

Autopoietic Dynamics of the Illegal Logging System in Papua Forest

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Abstract

Illegal logging in Papua's forest areas has been a cause of unresolved degradation or deforestation and has developed into a complex problem. This study intends to elaborate on the complex dynamics of illegal logging in Papua, Indonesia, using Niklas Luhmann's Social System theory. The findings of this study are expected to provide a better understanding of the complexities of illegal logging and to encourage stakeholders to respond with more appropriate decisions and policies in accordance with their respective roles and authorities. The results of the research show that illegal logging in Papua is a social system that is formed from a simplification of the meaning of forests by actors who are purely economic-oriented. In facing the pressure from efforts to eradicate this system, the system has been reproducing in an autopoietic manner through differentiation to penetrate all other social systems pointed toward handling illegal logging and sustainable forest management, especially the law enforcement system and the customary forest community system. The ability of autopoietic to reproduce makes this system very flexible and cannot be handled by a rigid and bureaucratic system for dealing with illegal logging. It is suggested that the system for dealing with illegal logging must also be transformed into one of an autopoietic nature through collaborative management.

Keyword: Papua, forest degradation, social system, autopoietic, forest management

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Introduction

Illegal logging and illegal timber trade are considered to be one of the causes of forest destruction in the world, including in Indonesia (Maryudi et al., 2014; Kleinschmit et al., 2016; Barri et al., 2019). In the last decade, the phenomenon of illegal logging in Indonesia has shown a rapid shift from the western part of Indonesia to the eastern region (Barri et al., 2019). In the 2006-2017 period, the deforested area of Papua reached ± 478,936 ha or ± 43,540 ha per year (Ditjen Penegakan Hukum, 2019). This shifting phenomenon is in line with the decline of forest resource potential in the western (Sumatera) and central (Kalimantan) regions. This practice has affected Indonesia's forestry sector in many aspects. In addition to degradation and deforestation, other adverse effects include the loss of forest products needed by the local communities, conflicts, as well as significant losses in forestry sector tax revenues (Tacconi et al., 2004; Kleinschmit et al., 2016; Barri et al., 2019). In a broader view, illegal logging has raised widespread concern

for the entire forest stakeholders, including the industry, environmental communities, academics, international aid organizations, and both producing and consuming countries (Rosenbaum, 2004). On the state revenue side, illegal logging has cost the government billions of dollars in lost taxes and forest owners have lost billions of dollars in stumpage value. It was estimated that the state lost ± IDR2.9 trillion due to illegal logging practices in Papua in 2018/2019 (Ditjen Penegakan Hukum, 2019).

From the governance perspective, illegal logging practices are an obstacle to the realization of good forestry governance. Illegal logging practices are intertwined with illegal timber business networks involving timber tycoons or loggers, timber transport entrepreneurs, timber traders, wood processing industries, officials in the bureaucracy system, as well as some people who are vulnerable to being mobilized to engage in illegal logging practices (Nurrochmat et al., 2010). Oftentimes, timber tycoons take advantage of local communities, enticing them to engage in collusion and

corruption with government officials (Hidayat, 2007).

The phenomenon of illegal logging practices has become more important to study after the enactment of the Law of the Republic of Indonesia Number 21/2001 concerning the special autonomy for Papua Province and Government Regulations Number 1/2008 concerning the amendments to previously mentioned law. This law explicitly mentions the protection of customary law communities in the form of the right to utilize land, forests, water, and their contents. However, at a practical level, the management of forest resources by customary law community is still in a vulnerable position economically and politically when faced with more affluent groups. Instead of being an obstacle, in practice there is a *modus operandi* for logging companies to pay premiums to customary law community as timber owners to legitimize illegal logging timber labeled as "community rights" timber (Papua Forest Rescue Coalition, 2015).

Indonesian illegal logging is inseparable from the high global demand for illegal timber from many countries including China, India, Australia, South Korea, New Zealand, and Hong Kong (EIA, 2021). Meanwhile, Hoare (2015) reported that globally, the destination countries for illegal logging trade included China, France, India, Japan, the Netherlands, South Korea, Thailand, England, USA, and Vietnam. The ability to penetrate global markets is due to the support and involvement of multinational syndicates (Hidayat, 2007). Thus, the practice of illegal logging in Indonesia is not only a national problem but also a global one (Kleinschmit et al., 2016).

These facts show that illegal logging involves many actors and clinch the opinion that illegal logging is an extraordinary crime and trans-national organized crime (Lampe, 2016). A number of concrete efforts have been made to eradicate this practice, both through law enforcement and other efforts, for example by controlling the international trade. Starting from the 'Bali Forest Law Enforcement and Governance (FLEG) Declaration' in 2001, a mandatory certification approach has been applied to management units through the timber legality verification standard (*verifikasi legalitas kayu* or VLK) and sustainable forest management (*pengelolaan hutan produksi lestari* or PHPL). However, this effort has not been effective yet, although it is possible that the scheme was unable to capture the problems on the ground with sufficient sensitivity (Yovi & Nurrochmat, 2018). One theory relevant to gaining a deep understanding of the illegal logging system as a social system is the autopoietic social system proposed by Niklas Luhmann (1927/1998). Luhmann proposed this theory not aiming to carry out a sociological analysis or formulating a theory about society (*gesellschaftstheorie*) but wishing to elaborate a conceptual framework for social theories. An important finding of the social system theory by Luhmann is placing autopoietic into the context of social systems (Nadilla, 2019). For Luhmann, the social system provides a conceptual instrument for observing various phenomena that exist in social reality, such as society, organizations, and the interactions that occur within them (Syawaludin, 2017).

Symptoms of the development of actors' involvement in illegal logging lead to the hypothesis that the complexity of illegal logging continues to increase because illegal logging

is an autopoietic system. Maturana and Varela (1980) defined an autopoietic system as a system that recursively reproduces the elements in the system through the elements themselves, based on their communication with the environment. In the context of social systems, Luhmann (1995) stated that the dynamics of this system can move in an autopoietic manner characterized by self-regulation to adapt to changes in the environment (outside the system boundary).

This study aims to uncover the supra-system of illegal logging in Indonesia, with Papua as the locus. With a better understanding of the complexity of illegal logging, stakeholders can be encouraged to respond with more appropriate handling decisions and policies in accordance with their respective roles and authorities. Given the complexity of the system, we employed Luhmann's (1995) autopoietic social system approach, which is expected to more systematically and comprehensively describe the complexity of illegal logging in Papua.

Methods

Study area This research was conducted on 48 cases (2018–2019) of illegal logging involving 29 forest concession corporations and 29 Papua customary law communities, which occurred in Jayapura, Keerom, Boven Digul, Merauke, Nabire, Manokwari, Bintuni, Kaimana, South Sorong, and Sorong (Figure 1), to gain an understanding deeply about its autopoietic dynamics. All of these cases are those in which the handling or law enforcement involved the researcher directly and have been decided by a court or have permanent legal force (*inkracht*). An *inkracht* case has comprehensive and reliable information because it was obtained through a careful investigative process. Where in the process of these illegal logging law enforcement, the researcher was directly and actively involved as the Head of the Papua Illegal Logging Law Enforcement Task Force.

However, the problem of illegal logging is a systemic problem that cannot be separated from its relationship with other systems with a wider/higher hierarchy, namely natural resource management in Indonesia and internationally. Therefore, the location of information collection in this research is not limited to the administrative area of the district, but also other systems related to forest management in Papua or Indonesia.

Procedures This research was based on the post-positivism paradigm, implemented through a descriptive qualitative research method, which seeks to find and collect scattered data, then constructed them in a more meaningful and easier theme to understand.

The research process—the stages of data collection, data processing, and data analysis—was carried out continuously and simultaneously during the research process. Data were collected from various sources: 1) empirical experience of researchers in their direct involvement in law enforcement and investigations of illegal logging cases, 2) sources from various parties related to forest management and governance in Papua, and 3) relevant documents or literature. A total of 48 cases investigated were used as samples, and during the investigation process, interviews were conducted with 48

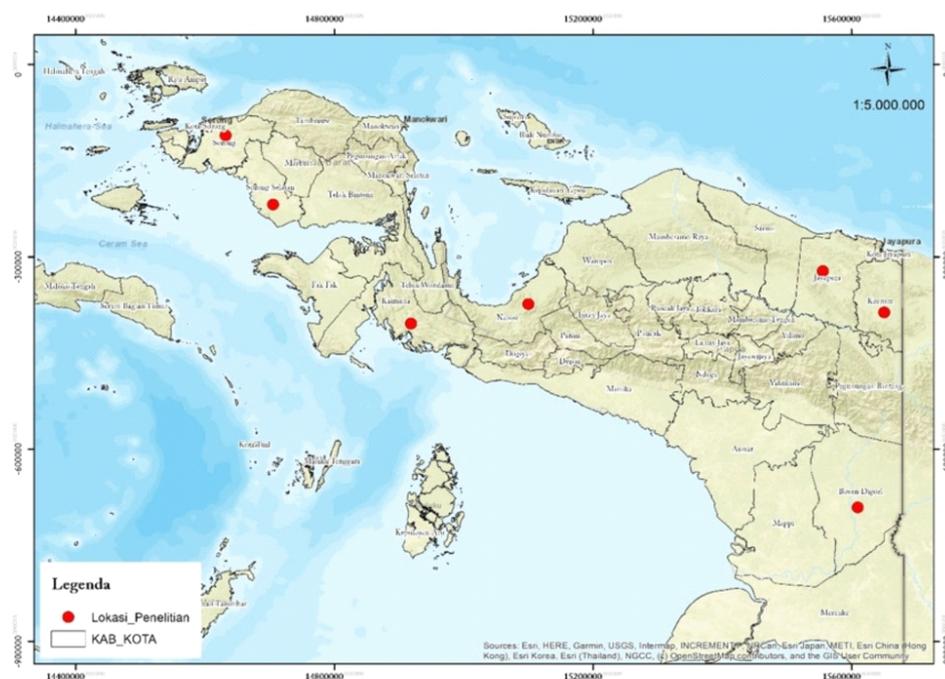


Figure 1 Research location.

suspected and 551 witness or source persons from various parties (Table 1), both from corporations, customary law communities and those from outside the two systems.

The next source of data was obtained from interviews and FGDs involving many source persons from various parties related to forest management and forest governance in Papua. They come from the bureaucrats of the Ministry of Environment and Forestry (including its technical implementation unit), bureaucrats in charge of forestry in the regional government, key persons from customary law communities in Papua, key persons in the forestry business; academics; and NGO activists (the number and origin of the source persons are presented in Table 1). Both informants and source persons were selected purposively based on the sampling principle focusing on intensity (Patton, 1990), namely informants who are believed to have rich data or information regarding the phenomenon of illegal logging in Papua. Meanwhile, the number of informants or resource persons was determined dynamically based on the need for the depth and saturation of the information obtained.

The data obtained from various sources was then validated through a triangulation process. Referring to Ali (2014), triangulation is implemented using a variety of different data sources. The meaning of information obtained from one data source was cross-checked with other data sources to obtain other information that may conflict with information obtained previously or even to enrich information from the first data source. This validated data was then analyzed through deductive coding, condensing facts, categorization and building narratives based on Niklas Luhmann's social systems theory to get a comprehensive picture of the dynamics of the illegal logging system in Papua.

Approach The approach used in this study is the Luhmann's

theory of autopoietic social system. The concept of autopoietic itself was first coined by Maturana and Varela (1980), who define an autopoiesis system as a system that recursively reproduces the elements in the system through the elements themselves. The reproduction of these elements is the result of the process of interaction between elements in the system, and the process in the autopoiesis system is a self-reproduction process.

Luhmann uses the term “autopoietic” to denote systems such as the economic, political, legal, scientific, and bureaucratic systems. The key concepts of Luhmann's system theory are self-regulating and self-creating or self-generating (Scott, 2012). For Luhmann, the processes in the social system are self-referential and self-reproductive (Rahardjo, 2006). Self-referential means that each operation refers to the previous one. In an autopoietic system, all elements that are part of the system are created by the system itself. Thus, the social system is a type of closed system: it is impossible to have direct contact between the system and its environment. The system always determines for itself how to make contact with the environment. The difference between autopoietic systems and closed systems is their recursive character, they not only produce and replace their own structures, but everything that is used as a unit in the system that is produced is also a unit within the system itself (Syawaludin, 2017).

The mechanism of Luhmann's system theory works with two concepts: interpenetration and structural coupling, with the former being used as the scope in this study. Interpenetration is an event of mutual penetration between sub-systems, which will always refer to the elements in each sub-system according to their respective codes (Luhmann, 1989; Luhmann, 1995). The concept of interpenetration considers that a system makes its complexity available to other systems.

Table 1 List of information sources

No.	Type of institution	Name of institution	Quantity (person)	Information source
1	Government	Director General of Law Enforcement Ministry of Environment and Forestry (MoEF)	1	Source person
2	Government	Structural Officer within the scope of the Directorate General of Law Enforcement MoEF	5	Source person
3	Government	Head of the Maluku Papua Forestry and Environment Law Enforcement Center	1	Source person
4	Government	Head of the Jawa Bali Nusa Tenggara Forestry and Environment Law Enforcement Center	1	Source person
5	Government	Civil Servant Investigator Directorate General of Law Enforcement MoEF	60	Source person
6	Government	Directorate General of Sustainable Forest Management MoEF	7	Source person
7	Government	Production Forest Management Office Regional XV Jayapura	2	Source person
8	Government	Production Forest Management Office Regional XVI Manokwari	2	Source person
9	Government	Production Forest Management Office Regional VII Denpasar	2	Source person
10	Government	Production Forest Management Office Regional XIII Makassar	2	Source person
11	Government	Legal Bureau MoEF	2	Source person
12	Government	Inspectorate General MoEF	1	Source person
13	Government	Directorate General of Social Forestry and Environmental Partnerships MoEF	1	Source person
14	Government	Head of the Papua Natural Resources Conservation Agency	1	Source person
15	Government	Ex Head of the Papua Natural Resources Conservation Agency	1	Source person
16	Government	Practitioner Corruption Investigation Commission	7	FGD/Source person
17	Government	The Attorney General's Office of the Republic of Indonesia	2	Source person
18	Government	Attorney General East Java	2	Source person
19	Government	Attorney General South Sulawesi	2	Source person
20	Government	Attorney General Papua	2	Source person
21	Government	Attorney General West Papua	2	Source person
22	Government	Attorney General Surabaya	2	Source person
23	Government	Attorney General Makassar	2	Source person
24	Government	Attorney General Jayapura	2	Source person
25	Government	Attorney General Sorong	2	Source person
26	Government	Indonesian Navy Main Base V Surabaya	20	Interviewee
27	Government	Indonesian Navy Command Headquarters Fleet II Surabaya	20	Interviewee
28	Government	Indonesian Navy Main Base VII Makassar	20	Interviewee
29	Government	Indonesian Police Criminal Investigation Agency	2	Source person
30	Government	Regional Police of East Java	2	Source person
31	Government	Regional Police of South Sulawesi	2	Source person
32	Government	Regional Police of Papua	2	Source person
33	Government	Regional Police of West Papua	2	Source person
34	Government	Head of Port Authority and Harbormaster Office Sorong	1	Source person
35	Government	Head of Port Authority and Harbormaster Office Nabire	1	Source person
36	Government	Head of Port Authority and Harbormaster Office Jayapura	1	Source person
37	Government	Head of Port Authority and Harbormaster Office Tanjung Perak	1	Source person
38	Government	Head of Port Authority and Harbormaster Office Makassar	1	Source person
39	Government	Indonesian Port Company III Surabaya	3	Source person
40	Government	Provincial Forestry Service Papua	3	Source person
41	Government	Provincial Forestry Service West Papua	3	Source person
42	Government	East Java Forest Product Circulation Technical Implementation Unit	3	Source person
43	Government	Provincial Forestry Service East Java	3	Source person
44	Academics and researchers	CIFOR	1	Source person
45	Academics and researchers	Academic Observer of Illegal Logging	1	Source person
46	Academics and researchers	Faculty of Forestry Academics UNIPA	1	Source person
47	Academics and researchers	Faculty of Sociology and Anthropology UNCEN	1	Source person
48	Academics and researchers	UNCEN	1	Source person
49	Academics and researchers	Lecturer at the Faculty of Forestry and the Faculty of Law UGM	4	Source Person - Expert witness
50	Academics and researchers	Research academics in forestry and natural resources (UNIPA)	1	Source person
51	Academics and researchers	WRI Researcher and Lecturer at Manokwari University	2	Source person
52	Non-government organization	Forestry foundation practitioner	2	Source person
53	Non-government organization	Kaoem Telapak	2	Source person
54	Non-government organization	Yayasan Pusaka	2	Source person
55	Non-government organization	Member of the Papuan Independent Committee	1	Source person
56	Non-government organization	Forestry Independent Monitoring Network	1	Source person
57	Non-government organization	Auriga Nusantara	2	Source person
58	Community figure	Special Autonomy Leader (MRP) and Founder of Elsam	2	Source person
59	Community figure	Papua Figure	2	Source person
60	Community figure	Customary Law Communities	10	Source person
61	Business association	The Indonesian Forest Concessionaires Association (APHI)	2	Source person
62	Suspect and witness or source persons	Investigation of illegal loggers suspect and witness or source person	599	Source person
Total			881	

Various studies have concluded that efforts to deal with illegal logging practices can no longer rely solely on a legal approach that relies on a number of administrative, civil, and criminal sanctions. The practice of illegal logging is a systemic problem and the effectiveness of handling it depends on the synergy of the roles and actions of the stakeholders (legal officials, government agencies/institutions and local governments, communities and their organizations, and international organizations) in accordance with their respective authorities (Setianingsih, 2009; Takamuli, 2018). However, the development of this particular system for handling illegal logging requires a comprehensive understanding to unravel the complexity and dynamics of the illegal logging system it faces.

Results and Discussion

The reality of Papua's forest management as an environment and illegal logging supra system Being considered an autopoietic social system, illegal logging in Papua is formed from a reduction in meaning to the complexity of its environment, a negentropy, where there is always an interaction between the social system and its environment. Thus, to gain a comprehensive understanding of the autopoietic dynamics of this illegal logging system, an understanding of the environment and its supra system is required. In the context of this study, the environment can also be interpreted as the supra system. In general, a “supra system” could refer to a system that is composed of multiple sub-systems and operates at a higher level of abstraction or complexity. In this case, illegal logging is one example.

The environment of the illegal logging system or forest management system in Papua is a very complex system as represented by the reality of its forest resources and people. Papua's natural forests have the most complete and unique natural tropical forest ecosystem, and they provide direct benefits for both timber and non-timber forest products, genetic banks, and biodiversity stores. The complexity of this environment can also be seen from the concept of customary zoning which is illustrated by the diversity of cultural elements, such as language, social organizational structure, leadership system, religion, and livelihood systems based on environmental ecology (Parsch et al., 2022). Geography and

climate conditions cause different adaptation patterns to occur between one or several other ethnic groups based on differences in the ecological environment in which they live (Song & Zhang, 2018). Adaptation creates differences in the development of social structures and life patterns. However, among this diversity there is a special characteristic of the traditional life: the layered relationship between humans and the land-nature that appears socially, economically, ecologically, culturally, and mystic-religiously. From the Papuan people's understanding of the forest, there is a view that the forest is a 'mother' or an 'identity'; therefore, customary law communities have a high degree of dependence on land (Zhou & Chen, 2006), collectively refer to traditional ownership rights over land and forests. The implication of this is that traditional forest management systems have never been separated from the customary rules that apply in the community. Additionally, legitimacy from the state is not needed (Biswas & Pal, 2021).

In this study, we found that this complexity shows a significant shift with the emergence of a state forest management system that is handed over to corporations. Almost all state forest areas for corporations in Papua are traditional forest areas which lead to various conflicts (Purnomo et al., 2013; Kuswandi et al., 2015), that increase their complexity, including the emergence of illegal logging carried out by both the corporations themselves and other parties.

Illegal logging develops rapidly and is continuing even after state forest management system is implemented (Figure 2). This study also identified two patterns of illegal logging occurring in Indonesia, one that is carried out by institutions with forest concession rights (*hak pengusahaan hutan* or HPH) and the other that involves the community. Illegal logging by HPHs is basically initiated by simplification of land ownership, silviculture systems and yield regulation. The simplification of the land ownership system by the state which does not accommodate the customary law communities ownership system has created a contingency in the form of land use conflicts between these communities and HPHs (Koalisi Anti Mafia Hutan, 2017; Auriga Nusantara et al., 2018). Meanwhile, the simplification of the silviculture system is not in line with the natural



(a)



(b)

Figure 2 Location of illegal logging in Papua forest (a) and condition of Papua forest after illegal logging (b).

dynamics of forest growth and demand growth (Baharinawati, et al., 2011). This whole contingency coupled with the licensing and supervision system which is laden with illegal levies has resulted in very high production costs and unfavourable business prospects. The communication process that develops from this meaning ultimately drives the process of differentiation of HPHs, one of which is the establishment of illegal logging system within.

In the latter, illegal logging is carried out by timber tycoons by manipulating local communities and colluding with government officials to take advantage of weak implementation of the rule of law (Tim Badan Penelitian dan Pengembangan Kehutanan, 2011). In its journey, the illegal logging system interacts with other social systems, through the involvement of its actors, reproduces, and adapts to the disturbances that threaten its existence. As social systems, these systems are actually closed systems that interact with each other referentially and they build a network of systems within the supra system. These systems can be used for reproduction either for eradicating illegal logging or for perpetuating it. The identified systems that exist in this supra-system are as follows:

- 1) Forestry system: a system related to the state's management and regulation of resource utilization. This system includes forest governance and forest management sub-systems. The forestry governance sub-system is related to regulating the use of forests as a public resource, while the forest management sub-system is related to the technical implementation of its management.
- 2) Living system of the customary law communities: a system of tradition arrangements related to the socio-economic and cultural aspects
- 3) Government system: a system related to governance at both the central and regional levels, especially with regard to the regulations of the use of natural resources and law enforcement.
- 4) Timber forest product marketing system: a timber forest product business system also includes trade, industry, and circulation systems.
- 5) Non-governmental institutional system: an institutional system outside the government system both at a national and international level formed by the awareness to encourage the realization of sustainable forest management

Reproduction dynamics of illegal logging systems in Papua forest Forest management and illegal logging in Papua's forest areas are basically a social system. Referring to Luhmann (1995) this social system was born from the reality of forests and their management which is very complex as it is related to forests as common pool resources. This complexity encourages a communication process that underlies its simplification through the selection of meaning into a more organized order, namely the social system of forest management, including the illegal logging system. This complexity is dynamic and encourages the evolution of its management systems.

Initially, the forest management system in Papua was the traditional forest management with the main actors being the customary law communities, formed through a

simplification of the meaning of the forest as a “mother” and a sacred place. This meaning refers to the human and nature relationships, and includes values or beliefs for maintaining relationships with nature as well as social structures regulating environmental harmony (Zhou & Chen, 2006; Lekitoo, 2020).

This traditional system began to change with the emergence and development of a forest management system by the state in the form of forest utilization concessions by corporations, which were actually formed by a simplification of the meaning of forests by the state which economically driven or extractive timber. The simplification of meaning is a contingency which also means risks (Ritzer & Goodman, 2008). In this case, the contingency is the neglect of the traditional forest management system within the state forest management system causes the management of this system to be uncertain, especially with regard to forest ownership and function. This uncertainty ultimately changes the composition of the actors, including customary law communities, and the subject of communication towards forests as mere economic resources and marginalizes the meanings that form traditional forest management.

Another contingency that carries risks to forest management arises from illegal timber business actors or local communities who are not accommodated by a forest management system. Communication among these actors creates the meaning that the illegal timber extraction business is much more profitable because it is free from the many obligations causing high costs. Most of the actors tend to no longer mean the forest as a common pool of resources, but only as an economic resource. The communication process that develops from this meaning eventually causes the formation or reproduction of illegal logging systems in Papua's production forest areas (Hidayat, 2007; FWI, 2019).

This illegal logging system was originally a simple social system with timber business activities in its core and with the main actors being the financiers or tycoons. In general, each financier represents a closed system of illegal logging. However, the profitable-unprofitable code has encouraged the tycoons to expand this business by reproducing the system with structural differentiation (in which they form a new, similar structure) and functional differentiation (in which they form various sub-systems to carry out certain functions, with the main objective of expanding production or avoiding various threats primarily law enforcement. This differentiated sub-system works in various modes, such as *tebangan cuci mangkok* (re-cutting of trees before their optimum time), illegal timber harvesting, data manipulation of forest product regulations, and involvement of officials and local communities (Telapak & EIA, 2005; Suarga, 2005; Eddyono, 2017; Barri et al., 2019; Ditjen Penegakan Hukum, 2019). This extensive reproductive nature is what ultimately accelerates forest degradation and deforestation in Papua.

In the end, the various parties or actors who are legally involved in state forest management respond to this new complexity arising from illegal logging to form a system for eradicating it. A series of activities have been carried out through the formation of regulations, such as Law Number 41/1999, Law Number 18/2013 and their derivative regulations and their enforcement; however, the effect is temporary, and it has a counterproductive impact on legal

timber utilization.

On the other hand, the existence of this system is responded to by the illegal logging system by reproducing the system functionally through a differentiation process by establishing a security subsystem. Through this subsystem, the illegal logging system builds the interpenetration of social systems related to the handling of the problems, especially the law enforcement system, to secure its existence (Figure 4). The binary code of profitable and unprofitable is used by the illegal logging system to interpenetrate dishonest officials and to persuade them to be involved in safeguarding the system against law enforcement and manipulating the legality of their products. Not only does illegal logging penetrates the eradication system, but it also penetrates the customary law communities using an additional binary code of “safe” and “unsafe”. The involvement of various officials and customary law communities as a result of penetration of the illegal logging system has resulted in law enforcement, focusing on prosecuting perpetrators, becoming less effective. The illegal logging system is still as intense as before (Telapak & EIA, 2005; Suarga, 2005; Eddyono, 2017; Barri et al., 2019; Ditjen Penegakan Hukum, 2019). This situation encourages a communication process between the state forest management actors or parties to shift the meaning of its governance.

Changes in the post-reform constitutional system, more specifically the shift in governance from centralization to decentralization with the enactment of the special autonomy law for the Province of Papua (Law Number 21/2001) causes the development of the antithesis of exclusive forest management by corporations. This antithesis means that forest management becomes more inclusive. This new meaning eventually became the driving force for the establishment of a state forest management system by customary law communities through timber utilization license (*izin usaha pemanfaatan hasil hutan kayu*).

From a socio-cultural perspective, illegal logging has changed the socio-cultural system of the Papuan people. Customary law communities actually still believe that forests provide the resources they need for life, and they carry out socio-cultural processes in forest areas (Siburian, 2018). This is confirmed by Lekitoo (2020), explaining from an anthropological point of view that in the life of customary law communities: 1) customary law communities in Papua identify or associate themselves with nature; for example, the native Papuans in general call the land '*ibu* or *mama*'; 2) values or beliefs are built to maintain relations with nature; and 3) the social structure regulates harmony with the environment. The involvement of Papuan Customary Law Communities in the manipulation of timber originating from the community (Auriga Nusantara et al., 2018) shows that there is an adaptation to the changes in social and cultural systems. This situation is actually contrary to the traditional beliefs which have a cosmic view of maintaining harmony with nature in culture and tradition (Mansoben, 2003; Deda & Mofu, 2014).

The simplification of forest management by customary law communities (Hamzah, 2001) also created a new contingency in the form of conflicting policies between the central government and the provincial government of Papua,

especially in relation to the nomenclature of the forest management (Situmorang & Susilawati, 2020). This situation is in accordance with the study of Hellstrom (2001) on conflict cultures and conflict management strategies. Further, this contingency has prompted the establishment of channels of communication between the customary law communities and illegal logging actors. This communication process ultimately leads to the reproduction of customary law communities-based forest management system; one of which is the emergence of an illegal logging subsystem where one of its functions is to legalize illegal activities and products.

A system for dealing with illegal logging, which still has the core of law enforcement, is basically a government bureaucratic system inspired by the Weberian bureaucratic model. However, one of the characteristics of this bureaucratic system is the existence of a hierarchical authority structure with clear boundaries of responsibility (Udy, 1959; Wright, 1992; Tjokrowinoto, 1995) causing this system to become rigid and unadaptable allopoietic system.

Various studies have concluded that efforts to deal with illegal logging practices can no longer rely solely on a legal approach that relies on a number of administrative, civil, and criminal sanctions. The practice of illegal logging is a systemic problem and the effectiveness of handling it depends on the synergy of the roles and actions of the stakeholders (legal officials, government agencies/institutions and local governments, communities and their organizations, and international organizations) in accordance with their respective authorities (Setianingsih, 2009; Takamuli, 2018). Studies proved that in dealing with illegal logging, bureaucracy and law enforcement alone are no longer able to meet the complex requests and it is not suitable for dealing with problems that often transcend organizational boundaries (Goldsmith & Eggers, 2004). Law enforcement in Indonesia is seen as inadequate to stop illegal logging, especially in decentralized areas where natural resource management is in the hands of multiple local governments (Kadir, 2019), which is contrary to Brazil's cases (Tacconi et al., 2019). Inadequate monitoring and law enforcement resources are a real problem that is exacerbated by the penetration of this system of illegal logging. The government has been burdened with very heavy responsibilities related to forest management, but they are seen as incapable to do much, one of which is caused by a centralized approach.

The process of reproduction of this illegal logging system even further accelerated during the reformation period with the formation of sustainable management of production forests (*pengelolaan hutan produksi lestari* or PHPL) assessment system. The PHPL assessment system, previously intended to control business actors in the forestry sector to be more responsible in implementing sustainable management of forests (Arshanti et al., 2017; Yovi & Nurrochmat, 2018), has reproduced with the emergence of 1) a forest certification system, 2) a certification-based timber marketing system, and 3) other subsystems related to PHL. Meanwhile, the forest certification system itself has also undergone differentiation with the emergence of the SVLK system; one of whose goals is to reduce illegal logging practices and trade (Maryudi, 2016). SVLK implementation involves many parties with statutory mandate status,

voluntary status and forest property rights regimes (Nugroho et al., 2022). Those who are mandatory to be directly involved are the Ministry of Environment and Forestry, certification bodies, forest management units, forest entrepreneurs, and communities surrounding the forest areas.

The dynamics of dealing with illegal logging show the reproduction of the system where the boundaries of the system change with the involvement of non-governmental parties, both domestic and international. Other than the certification, the shift in the handling of illegal logging can be seen from the emergence of more inclusive forest management schemes such as social forestry. This scheme is considered to touch more on the source of the cause of logging: community poverty due to limited access to forest resources.

This illegal logging management system carries out its reproduction process by penetrating various systems related to forest management, including the illegal logging system through a binary-coded communication process representing PHL such as sustainable—unsustainable, legal— not legal, fair— unfair, safe— unsafe, dangerous— not dangerous, good— not good, and profitable— unprofitable. However, the semi- autopoietic process of the illegal logging management system must always face the autopoietic capability of the illegal logging system. The logging system with the binary code profit profitable— unprofitable and safe— unsafe penetrates not only the management system but also the systems within the supra system (the wider system order) as illustrated in Figure 3.

The resultant of the interpenetration facts abstracted by Figure 3 forms a penetration accumulation pattern that acts as

a power field. Based on the results of the interpretation of the interpenetration facts which are supported and validated through focus group discussions from resource persons and informants, the abstraction of power space is presented in Figure 4. This figure shows that the power field of the illegal logging system is stronger than the penetration of systems related to forest management in the Papua Forest and almost all systems related to forest management have been penetrated by this illegal logging system. Penetration of the power field also shows that the three strongest forces are the forestry management system by the Ministry of Environment and Forestry, the law enforcement system, and the forest management system by corporations. The penetration by these three systems is a bureaucratic intervention because basically these three systems are the subsystems of the bureaucratic forest management system which also includes the bureaucratic system for dealing with illegal logging.

The level of this penetration is relatively great; yet, the illegal logging system also penetrates this bureaucratic system quite deeply, filling it with bureaucratic disorders. An interesting figure of the power field is also shown by the interpenetration between the illegal logging system and the forest management system by the customary law communities. Since the existence of the customary law communities system is contingent on the availability and quality of forest resources controlled by the communities, this situation presents a paradox for forest management and control. These interpenetration facts indicate the high complexity of illegal logging in Papua. Dealing with this kind of complexity and the limitations that the handling

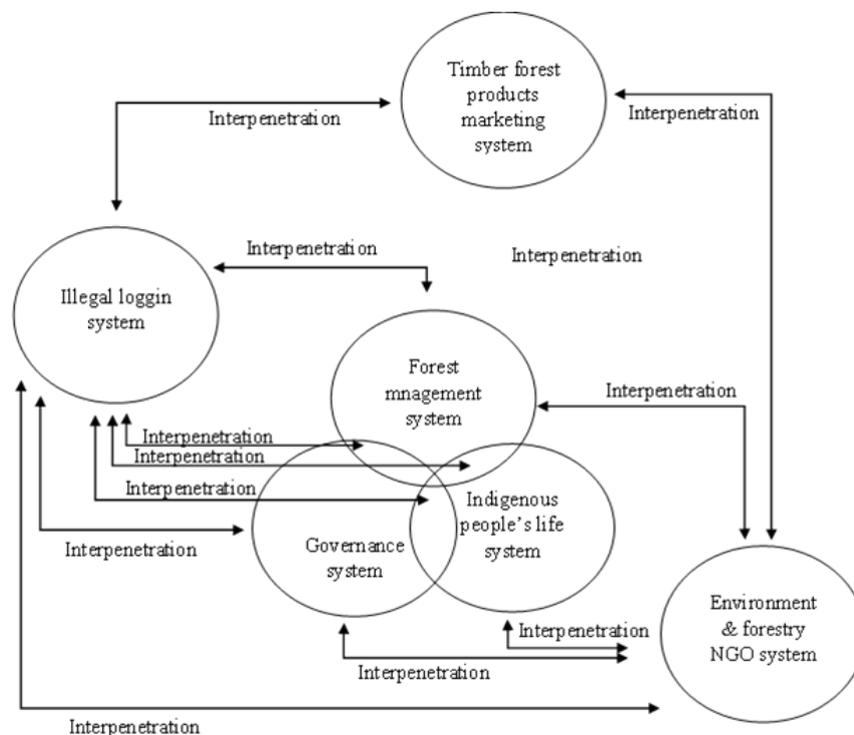


Figure 3 Abstraction of illegal logging system interpenetration with other systems in the related supra system.

system has, we proposed that the system for dealing with illegal logging must be transformed from a rigid bureaucratic system to a management system that is autopoietic in nature.

One of the governance systems that have autopoietic characteristics is collaboration-based governance (Ansell & Gash, 2008; Bianchi et al., 2021). Collaboration is a rational choice (Agranoff & McGuire, 2003), because it is a process of forming or reproducing a social system. In Luhmann's perspective, collaboration will occur when there is coupling between systems that interpenetrate and communicate with each other. The intended coupling is that each system that penetrates each other will differentiate or reproduce subsystems in their respective systems, in an effort to realize the goals formed by interpenetration which are also the goals of collaboration. Both interpenetration and coupling can be created if the two systems communicate with each other to build the same meaning for the interpenetrated subjects.

There are several collaborative governance models, but not all of them are suitable for dealing with the autopoietic dynamics of illegal logging systems. A collaborative governance model that is dynamic and capable of reproduction is needed to anticipate the penetration of the illegal logging system. One model that meets this demand is the collaborative governance regime model (Emerson & Nabatchi, 2015) which manages collaborative actions as a cycle that continuously moves and interacts dynamically.

Conclusion

Illegal logging in Papua is essentially a social system capable of reproducing itself via the process of autopoietic. The establishment of the illegal logging system in Papua begins with the simplification of the complexity of forests and their management by corporations engaged in forest management (centered on timber extraction). Due to the corporate system's inability to accommodate traditional forest management practices, this simplification generates a number of unexpected problems. This contingency fosters the emergence of actors outside of the corporate system capable of penetrating customary law communities and corporations. The engagement of these outside actors facilitates contact between corporations and perpetrators of the illegal logging system, causing corporations to become perpetrators of illegal logging activities, resulting in massive forest and land degradation in Papua. Control attempts involving bureaucracy and law enforcement, as well as the certification systems (PHPL and VLK), did not yield the desired outcomes. Involving customary law communities in the forest management system is another approach taken to reduce illegal logging. However, the continuous power struggle between the national and local (Papuan) governments has left this institution unprepared, allowing the illegal logging system to infiltrate and abuse it as well. The emergence of this autopoietic illegal logging system has led to the devastation of Papua forests. In light of these

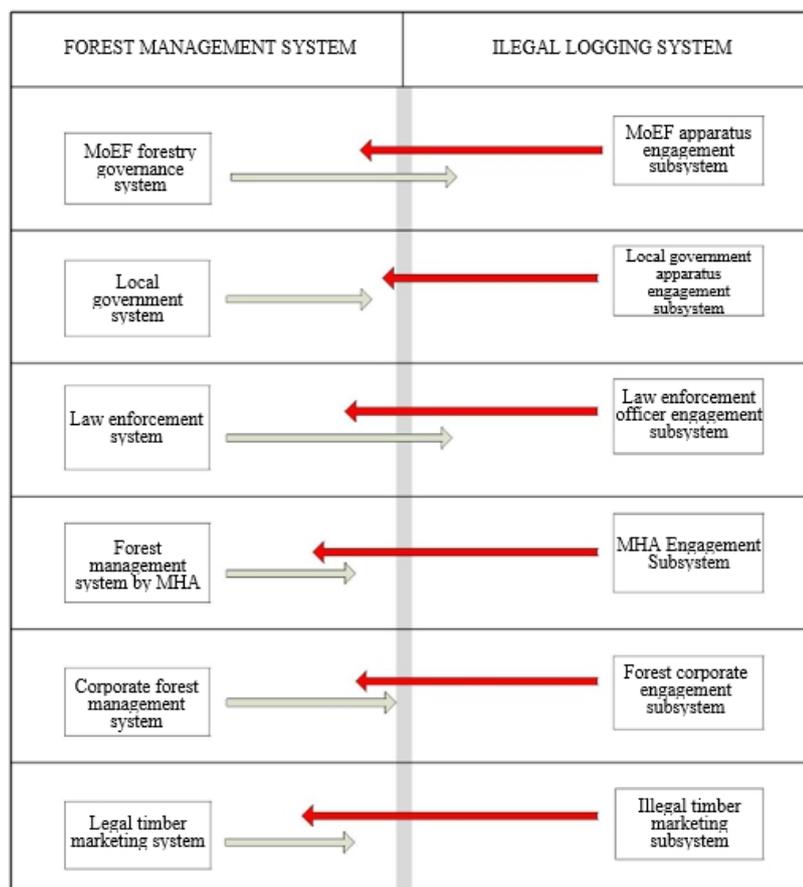


Figure 4 Interpenetration abstraction of the illegal logging system and systems/sub-systems related to forest management in Papua forest.

findings, it is recommended that the sustainable forest management system likewise undergo modifications in order to become an autopoietic system. Further, to develop the concept of sustainable forest management in all systems associated with forest management in Papua, it is highlighted that collaboration based on efficient communication is required.

Conflicts of Interest

The authors declare no conflict of interest.

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