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# Developing business model with community groups for fire prevention and peatland restoration: a case study of Siak Regency

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**Abstract.** Forest and land fires are one of the main environmental challenges in Riau, that majority of its land covered by peatland. Therefore, the main challenge is to introduce fire-free alternatives to clearing agricultural land, while recognizing that local people lack the resources, knowledge, and technology on potential alternatives to zero-burning agriculture. A community-based business model for fire prevention and peatland restoration is urgently needed by making the community the main actor capable of generating value. This study aims to develop the alternative livelihood to support peatland restoration through Sustainable Business Model for the Community (SBMC) by applying Participatory Action Research (PAR). We conducted surveys, focus group discussions (FGDs), and field interviews as well as implemented Canvas Business Model (CBM) to identify the business component. Our finding showed that community groups were able to develop an agrosilvofishery business model that not only implement sustainable practices for land preparation without fire but also determined varieties of commodities that are ecologically and economically suitable for agroforestry techniques on peatlands. Hence, CBM is a suitable tool that helps in developing an integrated sustainable business model for community and can be applied in participative setting. CBM also ensured equity by identifying and agreeing on a cost structure and benefit sharing.

## 1. Introduction

Indonesia is a country that has the second largest peatlands in the world with an area of around 22 million hectares or 45% of the world's tropical peatlands [1,2]. Peatland are formed due to dense accumulation of wet plant material over a period of about a thousand years therefore, they are classified a fragile ecosystem [3]. Areas of peat are characterized by an acidic pH, poor nutrients, thick organic material, and regions that are permanently submerged by water [4]. This means that these ecosystems have a unique biodiversity and only support the existence of certain flora and fauna. Peatlands not only does it serve as direct life support, especially by providing areas for agricultural purposes, it also plays an ecological role in global climate [5]. Furthermore, state that Indonesia's peat swamp forest provides



significant benefits on both a local and a global scale. For some local communities, especially for small farmers, these ecosystems offer a significant source of income and many sustainable livelihood options [6]. Although people have inherited good use practices that intensively relied on peatland, large-scale timber plantations, logging, deforestation, and oil palm cultivation, have changed them and made them vulnerable to fire [7].

The activities of human communities living on and utilizing the peatland constitute one of the most important influences on environmental and ecosystem sustainability. Peatland destruction or degradation gives rise to serious air pollution due to burning. Fire, which is the cheapest and quickest way to clear and prepare land for agriculture and plantation development, generates large amounts of smoke [8]. The land use sector and peat fires dominate GHG emissions in Indonesia contributing approximately 60% of Indonesia's overall GHG emissions [9], [10] posing a challenge for Indonesia which is committed to reducing GHG emissions by 29% [11]. Restoring these peatlands has become a national priority for Indonesia, and an international priority for the region [12].

The alignment of peatland restoration and fire prevention efforts with the government agenda on PEN (*Pemulihan Ekonomi Nasional*/ National Economic Recovery) and FOLU Net Sink 2030. Government through PEN has established strategies for economic recovery however it is largely focusing on direct subsidies and cash transfers. The peatland pathway also plays the most important role in achieving Indonesia's Nationally Determined Contribution (NDC). Hence, there are opportunities to build green businesses for the national economic recovery agenda and to sustain the peatland restoration efforts.

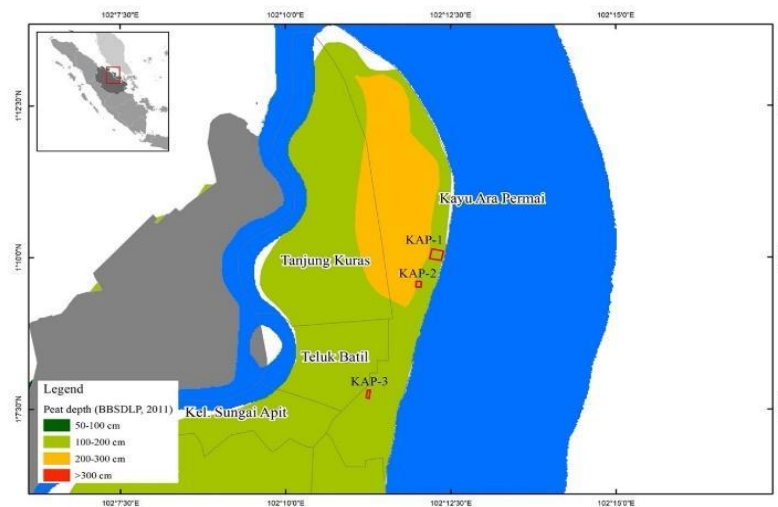
Riau Province has the largest peatland in Sumatra covering an area of 5,355,774 ha or 55.76% of the peatland area in Sumatra [2]. Fire is one of the most influential direct causes of ecological damage in Indonesia, especially in Riau Province [13]. Therefore, the main challenge is to introduce fire-free alternatives to clearing agricultural land, while recognizing that local people lack the resources, knowledge, and technology on potential alternatives to zero-burning agriculture. Socio-economic revitalization of the community includes planting crops activities that have economic benefits for the surrounding community. The type of plants cultivated must be following the type of land and the capability of the community.

A community-based business model for fire prevention and peatland restoration is urgently needed by making the community the main actor capable of generating value. Therefore, this paper presents an integrated business model to improve community's livelihoods and practices in managing peatlands in Siak Regency. This study aims to develop the alternative livelihood to support peatland restoration through Sustainable Business Model for the Community (SBMC) by applying Participatory Action Research (PAR).

## 2. Methods

### 2.1. Research site

This study is conducted in Riau province which has the largest Peatland Hydrological Unit (PHU) area in Indonesia, with case studies in Kayu Ara Permai Village, Siak Regency, Riau Province. Kayu Ara Permai is located by the sea, has a sloping topography, and has a shallow peat depth of less than 3 meters. Kayu Ara Permai has 1,716 ha of peatland with the history of fire in 389 ha in its village burned area from occurred fires during 2015-2020. The drivers of fire at Kayu Ara Permai were the intentional use of fire combined with the dry and fire-prone peatland condition. There were about 2 spots of fire prone land in the village and 4 spots of idle land with fire risk.



**Figure 1.** Map of peat depth in Kayu Ara Permai

## 2.2 Sustainable Business Model for the Community (SBMC) in Participatory Action Research (PAR) approach

Participatory Action Research (PAR) was carried out between 2021-2023 in Kayu Ara Permai. On the ground activities were implemented within the framework of participatory action research (PAR) that consists of four main phases: 1) Reflection and co-elevation, 2) Co-creation and planning, 3) Connected actions, and 4) Co-monitoring and learning. In the phases, basic data and information collection was carried out by conducting interviews, and various surveys for institutions, households, commodities and business potential, value chains, and biophysical conditions of peatland ecosystems. The results of this baseline study were to gain a comprehensive understanding of current conditions and serve as input for carrying out the next phase. SBMC development is carried out at the co-creation and planning phase, then each activity was implemented at the connected activity phase and monitored at the co-monitoring and learning phase.

SBMC framework comprises of the eleven components derived nine Business Model Canvas components developed by Ostewalder and Pigneur (2010). It consists of 1) Value proposition, 2) Customer segment, 3) Customer relationship, 4) Channels, 5) Key activities (pre, during and post-production), 6) Key resources, 7) Key partners, 8) Costs structure (direct and indirect costs), and 9) Costs-sharing mechanism 10) Revenue stream (from tangible and intangible goods/services), 11) Benefit-sharing mechanism.

## 3. Results

### 3.1 Livelihood and institutional conditions in Kayu Ara Permai

The results of data collection in the reflection and co-creation phase showed that main livelihood in Kayu Ara Permai was farmer and fisherman, depending on the seasons. The farmer cultivated pineapple, rubber, and palm oil with most of the community owned palm oil. Except for the aquaculture and rubber plantation businesses, most of the business at Kayu Ara Permai are under five years since its establishment. However, these businesses continue to grow, both from agricultural, industrial, and service-based business groups. This also includes variations in business scale, which range from small businesses with capital of under 100 million, medium scale with a capital of 100-1 billion and large businesses with a capital of more than Rp. 1 billion.

The community groups in Kayu Ara Permai were relatively new and established in less than five years. The members were dominated by Malay ethnic and few Javanese. Most of the groups were funded by membership fees and state funding. Only one farmer group was funded through membership fee and

business profit. Members of community groups have relatively high levels of formal education, and many of them have also undergone various training organized by the government.

### 3.2 Developing SBMC through PAR process

In the co-creation and planning phase, the community together with the facilitator developed community groups and a common vision and identified goods/services. The selection of these commodities was also combined with market surveys around the Siak Regency, topographical mapping, and peat depth surveys which have been carried out in the reflection and co-elevation phases. After an agreement was reached regarding the choice of goods and services, the community groups developed the adopted Business Model Canvas (BMC) by Osterwalder and Pigneur for planning sustainable business. Each community group identified and filled in each BMC component with guidance from the facilitator. Their ideas were organized around the eleven key components to make it easier for them to understand the big picture of the model and formulate an action plan.

Community groups proposed ecotourism on peatland where they will plant hardwood tree species and breed/utilize native peat fish (value proposition). They targeted the local community and intermediary trades who demand fishing spots, pineapple fruit, and ginger (customer segment). They will reach these customers through mouth-to-mouth marketing and utilizing social media for engagement (customer relationship, channel). The manager expected the business model to generate revenue from admission tickets or fees for fishing. Additional revenue sources include the revenue from fishing activity, fresh ginger, pineapple, as well as their derivative products such as ginger powder and *dodol* (revenue stream). Profit from the revenue will be shared to the manager/member based on attendance and performance (profit sharing). The arena manager will utilize human resources, land, seedling, supporting equipment, and construction materials in carrying out its business model’s activity (key resources). They will conduct land preparation, planting, maintaining, and harvesting. They will also construct ponds and hut. (key activity). Based on the activity, the costs incurred include cost for procurement or purchasing of seeding and supporting equipment, cost for land preparation, planting, maintenance and harvesting, cost for construction of restoration facilities, and operational cost (cost structure). CIFOR helped to cover some of the cost during the duration of the program and the manager will contribute to the cost/labor time (cost-sharing). Finally, to realize the business model, the manager planned to partner with the government, CIFOR, *Bumkam*, company, and university (key partner). The business model canvas including cost-benefit sharing mechanism is shown in Figure 2.

<b>Key partner</b> <ul style="list-style-type: none"> <li>• Government</li> <li>• CIFOR</li> <li>• <i>Bumkam</i></li> <li>• Household</li> <li>• Company</li> <li>• University</li> </ul>	<b>Key activity</b> <ul style="list-style-type: none"> <li>• Training</li> <li>• Land preparation</li> <li>• Construction of nursery, ponds, and hut</li> <li>• Planting, maintenance, application of fertilizer</li> <li>• Harvesting and fishing</li> </ul>	<b>Value proposition</b> Planting hardwood tree species and breeding native peat fish	<b>Customer relationship</b> <ul style="list-style-type: none"> <li>• Mouth-to-mouth marketing</li> <li>• Social media engagement</li> <li>• Maintaining communication</li> </ul>	<b>Customer segment</b> <ul style="list-style-type: none"> <li>• Local community</li> <li>• Intermediary trades</li> </ul>
	<b>Key resources</b> <ul style="list-style-type: none"> <li>• Land</li> <li>• Human resources</li> <li>• Fish and tree seedling</li> <li>• Supporting equipment</li> <li>• Construction materials</li> </ul>		<b>Channel</b> <ul style="list-style-type: none"> <li>• Social media</li> <li>• Market</li> </ul>	
<b>Cost structure</b> <ul style="list-style-type: none"> <li>• Cost of training</li> <li>• Cost of construction</li> <li>• Cost of purchasing seedling, fertilizer, and supporting tools</li> <li>• Operational cost</li> <li>• Cost for land preparation</li> <li>• Cost for planting, maintenance, harvesting and application of fertilizer</li> </ul>		<b>Cost sharing</b> <ul style="list-style-type: none"> <li>• CIFOR (during the program duration)</li> <li>• Action Arena manager</li> </ul>	<b>Revenue stream</b> <ul style="list-style-type: none"> <li>• Admission ticket fee from fishing</li> <li>• Fresh ginger and pineapple</li> <li>• Pineapple jam, pineapple chips, ginger drink, and <i>dodol</i></li> </ul>	<b>Profit sharing</b> Action Arena manager will share the profit based on attendance and performance

**Figure 2.** Business model and cost-benefit sharing mechanism

### 3.3 Implementing agrosilvofishery business model

After the agrosilvofishery business model was developed, then the model is realized in the implementation roadmap. This roadmap summarizes the activities carried out in each timeline and the outputs or targets expected so that the business model becomes reliable. The action phase begins with a series of training and discussions on sustainable cultivation of peatlands and land preparation without using fire. Training also focuses on the selected commodity to be cultivated in the action arena. Communities also built nursery that can be used to conduct nurseries independently or can be used to receive seed assistance programs from various institutions.

Revegetation activities began with the preparation of land without burning, which is done manually and combined with limited and controlled use of herbicides. The manager planted the commodities that have been determined at the planning phase. The manager has planted 2,000 *geronggang* trees, 5,000 pineapple plants, and 1,000 red gingers. They used ponds for cultivating and breeding snakehead fish. Managers also built a hut that serves as a shelter for visitors.

Revetting was carried out by building three ponds measuring 5x50 meters. The construction of ponds was carried out because the land in this arena has a high risk of recurring fires (Figure 3). As this area drains into the shoreline, shallow ponds are useful for providing and storing water during dry months in anticipation of future peat fires. Ponds were positioned at the lower part of the area for maintaining water availability during dry months. In the rainy season, this pond can function for agrosilvofishery activities.



**Figure 3.** Illustration of rewetting and revegetation layout

Every activity to realize the business model is monitored for its output and impact in the medium and long term. Monitoring carried out consists of groundwater monitoring, crop monitoring, monitoring of community institutions, and economic changes. The online platform developed by CIFOR for monitoring trees, peat, and the environment is called the Community-based Peatland Restoration Monitoring System (CBRMS) [14]. In this phase, the community and research team involved in the augmented PAR process also "learn" about the challenges and difficulties in implementing the action plan.

Weather conditions were one of the factors that become obstacles in implementing revegetation activities. Kayu Ara Permai village experienced heavy rainfall in 2022, which caused the ground to become waterlogged. If the seed is planted in these conditions cause root rot. In addition, high rainfall can also dissolve and dry fertilizer quickly before it can be absorbed by plants. Therefore, the manager postponed planting and fertilizing activities to minimize risks. In addition to the weather factor, there were commodity adjustments selected in the action phase by increasing the number of *geronggang* seedlings planted because this species is suitable for peat swamp conditions which are often inundated.

#### 4. Discussion

Peatlands have a central role in the livelihoods of local communities, so peatland degradation can disrupt people's livelihoods and encourage people to exploit peatlands regardless of threats. Therefore, mitigating fire disasters with peat restoration must focus on revitalizing people's livelihoods. Livelihood revitalization should be based on the potential and socio-economic conditions of the community [15]. With increasing pressure on peatlands, community involvement in peat restoration can provide many social and economic as well as environmental benefits [16,17]. Lessons from peatland management carried out by the community will be invaluable to further support sustainable peatland management. Therefore, the facilitator with the community developed SBMC to encourage the community to become drivers of action that provide business that not only generates economic value but also generates environmental, and social benefits and reduces the rate of fires.

For developing community-based business model for peatland restoration and fire prevention, we used Participatory Action Research (PAR). The participatory approach helped us to have inclusive process where the action arena and action arena managers as well as business activity is determined by community. Based on our experience, the business model developed by the community has provided benefits in the form of increasing community knowledge about cultivating peat-friendly commodities and preparing land without burning, increasing the groundwater level, and reducing the incidence of land and forest fire.

#### 5. Conclusion

Community groups were able to develop an agrosilvofishery business model that not only implement sustainable practices for land preparation without fire but also determined varieties of commodities that are ecologically and economically suitable for agroforestry techniques on peatlands. Hence, CBM is a suitable tool that helps in developing an integrated sustainable business model for community and can be applied in participative setting. CBM also ensured equity by identifying and agreeing on a cost structure and benefit sharing. In our case, the established business model can generate income for community as well as preventing fire and support peatland restoration in the village.

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