefits can build broader support, especially in culturally diverse communities. Ongoing research and evaluation are necessary to assess the impact of carbon trading on the environment and local economies, refining mechanisms as needed. Additionally, investing in innovative technologies will improve the accuracy of measuring and verifying carbon reductions. These steps aim to make carbon trading more inclusive, effective, and sustainable.

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