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Linking Actors Related-Stakeholders By Applying Network Analyses In Promoting Economic Advantages of The Goat Business In West Papua

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ABSTRACT

The goat has been taking the places on farmers' needs just recently due to its products, i.e. slurry. It has brought a significant impact on economic advantages for small farmers. Those are due to stakeholders' involvement in promoting its development. The study was done in Manokwari using the descriptive method by using focus group discussion towards twenty various represented individuals, groups, and mass institutions. The queries discussed concerning the background, resources delivery, inter connectivity among actors using Pearson correlation coefficient and similarity matrix, power, and interest of actor's delivery of intervention and innovation of actors. The goat farming system in West New Guinea is shaped by related groups, lawyers, privates, and stakeholders rather than shareholders. The actors are important and have a positive effect. The actors have a low direct threat and slight high turn back effect. The four top shared resources consist of access, satisfaction, time, and space. The actors have a willingness to contribute in a long-term period and can sustain their support. However, the power of resources shared is neutral and therefore needs further intervention. The relationship of SNA is showing a relationship of similarity and with a greater positive correlation of each actor due to high interest and high power. The five top intervention for goat farming system is skills, feed materials, policy, funds, and satisfaction. While innovation needed by actors are skills, policy, knowledge, feed materials, and fund.

1. INTRODUCTION

In the world, goats have been kept and bred around the Middle East Countries, some parts of Africa, some

countries of ASEAN, and Latine America. Examples of how extent goat is raising reported by [16] While in Indonesia, the goats are recognized as having multi-functions [31]. Besides it has an economic function, this animal agriculture has been preferred by many small-scale farmers to keep in backyard farms for social capital. The only preferred product recently, besides meat, hair, and milk of goat, known is its slurry. The slurry goat has potency as a super bio-fertilizer for growing plants particularly crops. The goat is now being introduced and kept on entire provinces and archipelagos of Indonesia. In Papua, goats play vital roles in some places such as Fak Fak, Sorong, Jayapura, and Manokwari. The goat has been seen as a potential animal not only for Non-Papuan farmers but also Papuan farmers. The goat was introduced in Papua since the era of the transmigrating policy was applied around the 1960s. Since then, the goat was imported to fulfill local market needs such as Idul Adha, Idul Fitri, and New Year among other societal ceremonials [52], [50]. Programs to enlarge the population per flock are seldom promoted. Goats seem to be reared extensively not inside the stalls but also reared outside stall by free-ranged systems. Systems run by farmers are various due to ethnics, place, and religion. What was concerned was the systems. Without known the systems prior, farmers will not have understanding resources and components that being used and have to be taken into account to improve their farming systems. In developing countries, factors influencing goat farming systems (GFS) are poverty, social functions, and the average income of farmers [6], [52]. Poverty causes that farmers do not have access to the necessary inputs to increase their production. The social functions of animals can be very important in areas such as the South Pacific, Papua New Guinea, and the outer islands of Indonesia. However, they might cause that opportunities are lost in reaching economic benefits. Rural goat farmers are reluctant to change their on-farm activities, due to the lack of attention given by extensionists' and government's services [11], [3], [15], [55], [38], [2], such as training and informal education. Simanungkalit (2001) and Pattiselanno (2004a) reported on goat keeping systems in Kebar valley using traditional knowledge, such as letting goats in cropland eat residues and tillage land. Distance from the city and lack of access to information can be causes why messages given to farmers were lacking. Farmers' reasons and knowledge towards goat keeping are unknown by livestock policymakers, which makes it difficult to develop goat keeping.

Understanding the background and the back-bound of the actors are of utmost important [36]. Best fitted and appropriate actors can play significant roles in promoting and sustaining the GFS particularly in Indonesia and specifically in West Papua. [29] identified several livestock farming systems in Manokwari, West Papua. Each GFS established has a certain relationship and typical involvement of various interests. Therefore, it is urgently needed to deeply dig up what characteristic of the institutions are, how it performs in real world livestock development. It is therefore needed to apply precise technical unit of analyses suited to predict the relationships of related and relevant stakeholders in benefiting economical- and social objectives and the production of the GFS. Characteristic of stakeholders or institutions can provide direction in executing implementing programs. One powerful social network analysis besides Gephi [8], Net map [46] is Social Network Visualizer beside SmartPLS [44]. The Social Network Analysis (SAN) is so far an adequate and appropriate software to compute networks and relationships [32]. By mapping the stakeholders, institutions, which have no power and interest, would identify and in turn, will be easy to promote their roles comprehensively. It is, therefore, the article of this study related to the GFS desired to become the objective of this research.

2. LITERATURE REVIEW

2.1 Leveling Institutional

Actors that are interconnected have mutual partnerships (Hendriks et al., 1997; Blok et al., 2015; Laktic et al., 2020), common resources (Holman 2008; Mandarano 2009), and administrative parallels (Hendriks et

al., 1997; Blok et al., 2015; Laktic et al., 2020). Each agent can choose which groups or organizations will create. All possess two main abilities: high and low (Borgatti et al. 2003; Blok et al., 2015; Blanchet and James, 2015). Similar to this, each actor has a strong, neutral, or weak relationship (Foti et al., 2018; [14]. As a consequence, keeping the networks and relationships as easy as possible is crucial. Gaining mutual control, as well as commitment, are all considerations that actors consider when deciding to shape networks (Mandarano 2009; [42], [27]. We tried to talk about two types of organizations: structural and contextual organizations (Blanchet and James 2015; [14], [32], Meens et al. 2018). Differentiation, formalization, and decision-making are three markers of structural organizations (Figure 1). There are five indicators in the contextual organization: typology (strategies), size (complexity and formalization), technology, climate, power, and culture [12]. Dimension plays a part in deciding how authority is used to advance rapid response and decision-making (Coad et al. 2019; Mandarano 2009). Weber was the first to propose the organizational theory. Procedures and functions, specialization and job desk, hierarchical authority, quality human resources, separation of working positions for objectivity, and written correspondence and recordings are the six dimensions he listed (Holman 2008). The types of organizations will be divided into 12 groups [53] based on figure 1, from recipient organizations to authority channel organizations. However, as seen in Figure 1, there were four types of organizations: a local organization, a national organization, a regional organization, and an international organization [4], [37], [28].

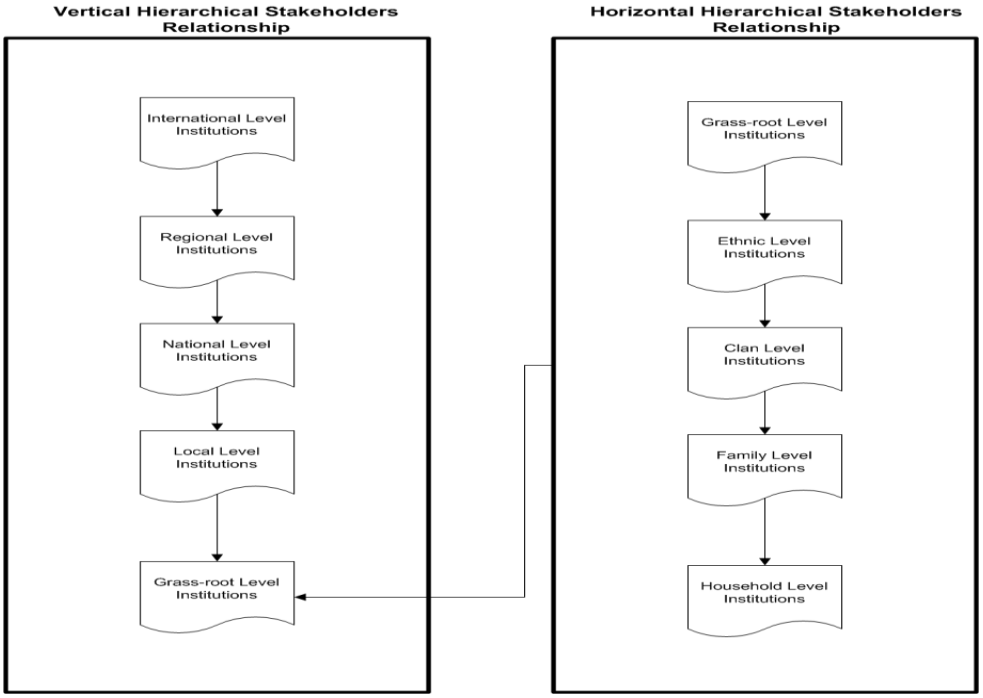

Figure 1. Comparisons of the two hierarchical models of actors level in Indonesia (Vertical and Horizontal models).

In Indonesia, the central government acted vertically, while local or grass-root stakeholders acted horizontally (Freeman 2015; Novoa et al. 2018; Kawuma and Ouma 2015; [14]. The central government and its networks were instrumental in forging deeper and mutually beneficial alliances, allowing for the sharing of related technologies and initiatives. West Papua's growth requires creativity and action, but the country's resources are limited. infrastructure shortages and a lack of market access Furthermore, coordination, governance, and policy are in short supply [55], [19], [32]. As a result, establishing a core dynamic typology of administration, complete with formal customs regulating the relationships between goat actors, is crucial. This relationship was explored using an empirical organizational, actor, and social

network analysis (SNA) approaches (Borgatti, 2006). The SNA helps the user to calculate the relationship between current and non-existing actor networks using numbers. A deeper understanding of how to design a multilayer network of stakeholders is needed to enhance actors' participation. The SNA should be used to better understand the tasks, duties, relationships, and network of good goat governance (GGG) in West Papua.

2.2 The framework of the research

The tools and typology of organizations were not illustrated in several stakeholder studies examined by most of the researchers [43], Mateo et al. 2016; [28], Blanchet and James 2015). However, as understood, it is necessary to share resources and recognized some thorough history of the institutions. Commonly, stakeholders provided services and funds [40], Mandarano 2009; Higginbottom 2004). [40], Mandarano 2009; Higginbottom 2004).

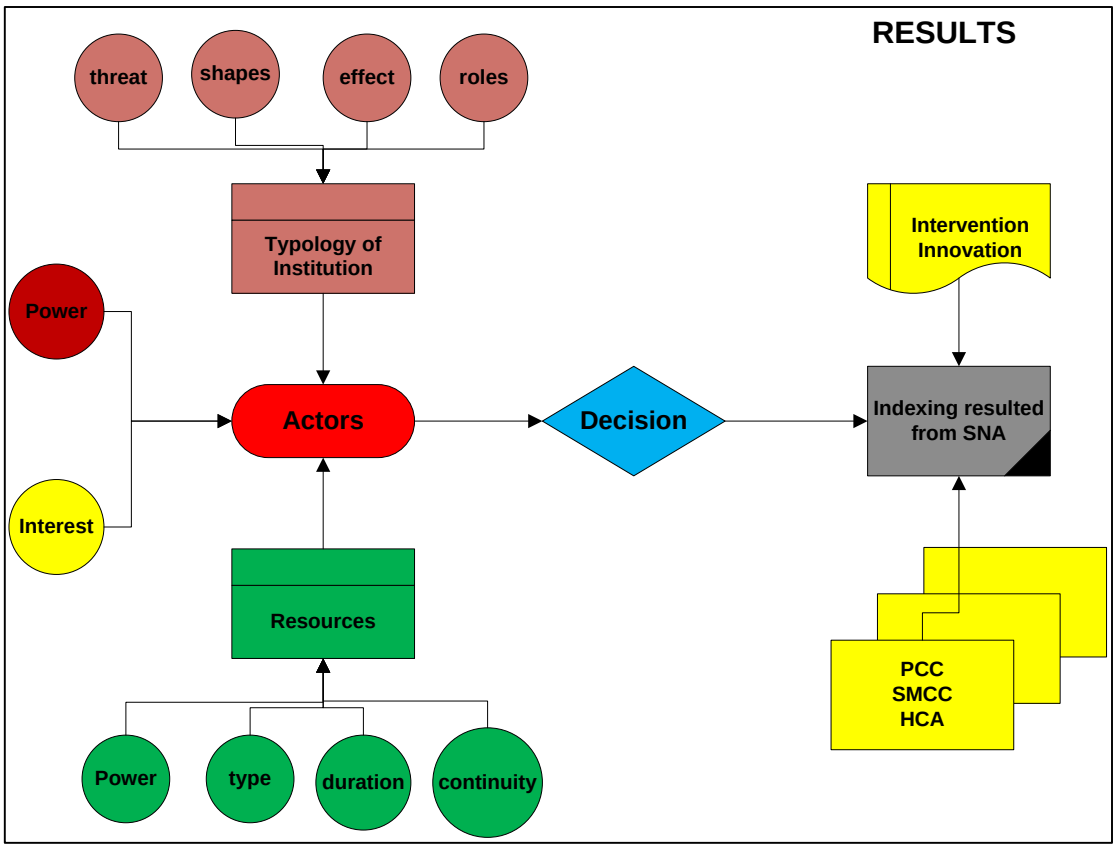

Figure 2. Schematic representation of key methodological study necessary for stakeholder analyses.

A resource is an asset that belongs to each of the actors involved in the donor-recipient relationship (Ullah and Kim 2020; Harrison et al. 2016; Milner-Gulland et al. 2014; Gunarso et al. 2009). Actors' resource types can differ. Resources are described as objects that can be exchanged and delivered to other people. There can be several shared services, and they can be delivered according to the needs [28], [43], Gallo et al. 2020). While all sides agree on taking and giving money, mutual resources will be achieved. Formally, all assistance will be distributed on a humanitarian basis, focusing on populations and ethnic groups that are suffering due to natural and human-made accidents [10], [24]. The organization's reputation is a feature of the organization that has a significant impact on power and interest (Boonstra and Vries 2005; Hellsten et al. 2019; Blok et al. 2015; [19]. The standard company will assess their commitment and behavior concerning all stakeholders (Higginbottom 2004; [11], Madsen et al. 2020; Devitt et al. 2016). Other parties

will change their interactions with the target company as well. Power and interest have a similar impact on performances and the consistency of the actor-actor relationship. Power and interest will affect help decisions and acts (Schmidt 1996; Hellsten et al. 2019; Freeman 2015). The company with both power and interest would be more effective in taking action and providing products and services to the target population, and the final targets would be more achievable [51], [43]. The two-fold indications that address the solution for the targeted population and user are innovation and interference. Although holes, challenges, lacks, limited resources and restrictions hindered stakeholders' decisions and actions, creativity, and intervention were possible [11], [7].

Using dynamic relations (interconnected actors) and positive, neutral, and weak scales, we establish a structure to explore our ideas. We used stakeholder network analyses to examine these scales (Springer and Steiguer 2011; [32], Holman 2008; Nyokabi et al. 2018; [42], Laktic et al. 2020; Busch and Richards 2000). The result will be shown in a PCC matrix and a clustering dendrogram [28].

3. MATERIALS AND METHODS

The research was done in Manokwari, West Papua. We have chosen several organizations, groups, and individuals who represented the institution. We approached them by collecting all relevant data and information concerning. Using desk study of qualitative research, relevant data collected consisted of information and data from research reports, policy documents, articles, daily newspapers, and magazines. We considered doing this for the reasons that bunches of information and data were written out and available even each was cheapest. We are concerned about the roles of stakeholders and shareholders in shaping and determining the pattern of goat development in West Papua, particularly in Manokwari. Manokwari is the central development of goat farming according to local livestock provincial offices. All stakeholders are grouped into the local community, government, banks, markets, private transportation, and university.

Table 1. Identified actors involved in the development of goat farming systems under West New Guinea.

No.	Actors	Roles and Responsibility
1	Goat Farmer	• Individuals and/or groups who have been raising goat
2	Extension services	• Serving farmers for the extension with related to knowledge and skills of raising goat
3	Crop Farmer	• Providing fee materials for men, animals, and industrial
4	Inseminator	• Individual who are serving the animal reproduction
5	Veterinarian	• Serving health of animal and farmers need
6	Government	• Providing policy and regulations
7	Consumer	• Individual who buy and consume the meat product
8	Banks	• Providing loans and account for farmers and community
9	Food court	• Providing an animal-based product for consumers
10	Local Livestock Officers	• Ruled policy, regulation, and programs related to livestock development
11	Vehicles	• Individuals and/or groups who have been raising goat
12	Retailers	• Serving as provision and sellers animal products
13	Village Cooperation	• Provide and distribute farmers need and production of farmers
14	Grass Farmers	• Planting animal feeds related to grass and legumes

During the research we collected information and data related to organizational function and characteristics

of the goat business-related stakeholders, i.e. shape of the organization, status of low, types of organization, roles, effect, and importance of organization. We also tried to collect data and information about traits and turn-back effects on cattle farming development. In knowing the roles and presence of the stakeholders, we also recorded the sharing resources of the organization, duration of period, continuity of the resources, power of resources, and intervention done so far by the organization. In analyzing the power and flows of information amongst stakeholders, we used Social Network Visualizer (SocNetV). SocNetV is a cross-platform, light, and free of charged social-stakeholder-related software in network analyses and visualization. To visualize those graphs, we used PCC matrix, similarity matrix (SM), power centrality (PC), Hierarchical clustering (HCA), clique census (CLQs), and information centrality (IC). The adjacency matrix of a social network (Figure 1.) is a matrix where each element a(i,j) is equal to the weight of the arc from actor (node) i to actor j. If the actors are not connected, then a (i,j)=0. Computes the Cocitation matrix, $C = A^T * A$. C is a n x n symmetric matrix where each element (i,j) is the number of actors that have outbound ties/links to both actors i and j. The diagonal elements, Cii, of the Cocitation matrix are equal to the number of inbound edges of i (in Degree). A key notion in SNA is that of structural equivalence. 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. By applying one of these methods, SocNetV creates a pair-wise actor similarity/dissimilarity matrix. Computes a pair-wise actor similarity matrix, where each element (i,j) is the ratio of tie (or distance) matches of actors i and j to all other actors. In the case of Simple Matching, the similarity matrix depicts the ratios of exact matches of pairs of actors to all other actors. If the element (i,j) = 0.5, this means that actors i and j have the same ties present or absent to other actors 50% of the time. These measures of similarity are particularly useful when ties are binary (not valued). Computes a correlation matrix, where the elements are the Pearson correlation coefficients between pairs of actors in terms of their tie profiles or distances (in, out, or both).

The Pearson product-moment correlation coefficient (PPMCC or PCC or Pearson's r) is a measure of the linear dependence/association between two variables X and Y. This correlation measure of similarity is particularly useful when ties are valued/weighted denoting strength, cost, or probability. The Power Centrality (PC) is a generalized degree centrality measure suggested by Gil and Schmidt. For each node u, this index sums its degree (with weight 1), with the size of the 2nd-order neighborhood (with weight 2), and in general, with the size of the kth order neighborhood (with weight k). Thus, for each node u the most important other nodes are its immediate neighbors, and then in decreasing importance the nodes of the 2nd-order neighborhood, 3rd-order neighborhood, etc. For each node, the sum obtained is normalized by the total numbers of nodes in the same component minus 1. This index can be calculated in both graphs and digraphs but is usually best suited for undirected graphs. It can also be calculated in weighted graphs although the weight of each edge (u,v) in E is always considered to be 1 (therefore not considered). Hierarchical clustering (or hierarchical cluster analysis, HCA) is a method of cluster analysis that builds a hierarchy of clusters, based on their elements dissimilarity. In the SNA context, these clusters usually consist of network actors. This method takes the social network distance matrix as input and uses the Agglomerative "bottom-up" approach where each actor starts in its cluster (Level 0). In each subsequent Level, as we move up the clustering hierarchy, a pair of clusters are merged into a larger cluster, until all actors end up in the same cluster. To decide which clusters should be combined at each level, a measure of dissimilarity between sets of observations is required. This measure consists of a metric for the distance between actors i.e. manhattan distance) and a linkage criterion (i.e. single-linkage clustering). This linkage criterion (essentially a definition of distance between clusters), differentiates between the different HCA

methods. The result of Hierarchical Cluster Analysis is the clusters per level and a dendrogram. The concept of a clique in every life is pretty simple: a clique is a group of people who interact with each other much more regularly and intensely than with other people not belonging in the clique. That is, a group of people forms a clique if they are all connected. In formal mathematics, a clique C is any subset of vertices of an undirected graph G, such that its induced subgraph is complete. This means that every two distinct vertices in a clique are always adjacent. In Social Network Analysis, the definition of a clique is much more narrow and precise: A clique is the largest subgroup of actors in the social network who are all directly connected. In terms of graph theory, this notion is the same as a maximal complete subgraph of the equivalent graph of the social network.

The word maximal means that for each clique the group of its members is expanded to include as many actors as possible; no other actors can be added to the clique. Essentially, a clique in Social Network Analysis consists of several overlapping closed triads. SocNetV applies the Bron–Kerbosch algorithm to find all maximal cliques in an undirected or directed graph. It produces a census of all MAXIMAL cliques in the network and reports some useful statistics about these. The clique census report includes disaggregation by vertex and co-membership information. The Information Centrality (IC) is an index suggested by Stephenson and Zelen (1989) which focuses on how information might flow through many different paths. Unlike SC and BC, the IC metric uses all paths between actors weighted by the strength of time and distance. The IC' score is the standardized IC (IC divided by the sum IC) and can be seen as the proportion of total information flow that is controlled by each actor. Note that standard IC' values sum to unity, unlike most other centrality measures. Since there is no known generalization of Stephenson & Zelen's theory for information centrality to directional relations, the index should be calculated only for undirected graphs and is more meaningful in weighted graphs/networks. Note: To compute this index, SocNetV drops all isolated nodes and symmetrizes (if needed) the adjacency matrix even when the graph is directed (Wasserman & Faust, p. 196).

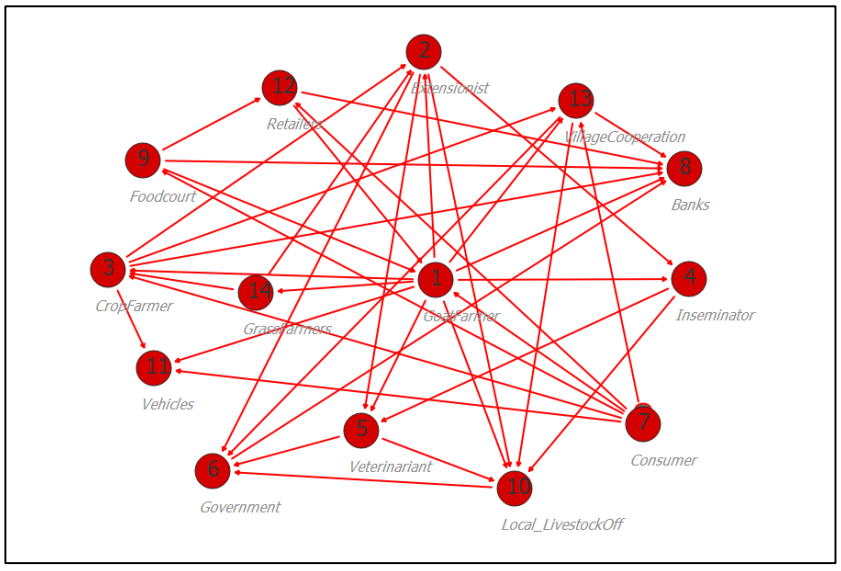

Figure 3. Mapping the involvement of actors amongst goat farming systems.

To calculate the IC index of each actor, we create a N x N matrix A from the (symmetrized) sociomatrix with: Aii=1+di, Aij=1 if (i,j)=0, and Aij=1−wij if (i,j)=wij. Next, we compute the inverse matrix of A, for instance, C, using LU decomposition. Note that we can always compute C since matrix A is always a diagonally strong matrix, hence it is always invertible. Finally, IC is computed by the formula:

ICi−1Cii+T−2·RN, where: T is the trace of matrix C (the sum of diagonal elements) and R is the sum of the elements of any row (since all rows of C have the same sum). IC has a minimum value but not a maximum. The steps in running this SocNetV version 2.5 are presented in Figure 3. To catch the intervention shared by the organization, we also look up into details what intervention was done and shapes of innovation done by stakeholders. All data collectively entered into a Microsoft Excel worksheet and tabled into the manuscript.

4. RESULT AND DISCUSSION

The finding of this field noted investigation revealed the shapes of the organization, status by law, types, roles, effect, importance, threats, and turn-back effect. Shapes of the organization as actors can be grouped into three types, i.e. individuals, groups, and mass. The findings recorded that organizational type dominated by 8 grouped actors (57.1%), followed by 6 individuals (42.9%) and two mass actors of the organization (14.3%). This portrait that goat actors' development in West New Guinea was on the stage of a local and traditional organization. They have no bargaining position in determining the shapes and rate of goat farming development. We identified that the actors of goat farming development ruled by law (92.9%) and the rest had no ruled by law (14.3%). The law of institutions determines the legality and power in the sounding policy of development. Types of the organization established in the goat business sector were grouped in private (57.1%) and state institutions (42.9%). The roles of organizations played by actors were stakeholders (92.9%) and shareholders (21.4%).

Table 2. The descriptive pattern of organization of goat actors in West New Guinea.

No.	Typical institutions	Sum	Proportion (%)
a	Shape of Organization		
	Individual	6	42.9
	Group	8	57.1
	Mass	2	14.3
b	Law		0
	Law	13	92.9
	No law	2	14.3
c	Types		0
	Private	8	57.1
	States	6	42.9
d	Roles		0
	Stakeholder	13	92.9
	Shareholder	3	21.4
e	Effect		0
	Positive	14	100
	Negative	2	14.3
f	Importance		0
	Important	13	92.9
	Unimportant	1	7.14
g	Threats		0
	Direct	1	7.14
	Indirect	3	21.4
h	Turnback Effect		
	Feedback	8	57.1
	No feedback	6	42.9

Effects felt by goat business cycles on involved stakeholders revealed that 12 actors had a positive effect (60%) and only 10 actors had a negative effect (50%). We were interested in recording the importance of the actors who ruled the goat business beneficiary. Several 18 (90%) actors stated important and the rest had stated less important (10%). To assure the continuity of this business we measured the threat buried on the business of goat. We recorded 12 organizations had direct threats toward the development of cattle production and the rest 8 actors had indirect effects. We were finally eager to seek whether goat business beneficiaries had a turn-back effect among actors. The finding of this research reported no turn-back effect found inside 13 institutions (60%) and only 40% had turn-back effects. By knowing these facts characteristic of actors, in reality, we concluded that goat business beneficiary can sustain and has future development in West New Guinea.

4.1 Available and status of resources

Shared resources inside goat business beneficiary cycles had some benefits, i.e. in the shapes of policy, finance, space, time, access, satisfaction, knowledge, skills, threat, power, and feed materials. The finding and phenomenon faced by goat farming systems was access and satisfaction in ranges of 100%. The shared resources can be offered in terms of time (85%), knowledge (70%), space and skills (65%), feed materials (45%), threat and power (40%), and lastly by policy and finance resources (35%).

Table 3. Identified shared resources of goat actors in West New Guinea

No.	Shared resources	Sum	Proportion (%)
a	Sharing resources		
	Policy	4	28.57
	Funds	6	42.85
	Space	11	78.57
	Time	13	92.85
	Access	14	100
	Satisfaction	14	100
	Knowledge	9	64.28
	Skills	8	57.14
	Threat	9	64.28
	Power	4	28.57
	Feed materials	5	35.71
b	Duration period		
	Short-term	4	28.57
	Long term	10	71.43
c	Continuity of Resource		
	Sustain	13	92.85
	Unsustain	1	7.14
d	Power of resources		
	strong	5	35.71
	Neutral	9	64.28
	Weak	0	
e.	Intervention		
	Need	12	85.71
	Unneeded	1	7.142

The duration of the period in sharing resources organized by actors consisted of short term (15%) and long

term (85%) periods. Of actor profile, we found continuity of resources, i.e. sustain (90%) and unstained (10%). Power of resources dominantly found was neutral actors (50%) followed by strong power (40%) and weak power (10%). Weak power needs further intervention and innovation in terms of resources' needs. The need for Intervention was found in 17 actors (85%) and the rest were no need to intervene (15%). Delivery intervention can be made related to policy, finance, knowledge, skills, and relevant needs [57]. These types of interventions will further explain in the subsequent discussions. To provide the highlight of the position and how to strengthen the relationship, we organized analysis of stakeholder network analysis (SNA). The graph of Figure 4. highlighted the mental model of this relationship.

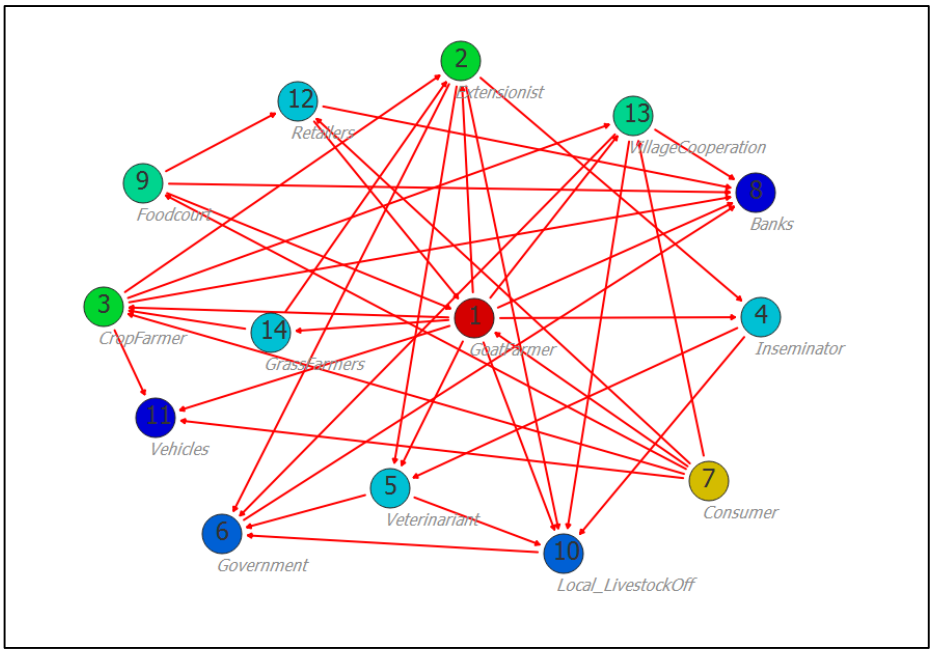

Figure 4. Stakeholder Network Analyses (SNA) of goat actors' relationship based on Power centrality index and Kamada-Kawai (Force-directed model). Small and big size cubes indicated power. Changed red to greed and blue colors indicating the importance and strategic actors' involvement from lower to high power.

Relationships that having the possibility to take into account are grass farmers 14 with government 6, grass farmers 14 with local livestock officers 10, retailers 12 with village cooperation 13, food court 9 with village cooperation 13, retailers 12 with vehicles 11, and vehicles 11 with village cooperation 13. It is considered by reasons that government has the responsibility to serve grass farmers. Village cooperation plays a strategic role in strengthening local village economic development. In Table 4., several actors from the 1st to 14th actors had positive similarity with SMCC= 0<C<1. Actors with SMCC=0 had no similarity at all. However, SMCC>0, actors have the same matches in their ties and/or distance. While SMCC=1 means the two actors have their ties to other actors the same all the time. Actors, in general, had their SMCC>0 and found SMCC=1 for several relationships. Actors that did not correlate were goat farmers 1 with crop farmers 3 (PCC=0.000), actor extension services 2 with banks 8 (PCC=0.000), actor crop farmers 3 with inseminators 4, consumers 7, local livestock officers 10 and village cooperation 13. Actor banks 8 did not correlate with actor extension services 2, actor local livestock officers 10 with crop farmers 3. Up to the last actor, actor village cooperation 13 did not correlate with actor crop farmers 3. As much as 12 relationships did not correlate (PCC=0.000). The greater number found in actor crop farmers 3, i.e. with 5 actors. The rest was found on average of one for some relationship.

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The SNA output (Figure 4) depicted the picture of SNA based on Power centrality. In Figure 4., with Table 4. and Table 5., we succeeded in mapping interlinked relationship networks amongst goat actors in production systems. In Central Java, constraints faced by cattle farmers were made in causal loop diagrams by [48]. In Table 5., several actors 1 up to 14 had a positive clear correlation with PCC=1.000. Actors with PCC=0.000 had no relationship at all. However, the rest had a negative correlation (PCC<0), and several had neutral relationships.

Table 4. Similarity Matrix: Matching Coefficient (SMMC) of goat actors.

Actor/Actor	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1.000	0.357	0.500	0.286	0.214	0.500	0.429	0.286	0.286	0.286	0.214	0.286	0.286	0.214
2	0.357	1.000	0.286	0.643	0.714	0.429	0.357	0.500	0.357	0.643	0.571	0.357	0.643	0.571
3	0.500	0.286	1.000	0.500	0.429	0.571	0.500	0.357	0.643	0.500	0.571	0.643	0.500	0.571
4	0.286	0.643	0.500	1.000	0.786	0.786	0.429	0.429	0.571	0.714	0.643	0.571	0.571	0.786
5	0.214	0.714	0.429	0.786	1.000	0.571	0.357	0.500	0.500	0.786	0.571	0.500	0.643	0.714
6	0.500	0.429	0.571	0.786	0.571	1.000	0.357	0.357	0.500	0.643	0.429	0.500	0.500	0.571
7	0.429	0.357	0.500	0.429	0.357	0.357	1.000	0.857	0.571	0.429	0.643	0.571	0.429	0.643
8	0.286	0.500	0.357	0.429	0.500	0.357	0.857	1.000	0.571	0.571	0.643	0.571	0.571	0.643
9	0.286	0.357	0.643	0.571	0.500	0.500	0.571	0.571	1.000	0.429	0.786	0.857	0.714	0.643
10	0.286	0.643	0.500	0.714	0.786	0.643	0.429	0.571	0.429	1.000	0.500	0.429	0.429	0.643
11	0.214	0.571	0.571	0.643	0.571	0.429	0.643	0.643	0.786	0.500	1.000	0.786	0.786	0.857
12	0.286	0.357	0.643	0.571	0.500	0.500	0.571	0.571	0.857	0.429	0.786	1.000	0.714	0.643
13	0.286	0.643	0.500	0.571	0.643	0.500	0.429	0.571	0.714	0.429	0.786	0.714	1.000	0.643
14	0.214	0.571	0.571	0.786	0.714	0.571	0.643	0.643	0.643	0.643	0.857	0.643	0.643	1.000

Actors that had positive correlations were goat farmers 1 with government 6 (PCC=0.304), actor extension services 2 with inseminators 4, veterinarian 5, local livestock officers 10, vehicles 11, village cooperation 13, and grass farmers 14. Actor crop farmers 3 had a correlation with government 6, food court 9, vehicles 11, retailers 12, and grass farmers 14. Down to actor grass farmers 14, a positive correlation was to actors of extension services 2, inseminators 4, veterinarian 5, consumers 7, banks 8, food court 9, local livestock officers 10, vehicles 11, retailers 12, and village cooperation 13. Actors with greater positive correlation found in actor grass farmers 14, followed by actor vehicles 11, actor village cooperation 13, actor inseminators 4, actor banks 8, actor food court 9, and actor retailers 12. Actors had negative correlation were goat farmers 1 with extension services 2 (PCC=-0.408), inseminators 4 (PCC=-0.194), veterinarian 5 (PCC=-0.548), consumers 7 (PCC=-0.059), banks 8 (PCC=-0.471), food court 9 (PCC=-0.194), local livestock officers 10 (PCC=-0.471), vehicles 11 (PCC=-0.284), retailers 12 (PCC=-0.194), village cooperation 13 (PCC=-0.471) and grass farmers 14 (PCC=-0.284). Down to actor 14, negative correlation shown on goat farmers 1 (PCC=-0.284), and government 6 (PCC=-0.026). Actor with greater negative correlation found in actor goat farmer 1, followed by actor government 6, actor veterinarian 5, and actor consumers 7.

Table 5. Matrix of Pearson Correlation Coefficient (PCC) of goat actors

Actor/Actor	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1.000	-0.408	0.000	-0.194	-0.548	0.304	-0.059	-0.471	-0.194	-0.471	-0.284	-0.194	-0.471	-0.284
2	-0.408	1.000	-0.429	0.316	0.447	-0.149	-0.289	0.000	-0.316	0.289	0.174	-0.316	0.289	0.174
3	0.000	-0.429	1.000	-0.000	-0.149	0.149	0.000	-0.289	0.316	0.000	0.174	0.316	0.000	0.174
4	-0.194	0.316	-0.000	1.000	0.519	0.519	-0.228	-0.228	-0.050	0.411	0.055	-0.050	0.091	0.440
5	-0.548	0.447	-0.149	0.519	1.000	0.067	-0.344	-0.043	-0.141	0.559	-0.026	-0.141	0.258	0.337
6	0.304	-0.149	0.149	0.519	0.067	1.000	-0.344	-0.344	-0.141	0.258	-0.389	-0.141	-0.043	-0.026
7	-0.059	-0.289	0.000	-0.228	-0.344	-0.344	1.000	0.708	0.091	-0.167	0.251	0.091	-0.167	0.251
8	-0.471	0.000	-0.289	-0.228	-0.043	-0.344	0.708	1.000	0.091	0.125	0.251	0.091	0.125	0.251
9	-0.194	-0.316	0.316	-0.050	-0.141	-0.141	0.091	0.091	1.000	-0.228	0.440	0.650	0.411	0.055
10	-0.471	0.289	0.000	0.411	0.559	0.258	-0.167	0.125	-0.228	1.000	-0.101	-0.228	-0.167	0.251
11	-0.284	0.174	0.174	0.055	-0.026	-0.389	0.251	0.251	0.440	-0.101	1.000	0.440	0.603	0.576
12	-0.194	-0.316	0.316	-0.050	-0.141	-0.141	0.091	0.091	0.650	-0.228	0.440	1.000	0.411	0.055
13	-0.471	0.289	0.000	0.091	0.258	-0.043	-0.167	0.125	0.411	-0.167	0.603	0.411	1.000	0.251
14	-0.284	0.174	0.174	0.440	0.337	-0.026	0.251	0.251	0.055	0.251	0.576	0.055	0.251	1.000

4.2 Relationships of Actors

Down to Figure 5., It was interested in mapping actors into another indicator of powers and interest (low-high) graph. We considered this as important due to organizational theoretical background [25]. An example was discussed by [5] in Bogor, Indonesia. We grouped these two indicators into four quadrants (Qw1-Qw4). In the first quadrant (Qw1), we had one actor involved with low power and high interest, i.e. local livestock offices. However, in the 2nd quadrant (Qw2), we identified goat farmers, extension service, government, consumers, banks, and crop farmers had high power and high interest. A similar situation was shared by [49]. Dominant actors of involvement are found in this quadrant.

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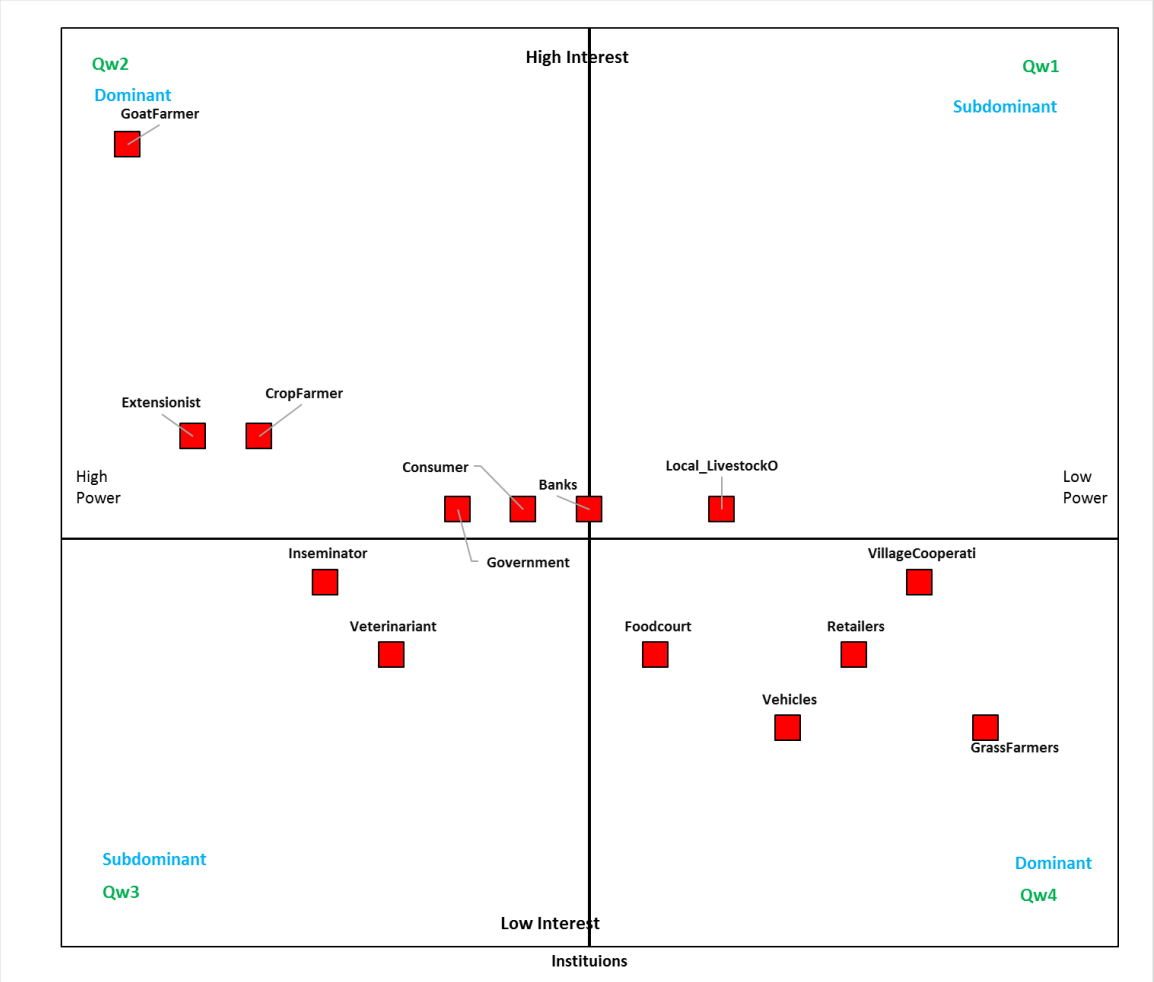

Figure 5. Stakeholder mapping on power and interest relationships under goat farming systems.

Of the 3rd quadrant (Qw3), two actors were grouped and distributed in this quadrant. They were actors with high power but had a low interest as well. They were inseminators and veterinarians. These actors are dominantly distributed in this segment of relational roles and plays. The last segment is a fourth quadrant (Qw4) that was dominantly also found filled by several organizations. They were food courts, vehicles, retailers, village cooperation, and grass farmers. Analyzing the places on quadrant by some actors, we suggest promoting several actors' capacity building, roles, and power. We aim to revitalize these organizations to have better roles and responsibilities. Actors in Qw1 should move to Qw2. Actors in Qw3 should move as well in Qw2. And finally, actors in Qw3 move to Qw2. Seeing this importation of actors' network analyses (ANA), we pursued it by analyzing clustering using Hierarchical Cluster Analysis (HCA).

There were three leaves (Figure 6.), i.e. single (simplicifolius) consisted of actor goat farmers 1, consumers 7 and vehicles 11, extension services 2, and government 6. The second is double (bifolius) which consisted of actor crop farmers 3 and grass farmers 14, banks 8 and village cooperation 13, food court 9 and retailers 12, and inseminators 4 vs veterinarian 5. And the third one was triple (trifolius) which consisted of actor goat farmers 1, crop farmers 3, grass farmers 14; consumers 7, food court 9, retailers 12; and inseminators, 4, veterinarian 5, and local livestock officers 10. These had similarities in terms of roles and responsibility. The δ clade consisted of actor extension services 2, inseminators 4, veterinarian 5, local livestock officers 10, and government 6 with clade β which consisted of clades α (actors 1, 3, 14, 8, 13) and clade ε, which consist of actor consumers 7, food court 9, retailers 12, and vehicles 11.

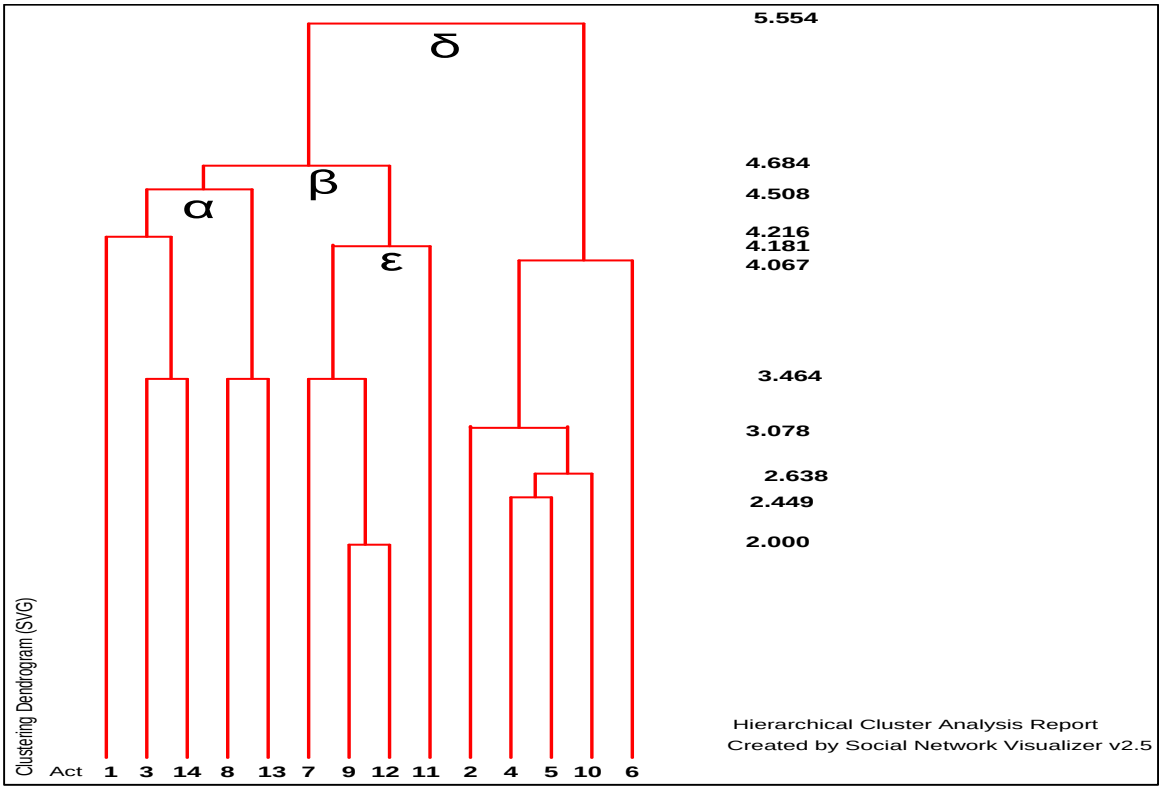

Figure 6. Hierarchical clustering analyses of goat actors' relationship.

Clades with similar heights had similar to each other. Clades with dissimilar heights had a dissimilar relationship. Actors food court 9 and retailers 12 along with had a similar relationship. Actors inseminators 4 and veterinarian 5 was as well, followed by actor crop farmers 3 and inseminators 4; grass farmers 14 and banks 8, which had also closed similar relationship.

4.3 Intervention and Innovation

The intervention will lead to assuring sustainability (Figure 7). We identified 4 actors who needed policy intervention (28.57%). More than half 4 actors (28.57%) needed financial intervention. For instance, by improving grassland and/or pasture as reported by [41]. We found only one stakeholder which needs spacing intervention. Spacing intervention meant for infrastructure and wholesale cooperation, exampled in Thailand [26]. It seemed that 2 stakeholders needed intervention for time resources. On one hand, more than 21.43% of actors (3) need access intervention. In the small number of the intervention of satisfaction was mentioned by 4 actors. Some actors (4) needed the intervention of the knowledge side (28.57%). More than 20% (6 actors) needed the intervention of skills.

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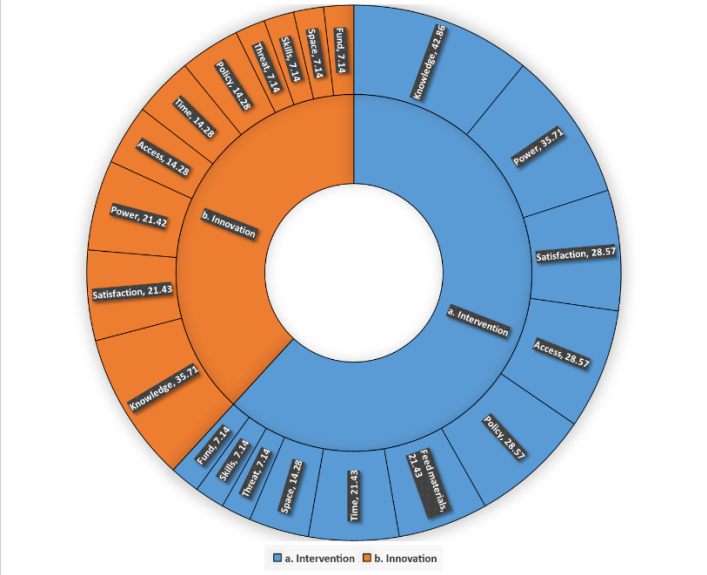

Figure 7. Intervention and innovation provided by goat actors.

The threat was experienced by 7.14% of the actor (1) and therefore needed intervention they faced. We also found only one actor needed power (7.14%). Last but not least, feed material (35.71%), were requested for sustaining the cattle business beneficiary. Differs from intervention, what innovations are needed are questionable and shall be addressed to obtain clear concept and programs for improving goat business beneficiaries in West Papua. Innovation needs to assure the sustainability of the goat business. In the policy sector, we found three actors (21.43%) needed innovation for policy improvement. Examples and experience reported by [22]. Specific innovation was regulation, law, standard operating procedures, research and development, monitoring and evaluation, and taxation. Example explained by [26] in Makassar, Indonesia. In the financial and space sectors, two actors (14.28%) needed innovation. Financial innovation will be designed to make it easy-access, and easy-payback with low rate loan. Related to space and time, innovation is needed by one actor. Access and satisfaction of actor services needed by actors (14.28%) for innovation. Knowledge and feed materials of innovation were needed by 3 actors (21%.42). Skills were needed by 5 actors (35%) for innovation. We found few proportions of threat (7.14%%) responded by one actor. While power component was also urgent done for innovation by an actor (7.14%).

5. DISCUSSIONS

Developing the GFS in Indonesia is difficult [21], [9], [45]. This is the reason that many actors are involved by using their capacity of the organization and shared resources [35]. The finding from Table 2 shown actors need to show their commitment due to many constraints faced by the GFS [16], [56], [3]. We have to map the potential actors who have shown high commitment and a positive relationship with the GFS. Establishing the GFS on the tract of sustainability need all resources. We have rich pictures of networks and interlinking relationships [17], [32], [42]. Although not all related stakeholders are linked to each other. This is due to actor interest. We also have a degree of power and interest of the actors (Figure 3.).

Leveling institutions in Indonesia occur due to designed programs [14], [60]. The central and local governments are in a dissimilar layer. Level central programs sometimes do not match with local programs. Locals have recognized the best and suitable programs for implementation. Bottom-up programs always apply to local community need and available resources [47], [52], [40]. In some part of provinces, goat development, and production are relevant to the local condition. However, in reality, proposed programs by locals are sometimes avoided.

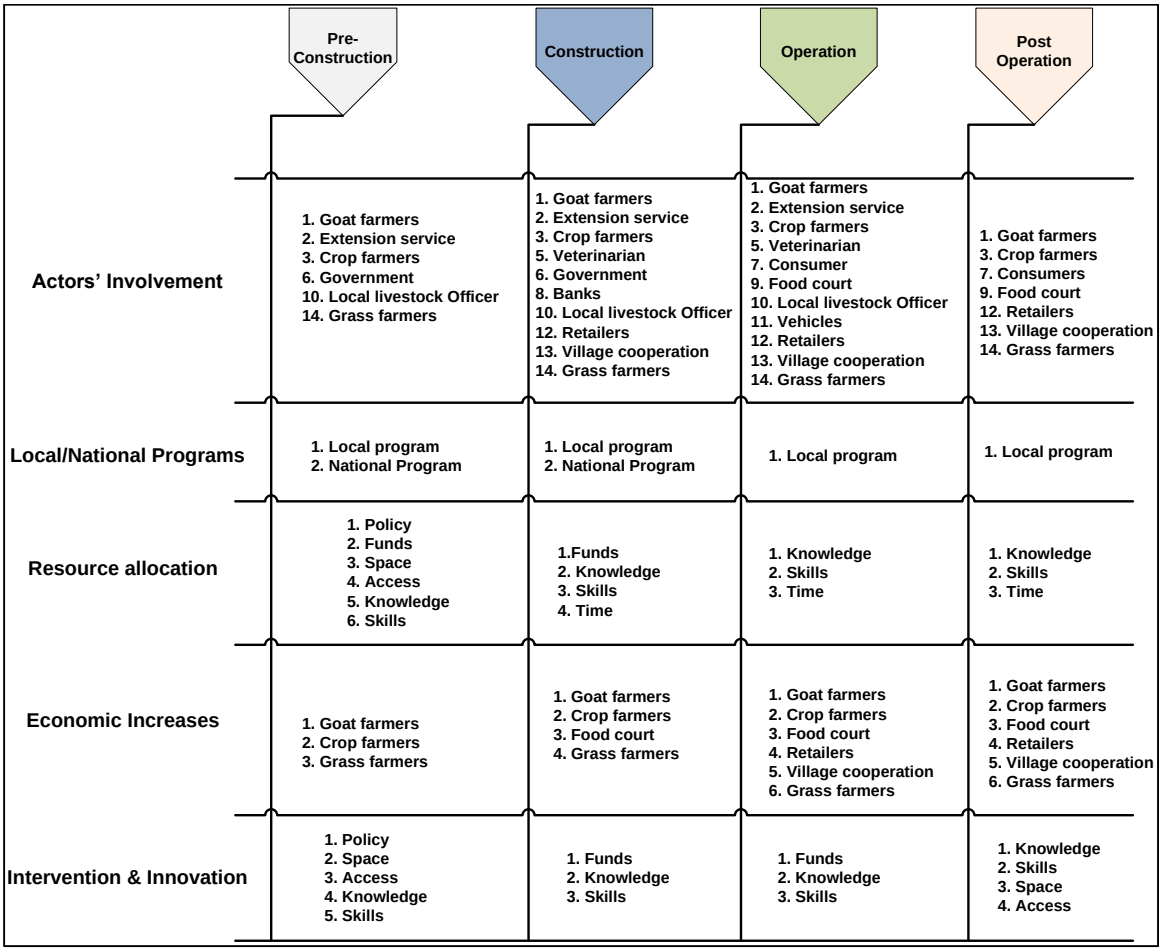

Figure 8. The cycle of goat development and actors' involvement and advantages.

Two-dimensional organizations consist of structural and contextual do not implement properly [39]. In structural one, three indicators such as differentiation, formalization, and decision making are not implemented yet. They are coming up with decision-making. Works with short-cut programs are in danger and still unsustainable. A contextual organization such as strategy, size, technology, empowerment, power, and culture, becomes principal rules and directions in strengthening and promoting the local community as recipients of the programs [53], [12]. Resource and organization identity (Figure 1) become prime driving factors in delivering and connecting actors as donors and community (recipients) such as goat farmers [33], [34]. Resources found in this finding confirmed several vital resources such as policy, funds, spaces, time, access, satisfaction, knowledge, skills, threat, power, and feed materials. Adding to this is the duration of the programs, continuity of the resources, power of resources, and intervention (Table 3).

Actor involvement in this sector of animal agriculture is absolute of utmost need. The goat as animal agriculture in Indonesia has recently been increasingly raised by household farmers. However, in driving the rapid production of the goat sector of development, all stakeholders shall be considered their economic and business involvement [59], [3]. Some of them will only involve in few parts of processes, i.e. pre-construction, construction, production, and post-production (Figure 8). As Muslim countries in the world, Indonesia becomes the business target potency, including middle Asia and Arabian countries. Therefore, local and national programs should meet and merit. In many experiences, this condition does not create long sustainability. Changed policy, changes programs, and actions. Nothing of the programs is sustain designed under West Papuan condition. Whereas, regions such as Fak-fak in West Papua, has suitable circumstance

in developing goat farming systems. The local community is in the ready position. However, they are not prepared yet with sufficient shared resources. Resource allocation, in the earlier beginning of the projects, needs more or less six shared resources, i.e. policy, funds, space, access, knowledge, and skills. Many stakeholders and/or actors contribute particularly in policy, funds, knowledge, and skills by doing several aids and community empowerment. However, spaces and access are two folds' other resources that are underestimated by several donor organizations. Economic increases will be gained by some actors in the earlier stage of goat farming development, i.e. goat farmers, crop farmers, and grass farmers.

Intervention and innovation delivered commonly are policy, space, access, knowledge, and skills. In the earlier stage, the policy shall be provided by local and national governments. Rules and regulations sometimes do not match with local needs and resource availability. This becomes a failure of programs and projects when the locally targeted community does not ready yet [30], [40], [52], [47], [13], [17]. Space, in this case, constitutes land availability. Land becomes scarce resources and any other categorized spaces. Expansion of the business of the goat must increase. Therefore, spaces are needed for expansion. Access to capital, land, and workers become coming up issues [1], [27], [20], [3], [40]. The contribution of fund-related institutions is rarely prepared. If any, they have certain regulations that are limiting the goat farmers' access. Knowledge and skills are needed by farmers [54]. This agriculture technical service still exists until the current time. However, their works and responsibilities do without obtaining support from the local and national government. Therefore, it is urgent to convincing actors to act properly according to the resources they have. On the one hand, offered intervention and innovation shall be based on local conditions and farmer profiles [23], [18], [28], [58]. This is why the GFS development in Indonesia and particularly in West Papua has been stack and hampered many risks. Reducing the impact of negative effects on actors and increasing positive impact will bring a better effect on goat farming production and shared beneficiary. Many programs and projects run by local government and central government tend to in-sustain due to low commitment of the rules and responsibility (Table 1.).

6. CONCLUSIONS

The goat farming system (GFS) in West New Guinea is shaped by related groups, under law, privates, and stakeholders rather than shareholders. The actors are important and have a positive effect. The actors have a low direct threat and a slight high turn-back effect. The four top shared resources consist of access, satisfaction, time, and space. The actors have a willingness to contribute in a long-term period and can sustain their support. However, the power of resources shared is neutral and therefore needs further intervention. The relationship of SNA is showing a relationship of similarity and with a greater positive correlation of each actor due to high interest and high power. The five top intervention for goat farming system is skills, feed materials, policy, funds, and satisfaction. While innovation needed by actors are skills, policy, knowledge, feed materials, and fund. Research findings are showing several significant and strategic characteristic typologies and resources belong to actors for national, local, and grass-root levels. Most studies done do not consider this finding. Whereas, we know that interest and power embedded into actors will determine how intense and how serious 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 numbers actors will sustain and have good goat governance (GGG) in promoting animal agriculture development programs and projects. Quantitatively using the SNA, we succeeded in computing connections between actors using Pearson Coefficient Correlation matrix. Added to this in the two-dimensional graph by applying a power-interest indicator we also found the existing position which pooled on the 3rd quadrant. 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 organizational characteristics has power and significant tools in analyzing actors-related development. This study implied that we succeeded to quantify the first layer actors' involvement in the goat production and development sector. The second and the third prospective actors' layer internationally, nationally, and locally level organization were not portrayed yet.

In the future, we will incorporate international institutions for digging details up for getting a comprehensive and general understanding of national institutional involvement. We need to test the parameters of character actors in quantitative statistical tests inferentially. We also argue that too many constraints faced and belong to actors are becoming the limiting factors in making those actors cannot provide programs and build perfect and intense connections. This study, method, and parameters can be applied to other wide fields of disciplines. The parameters can be extended according to the needs of each field. The SNA provides several choices of analytical tools that are useful in implementing stakeholder analyses. The limitation we found during collecting and analyzing 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 create collaboration in facilitating the programs to lowering the rapid decrease of the goat population. We need to also test the typology of characteristical institutions such as the shape of the organization, law status, types, roles, effect, importance, threats, and turn-back effect in modeling the healthy and prospective actors.

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