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TRANSFORMATION OF THE *BAHUMA* TRADITION: THE IMPACT OF AGRI CULTURAL MODERNIZATION ON SOCIOECONOMIC AND ENVIRONMENTAL CONDITIONS IN BANUA HANYAR VILLAGE, KERTAK HANYAR DISTRICT

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Abstrak: Proses modernisasi dalam praktik *bahuma* mengakibatkan tradisi masyarakat Banjar mengalami pergeseran nilai. Kajian ini bertujuan menganalisis dampak modernisasi praktik *bahuma* terhadap aspek sosioekonomi dan lingkungan. Penelitian dilaksanakan di Desa Banua Hanyar Kecamatan Kertak Hanyar Kabupaten Banjar. Pengumpulan data menggunakan pendekatan kualitatif deskriptif melalui wawancara mendalam dengan narasumber terpilih. Data pendukung dikumpulkan untuk memperkuat validitas temuan dalam penelitian ini. Hasil penelitian menunjukkan modernisasi memberikan keuntungan ekonomi bagi pemilik pabrik dan lahan. Pengurangan tenaga kerja upahan pada masa panen menjadi faktor utama peningkatan keuntungan tersebut. Namun demikian, pekerja upahan mengalami kesulitan memenuhi kebutuhan hidup akibat penggantian tenaga manusia. Dampak lingkungan dari penggunaan mesin dan pupuk sintetis menimbulkan kerugian bagi pemilik lahan. Pengoperasian mesin secara intensif menyebabkan penurunan permukaan tanah gambut secara signifikan setiap tahunnya. Beban mesin yang berlebihan tidak dapat ditahan oleh struktur tanah gambut dengan baik. Mesin *combine harvester* menimbulkan ancaman serius terhadap keberlangsungan ekosistem persawahan di lokasi penelitian. Penggunaan pupuk sintetis secara berkelanjutan juga memberikan dampak negatif terhadap kualitas kesuburan tanah pertanian. Modernisasi praktik *bahuma* menghadirkan dilema antara efisiensi ekonomi jangka pendek dengan keberlanjutan lingkungan. Diperlukan pendekatan teknologi ramah lingkungan yang tetap memperhatikan kesejahteraan masyarakat lokal dalam jangka Panjang

Kata Kunci: Modernisasi *Bahuma*; Dampak Sosioekonomi; Degradasi Lahan Gambut

Abstract: *The values of the Banjar community have changed as a result of the modernization of bahuma practices. The purpose of this research is to examine the consequences of the modernization of bahuma practices on social, economic, and environmental issues. The study took place in Banjar Regency's Kertak Hanyar District's Banua Hanyar Village. The descriptive qualitative method was used for data gathering through in-depth interviews with chosen informants. In order to increase the validity of the results in this investigation, supporting data was gathered. The study's findings indicate that factory and property owners gain financially from modernization. The decline in employed labor during the harvest season is a significant contributor to this rise in earnings. But because of the substitution of human labor, paid employees have a hard time making ends meet on a daily basis. Landowners suffer losses as a result of the*

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environmental harm caused by the usage of machines and chemical fertilizers. The peatland surface area decreases significantly every year as a result of heavy machinery operations. The peat soil's structure is inadequate to bear the machines' massive load. The sustainability of the rice field ecosystem at the research location is seriously jeopardized by combine harvesters. Additionally, the fertility of agricultural land is adversely affected by the regular application of synthetic fertilizers. The dilemma between short-term economic efficiency and environmental sustainability is brought about by the modernization of agricultural methods. A sustainable technological strategy that considers the long-term well-being of the surrounding population is necessary.

Keywords: *Modernization of Bahuma; Socioeconomic Impact; Peatland Degradation*

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INTRODUCTION

Rice is one of Indonesia's staple foods. It comes from rice plants cultivated by farmers. Each region has its own distinctive rice characteristics. Rice from Java has a clumpy texture when cooked and a shorter harvest time. Meanwhile, rice from South Kalimantan does not clump when cooked and has a longer harvest time.

Residents of South Kalimantan refer to the process of rice cultivation as "*bahuma*." *Bahuma* is an agricultural cultural heritage that has been practiced by the Banjar people for generations. This traditional agricultural system reflects local wisdom in sustainable land management. *Bahuma* practices involve crop rotation, organic land management, and a system of mutual cooperation. However, agricultural modernization has altered the patterns and practices of *bahuma* in various regions. The penetration of modern technology has brought significant transformations to the farming methods of traditional communities.

The village of Banua Hanyar in Kertak Hanyar has experienced rapid changes in agricultural practices. The adoption of modern technologies such as tractors, chemical fertilizers, and pesticides is on the rise among farmers. The shift from traditional to modern methods has had an impact on the community's socioeconomic aspects. On the other hand, this transformation also has implications for the local agricultural environment. Research on the impacts of this agricultural transformation in the region remains very limited and needs to be conducted.

An in depth study of the transformation of the *bahuma* tradition is essential for sustainable agricultural development policies. Understanding the socioeconomic impacts of modernization on farmers can provide insight into the well-being of rural communities. An analysis of post-transformation environmental conditions is necessary to assess the ecological sustainability of local agricultural systems. This study is expected to provide recommendations for policymakers in the agricultural sector. The integration of local wisdom and modern technology is key to the future of sustainable agriculture.

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METHODS

This study employs aqualitative descriptive approach with the aim of explaining and understanding in detail the social, economic, and environmental transformations resulting from agricultural modernization on the *bahuma* tradition in Banua Hanyar Village, Kertak Hanyar. This method was chosen because it is capable of revealing the meanings, steps, and experiences of the research subjects in a natural and contextual manner (Niam et al., 2024). By using this approach, the researcher can gain a comprehensive understanding of the changes experienced by the community in maintaining traditional values amidst the development of agricultural technology.

This study was conducted in Banua Hanyar Village, Kertak Hanyar South Kalimantan Province. This location was deliberately chosen because the community still maintains some traditional *bahuma* practices, yet has also adapted to modern agricultural systems that utilize new tools and technologies. The research was carried out over a specific period, aligned with agricultural activity cycles such as planting and harvesting seasons, so that researchers could directly observe the changes occurring in the field.

The subjects of this study are the people who directly participate in agricultural activities in Banua Hanyar Village. Research informants were selected using purposive sampling, which involves selecting informants based on specific criteria because they are considered to have in depth knowledge and understanding of the phenomenon under study. The informants in this study consist of farmers who practice *bahuma* both those who still use traditional methods and those who have switched to modern systems community leaders or village heads who understand the history and cultural values of local agriculture, providers of modern agricultural equipment such as combine harvesters, casual workers or hired laborers who typically assist farmers in the fields, as well as owners of rice milling and storage facilities.

Data collection was conducted using three main techniques: in depth interviews and participatory observation. In depth interviews were conducted to explore the informants' experiences, perspectives, and perceptions regarding the transition from the traditional *bahuma* system to modern agriculture. Meanwhile, participatory observation was carried out by researchers going directly into the field to observe agricultural activities and social interactions within the community; researchers conducted direct observations in agricultural areas with the aim of observing farming activities and social relationships among residents, thereby obtaining a realistic picture of the practices and values that are still maintained as well as those that are beginning to change. (Rosmita et al., 2024)

The analysis of information in this study uses a model developed by Miles and Huberman, which is divided into three main steps: data reduction, data presentation, and drawing conclusions or verification (Miles, 1994). Data reduction is carried out by selecting, simplifying, and focusing on information relevant to the research objectives. Next, the data that has been selected is presented in the form of narrative explanations, tables, or excerpts from interviews to facilitate understanding of the research findings. The final step is drawing conclusions and conducting verification, which is the process of deriving meaning from the analyzed data and ensuring that the conclusions drawn are supported by concrete evidence from the field (Rosyadi, 2023).

To ensure data accuracy, the researchers applied triangulation techniques, which involve verifying the validity of data by comparing information from various sources and

methods (Muid et al., 2025). Source triangulation was conducted by comparing information from farmers, community leaders, and other relevant parties, while method triangulation was performed by comparing the results of interviews and observations. With this approach, it is hoped that the data obtained can be considered valid, consistent, and scientifically accountable.

RESULTS ANDDISCUSSION

A. The History of *Bahuma* from the Past to the Present

Bahuma (derived from the word *huma*, meaning to plant rice; to cultivate rice fields; to farm; land used for planting rice or cultivating rice fields is called *pahumaan*) is a term commonly used by the Banjar and Dayak communities to refer to the tradition of rice cultivation, both on dry land (fields) and on peatland or tidal swamps (Hapip, 1977). The history of *Bahuma* is deeply rooted in the early agricultural traditions of the communities in the interior of Kalimantan, particularly those associated with Austronesian speaking peoples who brought rice cultivation expertise.

Evidence regarding shifting cultivation in Kalimantan indicates that this practice began around 2000 BCE. In the early stages, they cultivated only wild rice varieties that matured in a single growing season. It is possible that when they first began shifting cultivation, they did not clear the trees because their tools were very limited (Bellwood 2000, 356). However, recent research by Bulbeck (2008) at Niah Cave in Sarawak indicates that rice domestication occurred more than 4,000 years ago (Hill 2010, 215–223) (Yogi, 2018).

Topographically, South Kalimantan is a region consisting mostly of lowlands with soil types that are generally podzolic, located at elevations ranging from 25 to 100 meters above sea level. Land use in South Kalimantan consists mostly of forest (29.56 percent), plantations (17.19 percent), farmland (10.44 percent), settlements (2.33 percent), and wasteland (1.55 percent). (Abduh, 2022).

Location is inseparable from history as the setting in which human activities take place. In fact, in many historical events, the emergence of various great civilizations was greatly influenced by locational factors that drove people to take action toward change and, in doing so, shape the history of their civilizations (Rosyida 2016). The natural environment determines the social dynamics of a community. Similarly, the natural and social environments of 15th-century Banjarmasin and its surroundings, to a greater or lesser extent, influenced the historical motives and movements of the *Bahuma* people, which are an important part of understanding the socio-economics and environment of Banjar Regency, South Kalimantan. More specifically, in the village of Banua Hanyar, Kertak Hanyar District.

1. *Bahuma Batahunan* or Shifting Cultivation:

Bahuma batahunan is a traditional farming method that has become a customary practice, tradition, and cultural norm among farmers in Kalimantan. The tools used in this activity primarily consist of axes and machetes. The average area of land cleared and burned is approximately two hectares per household. (Wardana, 2022).

In the early days, particularly in mountainous and inland regions (such as among the Dayak Meratus), *Bahuma* was practiced using a shifting cultivation system *(bahuma batahunan),* intended for family subsistence. Under this system, a plot of land was used for a maximum of two years and then left fallow. This was done to restore soil fertility. The land

could only be reused after being left fallow for at least six years. The farming activities of the Dayak Meratus people consist of several steps:

a. The first step involves selecting a location for the field. This is done by seeking guidance from God or through dreams and specific signs.
b. The second step is the clearing process, which is carried out through community cooperation. Around the field area, a firebreak approximately 4–6 meters wide is created to prevent the fire from spreading during burning. This firebreak is crucial for preventing the fire from spreading.
c. Third, the land is burned once it is dry and the firebreaks are ready.
d. Fourth, the planting process begins with a ceremony. The seedlings used are typically mountain rice of a local variety that requires a growing period of about six months (Efendi et al., 2020).
e. In the fifth step, when the rice begins to bear fruit, the Dayak Meratus people perform the *Aruh Basambu* ceremony as a prayer to God that the rice will be protected from pests until harvest time.
f. The sixth step is to celebrate the first rice harvest with a ceremony called *Aruh Bawanang* or *Mahanyari*. This ceremony lasts for five days and five nights (Karsudjono et al., 2023).

The *Bahuma* process is highly sacred and involves a series of traditional ceremonies and rituals aimed at seeking permission and blessings from nature (for example, Jubata among the Dayak), as well as ensuring fertility and abundant harvests (Rahmi et al., 2024). Examples of these rituals include *Adat Ngawah* (commencing), *Adat Nabang* (cutting/ clearing), *Adat Nunnu Uma* (burning the fields), *Adat Nugal* (planting with a *tugal*), and harvest ceremonies such as *Aruh Adat* (among the Dayak Meratus) or *Adat Ngaleko* (praying for new rice)

2. *Bahuma* During the Colonial Period and the Old Order

During the colonial period and continuing into the post-independence era, or the Old Order, the practice of *Bahuma* began to face challenges with the introduction of central government policies (Kurniawan et al., 2018).

a. Restrictions on *Bahuma* (Shifting Cultivation)

Shifting cultivation may appear to be destructive to the forest, but according to the customs and traditions of the Dayak people, this farming method is considered to be in harmony with nature. It is described as being in harmony with nature because, after the rice is harvested from the shifting cultivation fields within 1–3 years, the land returns to forest. The annual shifting cultivation system is considered one of the causes of fires and haze disasters; consequently, in 2019, the Central Kalimantan Government documented several recent incidents, and in 2020, as forest fires occurred in Central Kalimantan, the Central Kalimantan Provincial Government issued Central Kalimantan Provincial Regulation No. 1 of 2020 regarding land fire control.

The government began to view the annual shifting cultivation system as an environmentally destructive practice (causing forest fires), leading to efforts to encourage communities to switch to settled agriculture or irrigated rice fields.

b. The Tension Between Regulation and Local Wisdom

Despite the ban, indigenous communities continue to uphold the *Bahuma* tradition because it is part of their social identity and food security system (Wardana, 2022). Local knowledge related to *Bahuma*, such as controlled burning and fallow periods, is often

overlooked in government policies. The impacts on the lives of *Bahuma* farmers (shifting cultivators) include:
1) Restrictions on communities' rights to use customary lands as a food source,
2) Decreased rice yields for farmers,
3) Government regulations that conflict with the customary norms, culture, and traditions held in high regard by local tribes.
4) Public concern about arrest or punishment for violating regulations.

3. *Bahuma* During the New Order Era

During the New Order era, the government subsequently developed the Mass Extension (Bimas) program. This program was introduced to teach more modern farming methods and provide assistance with agricultural activities. Agricultural extension services also began to be expanded to regions outside Java, such as the islands of Kalimantan, Sumatra, and Irian Jaya. It was then further developed into Inmas (Mass Intensification) in 1969. Through Panca Usaha Tani, the Inmas program focused on efforts to optimally increase land productivity (farmland) and the quality of agricultural products. The next step was to launch the Spata Usaha Tani program, which encompassed proper soil management, regular irrigation, selection of high-quality seeds, fertilization, pest and disease control, as well as post-harvest care. The combination of these programs successfully doubled agricultural production during the New Order era (Putri et al., 2024).

In 1995, the food issue once again became a major topic due to high import levels. The push to make Indonesia the "world's food warehouse" was evident in President Suharto's directive to the then Minister of Public Works, Dr. Radinal Muchtar, and other ministers to plan the development of one million hectares of peatland, known as the One Million Hectare Peatland Project in Central Kalimantan between 1995 and 1999, using a One Way Water Management System. The development of peatlands proceeded in line with the government's commitment. Creating peatlands as a source of food and energy for the future is crucial, yet this project faced numerous challenges and was temporarily halted in 1999, before being gradually resumed starting in 2007 (Presidential Instruction No. 2/2007) (Hastuti et al., 2019)

4. *Bahuma* Today Currently

The agricultural sector in Kalimantan is undergoing significant modernization, and this is no exception in Banua Hanyar Village, Kertak Hanyar, as evidenced by

a. Land Clearing Land clearing is carried out by the central government through Forest Concession Rights (HPH) in several areas of Kalimantan, resulting in a shift from shifting cultivation to settled farming (paddy fields/irrigation).
b. Land Preparation Although there is a ban by the government on burning forests, many farmers are afraid and no longer dare to farm. However, there are some farmers who still practice nunu, because they must clear the area so it can continue to be used for farming. But nunu is no longer done every day because the land being managed is not as large as before, and the farm owners will supervise the burning. (Putri et al., 2024).
c. Agricultural Technology The following are the agricultural tools used from the past to the present.

Period	Stage of Activity	Agricultural Tools	Description and Function
Past (Traditional)	Land Clearing (*Menabas*)	Machete *(Mandau)*	The primary tool for cutting through thickets and small branches. Used manually
	Planting Hole	*Tugal* (*Penugal*)	A wooden stick with a pointed tip used to make holes in the ground where rice or secondary crop seeds are planted (*Manugal*). This is a key feature of traditional behuma farming.
	Weeding	*Weeding Knife/Scraper /Short Machete*	Simplemanual toolsforclearing weedsorwildgrassaround plants.
	Harvesting	*Ani-ani (*Reaping*)*	A traditional harvesting tool consisting of a small knife hidden in the palm to cut rice stalks one by one.Theuse of the *ani-ani* is as sociated with a ritual honoring the spirit of the rice (*Sangkaning*).
	Processing	Mortar and Pestle	A tool for mannually threshing rice.
Now (Modernizati on)	LandClearing	Chainsaw	Used to speed up the felling of large trees,replacing the axe or machete.
	LandClearing	Two or Four Wheel Tractors	Used for plowing or tilling flatter land, replacing land burning, which is now prohibited (although this practiceis more common in rice fields than in pure slash and burn agriculture).
	Fertilization/Pr otection	Sprayer	Equipment for spraying liquids (liquid fertilizer or pesticides) to in crease yields and protect crops from pests, in line with the adoption of the Green Revolution.
	Harvesting	Sickle	A manual harvesting tool, but faster than the ani-ani. In hard to reach swampy are as, simple harvesting machines are sometimes used.
	Crop Processing	RiceMilling Unit (RMU)	A modern machine for quickly separating husks from rice in large quantities, replacing the mortar and pestle.

B. Forms of *Bahuma* Transformation

The *bahuma* tradition in Banua Hanyar Village is essentially a form of local wisdom among the Banjar people in managing agricultural land, particularly land that has been passed down from one generation to the next. This activity is viewed not only as an economic endeavor but also as an integral part of the Banjar community's social and spiritual system, which values solidarity and harmony with the environment. In the past, *bahuma* activities were carried out using traditional methods from soil preparation and planting to harvesting relying on human labor and simple tools. Over time and with the advancement of agricultural modernization, *bahuma* practices have undergone significant transformations in nearly all

aspects, including technology, work patterns, socio-cultural values, environmental management and economic systems.

1. Transformation in Agricultural Technology

One of the moststriking changes in farming practices is the adoption of modern agricultural technology. In the past, farmers used traditional tools such as hoes, sickles, and ani-ani. The process was time-consuming but held strong social value because it involved community cooperation. Today, most farmers in Banua Hanyar Village use tractors, rice threshers, and combine harvesters. These tools speed up the planting and harvesting processes, increase productivity, and reduce dependence on human labor. However, technological modernization has also led to inequality in tool ownership, where only farmers with substantial capital can afford to buy or rent machinery, while small scale farmers must rely on others. (Fitri et al., 2024)

2. Transformations in Work Patterns and Social Systems

Technological changes have also transformed farmers' work patterns and social systems. In the past, farming activities were carried out through a system of mutual aid (*baarian*), in which farmers helped one another without monetary compensation but through labor that is, by taking turns assisting each other in the fields. These activities strengthened a sense of solidarity and community. Today, this system of work is shifting toward a wage-based or service contract system. Labor that once came from the same social circle is now being replaced by machine operators from outside the village. Consequently, social relationships have become more individualistic and pragmatic. Nevertheless, some social traditions, such as harvest celebrations, are still maintained by some farmers as a symbol of community.

3. The Transformation of Behuma's Values and Meaning

In the context of Banjar culture, *bahuma* holds deep spiritual and philosophical significance. Farming is viewed as a form of devotion to God and an expression of gratitude for nature's bounty. In the past, communities often held ceremonial feasts before planting rice, avoided burning straw indiscriminately, and maintained harmony with the surrounding environment. However, modernization has shifted someof these meanings. *Bahuma* is now understood primarily as a purely economic activity focused on output and profit. The once-strong religious and ecological values have begun to diminish, though they have not entirely disappeared. There are still community groups that uphold traditional rituals, indicating that this transformation of values is adaptive in nature, rather than a complete replacement of old traditions.

4. Transformation in Environmental Management

The transformation of agricultural practices has also influenced environmental management patterns. The use of heavy machinery and synthetic fertilizers brings short-term efficiency but causes long-term ecological impacts. In Banua Hanyar Village, where part of the area consists of peatland, the use of combine harvesters has caused land subsidence and disrupted the fragile soil structure. Furthermore, excessive use of chemical fertilizers reduces soil fertility and disrupts the balance of the rice field ecosystem (Erlinawati et al., 2022). Unlike traditional systems that utilize natural organic fertilizers and regulate irrigation based on river water conditions, modern systems rely more on external inputs and create a higher level of environmental dependency. Therefore, sustainability has become a critical issue in the transformation of *bahuma*.

5. Economic Transformation and Market Dependency

In the past, *bahuma* harvests were used primarily to meet family needs, with a small portion sold at local markets. Today, however, the focus of agriculture has shifted toward commercial production, involving an economic chain that includes suppliers of agricultural equipment, rice millers, and grain storage facilities. Modernization benefits landowners and rice mills by saving time and labor. On the other hand, however, wage laborers have experienced a decline in income due to reduced demand for human labor resulting from mechanization. This situation creates a high degree of dependence on markets and capital, where the survival of smallholder farmers increasingly depends on market prices and government policies. Thus, the economic transformation in *Bahuma* reflects a shift from a subsistence-based agrarian system toward a capitalist system integrated with the global market.

The transformation of *bahuma* in Banua Hanyar Village is a multidimensional process of change that reflects the social dynamics of the Banjar community as it grapples with modernization. This transformation is not limited to the technological and economic spheres but also encompasses social norms, interpersonal relationships, and environmental management practices. While it has brought progress in terms of production efficiency and income for some, this transformation has also created new challenges in the form of social inequality and ecological vulnerability. Therefore, an agricultural approach rooted in local wisdom and environmentally friendly practices is needed to ensure that the noble values of *bahuma* are preserved amidst the tide of modernization.

C. Socioeconomic Impacts

1. Economic Impacts

a. Increased Productivity & Revenue

Research has shown that agricultural modernization has various positive impacts. In line with (Connor et al.., 2021), the adoption of contemporary agricultural technologies has brought about significant transformations in the global agricultural sector. The use of high-yielding seed varieties with strong pest resistance has led to a substantial increase in land productivity. The use of agricultural mechanization tools such as tractors and harvesters reduces dependence on labor-intensive manual labor. Increased time and operational cost efficiency consistently leads to higher net income for farmers. Increased supply of agricultural products to the domestic market leads to a decrease in food commodity prices at the consumer level (Sudaryanto et al.., 2021). Public access to basic necessities improves due to affordable prices. This situation contributes positively to poverty alleviation efforts in both rural and urban areas (Dandi et al.., 2023).

b. Employment Opportunities & Challenges

The process of modernizing the agricultural sector has led to a decline in demand for labor that relies on human physical strength (Dandi et al., 2023) . The use of machinery and automation technology has taken over most of the work previously performed manually by farm laborers. This situation has resulted in many workers in the agricultural sector experiencing reduced working hours or even losing their livelihoods (Griffin et al.., 2024).

2. Social Impact

a. Changes in Social Structure

The use of modern equipment in agricultural activities has transformed the kinship-based collective work system into contractual labor relationships centered on wage payments. The values of community and mutual aid, which previously formed the foundation of traditional agricultural activities, have begun to fade and are being replaced by individualistic attitudes toward land management. In response to these changes, various new farmer groups have emerged that serve as platforms for coordination and capacity building among their members. Contemporary agricultural institutions such as producer cooperatives, modern farmer associations, and agricultural technology user communities have developed to accommodate the need for adaptation in this era of mechanization (Dandi et al.., 2023).

b. Social Inequality

The ability to adopt modern agricultural technology is not evenly distributed among all farmers due to limited capital and access to information. This situation creates a widening gap between large-scale farmers with adequate resources and small-scale farmers with limited financial means (Connor et al.., 2021). Similar disparities also occur geographically, where regions with advanced infrastructure can take advantage of agricultural innovations, while remote and underdeveloped areas still use less productive conventional methods (Griffin et al.., 2024).

D. Environmental Impact

The environmental impacts of peatland degradation occurring in Banua Hanyar Village, Kertak Hanyar Subdistrict, Banjar Regency (Central Statistics Agency, 2024) are inextricably linked to the environmental resilience of the village.

One key element of environmental resilience is peatland, which is now receiving significant global attention and has become a hot topic in various environmental discussions, both at the national and international levels (Irma et al., 2018). Damage to peatland can increase the risk of disasters in the area. Disasters such as fires, smoke, and flooding in peatlands pose a serious threat to regional resilience (Asrofi, 2017).

The environmental impacts observed in Banua Hanyar Village, Kertak Hanyar Subdistrict, Banjar Regency, based on interviews with agricultural experts, are as follows:

1. Soil structure damage caused by the use of combine harvesters

The use of heavy combine harvesters on peatlands poses a far more serious risk of soil structure degradation than on mineral soils. The high pressure exerted by the machine's wheels accelerates the compaction and consolidation of peat, which already has low bearing capacity and high water content. This causes significant ground subsidence, disrupts natural drainage, and accelerates the decomposition of organic matter in the peat. The consequences are permanent land subsidence and the potential for increased greenhouse gas emissions.

Damage to peatlands caused by the construction of drainage channels leads to a drop in groundwater levels and an increase in soil temperature. This also contributes to CO_2 emissions from the soil due to increased air content in the soil and the aerobic decomposition of organic matter (Hooijer et al. 2012; Hirano et al. 2007). Improper construction of drainage channels in already degraded peatlands makes them drier and more prone to fire (Hooijer et al. 2012; Ritzema et al. 2009). This disruption of the peatland's hydrological balance is evident during the wet season, when the peat water table rises and floods the surface (Takahashi et al. 2002). Conversely, during the dry season, the peat water table drops, making

the peat highly flammable (Rieley and Page 2008). Fires on peatlands result in the loss of carbon stocks, water sources, and significantly impact biodiversity (Adji et al., 2019).

2. The decline in the number of workers employed in the agricultural sector due to the modernization of agricultural technology (combine harvesters)

Based on observations over the past few years, the use of agricultural tools has become essential for farmers to carry out their farming activities; consequently, farmers in Pekuwon Village have begun to abandon traditional agricultural tools and switch to modern agricultural machinery. This shift in the use of agricultural tools is a result of the modernization of the agricultural sector (Selvia & Monita, 2019). Consequently, the process of modernization inevitably impacts the farming community, including both farmers and farm laborers (Nurrohmah and Bhumi,2025).

The modernization of agriculture, marked by the adoption of advanced technologies such as combine harvesters, has significantly reduced the need for human resources in the agricultural sector. The use of these machines has replaced the dozens of workers previously required for manual harvesting, which in turn has led to a shift of labor from agricultural fields to other sectors, while simultaneously improving the overall efficiency and productivity of the harvest.

3. The effects of global warming have led to changes in weather patterns during the dry and rainy seasons and have altered the timing of the planting season (*bahuma*) and the rice harvest (*musim katam*)

These weather changes are inevitable due to global warming and are expected to have a significant impact on many aspects of life, including agriculture. Changes in rainfall patterns, increased frequency of extreme weather events, and rising air and sea surface temperatures are serious effects of the weather changes facing Indonesia (Surmainia et al., 2015). Global warming has fundamentally disrupted the climate balance, resulting in significant changes to the previously regular patterns of the dry and rainy seasons.

This climate uncertainty directly impacts the agricultural sector, forcing a shift in the seasons regarding the ideal time to begin planting and the rice harvest season (katam season), thereby posing major challenges for farmers in planning their agricultural activities.

4. Excessive soil acidity

Modern agricultural practices often rely on the intensive use of synthetic chemical fertilizers, particularly those based on nitrogen and sulfur, which are the primary causes of excessive soil acidification (low pH). This high acidity significantly hinders the uptake of essential nutrients by plants, reduces the activity of soil microorganisms vital for natural fertility, and ultimately degrades the quality and productivity of agricultural land over the long term.

E. Analysis and Interpretation

1. The Dialectics of Modernization: Efficiency versus Socio-Ecological Degradation

The adoption of modern technology significantly boosts agricultural productivity and economic efficiency. Tractors and combine harvesters generate production surpluses and increase farmers' incomes. However, this efficiency comes at the expense of the mutual aid system that strengthens communal solidarity. The sacred value of *bahuma* is reduced to purely profit-oriented economic activity. The use of heavy machinery leads to soil structure

damage and increased carbon emissions. Modernization ontologically transforms the fundamental relationship between humans, nature, and the community.

2. The Policy Paradox: Between Conservation and the Marginalization of Farmers

Regulations banning land burning aim to prevent forest fires and haze. However, this policy actually marginalizes traditional farmers by restricting their customary rights. The ban has led to reduced harvests and conflicts with local cultural norms. The government has failed to distinguish between traditional controlled burning and destructive commercial forest burning. The failure of the One Million Hectare Peatland Project demonstrates that a top-down approach is ineffective. The policy disregards the knowledge of indigenous communities, which has proven to be sustainable.

3. NewSocial Stratification and Structural Inequality

The modernization of agriculture has created a new social stratification that is becoming increasingly entrenched in the agrarian sector. Access to modern technology is uneven due to limited capital and information. This situation deepens the polarization between large-scale farmers and small-scale farmers. Mechanization reduces the need for manual labor, causing workers to lose their livelihoods. The shift toward commercial production creates a dependency on external inputs and the market. Small farmers bear market risks without the capacity to influence prices or policies.

4. The Ecological Crisis of Peatlands and the Threat to Long-Term Sustainability

The use of combine harvesters on peatlands causes compaction and permanent subsidence. Hydrological disturbances lead to excessive waterlogging during the wet season and extreme droughts. This damage is irreversible and threatens the vital functions of peatlands. Synthetic chemical fertilizers increase soil acidity and inhibit plant nutrient uptake. Global climate change causes shifts in planting seasons and uncertainty in rice harvests. Modern agricultural models are incompatible with the ecological characteristics of tropical peatlands.

5. Loss of Traditional Ecological Knowledge and Erosion of Cultural Identity

Thetraditional *bahuma* system is a body of knowledge that integrates spiritual and ecological aspects. Rituals such as batunung and pemataan reflect a sacred worldview regarding the relationship between humans and nature. The transformation of *bahuma* into a pragmatic economic activity has led to the loss of this sacred meaning. The erosion of traditional values is progressively and continuously threatening the cultural identity of the Banjar community. The younger generation is losing the opportunity to inherit ancestral knowledge about reading the signs of nature. This loss cannot be compensated for by short-term increases in economic productivity.

CONCLUSION

The transformation of *bahuma* in Banua Hanyar Village reflects a fundamental shift from traditional agricultural systems toward modernization, which has had multidimensional impacts. Modernization has increased farmers' productivity and income, but at the expense of community cooperation, sacred values, and ecological sustainability. The use of heavy machinery on peatlands causes irreversible soil structure damage and increased carbon emissions. Government policies banning land burning marginalize traditional farmers and disregard sustainable local wisdom. Inequalities in access to technology deepen social divides, while the loss of traditional ecological knowledge threatens the cultural identity of

the Banjar community. A sustainable agricultural approach is needed that integrates modern technology with local wisdom to maintain a balance between economic progress, ecological sustainability, and socio-cultural cohesion.

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