

Livelihood Structure Transformation of Rural Communities: A Livelihood System Analysis of the Dayak Punan of Berau District, East Kalimantan, Indonesia

Dyah Ita Mardiyarningsih (Corresponding author)

Rural Sociology Study Program, Graduate School of Bogor Agricultural University

Jln. Kamper, Kampus *IPB* Darmaga, Bogor, West Java, Indonesia

Tel: +62 81310326135 E-mail: ditam.kamal@gmail.com

Arya Hadi Dharmawan

Department of Communication Science and Community Development

Faculty of Human Ecology, Bogor Agricultural University

Jln. Kamper, Kampus *IPB* Darmaga, Bogor, West Java, Indonesia

Tel: 62-251-8425252/8627793 E-mail: aryahadidharmawan@gmail.com

Lala M Kolopaking

Department of Communication Science and Community Development

Faculty of Human Ecology, Bogor Agricultural University

Jln. Kamper, Kampus *IPB* Darmaga, Bogor, West Java, Indonesia

Tel: 62-251-8425252/8627793 E-mail: lalakolopaking@gmail.com

Muhammad Firdaus

Department of Economic, Faculty of Economic and Management, Bogor Agricultural University

Jl. Agatis Kampus *IPB* Darmaga, Bogor, Babakan, Dramaga, Bogor, West Java, Indonesia

Tel: 62-251 8626520 E-mail: firdausfemipb@yahoo.com

Martin Reinhardt Nielsen

Department of Food and Resource Economics, University of Copenhagen

Rolighedsvej 25 DK-1958 Frederiksberg C Denmark

Tel: +45 35336800 E-mail: mrni@ifro.ku.dk

Abstract

Forests are not only the main source of livelihood but are also at the centre of the culture of hunter-gatherer communities. Changing interaction with the outside world and increasing outside influence as well as reduced access to the forest has initiated a community livelihood systems transformation. Here we present a typology describing the level of transformation of Dayak Punan communities in Berau district in the East Kalimantan province of Indonesia. Based on a case study using a mixed methods approach in five communities we explore how hunter-gatherer communities slowly but surely are being transformed from nomadic to sedentary by external influences and circumstances and has become increasingly involved in the market economy and dependent on cash transactions. Resettlement, expansion of large-scale economic activity and community empowerment programs serves as driving external factors that replace high reliance on forest income with new cash-based livelihood opportunities. The livelihoods transformation provides hunter-gatherer communities access to higher material welfare but simultaneously increases economic inequality and reduces livelihoods resilience to shocks.

Keywords: *Dayak Punan, hunter-gatherers, livelihood structures, cultural ecology, rural livelihood system dilemma.*

1. Introduction

1.1 Background

Globalisation changes social, cultural, economic, and political structures that directly or indirectly have positive or negative implications for people and the natural environment (Ritzer and Dean 2015; Baylis *et al.* 2014). Globalisation can potentially provide options for improved material welfare for some groups in society but also entails risks of increased vulnerability for marginalised groups. The process of globalisation must, therefore, be regulated to ensure environmental sustainability and to promote pro-poor and equitable development outcomes (Panayotou 2000). In Indonesia, globalisation is manifested through increasing capitalism, liberalisation, democratisation and a focus on human rights the outcome of which, however, are difficult to separate from general political, social and cultural change (Murphy 1999). People's ways of thinking and behaving are increasingly based on cost-benefit calculation and efficiency considerations rather than taking departure in morality and a sense of community. Hence, society is experiencing an evolution, characterised by Herbert Spenser (in Turner 1998:80-81) as progress involving an increasing complexity of social structures. Such complexity increases human capacity for adaptation and ability to survive changing environments and produces either social integration or social differentiation.

Societal evolution can be engendered by government policies through development programs. "Development" is a form of planned social change that seeks to liberate society from traditionalism. "Development" is understood as a deliberate and planned process of socio-economic and cultural transformation to achieve a certain degree of progress in accordance with the standards of quantitative and qualitative measures of welfare in a society (Dharmawan 2007). The Government of Indonesia embraces "modernisation" as a development approach that adapts Rostow's theory of five growth stages: traditional society; pre-takeoff; take-off; growth maturity; and high-mass consumption (Suwarsono and So 1991). Rural modernisation programs involving economic development, large-scale natural resource extraction, and community empowerment has led to changes in both institutional, socio-economic, ecological aspects transforming the livelihood systems of rural communities throughout Indonesia. Available evidence indicates that rural communities have become more vulnerable to shocks as a consequence of modernisation programs negatively affecting the sustainability of their livelihood systems (Sajogyo 1982; Dove 1985; Day 1999). Sajogyo (1982) claims that the Government initiated green revolution and land tenure reforms in Java, has led to the concentration of land in the hands of the few while most people are left with less land, as well as to the loss of traditional values, institutions, and social ties. These changes, in turn, has lead to loss of independence of rural communities in the form of increasing reliance on the Government for subsidised seeds, fertilisers and pesticides. Outside Java, rural modernisation programs have transferred communal land ownership to private individuals, in turn, increasing the transfer of land to outsiders through sale and leading to local landlessness (Dove, 1985). The process of creation of formal institutions representing Government administration at the sub-district and village level furthermore challenges local leadership based on customary law and agricultural institutions for managing natural resources such as the *senguyun*, which coordinates collaborative work in shifting cultivation activities through the exchange of labour in Kalimantan. While labour-exchange systems have been transformed, wage labour markets have arisen as communities have become increasingly involved in cash based market exchanges (Day 1999 in Eghenter and Sellato, 1999). Community resettlement programs have furthermore lead to the loss of traditional ecological knowledge and communities placed on degraded land or land from which they have no experience in deriving a livelihood have experienced deprivation (Sarman 2006). Finally, expansion of private sector large-scale economic activities, including transnational corporations, has caused environmental damage threatening the livelihoods of indigenous people. Such transformation at the local level is increasingly driven by and inseparable from global economic activities (Gwenny 2002; Bury 2008).

Development of large-scale commercial activities and transmigration projects in East Kalimantan has created new markets for local products replacing traditional activities but with no or limited trickle-down effects outside the agricultural sector except for the benefits of expanded transport networks (Dewi *et al.* 2005). Cramb *et al.* (2009) claim that agricultural transformation away from shifting cultivation has caused fundamental cultural redefinition and loss of group identity with implications for access to resources. The net effect of the change of agricultural systems varies. Change can improve the well-being of previously isolated groups, but the transformation process can leave marginalised groups worse off. The Dayak Punan community in Malinau, for instance, experienced a cultural shock as a result of a conservation and development program. The Punan desired modern amenities like urban dwellers while maintaining the condition of the forest. However, financial means to support this transformation was not available, and the younger generation instead felt they lost their identity and many became addicted to alcohol and narcotics (Levang *et al.* 2007).

In addition to development programs and large-scale economic activities, community empowerment programs also cause social change in rural areas. Just like development programs can have negative impacts on rural livelihood systems, community empowerment programs initiated by international and national NGOs also can have unintended negative consequences and especially empowerment programs concerned with the livelihood systems of communities' relying on income directly from forests or land. Therefore, communities acceptance of empowerment programs is determined by the

extent to which program implementation affects the security of their subsistence system (Hartanto *et al.* 2013). When the incentives provided by the empowerment program in compensation for lost access to resources are not proportional to the economic value of the resources that are the source of the community's livelihood, the community rejects the program. This happens because people tend to use the land for economic purposes (crop cultivation) rather than for community forest development (Karky *et al.* 2013). Studies have also found that rural and indigenous communities become vulnerable to shocks following the implementation of development programs, large-scale economic expansion, and community empowerment programs due to major changes wrought on their livelihood systems (Sajogyo 1982; Dove 1985; Eghenter and Sellato 1999; Sellato 1994; Dewi *et al.* 2005; Levang *et al.* 2007; Cramb *et al.* 2009; Hartanto *et al.* 2013; Karky *et al.* 2013).

The Dayak Punan community in East Kalimantan constitutes an economic, social, political and ecological unit that over the past decades has undergone a radical transformation driven by the entry of external actors, including Government, private companies and NGO's, pushing a "modernity" and social reform agenda. However, the impact on livelihood activities and household resiliency remains relatively understudied. Hence the objectives of this manuscript are to explore this transformation and its implications for households based on a typology of communities adaptation to this process in five Dayak Punan communities in East Kalimantan. The study provides a snapshot of the process of livelihoods transformation taking place and the social changes affecting the Dayak Punan community as the last hunter-gatherer community in East Kalimantan. Specifically, this study: (1) maps the transformation of livelihood structures; (2) analyse livelihood strategies; and (3) evaluates the livelihood resilience of the Dayak Punan community.

2. Research Methodology

2.1 Research Paradigm and Methods

This study combines several approaches previously used to describe livelihood systems of indigenous communities in Kalimantan to evaluate livelihood transformation and social change in selected communities. Following the sustainable livelihood framework developed by Scoones (1998), large-scale economic expansion, development programs, and community empowerment programs are seen as drivers of change that directly or indirectly affect the livelihood system of Dayak Punan communities. The framework developed by Dharmawan (2007) focus on three vital elements of rural livelihoods: social infrastructure, social structure, and supra-social structure. The social structure is determined by the type of production system that according to Steward (1955) is the cultural core of a community and can be characterised by three parameters including population, technology and production organisation. The social structure is part of the elements that determine households' livelihood strategies. Based on Scoones (1998), households' livelihood strategies in the area can be divided into three categories: intensification and extensification of agriculture; diversification of livelihoods; and migration. The choice of strategy has different impacts on the vulnerability and resilience of household's livelihood system. By connecting the concept of social structure and livelihood strategies selected by the household, this study aims to describe the transformation of the Dayak Punan community's livelihood system.

This research applied a post-positivist paradigm to examine the Dayak Punan community transformation. Mixed methods (Creswell 2012) were selected to obtain the necessary data and information. First, a qualitative approach was applied to obtain an understanding of the social reality of the Dayak Punan community in September 2014. In the next stage, quantitative data was collected through a household survey. Subsequently, further qualitative data was collected through in-depth interviews and participatory observations to verify the results of the quantitative survey. By combining these methods, it is expected that the weakness of the post-positivistic paradigm such as deterministic, reductionistic, and objective reality emerging from the outside can be minimised.

The qualitative approach including in-depth interviews and direct observation was conducted at the household, community and supra-community level. The quantitative approach involving a questionnaire survey at the household level was conducted using the Poverty Environment Network (PEN) survey protocol (Angelsen *et al.* 2011) and a perception questionnaire developed to compare livelihoods between years. The PEN questionnaires obtained detailed information on household income including both cash and subsistence income from forests and the environment outside the forests, agriculture, livestock, fisheries, wages, business and trade, and other sources. Quantitative data were collected in two stages. The first stage was conducted January-February 2015 recoding income in 115 households over the past six months using the PEN survey approach. The second stage was conducted in September 2016 surveying 131 households the majority of which were also respondents in the first stage. The second phase of the survey used an income portfolio scoring against a nominal baseline approach (Catley *et al.* 2007) to determine reliance on different income sources in 2016 and in 2006 and to evaluate households perception about changes in the contribution of each livelihood sources over the past ten years (2006 to 2016) with livelihood source categories referring to the first phase of the survey. All data analysis was conducted in STATA version 13 and Microsoft Excel 2013.

The Dayak Punan community in Berau District consists of three sub-tribes: Punan Kelay and Segah, Punan Basap or Lebok and Punan Batu (Sellato 1994; Sercombe and Sellato 2007). The Dayak Punan community traditionally lived nomadically based on a subsistence economic system involving hunting and gathering in the forest (Sellato 1994). The study was conducted in five Dayak Punan communities in Berau District in East Kalimantan Province selected to represent the diversity of the Dayak Punan community from small groups (5-20 families) to villages with a formal village administration. Table 1 shows the characteristics of selected communities. The communities identified as Punan 1 and Punan 2 were in some analyses combined as both are located in the administrative area of Kampung Birang.

Table 1. Characteristics of selected communities.

Location	Households	Livelihood strategies	Drivers of change
Punan 1, Birang	17	Honey harvesting and wage labour	Large-scale economic expansion (logging and mining concessions)
Punan 2, Birang	5	Hunting-gathering	Large-scale economic expansion (logging concession)
Long Duhung	34	Hunting-gathering and farming	Large-scale economic expansion (logging concession), empowerment programs by NGOs
Merabu	52	Farming and ecotourism	Empowerment program by NGOs
Merapun	328	Employment ins oil palm plantation	Large-scale economic expansion (oil palm plantation)

3. Results

3.1 Transformation of Livelihood Structure

The entry of external influences in the forest area of East Kalimantan directly or indirectly cause physical changes of the forest, to which the Dayak Punan community must adapt. The cultural, ecological framework (Steward 1955) was used to examine the transformation of social structures in the subsistence system involving a shift in the type of production mode in terms of population, technology and production organisation parameters. The Dayak Punan culture as a hunter-gatherer community was originally characterised as a highly independent subsistence economy. The technology used is still very traditional but effective for hunting, fishing, and gathering. Forests are the main source of subsistence for the community, but the conditions are changing as observed in the five Dayak Punan communities in the study sites.

The role of forests has changed the last ten years (2006-2016) and for most Dayak Punan communities forests no longer serve as the primary source of income. This is particularly the case in Dayak Punan communities that are increasingly open to outside influence. In these communities, the forest has been replaced by other service-based income sources, mainly wage labour, as the primary livelihood source. In 2006 communities had only experienced limited exposure to large-scale economic activities and community empowerment programs and forest income still on average scored as the most important income sources for households in all locations (Table 2). Particularly, in Punan-Birang and Long Duhung, more than 70% of household income originated from the forest and mainly in the form of subsistence income from hunting and gathering. However, income sources were more diverse in Merabu and Merapun. Although the contribution of forest income to total household income on average was higher than any other single source (36-44%), it was lower than the total income from other sources combined. Sedentary agriculture and working as labourers for a company harvesting swallow nests had become an integral part of both communities livelihood system. However, the forest and particularly primary forest was still considered an important source of livelihood and the cultural and historical centre of community values, and the habitat of plant and animal life. Hence, the forest remained a source of wild food, rattan for weaving material, and various materials for house and boat construction.

Over the past ten years, while large-scale economic expansion in the form of logging, mining and oil palm plantation activities initiated by private companies and community empowerment programs implemented by NGOs has come into direct contact with the Dayak Punan communities in the five locations, community reliance on the forest as a source of livelihood has begun to decline as evident of the income portfolio scoring against the nominal baseline of 2016 (Table 2). Although the forest on average still contributes most to household income in Punan-Birang and Long Duhung its share in total household income has decreased. In Merabu and Merapun, forest no longer serves as the primary source of income. In Merabu the development of eco-tourism facilitated by NGOs through the SIGAP REDD + program means that the forest remains a source of indirect income through the environmental services provided in attracting tourists. The contribution of agricultural income has also decreased, and rubber plantations introduced by NGOs, that would be recorded under

agricultural income have not yet started producing income. However, wage income working for the swallow-nest company and NGOs as well as small business enterprises has increased considerably as a source of livelihoods. Particularly in Merapun, wages income from working in oil palm plantations have almost entirely replaced forest income, and wage income is now the primary source of income.

Table 2. Mean contribution of income sources to Dayak Punan households in 2006 and 2016 base on income portfolio scoring against 2016 as a nominal baseline.

Source of Income	Punan-Birang (%)		Long Duhung (%)		Merabu (%)		Merapun (%)	
	2006	2016	2006	2016	2006	2016	2006	2016
Forest and environment	73.02	50.33	79.18	51	44.37	26.52	35.79	6.1
Agriculture	11.86	24	15.43	25	27.29	19.57	22.54	16.8
Livestock	0	1	1.3	6	4.07	5.33	2.88	3.1
Fishery	0	0	0.37	0.5	0	0.33	0	0
Wage	14.65	19.33	1.86	14	22.76	33.59	34.51	52.2
Business and trade	0.23	3.33	1.86	3	0.7	9.24	3.74	5.3
Others	0.23	2	0	0.5	0.81	5.43	0.53	16.5

Source: Primary data processed in 2016

In addition to changing reliance on forests, the technology used to derive a livelihood from the forest has also changed. Traditional technologies used for hunting, fishing, collecting forest honey and searching for tubers are still used in Punan-Birang and Long Duhung where some people are still highly reliant on the forest. However, in Merabu and Merapun, this equipment is now rarely used. Any forest extraction still conducted is done with modern equipment. For instance, traditional equipment for harvesting forest honey has been replaced by rock climbing equipment, and many community members now use air guns for hunting.

Production organisation based on small groups with family ties only partly survive today. In Dayak Punan communities, group organisation of production systems were previously common. This includes hunting groups usually consisting of male members of several households; fruit-harvesting groups consisting of women; and honey-harvesting groups consisting of both male and female members all having a detailed system for sharing the products obtained. Having taken up cultivation activities, the organisation of production is still undertaken in groups with a turnover system for sharing non-hired labour. However, contractual production organisation involving wage labour has begun to eliminate the family- and solidarity-based systems relying on teamwork and community. Sharing of the catch from hunting has also changed into the trade of game meat. Only the Punan-Birang community maintain family-based production organisation. However, the relation of production organisations with outside communities is commercial and contractual.

Based on the three parameters of the social structure of the Dayak Punan culture as described by Sellato and laid out in the methods section their livelihood structure has been transformed. The Dayak Punan community is no longer a nomadic hunter-gatherer community but has become a sedentary community with commercial production and market dependent economy. More advanced technology is used, and production is not limited to primarily subsistence-oriented activities. Community relations with forests are more indirect, and the forest is no longer the dominant source of livelihood.

3.2 Level of Welfare and Resilience

Development has transformed Dayak Punan community from hunting societies into communities with a variety of livelihoods sources originating from both forest use and other sources. The average annual household income of a Dayak Punan household across the four communities according to the PEN survey amounted to Rp 28,213,701 in 2016 equivalent to 2,090 USD (using an exchange rate of 1 USD to Rp 13,500) (Table 3). Wage income on average generated the highest income compared to other sources in all communities except Punan-Birang where other income sources and forest income on average provided considerably and slightly more, respectively. Average total annual income in Punan-Birang was Rp 16,586,033 (equivalent to 1,229 USD), while the highest total annual income was in Merapun at Rp 36,655,200 (equivalent to 2,715 USD). Wage income in Merapun mainly originated from work in the oil palm plantation. In Long Duhung the average total annual income was Rp 31,337,955 (equivalent to 2,321 USD). Income sources in Long Duhung were quite diverse originating from several sources including a large amount from wage, other and forests. "Other" income include mainly timber extraction fees paid to the villages by the logging company. Although the forest resources are abundant

around Long Duhung, the wage received from logging companies on average contributed more to total household income than direct forest income. Average total annual income in Merabu was Rp 28,275,615 (equivalent to 2,094 USD) with wages primarily from labour collecting swallows nests for the Walesta Company, village forest-based eco-tourism business and severance payment from the logging company constituting the main sources and putting this community at the intermediate level of welfare compared to other communities. Direct forest income was low in Merabu.

Table 3. Average annual household income in 2015 in Indonesian Rupees.

Research Location	Sources of Income (IDR)							Total Income
	Forest & Environment	Fishery	Agriculture	Livestock	Wage	Business	Other	
1. Punan-Birang (n=16)	6,573,825	2,682,855	936,833	567,203	5,620,860	0	204,458	16,586,033
2. Long Duhung (n=24)	5,061,555	1,183,410	614,385	198,180	12,590,910	2,139,345	9,550,170	31,337,955
3. Merabu (n=44)	1,906,200	148,500	309,015	256,230	11,539,665	10,485,450	3,630,555	28,275,615
4. Merapun (n=31)	1,159,785	565,245	415,935	191,295	15,966,990	9,815,310	8,540,640	36,655,200
Average Income	3,675,341	1,145,003	569,042	303,227	11,429,606	5,610,026	5,481,456	28,213,701

Source: 2015 primary data

The difference in magnitude of income follows an increasing trend from Punan-Birang over Long-Duhung to Merabu and Merapun coinciding with decreasing forest income and increasing wage income. Household income can be considered a measure of the level of welfare of the Dayak Punan community as well as an indicator of the level of household resilience. This notion builds on the assumption that higher income is correlated with higher savings, which the household can draw on in times of crisis. Inherently, this also assumes that higher income is not translated into an equivalently higher consumption with no savings generated. Another indicator of household resilience is the diversity of income sources. A higher number of income sources reduce household vulnerability to the loss of one income source because there is a higher number of other options on which to subsist. The Simpson's diversity index was calculated as a measure of the diversity of income sources in the four communities (Table 4). The Simpson diversity index was highest in Punan-Birang lower in Long Duhung but lowest in Mearbu and Merapun. This trend indicates that resilience decreased with development (or "modernity") and higher reliance on wage income. The level of household expenditure was not quantified, but it is conceivable that household food expenditure increases as the importance of forest income decrease and wage income increase because food-needs that were previously obtained free from the forest and the environment are no longer accessible and instead must be purchased.

The Gini coefficient of inequality was calculated from income in each community and are presented in Table 4. The results indicate a trend of increasing inequality from Punan-Birang to Long Duhung, slightly lower in Merabu and lower still in Merapun than in both Long Duhung and Merabu. The higher the Gini coefficient, the higher the proportion of income generated in the community is controlled by a smaller proportion of the households in the community. Hence the results indicate that the gap between low- and high-income households increase as forest reliance decrease but then decrease again at high reliance on wage income. High inequality in a community increases the likelihood of social conflicts in the future. Even today envy and competition between households are visible. This competition means that the sense of kinship and community and the traditions for sharing that previously supported the subsistence resilience of households is gradually disappearing.

Table 4. The Simpsons diversity index and the Gini coefficients for each community.

Community	Simpson's diversity index	Gini coefficient
Punan-Birang (n=16)	0.31	0.39
Long Duhung (n=24)	0.16	0.61
Merabu (n=44)	0.06	0.57
Merapun (n=31)	0.07	0.49

Source: 2015 primary data

3.3 Typology of Transformation towards Modernity

Five parameters are evaluated to describe the level of transformation. These include: (1) level of transition from community dependence on natural resources in the form of reliance on hunting-gathering towards sedentary agriculture, (2) level of transition from subsistence-oriented production organised based on collaboration and sharing of labour to the contractual based commercial orientation of labour and production, (3) use of traditional and manual technologies and its transition towards the use of modern and mechanised technologies, (4) level of change from exploiting existing natural resources to dependence on industrial activity, and (5) type of religious systems embraced by community members. Based on these characteristics the three typologies, subsistence-nomadic, commercial semi-nomadic, and commercial settled are developed, and the four Dayak Punan communities are placed in these.

Typology I (subsistence-nomadic). The Dayak Punan community in Birang Village still obtains most of their subsistence from the forest through hunter-gathering and are partially nomadic in order to obtain their food needs from the forest. Both of the communities that constitute this sample were resettled to houses constructed to them to make room for logging concessions and mining operations. However, community members are instead often in the forests searching for food and non-timber forest products that can be sold to generate income. The technology used to hunt, catch fish and search for honey and tubers, is still very traditional and mainly self-made. Chopsticks and baskets are made from forest products, and some use their hands to catch fish. Although reliance on the forests and rivers as a source of subsistence and income is high in this community, the community also receives some food aid from logging and mining concession operators as well as preferential access to some development programs. However, as community members are often in the forest and perform activities outside the settlement, development programs are challenging to implement, and the community does not receive all aid due. The religious belief system differs between the two sub-communities constituting the Punan-Birang sample. One is Muslim, and the other is Christian. However, neither practice these religious beliefs very stringently.

Typology II (commercial semi-nomadic). The community in Long Duhung lives in a remote forest area. However, the community has a village administration and are largely sedentary although trips of longer duration into the forest are still conducted. The community practices a shifting cultivation system with burning taking place once a year during the rainy season. During the dry season, community members search for gold in the river. Hunting is practised to obtain protein and for trade and the season's forest fruits are collected. Vegetable gardens, cocoa and rubber trees are increasingly common introduced by a community empowerment program. However, the largest source of cash income originates from wage work for the logging company and as village government staff. The technology used to conduct subsistence harvesting activities is still relatively traditional although outboard engines are increasingly used on boats, and air rifles are used to hunt birds. The organization of work that previously was carried out in groups is now done individually by each household. However, many other community activities are organised by the community or the village church, and most community members are devoted Christians and practising Christianity is a vital source of community cohesion.

Typology III (commercial settlement). Communities in Merabu and Merapun are both placed in this category because both communities rely heavily on wage work in the oil palm plantation in the case of Merapun and wage working for NGOs and swallow nest harvesting companies in the case of Merabu. These activities are mainly of a contractual nature and rely on the use of modern technology. Very little income originates from the forest and the environment, particularly in Merapun. However, in Merabu the community relies on the environment for more than subsistence as economic activities in the community includes forest-based ecotourism. Ecotourism generates income from business activities such as homestays, boat rentals, small shops and guided tours. The activity is largely coordinated by Kerima Puri, a new institution incorporated under the government structure of Kampung Merabu through the formation of an environmental NGO. The emergence of new institutions at the village level including a cooperative at Merapun reveal that organisation of the production system is already complex in both communities. Community members are either Christian or Muslim, and both religions are practised relatively devotedly.

4. Discussion

The observed symptoms of livelihood system transformation occurring in the four communities are supported by other studies that have found: (1) similar direction of change from a subsistence economy to one based on commercial transactions, (2) decline of community cohesion and shared labour arrangements as these are replaced by more market-oriented and contractual arrangements, (3) social reorganisation leading to higher inequality at the community level, and (4) decreased diversification of livelihood sources leading to lower resilience and potentially generating poverty due to increased vulnerability to shocks (e.g. Mirajiani *et al.* 2014; Amrifo 2013; Cramb *et al.* 2009). The transition can be characterised through typologies namely subsistence nomadic, commercial semi-nomadic, and commercial settled. The Dayak Punan community was according to Sercombe and Sellato (2007) until the early 21st century a nomadic group of hunter-gatherers relying highly on the forest for their livelihoods needs. In the 21st century, indigenous people in Borneo

live in various types of society as nomadic, semi-nomadic and settled. However, communities are increasingly sedentary practising livelihood systems relying on wage income reducing their resilience to shocks. Indicators of livelihood system resilience include: (1) diversity of livelihood activities (i.e. income sources), (2) the level of dependence on external sources of income (i.e. external income or remittance providers from outside the community), and (3) the level of reliance on the forest as a source of livelihood. Indicators of development or “modernity” of livelihood systems include: (1) the main livelihood activities undertaken, and (2) the main objective of economic activities in terms of subsistence-or market-oriented. The way these indicators describes the transformation of livelihoods systems is illustrated in Figure 2. Figure 2 forms four quadrants where quadrant IV is the ideal combination of high resilience and sustainable rural livelihood system. The observed change of the Punan Dayak livelihood system, in this case, is primarily a transition from Quadrant I to Quadrant III. This transition is driven by outside influences and by adaptation to environmental change. Furthermore, the transformation of the Dayak Punan livelihood system does not occur through Quadrants I, II to Quadrant III. There is a tendency that development occurs in leaps from Quadrant I to Quadrant III passing by Quadrant II due to limited access to land and forest resources. Moreover, it can be expected that the Punan-Birang community will skip Quadrant II due to diminishing access to the forest and agricultural land with appropriate government assistance providing education and access to employment.

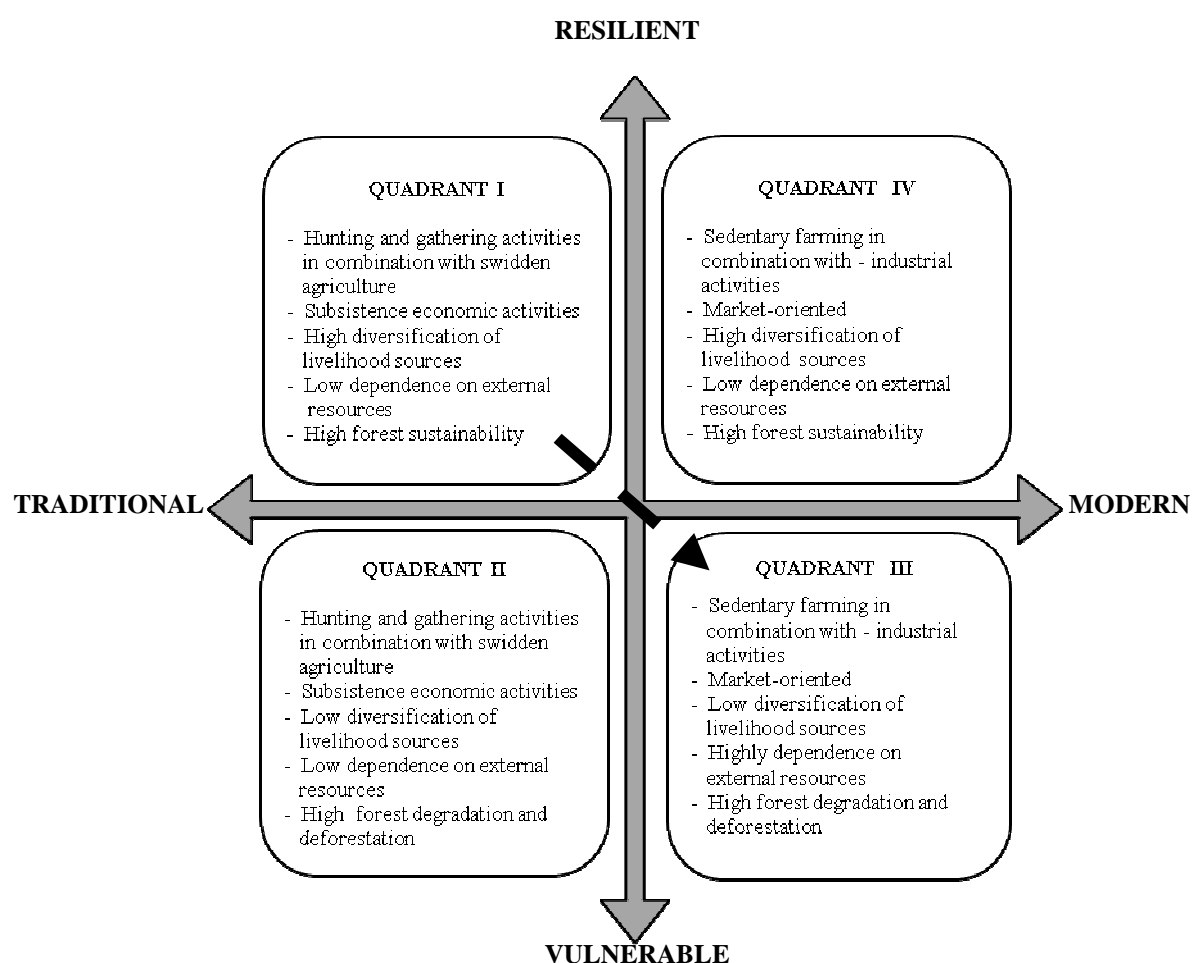


Figure 2. Matrix of livelihood system transformation traditional to development (“modernity”) and between resilient and vulnerable for Dayak Punan Communities.

For communities in Quadrant III, the change from forest to monoculture oil palm plantation has put stress on the household’s subsistence system. In order to survive, households have had to adopt new strategies, which according to Scoones (1998), can be either agricultural intensification, diversification of livelihoods sources or migration. In this case of Merapun, taking up wage labor in the oil palm plantation was the most viable option for most households as agricultural land is scarce and the isolated nature of the community means that migration is not an option. Bleyer *et al.* (2016) found that large-scale land transformation changes the livelihoods of rural people and particularly those dependent on natural

resources such as forests, gardens, rivers, and agriculture. Bleyer *et al.* (2016) observed that investment in industrial timber plantations produced several changes, including: (1) changing the traditional rural life through reduced availability of natural resources and conversion of agricultural land, (2) technological improvement of traditional agricultural practices leading to over-exploitation of natural resources, (3) diversification of income strategies through increased availability of formal employment and business opportunities and trade, and (4) non-natural resource-dependent subsistence strategies increasing household resilience. The transformation of the Dayak Punan community to Quadrant III has more severe consequences, particularly in Merapun as: (1) traditional rural livelihood strategies, have been lost - including swidden agriculture that is no longer practised, (2) high reliance on a single income source - wages from the companies, (3) high land transformation to plantation reducing available land for agricultural production as well as forest resource extraction, and (4) almost no subsistence use of natural resources that could function as a subsistence security net in case of an income crisis increasing household resilience to shocks.

The potential economic benefits of oil palm plantation cannot be fully exploited by the Dayak Punan community, and instead, benefits are reaped by outside entrepreneurs. The isolation of the location also means that few other opportunities for economic activities exist. Hence the expected improvement of household welfare through diversification of livelihoods taking up options for wage labor does not occur. As indicated by Ellis (2000) a subsistence strategy based on sustainable natural resources extraction, subsistence agriculture, fisheries, and small-scale livestock production combined with small-scale trade and transfer payments would be more appropriate in a location in interior East Kalimantan. The results are also consistent with Martin and Lorenzen's (2016) observations that rural subsistence diversification does not occur because there are insufficient options for investment of the accumulated wealth generated for more affluent households. Poor households remain unable to exploit the new economic opportunities for income generation (Gautam and Andersen 2016). The fact that livelihoods rely mainly on a single non-natural resource-based income source in Quadrant III indicates that the resilience of the community households is lower and more vulnerable. Moreover, the forest is no longer able to sustain the needs of the community in the event of a crisis. Thus, development activities, large-scale economic expansion, and empowerment of rural communities aimed at improving the welfare and resilience of their livelihoods have not succeeded. Instead, the "modern" and commercial oriented livelihood system is increasingly vulnerable.

Of the four Punan Dayak communities, the livelihood system in the Punan Dayak community in Merabu appears the closest to a sustainable rural livelihood system (Quadrant IV) although under the current conditions it is still classified in Quadrant III. However, the existence of the Berau carbon program (the SIGAP REDD + project) has safeguarded the preservation of forest resources by developing ecotourism. To achieve conditions resembling Quadrant IV, the diversity of household livelihood activities must be increased, especially those that do not depend on livelihoods outside the community (NGOs and companies).

5. Conclusion

Changes are unavoidable for rural communities due to the rapid development occurring in various forms. Development, empowerment and expansion of large-scale economic activities in rural areas have accelerated changes in rural livelihood systems, including the Punan Dayak tribe a hunter-gatherer community in East Kalimantan. The difference between communities in human and natural relations, production orientation, use of technology, adaptation to ecological change, and adherence to a religious system can be characterised in three typologies, namely: subsistence-nomadic, commercial semi-nomadic, and commercial settlement. For better or worse, the change from a subsistence-nomadic community to commercial settled society has driven economic growth but reduced livelihoods resilience. In other words, the transformation of livelihoods systems involves a dilemma. The experience from the livelihoods system transformation of the Dayak Punan community in East Kalimantan reveals that development policies and community empowerment projects must acknowledge rural communities as diverse entities. Expectations of the implementation of development policies and community empowerment cannot be the same from one location to another, especially if there are different cultural and livelihood systems. Efforts need to be made to improve the resilience of household livelihoods and develop local institutions that can ensure household livelihoods through advocating the rights of indigenous communities to their land and natural resources. Indigenous communities need further awareness raising to improve the outcome of their interactions with the outside including to avoid that they accept large-scale economic activities on their land that lead to degradation of the quality of their environment.

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