

## Developing Stakeholder Dynamic Assessment for developing wild animals conservation: an evidence from West New Guinea

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## Abstract

In managing and organising the development of wild animals for humans, many actors have been involved. The involvement of actors in promoting conservation and all related saving environment has been weak and un-ruled. The objective of this study was mapping, and providing apparent involvement of stakeholders related to actor characteristics, resources used, power-interest created, and contribute to wild animal conservation using the concept of stakeholder and institutions relationships. This research aims to distinctively map and provide apparent involvement of actors or stakeholders concerning their contribution towards wild animal development in West Papua. As many as 15 institutions were interviewed according to the roles and resources of individuals working formally and informally. The parameters collected include the structure, status of law, and types of the organisation and stakeholders' role, effect, importance, threat, and turn-back impact. The data gathered include shared resources, power-interest actors, and interventions-innovations. All data were stored in a Microsoft Excel worksheet and exported to software SNA version 2.5. Research findings showed several significant and strategic characteristic typologies and resources belong to actors for national, local, and grass-root levels. The interest and power embedded into actors determined how intense and severe an actor works in establishing the programs and projects. We inventoried shared resources, duration of the period played by actors, continuity resource roles, power of resources, and intervention needs.

**Keywords:** *wild animal, stakeholders, Actors, Social Network Analysis, West Papua*

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## 1. Introduction

The losses of wild animals in the World have been run quickly (Stephen and Zimmer 2015; Honda et al. 2018; Fratini et al. 2016). The usages of a wild animal in supporting human life are undoubtedly solid and varied according to the traditions and beliefs in forest-dependent and tropical countries (Higginbottom 2004; Mateo et al. 2016) such as Indonesia. In the World, many scholars reported that the usages of wild animals in the tribes brought values and advantages (Larsen et al. 2020; Lindenmayer 2011; Altrichter 2006; Woinarski 2010; M Altrichter 2005; Obasi and Vivan 2016). It is from Asia, Africa, America, Australia. There are ten countries with larger biodiversity counts in the World, i.e. Brazil, South Africa, Madagascar, Ecuador, Mexico, United States, China, Philippines, and Australia (Sustainability 2009). Many scholars repost the decreasing number of population and species. From the figure released by IUCN, there are 40% amphibians, 26% mammals, 14% birds, and 34% reptiles (IUCN 2021). Some mega-biodiversity countries in ASEAN are China, Indonesia, India, Philippines, and Malaysia (Profauna-Indonesia 2021). In Indonesia, West Papua island has kept the first rank of species richness and diversity. It also has a high number of ethnicities and forest abundances. Therefore, the ethnicities in West Papua also rely on forest resources and wild animals.

Many actors have been participating in managing and organising wild animals for humans. The involvement of actors in promoting conservation and all related saving environment has been weak and un-ruled. Wild animal trade implied vast and diverse species, multi-function uses and end-up in the market gate. It meant that they were produced not from legal and captured around their natural habitat. The report of UNEP, 2014 global wild animal trades for plants and animals, yielded \$7-\$23 billion. The trade was \$2.5 billion (UNEP 2014), and lowering species richness 1/3 threatened.

Actors in terms of individuals and groups called stakeholders are individuals, groups, and institutions that have direct and indirect effects in changing an inevitable process (Freeman 2015). Many stakeholders play a role in determining a development process (Slater et al. 2020; Jayant 2019; Carvalho et al. 2020). Many scholars discussed advances, dynamic, and modern developed issues regarding wild animal actors, their lack and lags of information available on the basic level such as typology, resources, power-interest, innovation, and intervention. We are interested in addressing these issues. Several actors are shaped and formed officially under the laws on both international levels, such as the CI, the WWF, and the TNC. While at the national levels, i.e. state (central government) and regional, i.e. governor and regents. Wild animal management in the World made and defined are natural parks, national parks, a corridor for animals, animal parks, ecotourism parks, and ecotourism villages, wild animal contests (Krupa et al. 2017; Sivalioglu and Berköz 2012; Bredin et al. 2015; Stephen and Zimmer 2015; Liu et al. 2020; Madsen et al. 2020). However, some stakeholders are not formed and shaped by the laws' interaction. They are honest and play a strategic and prominent role in determining development. How the stakeholders work in every country is varies. The stakeholders, particularly in the wildlife and the environment, should embed and follow national regulations and policies (Ileana et al. 2020; Jayant 2019; Fratini et al. 2016; Engen, Fauchald, and Hausner 2019; Ahmad et al. 2012; Stryamets et al. 2019). Indonesia's experience is not

similar to the other countries in the World. Therefore, it is determined how fluent and sustains the program they work and achieve for. International organisations which have been established and worked so far are such as WWF, CI, and the TNC (Ullah and Kim 2020; Sheil et al. 2009; Rametsteiner and Simula 2003; Coad et al. 2019; Lindenmayer 2011; Widjaya et al. 2014; Pattiselanno et al. 2015; Publication, Been, and In 2012).

Many parties are interlinked, connected, and shaped by complex systems in developing wild animal programs. The complex development system, including social, economic, and environmental, has the definition and knows their roles. Actors or institutions are a part of it. Without knowing the roles of actors' systems, it is hard to drive the parties that play vital roles in shaping the presence of the development, particularly wild animals. In some of the fundamental researches on stakeholders, the typology, resources, innovation, and interventions were not highlighted. Researching and knowing, including recognised stakeholder resources, typology, and details innovation and intervention, will not reduce their roles. Each stage of wild animal development has its process and related parties and stakeholders involved (Linnell et al. 2020; Howard 2018; Flaherty et al. 2019; Su et al. 2020; Park, Williams, and Zurba 2020; Hoveka et al. 2020).

Each stakeholder cares and desires to increase their business and is market-oriented, but it aims to provide feeds for the World. Stakeholders and shareholders have prominent roles in creating the compact demand for wild animal products, particularly meat, hair, offspring, eggs, hair colours, voice, aesthetic, and amusement (Vega et al. 2013; Coad et al. 2019; Obasi and Vivan 2016; Altrichter 2006; Abbott and van Kooten 2011; Mateo et al. 2016; Robinson et al. 1999; Kwapena 1984). This is then created the exploitation of wild animals in massive ways, such as birds, mammals, reptiles and amphibians, and insects (Larsen et al. 2020; Flaherty et al. 2019; Alakoski et al. 2020; Fratini et al. 2016; Ebu et al. 2011) how the stakeholders' involvement in balancing and protecting the wild animals in collaboration under institutions and or organisations become the objective of this study. The looks of wild animal products available in food stores shall attract the interest of consumers to buy the products. In many tropical and developed countries, the involvement of stakeholders is undoubtedly actual. Some play a vital role in controlling the powers, resources, and access, even controlling the threat. They are playing vital roles and sharing essential relationships. Therefore, it is vital and urgent to dig up the involved stakeholders, their roles, function, and connection with other parties in shaping the services on the existing and future works (Hellsten et al. 2019; Slater et al. 2020; Reed et al. 2009).

It seemed that inside and outside aspects of wild animal development and stakeholder involvement should be developed and mapped (Krupa et al. 2017; Hellsten et al. 2019; Saadi et al. 2020; Slater et al. 2020). So far, the existing stakeholders do not count the government and the local community yet. However, they have been working for years. In many scientific areas, social networks are critical when we study the way problems, diseases, organisations, and the degree to which individuals succeed in achieving their goals. Software is being developed and applied to explain the phenomena. Social Network Visualizer is one robust social network analysis besides SmartPLS (Ringle et al. 2005), Netmap (Schiffer 2007), and Gephi (Bastian et al. 2009). By mapping the stakeholders and institutions with no power and interest, we will identify, and it will be easy to promote their roles. Therefore, mapping and providing apparent involvement of stakeholders related to actor characteristics, resources used, power-interest created, and contributing to wild animal conservation becomes the aim for this manuscript using the concept of stakeholder and institutions relationships.

## **2. Materials and Methods**

### **2.1. Location and analysed actors**

Descriptive and social researches were done in Manokwari, West Papua. We invited several organisations, groups, and individuals representing institutions. We approached them by collecting all relevant data and information concerning action done by actors on existing wild animal presence, including preservation, protection, trading, and trafficking. Data were collected using personal mobile phones, personal dialogues, and desk studies from qualitative research (Moleong, 1991). Relevant data collected consisted of notes and reports from field research documents, policy documents, articles, daily newspapers, and magazines. We considered doing this because bunches of information and data were written out and available, in easily accessed. This approach was made for the reasons due to the multi-regional and multi-roles played by stakeholders. All stakeholders were grouped into the local community, local government, central government, NGOs, market users, army forces, and university researchers (Table 1).

**Table 1. Description of roles and responsibilities of the wild animal actors in Ecoregion of West Papua, Indonesia.**

No.	Actors	Roles and Responsibility
1	Hunter	Individuals and groups of people who work for hunting as their hobbies, primary livelihood, and as a collector of all kinds of wild animal products
2	Village community	A group of people who are living together in an official permanent resident (Kampong)
3	NGOs	Individual and a group of non-governmental organisation which has the interest and been working to promote wildlife resources using their resources
4	Government	The governmental organisation which has the interest and been working to promote wildlife resources using their resources
5	Community_LR	A group of people living together in an official permanent resident (Kampong) and outside resident have the power to control their land rights.
6	Ministry of Forest and Environment	The central government has been working to lead and manage natural resources and its all component in Indonesia
7	University researchers	Individual and group of people who have been working to provide data and information related to wildlife
8	Government Research Institute	A governmental organisation that has the interest and has been working to promote wildlife resources using their resources
9	Local security guard	Individuals and institutions who are working to protect territory, including wildlife in Indonesia
10	Local security peacekeeping	Individuals and institutions who are working to protect territory, including wildlife in Indonesia
11	Quarantine officer	Individuals and institutions who are working to protect and monitor the transportation of wildlife and its product inside and outside territorial of a region in Indonesia
12	Harbor inspector	Individuals and institutions who are working to protect territory, including wildlife in Indonesia
13	Airport Security Office	Institutions who are working to monitor and protect transporting wildlife and its product inside and outside a region in Indonesia
14	Suppliers	Individuals and institutions provide services for all goods and things needed by relevant stakeholders in accessing wild animals and their products.
15	Extension servicer	Individuals and institutions who are working to provide sources of knowledge and skills related to improving livelihood resources

## 2.2.Data collection

During the research, we collected information and data related to organisational function and characteristics of the wild animal usages-related stakeholders, i.e. shape of the organisation, status of low, types of organisation, roles, effect, and importance of organisation (Gallo et al. 2020; Engen et al. 2019; Laktic et al. 2020; Ahmad et al. 2012). We also tried to collect data about threats and turn-back effects on wild animal development. In knowing the roles and presence of the stakeholders, we also recorded the sharing resources of an organisation, duration of period, continuity of the resources, power of resources, and intervention done so far by the organisation.

## 2.3.Method of analyses

In analysing the power and flows of information amongst stakeholders, we used Social Network Visualizer (SocNetV). SocNetV (Kalamaras, 2019) is a cross-platform, light, and free of charged social-stakeholders-related software in network analyses and visualisation. We used the CC matrix and Hierarchical clustering (HCA) to visualise those graphs. A fundamental notion in SNA is that of structural equivalence.

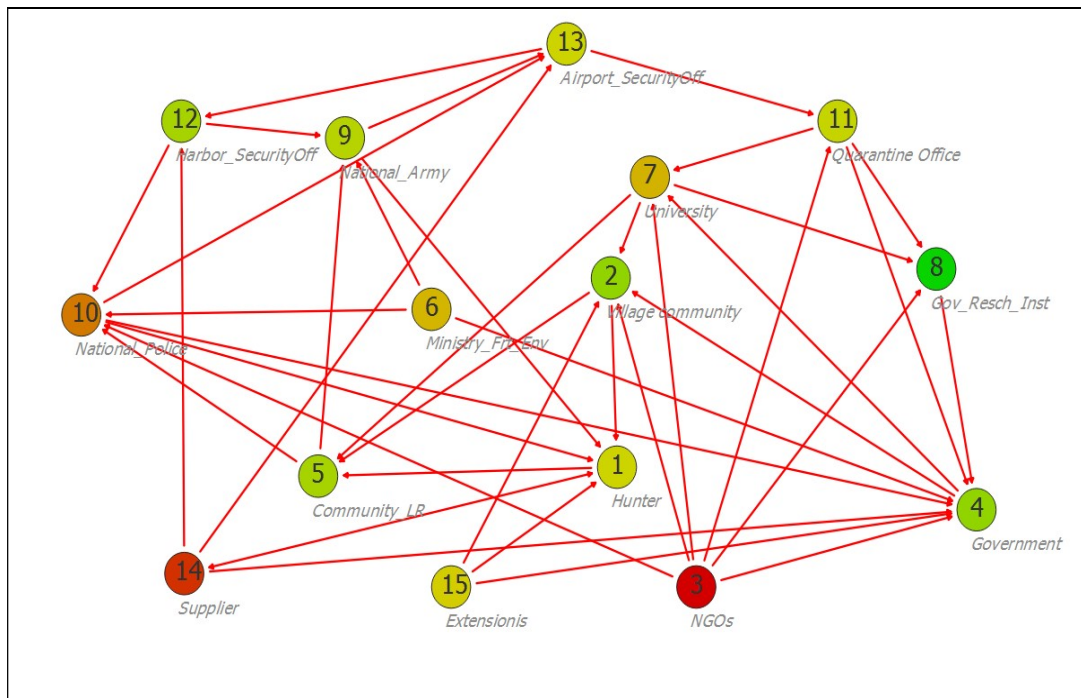


Figure 1. Design actors on a mental model map of relationships using SNA under the wild animal sector.

The idea is to map the relationships in a graph by creating classes or groups of actors who are equivalent in some sense. One way to do that, to identify groups of structurally equivalent actors, is to examine the relationships between them for similarity patterns. There are many methods to measure the similarity or dissimilarity of actors in a network. SocNetV supports the following methods: Similarity by measure and Pearson Correlation Coefficients. SocNetV creates a pair-wise actor similarity/dissimilarity matrix by applying one of these methods. Hierarchical clustering (or hierarchical cluster analysis, HCA) is a method of cluster analysis that builds a hierarchy of clusters based on their elements dissimilarity. The steps in running this SocNet version 2.5 are presented in Figure 1. To catch the intervention shared by the organisation, we also lookup into detail what intervention was done and shapes of innovation done by stakeholders. All data was collectively entered into a Microsoft Excel worksheet and tabled into the manuscript.

### 3. Results

#### 3.1. Organisational function and characteristics

The finding of research succeeded in digging up the backbone of the actors. Actors involved in affairs of wild animals' utilisation and conservation programs dominantly consisted of group-related actors (66.67%), followed by mass- (33.33%), and individual actors (26.67%). From this stage, we found that almost all actors have ruled by-laws (86.67%).

Table 2. Characteristic of the wild animal actors\*

No.	Item		Sum	Proportion (%)
A	Shape of organisation	Individual	4	26.67
		Group	10	66.67
		Mass	5	33.33
B	Law	Law	13	86.67
		Unlaw	2	13.33
c	Types	Private	5	33.33
		State	11	73.33
d	Roles	Stakeholder	13	86.67
		Shareholder	3	20.00
e	Effect	Positive	14	93.33
		Negative	9	60.00
f	Importance	Important	14	93.33
		Unimportant	2	13.33
g	Threats	Direct	6	40.00
		Indirect	13	86.67
h	Turn-back Effect	Feedback	7	46.67
		Non-feed-back	8	53.33

\*Data available on request from the authors.

The typical actors involved in the conservation and utilisation of wild animals were state actors (73.33%). From the 15<sup>th</sup> strategic and vital stakeholders, actors dominantly had a role as stakeholders (86.67%) compared to shareholders. The fact of this research also found that dominant actors had positive effects (93.33%) higher than adverse effects. On the one hand, actors could be grouped into important and strategic actors (14.33%). We also succeeded in identifying the threat possibility for the ruin of the conservation program and found only six stakeholders that had a direct effect. The rest had an indirect effect on the conservation of wild animals. In terms of the turn-back effect, we found exciting numbers. Equal numbers of actors had non-feed-back of turn-back effect (53.33%) slightly higher than feedback (turn-back effect) on utilisation and conservation programs.

The other reality of actors is depicted in resource sharing. The resources that can be shared by actors are policy, funds, space, time, access, satisfaction, knowledge, skills, power, and feed materials. Policy (60%) was the top amongst the rest of offered resources by actors. Similar experiences shared by Santos et al. (2006), Howard (2018), Son (2003), Holman (2008). It is then followed by time allocation, power, skills, knowledge, funds, feed materials, access, and spaces.

Table 3. Shared resources, power, and intervention of the wild animal actors\*.

No.	Item	Sum	Proportion (%)	
a	Sharing resources	Policy	9	60.00
		Money	6	40.00
		Space	2	13.33
		Time	8	53.33
		Access	3	20.00
		Satisfaction	2	13.33
		Knowledge	6	40.00
		Skills	7	46.67
		Power	8	53.33
		Feed materials	3	20.00
b	Duration of period	Short term	2	13.33
		Long term	15	100.00
c	Resource continuity	Sustain	13	86.67
		Unsustain	3	20.00
d	Power of resource	Strong	9	60.00
		Neutral	1	6.67
		Weak	5	33.33
e	Intervention	Need	12	80.00
		No Need	3	20.00

\*Data available on request from the authors.

The duration of periods that actors could offer was long-term resources offered by 15 actors. Actors showed sustaining actions in sharing resources (86%) higher than non-sustainable resource continuity (20%). We were interested in knowing the resource power. The power of resources that could be shared by actors was strong and followed by actors with weak shared resources power (K Higginbottom 2004; Schmidt 1996; Lute et al. 2020). Only one actor who had neutral in sharing power resources. We counted actors who need further intervention, i.e. as many as 80% of actors compared to actors with no intervention (20%).

To highlight the position and how to strengthen the relationship, we computed and ran an analysis of stakeholder network analysis (SNA). The graph of Figure 3 highlights the mental model output of these actors' relationships.

The SNA output (Figure 2) resulted in the output of the picture of SNA based on Power centrality. In Figure 2 and Table 4., we succeeded mapping interlinked relationship networks amongst wild animal actors. Down Table 4., several actors 1 to 15 had a clear positive correlation with PCC=1. Actors with PCC=0 had no relationship at all. However, the rest had a negative correlation (PCC<0).

Actors with positive correlations were one vs 2 and 7. On the second actor, a positive correlation is shown by actors 1, 7, 9, 10, 14, and 15. Actors with positive correlation in the third actor had positive correlation shown in 4, 5, 6, 7, 8, 11, 12, 13, and 15. In the last actors (actor 15), a positive correlation is shown by actors 2, 3, 4, 6, 7, 8, 9, 10, 11, and 14. The datasets generated during and analysed during the current study are available from the corresponding author on reasonable request.



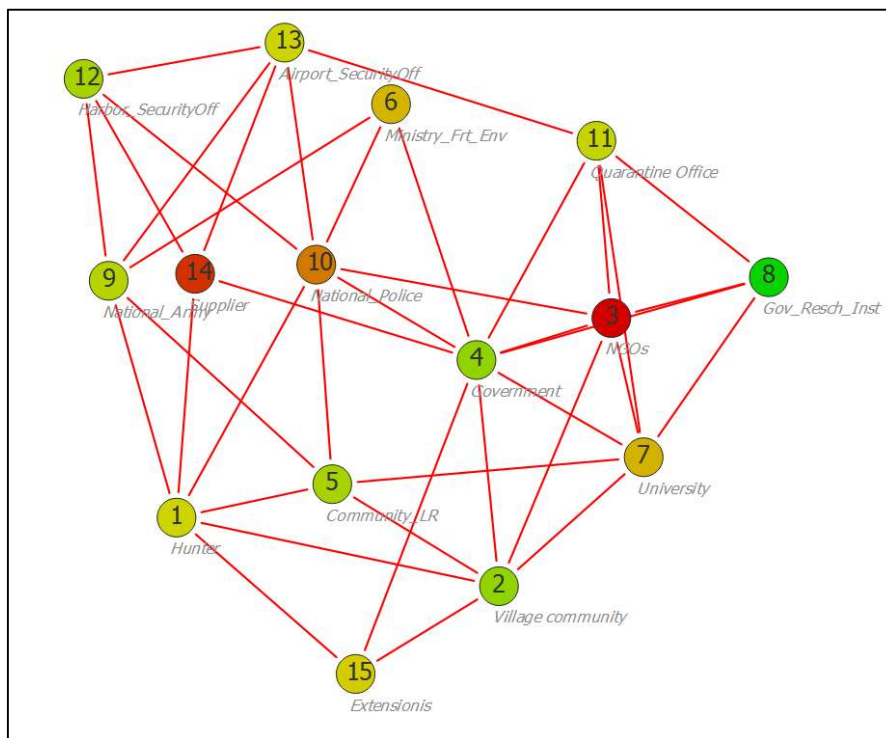


Figure 2. Stakeholder relationships are analysed based on power centrality (analysis referred to as supplement data). Small and big cycles determined the power. Changed red to green and blue colours meant the importance and strategy of actors from high power to sub-dominant actors.

Table 4. Pearson correlation coefficients (PCC) matrix.

Actors/Actors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.000	0.423	-0.320	-0.154	-0.154	-0.196	0.294	-0.105	-0.154	-0.196	-0.196	-0.154	-0.154	-0.237	-0.196
2	0.423	1.000	-0.320	-0.154	-0.154	-0.196	0.294	-0.105	0.423	0.294	-0.196	-0.154	-0.154	0.207	0.294
3	-0.320	-0.320	1.000	0.480	0.080	0.272	0.272	0.327	-0.320	-0.068	0.612	0.080	0.080	-0.185	0.272
4	-0.154	-0.154	0.480	1.000	-0.154	-0.196	0.294	-0.105	-0.154	-0.196	0.294	-0.154	-0.154	-0.237	0.294
5	-0.154	-0.154	0.080	-0.154	1.000	0.784	-0.196	-0.105	-0.154	-0.196	-0.196	1.000	-0.154	-0.237	-0.196
6	-0.196	-0.196	0.272	-0.196	0.784	1.000	-0.250	0.535	-0.196	0.167	0.167	0.784	-0.196	0.075	0.167
7	0.294	0.294	0.272	0.294	-0.196	-0.250	1.000	-0.134	-0.196	-0.250	0.167	-0.196	-0.196	-0.302	0.167
8	-0.105	-0.105	0.327	-0.105	-0.105	0.535	-0.134	1.000	-0.105	0.535	0.535	-0.105	-0.105	0.443	0.535
9	-0.154	0.423	-0.320	-0.154	-0.154	-0.196	-0.196	-0.105	1.000	0.784	-0.196	-0.154	-0.154	0.650	0.294
10	-0.196	0.294	-0.068	-0.196	-0.196	0.167	-0.250	0.535	0.784	1.000	0.167	-0.196	-0.196	0.829	0.583
11	-0.196	-0.196	0.612	0.294	-0.196	0.167	0.167	0.535	-0.196	0.167	1.000	-0.196	-0.196	0.075	0.167
12	-0.154	-0.154	0.080	-0.154	1.000	0.784	-0.196	-0.105	-0.154	-0.196	-0.196	1.000	-0.154	-0.237	-0.196
13	-0.154	-0.154	0.080	-0.154	-0.154	-0.196	-0.196	-0.105	-0.154	-0.196	-0.196	-0.154	1.000	0.207	-0.196
14	-0.237	0.207	-0.185	-0.237	-0.237	0.075	-0.302	0.443	0.650	0.829	0.075	-0.237	0.207	1.000	0.452
15	-0.196	0.294	0.272	0.294	-0.196	0.167	0.167	0.535	0.294	0.583	0.167	-0.196	-0.196	0.452	1.000

Notes: PCC = 0 when there is no correlation at all. PCC > 0 when there is a positive correlation, i.e. +1 means actors with the same patterns of ties/distances. PCC < 0 when there is a negative correlation, i.e. -1 for actors with exactly opposite patterns of ties.

It meant that actors with negative correlation shown by actor one towards actors 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, and 15. There is a negative correlation between actor ten towards actors 1, 3, 4, 5, 7, 12, and 13. Actor 15 negatively correlated with actors 1, 5, 12, and 13. The datasets generated during and analysed during the current study are available from the corresponding author on reasonable request. The power centrality (PC) index is the sum of the sizes of all Nth-order neighbourhoods with a weight of 1/n (Prell et al., 2016; Holman 2008). The PC ranges from 8 to 11.5, and when PC' is equal to 1, then the node is connected to all. The output from Table 5. highlights that no one of the actors had an index equal to 1.00. It means that actors' connectivity in wild animal

development in West Papua, Indonesia, has been linearly connected with and works together to promote wild animal development. The power centrality percentages showed connectivity of actors only in the range of 58.33% to 82.14%. The datasets generated during and analysed during the current study are available from the corresponding author on reasonable request.

Table 5. Power centrality.

Node	Label	PC	PC'	%PC'
1	Hunter	9.667	0.690	69.048
2	Village community	9.667	0.690	69.048
3	NGOs	9.833	0.702	70.238
4	Government	11.500	0.821	82.143
5	Community_LR	9.500	0.679	67.857
6	Ministry of Forest and Envi	8.500	0.607	60.714
7	University researchers	9.667	0.702	70.238
8	Government Research Institute	8.500	0.607	60.714
9	National Army	9.167	0.655	65.476
10	National Police	10.500	0.750	75.000
11	Quarantine officer	9.333	0.667	66.667
12	Harbor inspector	8.333	0.595	59.524
13	Airport_Security Office	9.167	0.655	65.476
14	Suppliers	9.000	0.643	64.286
15	Extension servicer	8.167	0.583	58.333

Down to Figure 3., it was interested in mapping actors into other indicators of power and interest (Bryson, 2007). We considered this necessary due to organisational theoretical background (Grimble & Wellard, 1997). The example was discussed by Ariansyah *et al.* (2013) in Bogor. We grouped these two indicators into four quadrants (Qw1-Qw4). In the first quadrant (Q1), we had zero actors involved with the function of low power and high interest. In Quadrant one, we shall manage the actors closely. However, no actors were grouped into this quadrant. However, in the second quadrant (Q2), we identified village community and harbour inspectors had high power and high interest. Less dominant actors of involvement are found in this quadrant. This second quadrant is defined as a “keeping satisfied” corridor. In the third quadrant (Q3), several actors pooled, i.e. hunter, NGOs, community with the land right (Community LR), government, government research institute, national army, national police, quarantine officers, ministry of Forest, and environment, and university researchers. By Mendelow (1981), this quadrant section shall define as "monitor (minimum effort)". Whereas in the fourth quadrant (Q4), we found three actors' involvement, i.e. airport security, extension provider, and supplier. This quadrant is defined as a “keep informed” corridor. The datasets generated during and analysed during the current study are available from the corresponding author on reasonable request.

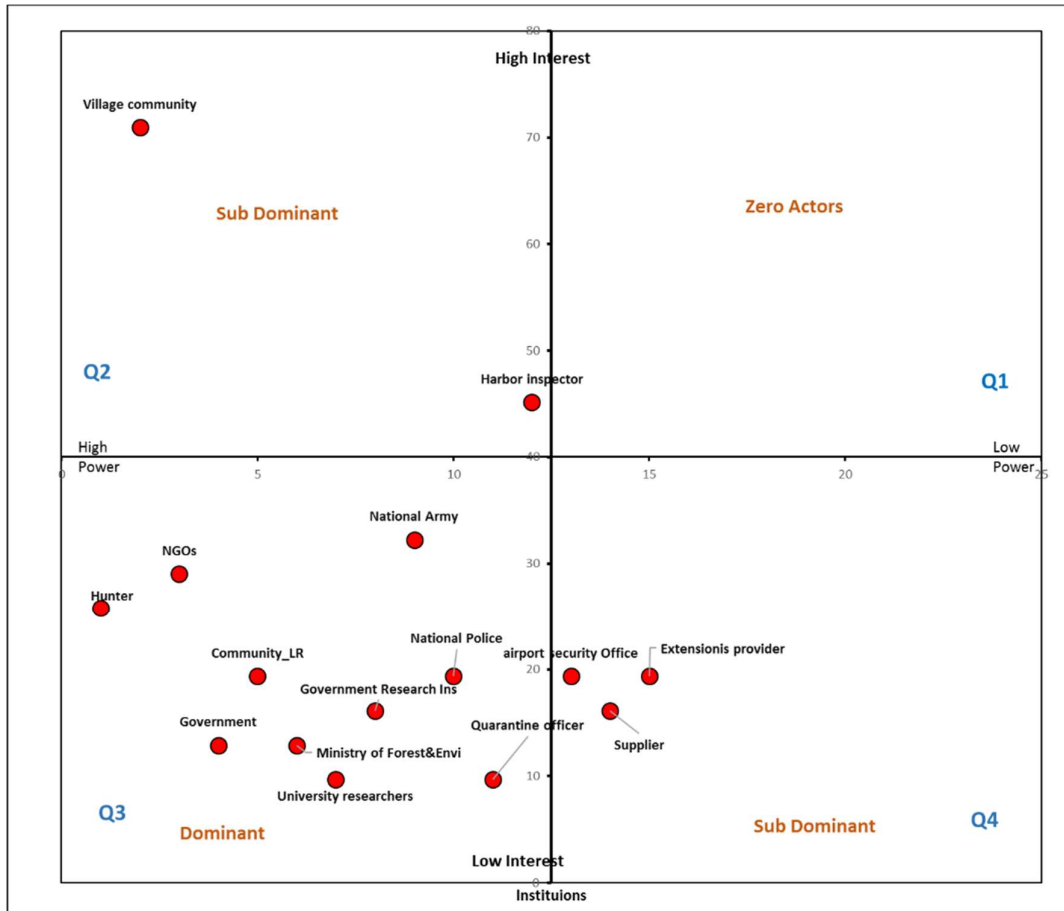


Figure 3. Stakeholders' mapping on pig farming systems in West Papua. Q1-Q4=quadrants. They are adapted from (Mendelow 1981). Data available on request from the authors.

Of the figure, actors were pooled distributed into the third quadrant. They have similar characteristics and share similar interests. In this quadrant, these actors had high power but low interest. Actors were sub dominantly distributed in the fourth and second quadrants. We need to count the movement of the actors who have significant contributions in promoting wild animal programs. Actors with low power-interest (4<sup>th</sup> quadrant) shall be moved to the second quadrant. The datasets generated during and analysed during the current study are available from the corresponding author on reasonable request.

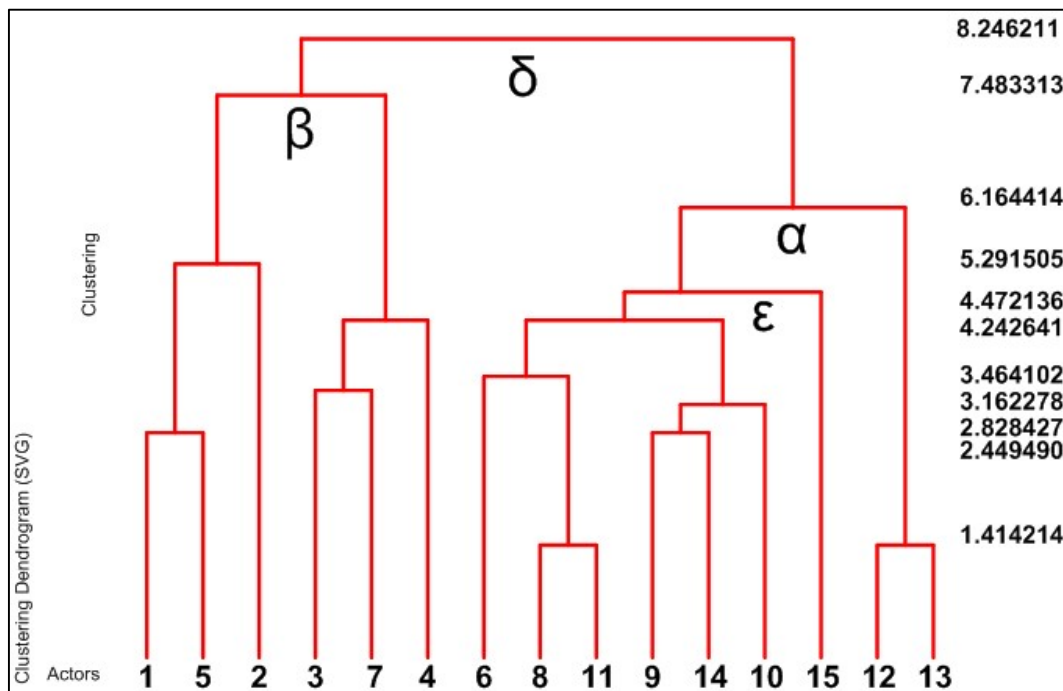


Figure 4. Hierarchical clustering analyses of wild animal actors' relationship.

### 3.2. Actors' relationships

In the context of interpretation hierarchical clustering output (Borgatti et al. 2003), there are three leaves (Fig. 4.), i.e. single (simplicifolius), double (bifolius), and triple (trifolius). In this case, the output produced three leaves, i.e. simplicifolius consisted of actor 15. In contrast, Double (bifolius) and triple (trifolius) were subsequently explained. The bifolius consisted of actors 12 and 13. At the same time, the triple dominated the leaves, i.e. 1, 5 and 7; 3, 7, and 4; 6, 8, and 11; 9, 14, and 10. These had similarities in terms of roles and responsibilities. Similar clades such as actors 8 and 11, 12 and 13 are explained similarity. It is found, and actors 1 and 5 proceed to actors 9 and 14. The  $\delta$  clade consisted of actors  $\alpha$  and  $\beta$ . Clade  $\alpha$  constituted actors 12 and 13 as well as clade  $\epsilon$ . Clade  $\epsilon$  consisted of actors 9, 14, 10, and 15. Clade  $\beta$  consisted of leaves' actors of 1, 5, 2, 3, 7, and 4. Clades with similar heights had similar to each other. The datasets generated during and analysed during the current study are available from the corresponding author on reasonable request. Clades with different heights had a dissimilar relationship (Mateo et al. 2016; Lees et al. 2015; Mandarano 2009).

### 3.3. Intervention and Innovation

In detail, the needed interventions were related to knowledge, skills, policy, spaces, time, access, power, and funds. In case of action needed, knowledge and skills (100%) were the top priority of intervention in the West New Guinea ecoregion. Other strategic interventions needed by stakeholders were policy, spaces, and time (93.33%). The last but not most minor interventions needed by actors in promoting wild animal conservation and future sustainable wildlife management were funds (40%), access (73.33%), and power (53.33%).

Table 6. Intervention and innovation inventoried in the development of the wild animal sector\*.

\*Data available on request from the authors.

No.	Item	Sum	Proportion (%)
a.	Intervention		
	Policy	14	93.33
	Funds	6	40.00
	Space	14	93.33
	Time	14	93.33
	Access	11	73.33
	Knowledge	15	100.00
	Skills	15	100.00
	Power	8	53.33
b.	Innovation		
	Policy	5	33.33
	Money	3	20.00
	Space	4	26.67
	Time	2	13.33
	Access	3	20.00
	Knowledge	10	66.67
	Skills	10	66.67
	Power	5	33.33

Modern innovations made and needed by actors were dominated by knowledge and skills (66.67%). In the second rank, policy and power (33.33%) were needed to promote actors' roles. In the third rank of innovation, spaces (26.67%), funds (20%), and access (20%) were needed to deliver innovation. Time was needed as innovation for only a few actors (13.33%). The datasets generated during and analysed during the current study are available from the corresponding author on reasonable request.

#### 4. Discussion

The idea of interconnected actors' relationships was discovered to provide new insight into mapping the dynamics of organisations and institutional participation. The definition is related to wild animal development in general and characterising actors, addressing capital, control, and interference. For improving the efficiency of the wild animal development sector on sustainable systems, further studies are suggested by computing more in-depth relationships within the innovation and intervention exchanged. Future research is suggested for interconnected actors using the Pearson Correlation Coefficient (PCC) and mapping the interest in a two-dimensional graph, including the power-interest, and compiling a list of all feasible and applicable interventions and innovations. Strategic direction in Indonesia consisted of Institutional reform, Policies, regulatory reform, Incentives, cost recovery, Information-sharing, Capacity-building, Dismantling national and international trade networks, Effective management of protected areas, Political will, and reducing demand, and Regional linkages. There are several stages in assessing sustainable wildlife, i.e. assessing the local context, engaging the community, enhancing community capacity, establishing parameters, monitoring and evaluation, and developing and implementing an exit strategy. In assessing the local context, stages will begin on socio-economic assessment, network, and stakeholder mapping (Mashizi and Sharafatmandrad 2020; Schlecht et al. 2014; Mateo et al. 2016; Higginbottom 2004; Triguero-ocaña et al. 2020; Stryamets et al. 2019; Hoveka et al. 2020). Then it follows on developing a multi-stakeholder process and, in stage three, building and assisting the community capacity. Then it proceeds with determining success criteria. The task will be set up during monitoring and evaluation to maintain improved community relations. At last and not least are networking and partnering.

The triangle principles in protecting wild animal trades and trafficking (Obasi and Vivan 2016), including poaching, can be done by stopping the demand, stopping the killing, and stopping the trafficking (Abbott and van Kooten 2011). Therefore, it needs a good design of communication, education, and public awareness strategies to be formulated in the right way and to the right target (Sysak et al., 2012; Hellsten et al., 2019). There are two dimensions of communication strategy, education, and public awareness: 1. Strategy based on communication methods: Direct and indirect communication / through communication media; and 2. Strategies based on different communication goals (Bremmers et al. 2004; Dawkins 2017; Blok et al. 2015; Bryson 2007). By doing this, relevant and related actors will be gained based on their power and interest in contribution.

## 5. Conclusions

Research findings show several significant and strategic characteristic typologies and resources belonging to actors for national, local, and grass-root levels. Most studies done do not consider this finding. We know that interest and power embedded into actors will determine how intense and severe an actor works in establishing the programs and projects from national, local, and grass-root levels. We inventoried shared resources, duration of the period played by actors, continuity resource roles, power of resources, and intervention needs. From these indicators, we can assure that these actors will sustain and have good wild animal governance (GWaG) in promoting wild animal development programs and projects. Quantitatively using the SNA, we succeeded in computing connections between actors using the Pearson Correlation Coefficient matrix. We have added this in the two-dimensional graph by applying a power-interest indicator. We also found the current position, which pooled on the third quadrant. Moving prospective actors into the high power-interest quadrant needs many efforts. Using a dendrogram graph, by applying clustering analysis, we also succeed in clustering actors into three leaves, i.e. single, double and triple leaves. In line with intervention and innovation, knowledge, skills, policy, space, and time were the most intervention and innovations needed. The sequence of this analysis of SNA and organisational characteristics has power and practical tools in analysing actors-related development.

This study implied that we succeeded to quantify the first layer actors' involvement in wild animal development. The second and third prospective actors' layers of international, national, and local organisations were not portrayed yet. It is then needed further study. In the future, we will incorporate international institutions for digging details up for getting a comprehensive and general understanding of international institutional involvement. We need to test the parameters of characteristic actors in quantitative statistical tests inferentially. We also argue that too many constraints faced and belonging to actors are limiting factors in making those actors unable to provide programs and build perfect and intense connections. This study, method, and parameters can be applied to other broad fields of disciplines. The parameters can be extended according to the needs of each field. The SNA provides several analytical tools that are useful in implementing stakeholder analyses.

The limitation we found while collecting and analysing the data was that interlinked actors' both direct and indirect involvement in this research were not dug up in detail. In Indonesia, various international institutions entered and created collaboration in facilitating the programs to lower the rapid losses of endangered and threatened wild animals. We also need to test the typology of characteristic institutions such as the shape of the organisation, law status, types, roles, effect, importance, threats, and turn-back effect in modelling the healthy and prospective actors.

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## Ethical Statement

### Ethical approval

Consent has been obtained from all the participants for this research and the Animal Ethics Committee of Animal Science Faculty, The University of Papua (No. of Reference letter: SP-004/UN42.3/PP/2022).

## Novelty statement

We highlighted the statement that a). not many tools of analyses have adequate and strong capacity in computing the roles and connectivity of actors in quantitative manner, b) Stakeholder network analysis (SNA) has been applied and it is a sharp analytical tool in analyzing actors related connectivity in actors of wild animal conservation management, c) Power and interest become the two folds components determined dimensions of actors' involvement dynamic in promoting sustainable wildlife management and d) Implication of the SNA in the sector of wildlife development has drawn significant broad connectivity, pattern, readable, and understandable.

## Authors' contributors

All authors composted the concept, analysed field data, and write the final manuscript.

## Declaration for competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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